



FINANCIAL MARKETS 2023

THE ROLE OF CENTRAL BANKS IN A HIGH INFLATION ENVIRONMENT

Proceeding from the 11th International Scientific Conference held in Prague on 30th – 31th May, 2023

Eva Kostikov (ed.)

Vysoká škola finanční a správní, a.s.
(University of Finance and Administration), Praha, 2023

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The risk of an emerging real estate price bubble following the global economic crisis in 2008 and the subsequent massive real estate price increases in Germany

Felix Florian Balz

Abstract

The German real estate market is characterized by stability and sound regulations, yet it is of great importance to keep an eye on the overall situation on the world markets, because the global economic crisis of 2008 also showed that problems on other markets can lead to considerable damage for the German economy and private households, regardless of whether developments on the domestic market are not a cause for concern. This paper aims to identify commonalities in the developments of the real estate and mortgage markets in order to determine whether, based on current market events and those of the last decade, a total economic loss as in 2008 is also to be feared. The hypothesis is that severe economic crises in Europe or on a global scale can have a strong impact on the German real estate market, even if the origin is not in Germany. The conclusion and outlook summarize the problems and misperceptions that led to the 2008 crisis. How the market in Germany has developed over the last 21 years, which problems can be observed in the current development and where, however, the all-clear could already be given. In addition, an outlook is given as to what consequences the German market can expect in the coming years and what role the changed interest rate level could play in this.

Keywords

Finance, Financial Crisis, Financial Economics, Real Estate Economics

JEL Classification

G1, R3

INTRODUCTION TO THE TOPIC

The end of the 2000s was marked by the global economic crisis of 2008 and the preceding subprime crisis. Finding its origins in this crisis, Europe was confronted with numerous other crises in the years that followed. These were followed by the Irish real estate and banking crisis (2008 to 2010), the Spanish real estate and banking crisis (2010 to 2012), the debt crises in Southern Europe (from 2010), the crisis of maritime shipping (from 2008) and of banks specializing in ship financing (from 2013), the problematic nature of the European financial system in the second half of 2011, and the crises of corporate loans of Italian and Greek banks (since 2012) (Hellwig, 2017). These crises are said to have resulted from excessive lending from the years before 2008 (Hellwig, 2017). Looking at the triggers of the listed crises in detail, it is easy to see that many of these issues are also related to real estate and its price developments.

This paper aims to take a closer look at the financial crisis from 2007 to 2009 and its impact on the German real estate market. The aim is to identify similarities in the developments of the real estate and mortgage markets in order to determine whether an economic total loss as in 2008 is also to be feared due to the current market events and those of the last decade. Based on this, the development of the real estate market in Germany up to 2008 – the outbreak of the global

economic crisis – is examined in more detail and the consequences resulting from the crisis are elaborated. After providing an overview of the real estate market situation in Germany prior to the global economic crisis, price developments since 2008 will be examined to determine whether a bubble is currently forming, as has been observed in other countries since the early 2000s (Kleiber, 2009).

The signs are examined and evaluated based on various literary sources. Current and older relevant paper publications, basic reference works that grant a stable foundation in this topic area, reliable online sources as well as current market data on the real estate market in Germany are used. The hypothesis is that severe economic crises in Europe or on a global scale can have a strong impact on the German real estate market, even if the origin is not in Germany. Finally, the conclusion and the outlook summarize the problems and misjudgments that led to the crisis in 2008, the development of the real estate market in Germany over the past 21 years, the problems observed in current developments, and where, however, the all-clear has already been given. This section also answers the hypothesis presented above. In addition, a forecast is given for what consequences the German real estate market could expect in the next few years and what role the changed interest rate level could play in this. To start the paper, first of all the underlined methodology of the information provided here is explained in a little more detail.

1 METHODOLOGY

This paper deals with the global economic crisis of 2008 and the developments of real estate prices in the German real estate market. The basic situation of the global economic crisis has been presented on the basis of significant literature. The literature was aggregated and analyzed for this purpose. The most important points and aspects of the crisis were thereby presented within the framework of the paper. In the literature analysis, reference was made to various relevant and current papers and to basic technical literature. Great care was taken to include sufficient sources with a good impact factor. In addition, the development of the German residential real estate market was analyzed. For this purpose, numerous literary sources were also evaluated, for which attention was paid to topicality, relevance and significance. Here, too, the impact factor played an important role. In addition to the literature, however, real estate market data quantifying the development of real estate prices was also included. The figures were explained and presented in the form of charts. A mathematical evaluation of the index data did not take place.

Data from the independent market research company bulwiengesa AG was used. The data from bulwiengesa enjoys a high reputation in Germany and is also used by the Deutsche Bundesbank, for example, in various decisions. Here, we take a look at the development of real estate prices before the global economic crisis and also after the global economic crisis up to the year 2021. At the end of the paper, arguments for and against the result of a speculative bubble on the German residential real estate market are derived from the development of real estate prices after the global economic crisis of 2008 on the basis of the literature evaluated and the data considered. In this context, we also take a look at the development of the interest rate situation. The data considered for this purpose was provided by Statista GmbH, a renowned German statistics company. This data was also only presented graphically and observations were derived. A mathematical evaluation has not taken place here either.

2 THE FINANCIAL CRISIS OF 2008

Household debt in the United States and many other industrialized countries increased significantly in the decade before 2008 (Glick & Lansing, 2010). In the years leading up to the onset of the crisis, it was a combination of factors, including low interest rates, lax lending standards, the emergence of a global market for securitized loans, and the proliferation of exotic mortgage products, that led to the high levels of household debt (Glick & Lansing, 2010). Especially in Anglo-Saxon countries, debt-driven consumption became the main demand driver and that too usually in conjunction with housing bubbles (Stockhammer, 2013). In 2007, the crisis of U.S. mortgage securitization then spilled over into Europe and subsequently led to a global financial crisis. In the process, this financial crisis contributed to the longest and most severe economic contraction since the Great Depression of 1929 (Glick & Lansing, 2010).

In this context, the subprime crisis is generally understood to have triggered the global economic crisis (Märker & Hillesheim, 2009). The subprime crisis involved the global trading of securitized U.S. mortgage loans. Household debt in the United States led to the observed Great Recession in the U.S. economy prior to 2007 (Mian & Sufi, 2009a,b). In this context, household debt in the United States averaged about 130% in 2007 (Glick & Lansing, 2009; Glick & Lansing, 2010). Interestingly, the literature cites in the U.S. mortgage problem as the main trigger for the global economic crisis. However, in 2007, the debt ratios of Denmark (199%), Ireland (191%) and the Netherlands (185%) were actually significantly higher than those in the U.S. (Glick & Lansing, 2010). Countries such as Italy (43%), France (60%), Belgium (64%) or Germany (82%), on the other hand, recorded far lower debt ratios (Glick & Lansing, 2010) and thus did not contribute to the global economic crisis in the same way as, for example, the USA did.

Mian and Sufi's research was able to demonstrate that housing prices rose faster in U.S. areas where subprime mortgages were prevalent. This fostered a self-reinforcing feedback loop: new buyers who had access to low-cost mortgage loans further fueled price increases as they sought to purchase properties, which in turn encouraged lenders to further entice the lending environment as property prices were assumed to rise indefinitely (Glick & Lansing, 2010). In addition, Mian and Sufi's study showed that in regions where debt was highest, the number of loan defaults also increased the most, and as a result, the recession was most severe, as measured by the decline in durable goods consumption and the subsequent increase in the unemployment rate (Mian & Sufi, 2009a,b; Glick & Lansing, 2010).

After the effects of the problems in the U.S. then reached the European and German economies, consumer advice centers were confronted with inquiries from thousands of aggrieved investors who suffered a total loss of their securities investments directly or indirectly as a result of the Lehman bankruptcy (Märker & Hillesheim, 2009). Lehman Brothers went bankrupt because, like many other banks at the time, they wanted to finance growth through debt. The extremely high level of debt ensured that the solvency of this investment bank was in doubt and as a result, financing via the money market stalled (Hellwig, 2017). In the process, this led to the bankruptcy of Lehman Brothers and triggered a run on money market funds, which in turn withdrew their funds from the banks (Hellwig, 2017). The subject of the economic crisis even had far-reaching consequences for language, as the term financial crisis was named "Word of the Year 2008" in 2008 (Märker & Hillesheim, 2009). For the Federal Republic of Germany, the problems in the U.S. and other economies were problematic primarily because it has a strong external economic nexus and this could become dangerous for its own economic development (Steinbrecher, 2009). For example, a 2008 annual report by the German Sachverständigenrat (German Council of Economic Experts (SVR)) found that German GDP could fall by around

one percent if there were export slumps caused by low demand from France, Spain, the U.S. and the United Kingdom (SVR, 2008).

A study by Steinbrecher (2009) examined well over 100 observed recessions around the world and found that 34 recessions were associated with a collapse in real estate prices (Steinbrecher, 2009). Thus, early evidence can be identified that economic downturns, regardless of their origin, often result in real estate price declines. Research by Chen and Funke in 2013 also supports this hypothesis. The economic crisis of 2008 caused the European real estate market to lose some of its potential. Although the course varied for EU member states, some coped better, others worse, and are still feeling the effects today (Mach, 2019).

3 DEVELOPMENT OF REAL ESTATE PRICES TIL 2008

The 2000s were characterized by cycles of excessive boom and bust in the housing market, although not all countries experienced high volatility in housing prices (Voigtländer, 2014). However, in countries where household debt was highest, housing prices also tended to rise the fastest during the same period and consumption declined the most once housing prices began to fall (Glick & Lansing, 2010). In Germany, stagnant or sometimes even falling real estate prices were observed for a decade, up to the Great Depression (Glick & Lansing, 2010; Chen & Funke, 2013). However, this price trend is preceded by a stronger price increase in the late 1980s and 1990s. The following figure illustrates the development of the real estate index in Germany from 1975 to 2008.

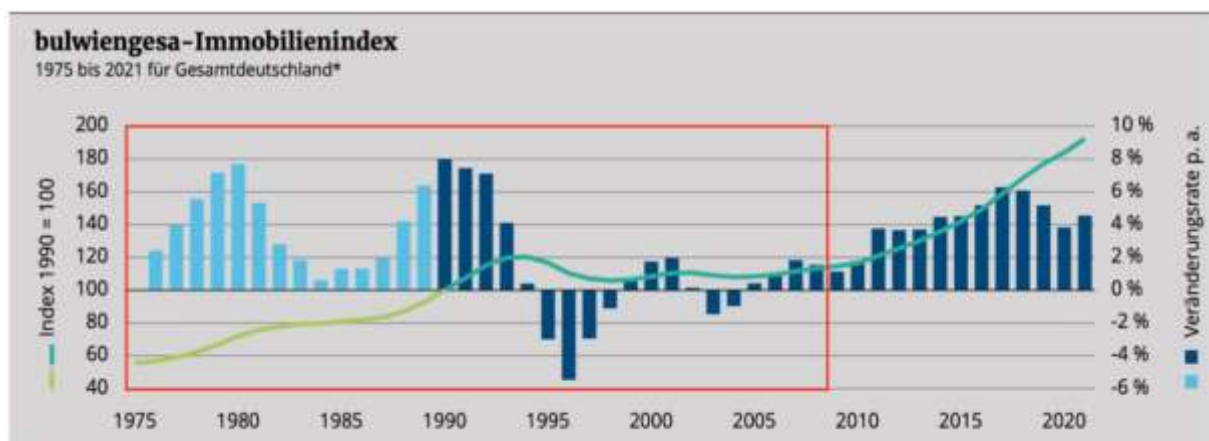


Fig. 1: Development of the real estate index from 1975 to 2008 according to bulwiengesa.

Source: bulwiengesa AG (2022)

Translation: bulwiengesa-Immobilienindex = bulwiengesa real estate index; 1975 bis 2021 für Gesamtdeutschland = 1975 to 2021 for All of Germany; Veränderungsrate p.a. = Rate of change p.a.

As can be seen from the figure, there was a sharp rise in real estate prices between the end of the 1980s and in the 1990s, followed by stagnating and in some cases falling real estate prices in the 2000s. Unlike in other countries, there was no excessive rise in real estate prices in Germany until the global economic crisis. In terms of real estate, the 2000s were characterized by marginal price increases, minor downturns and stagnation. Unlike the recessions studied by Steinbrecher, the global economic crisis in Germany did not lead to a collapse in real estate prices.

4 DEVELOPMENT OF REAL ESTATE PRICES AFTER 2008

After real estate prices in Germany stagnated for a long time in the 2000s or even fell in parts, a continuous upswing has been observed since 2010, which was strongly promoted by the low-interest environment (Chen & Funke, 2013). In the large German cities and metropolitan areas, even large markups could be recorded. The continuous price increases were attributed by Chen & Funke (2013) not only to the low interest rate environment, but also to the euro crisis from the years before. If we take a look at the development of real estate prices in Germany since the financial crisis of 2008, we can observe continuous price increases as well as recent historic highs. At the time of the financial crisis, some experts assumed that the 2008 economic crisis would lead to a decline in real estate prices in Germany, but not a collapse in real estate prices (Steinbrecher, 2009). The following chart illustrates the development of the real estate price index according to the independent market research company *bulwiengesa AG*:

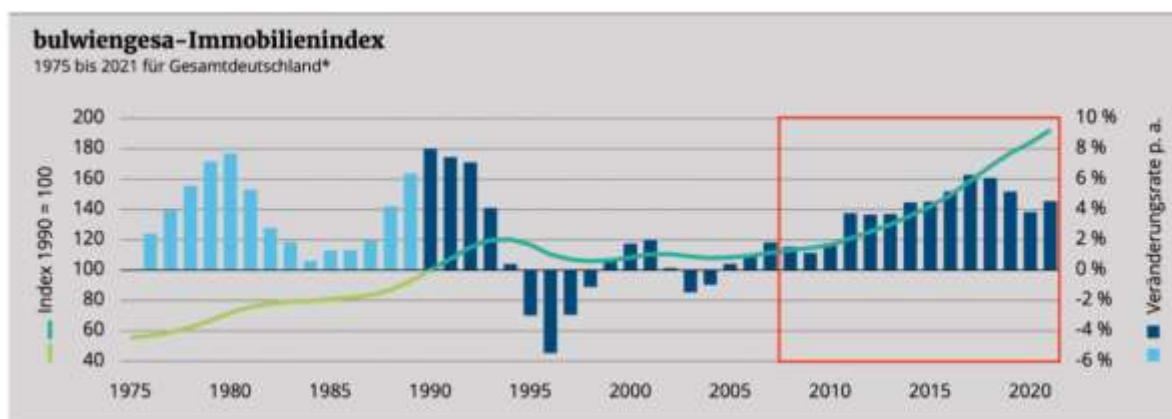


Fig. 2: Development of the real estate index since 2008 according to bulwiengesa.
Source: bulwiengesa AG (2022)

Translation: bulwiengesa-Immobilienindex = bulwiengesa real estate index; 1975 bis 2021 für Gesamtdeutschland = 1975 to 2021 for All of Germany; Veränderungsrate p.a. = Rate of change p.a.

The figure once again illustrates the continuous rise in the real estate price index, although the COVID-19-pandemic has caused an interruption in the long-term upswing. For many market participants, the question at this point is whether the upward trend is coming to an end or whether this is merely a minor setback in the trend. However, the developments clearly show that real estate prices continued to rise regardless of the economic turmoil caused by the COVID-19-pandemic. In 2020, the cost of homes and condominiums in Germany's 114 largest cities rose by an average of more than nine percent year on year (Kholodilin & Michelsen, 2021). Rents also continued to rise, albeit at a much lower rate than in the previous year (Kholodilin & Michelsen, 2021).

In recent years, the real estate investment market has become the most important real estate market in Germany and is enjoying dynamic and innovative development (Vornholz, 2022). Open-ended mutual property funds were a popular investment vehicle for private investors for decades, before the end of the 2000s saw strong outflows of funds and thus many fund closures (Schöffel, 2012). In general, the 2008 financial crisis ensured that real estate investments were no longer registered as fundamentally safe investments (Kleiber, 2009).

5 SIGNS OF REAL ESTATE PRICE BUBBLE ORIGINATING IN THE 2008 FINANCIAL CRISIS

Looking at developments in the German real estate market, starting with the global economic crisis in 2008, many experts agree that real estate prices in the German market were undervalued at that time and not overvalued as in many other countries (USA, UK, and Ireland) (Steinbrecher, 2009). So, while there was a crisis at that time, the German market was able to exude a certain stability even during this period and to record “healthy” developments. Therefore, it was already assumed at that time that Germany should be spared from serious consequences due to strong real estate price collapses (Steinbrecher, 2009) and the development of the real estate index according to *bulwiengesa* can underline this once again by a contrary development.

A 2013 study by Chen & Funke found that real estate prices in Germany do not deviate significantly from underlying economic fundamentals and thus there need to be any concerns about a real estate price bubble at this time either (Chen & Funke, 2013). Other studies also repeatedly confirm that no bubble risk has been observed for the German market in recent years (Koller, 2013; Kholodilin et al., 2014; Schier & Voigtländer, 2015; Kholodilin & Michelsen, 2018) or that the risk is limited to individual regional markets (Kholodilin et al., 2014). In recent years, however there has been talk of overheating in individual markets. Condominium prices in major cities are the main contributor to this (Koller, 2013; Kholodilin & Michelsen, 2018). However, recent research shows that the aforementioned overheating is now occurring in more and more regions and that this will result in price corrections (Kholodilin & Michelsen, 2021). However, even at this point, there is no talk of a bubble, although the increasing discrepancy between rental and purchase prices is promoting the risk of a real estate bubble occurring.

The risk of a real estate price bubble in Germany has so far been classified as low, based on a wide range of market data evaluations, on the one hand, and on the other hand, due to the still low level of private household debt (Kholodilin & Michelsen, 2018): The continued constant interest of foreign investors in the German real estate market and the perceived stability also help to identify a fundamental justification for the price development (Kholodilin & Michelsen, 2021; Engerstam, 2021). Comparisons between the German and Swedish real estate market have shown, for example, that German real estate prices react less strongly to changes in fundamentals than Swedish prices (Engerstam, 2021). This also illustrates the stability mentioned above. Taking Stiglitz’s (1990) definition, a speculative bubble can be defined as follows: “If the reason that the price is high today is only because investors believe that the selling price will be high tomorrow – when “fundamental” factors do not seem to justify such a price – then a bubble exists” (Stiglitz, 1990). However, the literature makes it clear in many places that this fundamental justification does exist. In addition, it should be added at this point that an overheating of one or more markets is not the same as a speculative bubble. It is merely a trend development that must be observed by those involved and subsequently counteracted in a targeted manner.

However, the economic past already shows that a prolonged period of low interest rates can often lead to speculative real estate bubbles as a consequence (Chen & Funke, 2013). This was the case, for example, in Ireland and Spain in the early 2000s. We have already had a low-interest phase since the global economic crisis in 2008. The figure below is intended to illustrate this interest rate development once again:

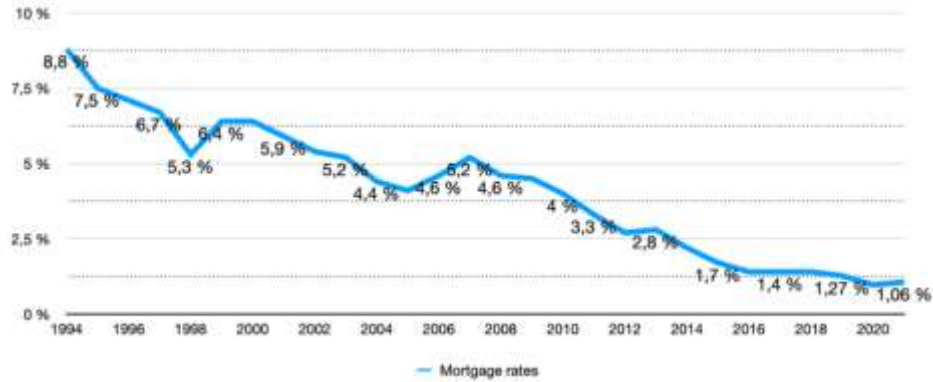


Fig. 3: Development of mortgage rates 1994 – 2021.

Source: own illustration based on Statista GmbH (2019)

As shown in the chart, the mortgage interest rate in Germany has been on a constant and almost unbroken negative trend since the global economic crisis in 2008 and is at a historically low level. In this context, a solid increase in interest rates in the coming months and years is essential to prevent demand from being boosted too much by a low interest rate. Current interest rate developments already show that interest rates are moving in a different direction again. The following chart illustrates once again how strongly interest rates have risen so far in the current year 2022:

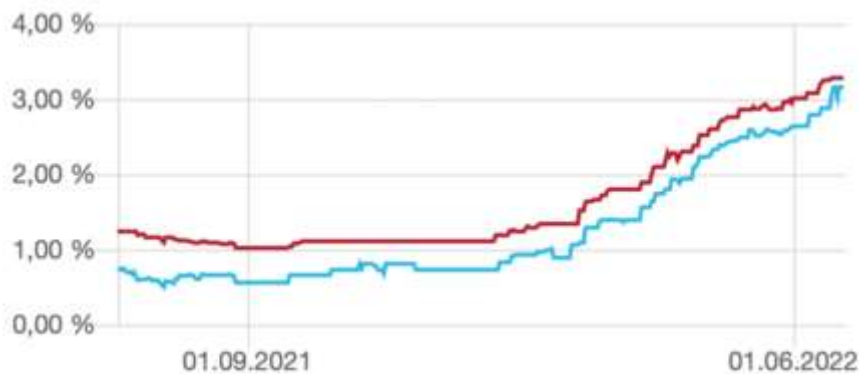


Fig. 4: Interest rate development in 2022.

Source: Dr. Klein Privatkunden AG (2022)

The figure shows that the interest rate tripled to quadrupled between the third quarter of 2021. Experts believe that although the higher interest rates will lead to a few price corrections, the increase in the mortgage rate will not lead to a collapse in real estate prices in Germany (Schier & Voigtländer, 2015). In the U.S. or the U.K., interest rate hikes led to a drop in real estate prices over the last two decades (Schier & Voigtländer, 2015), which is why, despite some expert opinions, this price-forming factor should not be disregarded lightly either.

In 2021, the Deutsche Bundesbank and the European Central Bank once again urgently warned against speculative exaggerations in price formation, which were not limited to urban areas alone (European Central Bank, 2021; Deutsche Bundesbank, 2021). Furthermore, if we examine other

countries, such as OECD countries¹, various studies show that signs of speculative bubbles were observed in eight OECD countries in 2018 (Kholodilin & Michelsen, 2018; Michelsen & Wittenberg, 2018). Among these countries are, for example, the United Kingdom, the United States, and also Sweden (Engerstam, 2021). These developments are particularly worrisome because, for example, after the global economic crisis of 2008, real estate bubbles were already bursting in countries such as the U.S., the U.K., and Spain (Kleiber, 2009).

The affordability of real estate in line with disposable income is another key factor in identifying real estate underdevelopment. Here, residential real estate prices are set in relation to disposable income. In Germany, the result for this is still good (i.e. real estate continues to be affordable), but this development has clearly continued to the disadvantage of private households (Kholodilin & Michelsen, 2021). Credit growth has also increased from 6.5 percent (2017) to about 8.5 percent (2021) (Kholodilin & Michelsen, 2021). Again, it is important to note that this factor is not moving in a direction similar to the subprime crisis from the United States.

6 CONCLUSION AND OUTLOOK

Lessons for the future must be learned from the 2008 global economic crisis and likewise from the other crises mentioned, which can help prevent a similar situation. A first learning from the 2008 financial crisis should be that investor protection mechanisms did not work at that time and that the capital market legal force field was dominated by those who opposed too strict investor protection in the past (Märker & Hillesheim, 2009). Future economic problems can be contained in their consequences if market regulations take the serious case into account. For example, the German real estate market is said to be reliable due to high stability in real estate financing and a widely developed rental market, and even currently the German real estate market is largely in a stable condition compared to other economies (Voigtländer, 2014; Kholodilin & Michelsen, 2015; Kholodilin & Michelsen, 2018).

Another important issue is the relationship between real estate and equity prices. A study by Gokmenoglu and Hesami (2019) has shown that in the long run, there are no diversification benefits from allocating equity and real estate assets in a portfolio (Gokmenoglu & Hesami, 2019). This finding is particularly important for pension funds, which have to invest a large amount of liquidity year after year. The relationship of these two assets can cause far-reaching problems in a crisis. Whereas Baranyai (2019) found that monetary inflows from funds decrease the real estate stock and outflows increase the real estate stock (Baranyai, 2019).

However, the aforementioned overheating in various regional markets is a concern. However, in order to identify problems in the German market at an early stage, it is not sufficient to merely examine national price indices (Kholodilin & Michelsen, 2021). Other international markets must also be considered, as these can also have a significant impact on the German economy, as the global economic crisis of 2008 alone has already shown. In a further research it would be of great interest to complement the presented German real estate price developments also by those of other countries. Especially the countries where real estate bubbles have occurred (e.g.

¹ The top 21 OECD countries include: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, USA, UK.

Spain, the U.S. or the United Kingdom) could be very relevant for the German real estate industry in the analysis.

According to Steinbrecher's (2009) research, it was already found towards the end of the 2007 – 2009 global economic crisis that the most severe recessions were accompanied by credit crunches and subsequently produced longer recessions with sharper declines in economic output. Recessions that were not accompanied by credit market disruption experienced less dramatic consequences (Steinbrecher, 2009; Joyeux & Milunovich, 2015). To prevent future problems, it is also worth mentioning here that the amount of credit extended must always be kept in mind. The problem here is that small amounts of credit severely hamper consumption and investment opportunities for households and business. This can lead to existential problems for companies that do not have sufficient liquidity reserves.

Economic crises accompanied by housing price booms and house price implosions also have more severe downturns, and the recessions that follow tend to last a quarter longer than those without this disruption (Steinbrecher, 2009). In the same wake, such recessions also substantially increase the unemployment rate and reduce private consumption expenditures. The misalignments that can lead to house price implosions cannot be identified by price series alone (Kholodilin & Michelsen, 2021). Other influencing factors, such as the volume of credit and the affordability of real estate, now also indicate worrying developments. In this context, it is of considerable importance to keep an eye on which path the development of the German real estate market is taking.

Going back to the hypothesis that was stated at the beginning, it can be said at this point that half of the hypothesis is true and other half is not. In general, it was found that economic crises outside Germany can also have a very strong impact on the domestic economy. The global economic crisis of 2008 in particular underlines this hypothesis, but so do demand problems caused by France or Spain, for example, when economic problems arise in these countries. However, the second part of the hypothesis does not apply according to the present study. No collapse in real estate prices was observed after the global economic crisis, and other crises cited did not trigger a crisis in the real estate industry in Germany.

However, it is clear that the central topic of this paper ("The risk of an emerging real estate price bubble following the global economic crisis in 2008 and the subsequent massive real estate price increases in Germany") is becoming increasingly present. More and more experts are alarmingly warning of the occurrence of a real estate bubble in Germany. At this point, it can also be added that the low interest rate policy finds its origin in the global economic crisis in 2008, as a measure to stimulate the economy again and consequently strengthened the demand for real estate through historically low interest rates. It is important that this strongly favored demand stimulation gradually undergoes a constructively managed trend reversal.

The description of past crises and worrying observations on the German real estate market illustrates once again that an upswing, regardless of its duration, will lead to a collapse at some point. In this context, credit institutions and policymakers need to keep a constant eye on the overall situation and critically scrutinize it in order to keep excessive debt and credit default risk under control. Even though the German real estate market seems to be characterized by stability and solid regulations, it is nevertheless of great importance to keep an eye on the overall situation on the world markets, as the global economic crisis in 2008 also showed that problems in other markets can lead to considerable damage for the German economy and private households, irrespective of whether developments on the domestic market are not a cause for concern. Until the 2008 financial crisis, even downward trends in Germany's average debt ratio could be observed (Glick & Lansing, 2010). Nevertheless, the global problems also reached the German economy and caused massive damage to the population and industry. The German real estate market does not currently show any crisis-

like problems, but overheating and undesirable developments can be identified in more and more regions. Appropriate measures must be taken to prevent a problem from another economy from perhaps fueling the country's own problems too strongly.

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CV – Felix Florian Balz

Felix Florian Balz has been enrolled as a PhD student at VSFS Prague in the Finance Department since September 2021. This is preceded by a Master’s degree in Entrepreneurship and Management (M.Sc.) and a Bachelor’s degree in Sports Management. In addition to this, intensive studies in Real Estate Asset Management were completed at the IRE|BS Real Estate Academy from spring 2021 to summer 2021. The focus on the dissertation is on the linking of the finance sector with the real estate sector. In particular, risks related to a low interest rate policy are analyzed. The interest in this topic arose from the company founded in 2020, which specializes in technology-driven real estate services in the German real estate market. Felix Balz is a co-founder and partner in this company, where he is responsible for the areas of real estate analysis and distribution. The knowledge gained in research is regularly applied in various business activities and expands the company’s expertise.

Examination of Macroeconomic Consequences of Real Estate Price Booms in a low-interest rate environment in Germany

Felix Florian Balz

Abstract

In the context of this paper, the macroeconomic consequences, related to real estate price increases in a low-interest rate environment, for the German real estate market will be considered. Starting with an introduction to the topic, the development of real estate prices over the past ten years and the relevant development of the interest rate situation will be presented. After indicating the direction of this development, the resulting macroeconomic implications are derived and explained. A conclusion will summarize the presented results and, within the framework of an outlook, a forecast for a possible development in the future will be given.

Keywords

Macroeconomics, Macroeconomy, General Financial Markets, Real Estate Economics

JEL Classification

E6, G1, R3

INTRODUCTION TO THE TOPIC

One topic that has become an integral part of Germany in recent years is the continued rise in real estate prices. In the 46th bulwiengesa real estate index, the company describes the 17th consecutive year of price increases on the German real estate market. Even the downward trend caused by the COVID-19 pandemic, which was mainly based on uncertainties, was overcome and renewed price increases were recorded (bulwiengesa AG, 2022). In the context of this paper, the macroeconomic consequences, related to real estate price increases in a low-interest rate environment, for the German real estate market will be considered. Beginning with an introduction to the topic, the methodology used in this paper, the development of German real estate prices over the past ten years and the relevant development of the interest rate situation will be presented. The development of the real estate prices is accompanied thereby by the factors, which have an influence on that development. After indicating the direction of this development, the resulting macroeconomic consequences are derived and explained. Finally, a conclusion will summarize the presented results and, within the framework of an outlook, a forecast for a possible development in the future will be given.

1 METHODOLOGY

This paper focuses on the macroeconomic consequences of real estate price booms resulting from a low interest rate environment. The development of real estate prices for German residential properties was analyzed on the basis of relevant, up-to-date and reliable literature. The literature was evaluated and analyzed and then the most important aspects from it were presented. In addition, market data of the German real estate market was included in the analysis. The market data was simply presented and observations were derived from it. A mathematical evaluation of the data has not taken place. These were provided by the independent, renowned market research company bulwiengesa AG. The data from bulwiengesa

is highly regarded in the German real estate market and is even used by the German National Bank in various decisions. The factors influencing the price of real estate were explained on the basis of current specialist literature.

The analysis of interest rate developments was carried out simultaneously with that of real estate prices. Here, too, relevant and current specialist literature was used, which was subsequently evaluated and compiled. The relevant findings were also presented in this paper. In this case, too, current market data on interest rate developments were presented, examined and key findings were derived. However, the data in this case comes from the renowned German statistics company Statista GmbH. Here, too, there was no mathematical evaluation of the data presented. Based on the analyzed literature and presented data, the macroeconomic consequences of the real estate price boom in the context of a low interest rate environment were then derived and presented. For all literature sources used and analyzed, emphasis was placed on the timeliness, relevance, and reliability of the source. In addition, the impact factor of the sources also played an important role. Great importance was attached to ensuring that the findings presented were based on meaningful and reliable analyses.

2 DEVELOPMENT OF PROPERTY PRICES IN GERMANY FROM 2011–2021

In Germany, real estate prices have continued to rise steadily in recent years. This brings with it both advantages and disadvantages. In the context of this paper, the focus will be on the development of real estate prices in the past ten years, in the observation period from 2011 to 2021. The following chart shows the development of real estate prices based on the index used for this purpose:

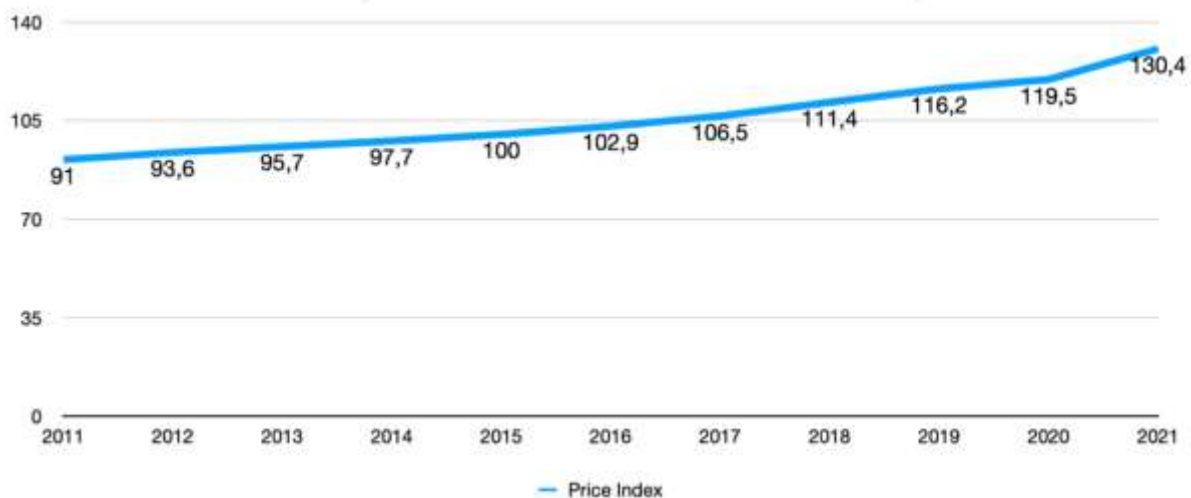


Fig. 1: Development of the real estate price index – residential property.

Source: own illustration based on bulwiengesa AG (2022)

As can already be seen from the figure, an index increase of around 40 points has been achieved over the last ten years, or an increase of around 43.30%. For real estate sellers and owners, these increases in value bring many advantages: higher sales prices are achieved, assets grow even with a sale and, in the case of real estate investors, the share price of a company can be positively influenced. However, those who want to purchase a property are sometimes confronted with

utopian purchase prices and, at the same time, have to calculate with the bank's interest, which is added as a further cost in addition to the ancillary purchase costs.

The bulwiengesa real estate index 2020 (publication on February the 2nd in 2021) showed the development of real estate prices for the 45th time in a row. In Germany, the values published by the independent market research company are generally used as an essential guideline in business and research, i.e. by the Deutsche Bundesbank (German Central Bank).

The results for the development of the German real estate market can be summarized at a glance: The overall index (i.e., across all segments) increased by +3.8%, the residential sub-index by +5.0% and the commercial subindex by +0.7% (bulwiengesa AG, 2021). Although contrary developments were observed in 2020, there was initially no major collapse in property prices. This index could already show that for the 16th time in a row an increase in real estate prices could be observed. However, the growth of prices since 2018 has not been as strong as in previous years. The rates of change are comparable with those from 2011 to 2013, but well ahead of those from the Lehman years of 2009/2010 (bulwiengesa AG, 2021). In the residential market in particular, prices are once again rising significantly, although the increase in rental prices is comparatively moderate at +2.85% on average (bulwiengesa AG, 2021).

Looking at the development of real estate prices in 2021, it is not difficult to identify some common features. Despite the ongoing COVID-19 crisis, the real estate index again increased by +4.6% (bulwiengesa AG, 2022). The increase in real estate prices in 2021 led to an index increase for the 17th consecutive year, even surpassing the previous year's results. The key findings of the 2021 Real Estate Index are as follows:

- All housing market variables recorded increases, some of them significant. This applies above all to properties to sale.
- The spread between the property index and inflation narrowed to 1.4%.
- The observed rates of changes again reached the level of 2014 and 2015, but the results still fall short of the boom years of 2016 to 2019.
- The losers in the development are retail rents. These remain in decline for the fourth year in a row, whereas commercial properties, however, were able to maintain their upward trend.

The results for the development of the German real estate market can be summarized at a glance: The overall index increased by +4.6% and thus increased its increase again, the residential sub-index was able to exceed its previous year's result and is increasing by +5.7% and the commercial sub-index is increasing more strongly this year, by +2.1% (bulwiengesa AG, 2022). Although the residential sub-index was unable to match the growth rates from 2016 to 2018, it has been rising steadily for three years. Purchase properties in the residential segment are once again the price drivers, as the construction of further housing continues to be the key issue in current housing policy discourse. Completion targets are regularly missed, resulting in the highest construction backlog since 1998 in 2021 (bulwiengesa AG, 2022). Overall, there is a construction backlog of over 800,000 housing units. Sufficient living space therefore continues to be a shortage in Germany, which of course also has an impact on prices. Despite this, average rent increases will remain comparatively moderate at +2.9% in 2021 (bulwiengesa AG, 2022).

Looking at the development of real estate prices, the question is increasingly being asked whether they can still be fundamentally justified. Residential property prices in particular have risen sharply in recent years, especially in major cities such as Berlin and Munich (Pretzell, 2015). In this context, concerns about a real estate price bubble are increasingly communicated

(Schier & Voigtländer, 2015). However, by applying the residential user cost concept, it can be shown that current price developments are still fundamentally justified in most criteria (Schier & Voigtländer, 2015). Furthermore, it should be added at this point that the real estate index may be deceptive. While prices in sought-after metropolitan areas such as Munich, Frankfurt or Hamburg continue to rise sharply, rural regions in Mecklenburg-Western Pomerania, for example, are seeing sharp price reductions (Westermeier & Grabka, 2017). In this federal state, but also in Saxony, for example, future price reductions of up to a quarter are expected (Westermeier & Grabka, 2017).

In this context, one should also take a look at the factors that can affect real estate price development. In 2000, Geoffrey Meen published a theoretical model showing the factors that have been identified as affecting the price of real estate. Table 1 shows the factors that affect the price of real estate in terms of value:

Tab. 1: Factors influencing the value of real estate according to Meen

Factor	Influence on the real estate price
Assets	Positive
Depreciation rate	Negative
Income	Positive
Inflation	Positive
Interest rate level	Negative
Investment income	Positive
Number of households	Positive
Real estate portfolio	Negative
Total User Cost of Capital (UCC)	Negative

Source: own illustration based on Meen (2000)

Table 1 already showed that the interest rate situation also has an impact on the development of real estate prices. The subprime crisis in the U.S. has already shown that the credit default risk can pose a major threat to banks (Gürtler & Rehan, 2009). In order to counteract this, a proper assessment is necessary. This crisis highlighted that aggressive lending with a lower customer interest-rate – and thus very low-interest margins between the customer interest rate and the refinancing rate – led to a number of loan defaults (Gürtler & Rehan, 2009). The failure to meet the cost of risk led to a downward trend in the real estate market. Accordingly, conservative lending is essential to keep default risks smaller and to stabilize the real estate market and keep the negative effects on the interest rate situation on real estate prices in check. Calculations show, for example, for the German real estate market that a large part of the price increases since 2010 can be attributed to lower financing costs (Schier & Voigtländer, 2015). This once again highlights the importance of the interest rate situation as a price-forming factor for real estate in Germany.

Since the turn of the millennium and into 2006, upward price dynamics have already been observed in global real estate markets. This has resulted in dramatic increases in assets in the portfolio of economic entities, credit-financed consumption and intensive construction activity

(Nastansky, 2017). Growth in various economies, such as the United States, is often based in part on rising consumption and investment effects from rising real estate prices (Nastansky, 2017). In this context, total UCC can be interpreted as the opportunity cost incurred when a consumer invests in real estate (Gürtler & Rehan, 2009). Thus, it corresponds to the utility loss that arises from the individual's decision for the alternative real estate purchase and against the alternative consumption (Gürtler & Rehan, 2009). Accordingly, it corresponds to rent.

Demographic trends in Germany also have an impact on the development of real estate prices. This connection is positively marked in Tab. 1 by 2030, declining population figures are expected in many regions (Westermeier & Grabka, 2017). In a study, Westermeier and Grabka have calculated the supply prices of real estate in Germany up to the year 2030 as part of a model calculation. The study is based on *empirica-systeme* market data and a population forecast by the *Bertelsmann Foundation*. Depending on the model specification, this shows an increasing polarization of real estate prices by the year 2030 (Westermeier & Grabka, 2017). According to this study, the real estate prices of owner-occupied apartments could fall by more than 25 percent in one-third of all districts and independent cities in Germany, and this would be the case for one- and two-family houses in about one-fourth of the districts. It is important to add at this point that the study focuses only on demographic trend and thus does not take other factors influencing real estate prices into account far enough. Nevertheless, the results illustrate the relevance of this factor.

Konstantin Kholodilin (Wittenberg & Kholodilin, 2008; Kholodilin et al., 2008) has also examined factors that have an influence on the development of real estate prices in Germany. He distinguishes between three groups of factors:

- Economic factors (e.g. real disposable income per capita or interest rate level).
- Demographic factors (e.g. population growth, household size and degree of urbanization).
- Institutional factors.

Comparing these influencing factors with those of Meen (2000), one can already see some similarities, especially in the economic and demographic aspects. Kholodilin also subsequently examined the factors he mentioned and found that real disposable per capita income, the long-term real interest rate, population growth and the degree of urbanization have the greatest influence on the development of real estate prices in Germany (Wittenberg & Kholodilin, 2008). The strongest influence, however, is exerted by real disposable income per capita, between which a strong correlation with the development of real estate prices has been established (Wittenberg & Kholodilin, 2008).

One aspect that both Meen and Kholodilin do not sufficiently consider is the behavior in free market markets. Supply and demand also play a major role in the price development of real estate (Pretzell, 2015). In this context, land prices have a significant impact on the level of the price. If there are fewer plots of land or also real estate on offer, prices rise. On the other hand, if there are suddenly more offers available on the market than demanded, prices decrease (Conway, 2011). In 2008, real estate prices in Miami (USA) plummeted. The reason for this was the completion of several large housing projects, which caused the housing market to suddenly become oversaturated and there were fewer demanders than there was supply (Conway, 2011). In addition, there are the prices that new construction has to follow. All the shell and finishing works have a major impact on the final selling prices of properties. If increases can be observed in these areas, this will inevitably be reflected in the real estate prices.

In a study by Wüstemann and Kolbe from 2017, another factor influencing the price of real estate was examined. The two researchers looked at the influence of urban green spaces on real

estate prices in Germany and found a positive influence of urban parks on real estate prices (Wüstemann & Kolbe, 2017). Another study looked at the impact of aircraft noise and flight corridors on real estate prices (Mense & Kholodilin, 2012). Properties affected by this generally suffer noticeable price losses. At this point at the latest, it should become clear that there are some factors that generally have significant influence on the pricing of real estate in Germany, but also countless other factors that can play a greater role in individual situations. It can therefore be assumed that numerous other influencing factors could also be mentioned over and above those mentioned.

3 DEVELOPMENT OF INTEREST RATE FROM 2011 TO 2021

A key factor in the development of real estate prices is the prevailing interest rate level. This has a positive influence on real estate prices (see Table 1). The interest rate situation in Germany has undergone a downward trend since the 1990s. From an interest rate high in 1981 (10.13%) to 0.4% in 2021 (Statista, 2022). Even though the current interest rate development is again taking a different direction (in May 2022, interest rates in Germany rose by almost two percentage points (Finanztip, 2022. Online source viewed on June 15th, 2022)), this paper focuses on interest rate developments up to the end of 2021. The following figure provides an overview of the development of the interest rate situation in Germany since 1975.



Fig. 2: Interest rate development in Germany – 1975 to 2021.

Source: Statista – Development of the capital market interest rate in Germany in the years from 1975 to 2021 (original language: “Entwicklung des Kapitalmarktzinssatzes in Deutschland in den Jahren 1975 bis 2021).

If you take a look at the development of interest rates in Germany, you can quickly see that financing a property has become increasingly affordable over the years. According to DVFA (Deutsche Vereinigung für Finanzanalyse und Asset Management e.V.) and IRE|BS (International Real Estate Business School), there are currently hardly any real economic indicators to suggest that the low-interest phase in Europe is merely a short-term phenomenon (DVFA & IRE|BS, 2015). The German credit market, similar to that in the U.K., underwent

deregulation in the 1990s (Gürtler & Rehan, 2009). However, unlike in the U.K., the credit market in Germany remains highly regulated (MacLennan, Muellbauer & Stephnes, 1999).

4 MACROECONOMIC CONSEQUENCES OF PROPERTY PRICE BOOMS IN LOW-INTEREST RATE ENVIRONMENT

A marginal factor in the development of real estate prices in Germany has an impact on the Deutsche Bundesbank. The data collected from the real estate index according to bulwiengesa is incorporated, among other things, into the price indices of the Deutsche Bundesbank (bulwiengesa AG, 2022) and thus has an impact on measures taken by this institution. Observed price increases by bulwiengesa AG lead to higher calculations by Deutsche Bundesbank, which also publishes numerous reports on market data, such as the “Indicator system for the German residential real estate market” (Deutsche Bundesbank, 2022). Another marginal factor in the real estate sector is climate neutrality. What is a partial aspect for a property has far-reaching economic significance. For example, the goals of climate neutrality will also require cost-intensive new construction and transformations of existing buildings. As a consequence, this will also lead to far-reaching price increases, which will be further intensified by rising demand (bulwiengesa AG, 2022).

In 2015, falling commodity prices, favorable financing conditions for companies and the weaker external value of the euro were observed. These should support a necessary economic recovery of the European economy (DVFA & IRE|BS, 2015). This situation encourages the financing of real estate and thus boosts Germany’s economic engine. Such a situation has a positive macroeconomic impact. According to Konstantin Kholodilin, even turbulence in the U.S. economy can have an impact on German real estate prices, albeit only indirectly. In this context, weaker growth or a recession in the U.S. can be transmitted to the German economy, which can lead to falling real estate prices (Wittenberg & Kholodilin, 2008). It can therefore be concluded that a positive development of the U.S. economy can have a positive impact on the development of real estate prices and thus also have a macroeconomic impact. An increase in interest rates, on the other hand, would have a negative impact on the development of real estate prices in Germany (Wittenberg & Kholodilin, 2008). In this context, the low-interest rate environment is extraordinarily conducive to the development of real estate prices. Relying further on Kholodilin’s explanations, it can be said that rising real estate prices are strongly conditioned by a rising real disposable per capita income of the population (Wittenberg & Kholodilin, 2008). This means that the population gains in wealth before the prices of real estate have increased. According to Conway, the resulting desire for home ownership and the resulting high level of debt among the population is thereby largely responsible for the outbreak of the 2008 financial crisis (Conway, 2011). According to Conway, the widespread financing of home ownership can lead to major financial difficulties and damage and thus also cause considerable macroeconomic consequences.

The big problem with a real estate boom and a subsequent bursting of the bubble is that it creates more profound problems than a stock market collapse or a crash in the price of other assets (Conway, 2011). If housing prices boom, this promotes an increase in the overall economy and consumer confidence – which should be emphasized at this point as a positive macroeconomic consequence. However, people then often start to be more generous with their money and also borrow more, knowing about the increase in value of their home (Conway, 2011). However, if there is then a crash in property prices, which will happen sooner or later, it can lead to an over-indebtedness trap for property owners, which only becomes a problem if the owner has to sell

the property (Conway, 2011). This subsequently leads to lower housing comfort or high payments to the bank.

Another macroeconomic observation of rising housing prices is part of the basis of the increase. If you take a look at the construction industry, which is continually adding to the housing stock and striving to eliminate housing overhangs, you quickly see significant price increases here as well. In February 2015, construction price components showed increases of +1.0% for shell work, +2.0% for finishing work, +5.0% for insulation and fire protection work, +4.5% for scaffolding work, +4.5% for painting work, and +4.3% for concrete work (Pretzell, 2015). Accordingly, real estate prices are also rising due to higher prices and growth rates in other sectors². In this context, higher prices are generally not detrimental to the country's economic growth. In 2015, the Deutsche Bundesbank already warned that some German markets were showing signs of overheating (Schier & Voigtländer, 2015). This was justified by the fact that the development of prices does not match the demographic development, income development and rent development. Such overheating phenomena could eventually lead to a bubble formation together with the subsequent bursting of the bubble (Kholodilin & Michelsen, 2019). This would cause significant economic damage to property owners and also have far-reaching other economic consequences. Some calculations from 2019 confirm what the Deutsche Bundesbank already warned about in 2015: that overheating has taken place in the German real estate market, and especially in A-locations (Kholodilin & Michelsen, 2019). A speculative bubble can be described as follows: "If the reason that the price is high today is only because investors believe that the selling price will be high tomorrow – when "fundamental" factors do not seem to justify such a price – then a bubble exists" (Stiglitz, 1990). On the other hand, studies show that although there are overheated real estate markets in Germany, the investment behavior is not due to a speculative bubble (Budde & Micheli, 2017). Accordingly, it can also be said that massive real estate price booms do not automatically have to lead to a bubble. What is important here are the fundamental reasons for the price increases. If a bubble nevertheless occurs, this also has a significant impact on companies, as they have more difficult access to capital with which to work due to a lack of collateral (Kholodilin & Michelsen, 2019). Thus, business investment is put on hold for now instead of flowing into the economy.

It should be added at this point that rising asset prices can be characterized as financial accelerators. They allow for higher lending to firms or allow households – if given savings targets are met – to demand more consumer goods (Kholodilin & Michelsen, 2019). If there is a sudden drop in asset prices due to a sharp drop in housing prices, this leads to a drop in demand for investment goods and lower private consumption (Bernanke et al., 1999; Iacoviello, 2005). At this point, however, it should also be added that the development of real estate prices in Germany has been largely supported by the very expansionary global monetary policy (Kholodilin & Michelsen, 2019). Accordingly, low-interest rate environment is in any case also a significant support for a real estate price boom and thus strong asset growth.

However, it should also be mentioned at this point that artificially created demand for real estate was already referred to as the subprime crisis in the aftermath of the 2008/2009 financial crisis and had a significant impact on the problems observed later (Schmidt & Deeken, 2022). The increase in assets brings benefits until speculative exaggerations occur and the asset value collapses. Loose monetary policy can bring with it great risks, despite the fact that it also brings with it many opportunities. When assessing macroeconomic risks in a low-interest rate

² It should be added at this point that these values explicitly refer to Berlin. In other regions of Germany, these values may vary, but the basic situation is likely to be similar in the various regions and is therefore useful as a basic assumption.

environment, it is generally important to draw a clear distinction between risks arising from the low-interest rate phase and those resulting from speculative investment behavior.

5 CONCLUSION AND OUTLOOK

If we take another close look at the macroeconomic impact of the real estate price boom in Germany due to a low-interest environment, the result is not exclusively negative. There are some positive aspects associated with real estate price development. Per capita income has been identified by Wittenberg and Kholodilin as a key determinant of price formation (Wittenberg & Kholodilin, 2008). While the low-interest rate environment is also a major factor influencing price developments, other price-setting factors also have a particularly strong impact. To examine macroeconomic consequences of price developments due to low interest rates would thus clearly be too one-dimensional. Even if there were a sudden reversal of the low-interest rate policy, this would only lead to small need for correction, which would, however, have to be much greater if the observations on the German real estate market could be explained by a speculative bubble. Accordingly, the risk of a speculative bubble can be assessed as low (Schier & Voigtländer, 2015), even if the permanent low interest rate policy entails the risk that behavioral patterns could change in the future. In general, the strong increase in real estate prices should be viewed with caution, as their starting point is basically the economic crisis from 2008 (Kholodilin & Michelsen, 2019). In their recent work, Schmidt and Deeken once again highlighted the subprimes crisis as a major driver of the problems before the outbreak of the financial crisis in 2008/2009. Here, demand for real estate was artificially boosted by cheap loans (Schmidt & Deeken, 2022), similar to the low-interest policy in Germany.

Furthermore, it should generally be noted that a low-interest phase favors sharply rising real estate prices. The favorable financing conditions lead to higher demand, which in turn leads to higher supply prices. This must be taken into account on a sustained basis in order to avoid a situation like that of Lehman Brothers in 2008. The low-interest rate situation enables many borrowers to obtain the necessary credit. In particular, it is an attractive business area for banks to generate profits themselves. However, the “reckless” granting of loans can become very dangerous if defaulting borrowers can no longer service their liabilities. Real estate owners did not bear any risks in existing crisis situations and could easily hand over their houses to the banks if there were difficulties in servicing the loan installments (Kholodilin & Michelsen, 2019). If a crisis nevertheless occurs, as in 2008/2009 – which also originated in the real estate sector – this also has significant consequences for companies. As a result, access to new capital would also become more difficult for companies, which would also postpone their investments due to the considerable uncertainties (Kholodilin & Michelsen, 2019).

At this point, however, it should also be added that real estate price development in Germany has been significantly supported by a globally very expansionary monetary policy (Kholodilin & Michelsen, 2019). Accordingly, a low-interest rate environment is in any case also a significant support for a real estate price boom and thus strong wealth growth of the population and the country. However, it is also important to distinguish which risks arise from the low-interest rate phase and which are due to speculative investment behavior. It is also important for regulators to identify price bubbles at an early stage. Evaluations of price-rent ratios can be valuable for this purpose, but an intensive examination of loose monetary policy may also be necessary (Kholodilin & Michelsen, 2019). Price increases could be problematic in this context, as recent years have shown that real estate prices are rising faster than the disposable income

of the population (Kholodilin & Michelsen, 2020). The chart below is intended to illustrate this development once again:



Fig. 3: Ratio of Real Estate Prices to Income in International Comparisons.

Source: Kholodilin & Michelsen (2020).

Translation: Deutschland = Germany; Spanien = Spain; Großbritannien = United Kingdom. The index figures are in percent and the value from 2015 equals 100.

Accordingly, interest rates for real estate financing can play a decisive role in the formation of speculative bubbles. However, this view is not universally accepted in research. Kuttner (2014) disputes the allegedly decisive role that interest rates play in the development of speculative bubbles according to other studies. There are numerous other factors that can have a positive influence on the formation of a housing price bubble. To relate the resulting macroeconomic consequences only to the interest rate level is definitely too one-dimensional in its consideration. The research conducted by Kholodilin and Michelsen in 2019 cited a number of points that can also have a strong influence on the emergence of a price bubble:

- A one percentage point higher GDP growth rate increases the probability of a speculative bubble occurring by about six percent (Kholodilin & Michelsen, 2019).
- This is also true if lending doubles as a share of GDP. In this case, the bubble probability would increase by about 28 percentage points, or even by about 47.5 percentage points in the case of mortgage lending (Kholodilin & Michelsen, 2019).

The above illustrations once again show that the interest rate is not everything when examining macroeconomic risks of rising real estate prices. Moreover, an increase in the real estate interest rate by just one percentage point leads to a reduction in the bubble probability of about three percent (Kholodilin & Michelsen, 2019). Thus, if one merely makes a small adjustment to the interest rate, this already has even very positive effects on potential speculative bubbles. Moreover, the results of Schier and Voigtländer from 2015 show that in many counties in Germany, living in property is significantly cheaper than renting (Schier & Voigtländer, 2015). Finding a comparable rental apartment involves significant additional costs in most counties in Germany, and this is despite the fact that such sharp price increases have been observed. In 2014, for example, it was cheaper to live on rent in only a handful of counties (Schier & Voigtländer). This can also be explained by the low-interest rate situation. However, the situation hardly changes if the interest rate level rises again. Even in this case, owner-occupied

housing will remain more affordable in most counties in Germany. In most of the metropolitan areas discussed, interest rates would have to rise considerably for renting to become more attractive again than owner-occupied housing.

In conclusion, given the observed development, a price correction will arrive if a strong interest rate turnaround is realized. This development may hit some property owners financially hard, who may have financed properties that they would not have been able to pay for under different financing circumstances. However, the price corrections will not occur until there are significant interest rate increases. In most metropolitan areas, these would have to exceed to 4% (Schier & Voigtländer, 2015). In this context, credit behavior in Germany is very moderate compared to Spain or Ireland and offers no reason for concern (Schier & Voigtländer, 2015). Referring once again to Stiglitz (1990) and his definition of a speculative bubble, one should not worry significantly about a renewed real estate price bubble in Germany. Nevertheless, the real estate market is driven by expectations and developments should continue to be examined continuously and carefully. This is because speculative bubbles can arise even on the basis of originally fundamentally justified price movements if expectations become irrationally optimistic (Shiller, 2005). In this context, the German market continues to be considered a safe haven for foreign real estate investors (DVFA & IRE|BS, 2015).

For a more detailed scientific analysis of this topic, however, it is essential to focus on a variety of price-forming factors and not only on the interest rate level. The preceding remarks have made it clear that there are numerous relevant factors that are important for a more detailed examination of the macroeconomic risks of real estate price booms. In addition, the latest publications in this subject area should also be taken into account even more widely. Due to a lack of access rights, not all works could be sufficiently considered in advance.

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CV – Felix Florian Balz

Felix Florian Balz has been enrolled as a PhD student at VSFS Prague in the Finance Department since September 2021. This is preceded by a Master's degree in Entrepreneurship and Management (M.Sc.) and a Bachelor's degree in Sports Management. In addition to this, intensive studies in Real Estate Asset Management were completed at the IRE|BS Real Estate Academy from spring 2021 to summer 2021. The focus on the dissertation is on the linking of the finance sector with the real estate sector. In particular, risks related to a low interest rate policy are analyzed. The interest in this topic arose from the company founded in 2020, which specializes in technology-driven real estate services in the German real estate market. Felix Balz is a co-founder and partner in this company, where he is responsible for the areas of real estate analysis and distribution. The knowledge gained in research is regularly applied in various business activities and expands the company's expertise.

Impact on Commercial Banks' Credit Risks caused by ECB's Negative Interest Rate Policy

Tobias Bücher

Abstract

ECB's negative interest rate policy leads to more and more higher risks in banks. The hypothesis is, that ECB's negative interest rate policy leads to significantly higher credit risks. The article researches the effects on credit risk indicators and the indeed risk development in banks. The author extends the analyzes carried out by other authors with his own data evaluation. External studies relate almost exclusively to macroeconomic data. The author researches one step deeper. For this purpose, raw data from all european commercial banks are analyzed. Therefore a correlation analysis between the 'deposit facility' and the respective characteristic was tested. This serves to check whether a change in the variable is causally related to the drop in the deposit facility. In addition, in individual cases a quadratic regression analysis supple the correlation analysis. This was useful in cases where lowering the deposit facility initially led to significant changes in the trait, but active management normalized it again.

Direct effects on commercial banks credit risks can be proven by authors quantitative research.

Key words

Banks Risks, Credit Risk, Financial Risk and Risk Management, Negative Interest Rate Policy

JEL classification

F34, G17, G32

1 Introduction

ECBs primary goal is price stability in the euro area. To this end, a number of monetary policy measures are carried out, which have a direct influence on market interest rates and indirect influence on the banks' investment and lending rates. In 2014, a negative interest rate was charged for the first time on the deposit facility. So far, there have never been negative interest rates in either the euro area or any of the member states. Therefore, historical or empirical knowledge is also lacking. The european economy becomes more and more dependent on cheap money. Commercial banks eased up their guidelines for customer loans, to counteract downcreasing profits. This could have an impact on banks main risk types. This article focuses on credit risk, cause negative interest rate policy leads to the fact, that commercial banks change their credit risk policy in times of downcreasing profits. The aim of the contribution is to evaluate, if ECB's negative interest rate policy (NIRP) leads significantly to increasing credit risks in commercial banks. The article focuses on the microeconomic view, focused on the raw data of commercial banks in Europe. The author examines these for significant causal negative associations with the NIRP.

The structure of the investigation is as follows:

First, in Chapter 2.2, an overview of the current state of research is given.

Chapter 3 Research then describes the aim of the investigation and the type of testing for the connection between credit risks and NIRP.

Chapter 4 describes the results. For this purpose, the author tests individual characteristics of the balance sheet for their connection with the NIRP in the subsections of section 4.1. In Chapter 4.2, the author evaluates the strength of the relationship between the characteristics of the individual characteristics.

In Chapter 5, the final conclusion is drawn from the results and limitations and further investigation approaches are shown.

2 Theoretical Background

2.1 Credit Risk

The term credit risk is understood to mean the negative consequences of defaults or the non-fulfilment of concluded contracts in the lending business due to a deterioration in the creditworthiness of the counterparty. The credit risk category can be broken down into counterparty, investment, securitization and concentration risk. In addition, there is another type of credit risk: residual risk from the use of credit risk mitigation techniques. With this type of credit risk, the risk is not to be seen in a change in the creditworthiness of the counterparty, but in an insufficient possibility of realizing the collateral received. This may be because the legal mechanism by which the security was pledged or transferred does not ensure that the bank has the right to liquidate or take possession of the security. Another possibility is that, contrary to expectations, the security proves to be of no value. (van Greuning & Brajovic Bratanovic, 2020) (Schierenbeck, et al., 2014) (Oesterreichische Nationalbank (OeNB), 2006)

2.2 Literature Review

To date, there has been no relevant published raw data research into the relationship between NIRP and commercial bank credit risk. However, there are fundamental, mainly macroeconomically focused, articles that deal with the phenomenon. These contents are briefly presented here.

The NIRP has brought about significant changes. These have macroeconomic effects, as well as microeconomic effects on commercial banks. The main macroeconomic effect is, that the NIRP ensures increasing liquidity in the market. This in turn stimulates the economy. The growth generated increases investments. In combination with the persistently low lending rates, this in turn leads to a significant increase in demand in the credit sector, equally for consumer loans, mortgage loans and corporate loans. (Giannone, et al., 2019) (Gros & Shamsfakhr, 2021) The measures are aimed at maintaining a stable inflation rate of 2%.

Further, the NIRP has an impact on bank balance sheets. The biggest influence is noticeable with the loans. The effects depend on the type of bank and the market environment. In general, the NIRP increases the demand for credit. A possible change in the value of the loan depends on whether variable or fixed interest rates are more common in the business environment. With fixed interest, the real value of the receivables from customers increases. There is no accounting impact in the case of variable interest rates. However, the resulting yields decrease with increasing time in the NIRP phase. (Eggertson & et. Al., 2019) (Gros & Shamsfakhr, 2021)

Another factor significantly influenced by the NIRP are the customers' deposits. The net worth of deposits is growing. The deposit interest rate decreases with the NIRP, the lower limit was for a long time the zero interest rate line. Meanwhile, however, depositors were increasingly

being asked to pay negative interest in order to compensate for the disadvantage of refinancing compared to the interbank market. (Eggertson & et. Al., 2019)

In the case of funding, the issuance of own bonds increases significantly below NIRP. This is certainly due to the increased demand for credit, which wants to be refinanced cheaply. (Lopez & et. Al., 2018) (Demiralp, Eisenschmidt, & Vlassopoulos, 2017)

Ultimately, this also affects the p/l statement. Overall, the effects can be seen most clearly in the net interest rate margin (NIM) (Lopez & et. Al., 2018). This is the difference between interest income and interest expense in relation to the sum of all interest-bearing assets. Since the stronger effects of changes in interest rates at times of negative interest rates could be attributed to an effective zero interest rate limit for financing costs, especially for customer deposits, the NIM is broken down into its components, the lending rate and the deposit rate (Klein, 2020). The assumption that a decrease in the interest rate level significantly above the zero interest line would make no difference compared to near or below the zero interest line is wrong. A decrease in the short-term rate from 3% to 2% means a decrease in the NIM by approx. 1%. A decrease in the short-term rate from 1% to 0%, on the other hand, means a decrease in the NIM by approx. 3.3%. The “low-for-long” interest rate level means that the NIM will melt away (Klein, 2020).

The longer the phase of low interest rates lasts, the more serious the effects on banks' margins over time (Claessens & et al., 2018). Banks that are more than 75% refinanced through customer deposits are particularly affected. Here the margins are particularly strong in the NIRP phase. (Lopez & et. Al., 2018). The usual reaction of the banks is therefore to reduce the interest rates on deposits much more than that on loans. The difference is around a factor of 2. (Klein, 2020)

The flattening of the yield curve causes the banks to lose profitability. The difference between long-term and short-term rates is decreasing. This makes maturity transformation less profitable. The result is lower margins for the banks. (Illing, 2018) The negative interest rate policy limits maturity transformation even further. (Bouchinha & Burlon, 2020) If the banks achieve clearly positive results from the maturity transformation in “normal” times, these become negative as soon as the short-term rate approaches the zero interest rate line. The effect is so strong that about 1% of the margin is lost. The effects are even more serious if the short-term rate breaks below the zero interest rate line. Then the effect increases again by around 10% compared to the previous scenario. This means that the zero lower bound for deposit rates plays a crucial role in measuring the effects of the NIRP on banks. (Klein, 2020)

3 Research

3.1 Objective

The research examines whether this increasing willingness to take risks is also associated with higher credit risks for banks. The focus of the consideration in this section is on banking microeconomic factors. The author assumes that balance sheet attributes are crucial factors. This article examines how the change of those factors affect banks' credit risks. Then the author looks at the developments of these factors during the time period of the ECB's negative interest rate policy (June 2013 – June 2021) and derives how the credit risks have consequently changed over time.

The following hypothesis can be derived from this: ECB's NIRP leads significantly to increasing credit risks for commercial banks in supervisory risk evaluation.

The research is carried out by a quantitative research.

3.2 Methodology and Data

The article assesses the effects of the NIRP on credit risk from a microeconomic perspective on the banking sector. This is done by analyzing data sets provided by the ECB. All freely accessible data sets were evaluated and compared with the independent variable 'deposit facility' in a time series. A correlation was always checked first. Depending on the usefulness, the test was extended to the quadratic relationship.

A correlation describes the relationship between the 'deposit facility' and the respective characteristic that was tested for. This serves to check whether a change in the variable is causally related to the drop in the deposit facility.

Quadratic regression is a statistical technique for finding the equation of a parabola. Here, too, a connection between the deposit facility and another feature is tested. This was useful in cases where lowering the deposit facility initially led to significant changes in the trait, but active management normalized it again. The decision to check for a quadratic relationship was made based on the author's expertise.

4 Results and Discussion

4.1 Results of Quantitative Research

4.1.1 Evaluation Category Asset Quality

The first major evaluation category is asset quality. In this article, this is assessed using three key figures: loan-loss-provision-ratio, forbore exposures and NPL ratio.

		deposit_facility	loan_loss_prov_ratio	foreborne_xposures	NPL_ratio
deposit_facility	pearson correlation	1	-,775**	,796**	,886**
	2-sid. conf. interval		<,001	<,001	<,001
	N	30	30	29	30

** The correlation is significant at the 0.01 (2-tailed) level.

Loan-loss-provision-ratio

Designation for measures of (passive) risk management that serve to anticipate (accounting/accounting) the possible occurrence of risks (through risk premiums or value corrections). Used on the bank balance sheet for the process or the result of the formation of contingency reserves for general banking risks and contingency reserves for credit institution default risks.

If the theory of increasing credit risk over NIRP time is correct, then the loan-loss-provision-ratio must be steadily increasing. The value of -0.075, with a significance level of less than 0.1%, clearly shows that there is a negative causal relationship between the decrease in the deposit facility and the loan-loss-provision-ratio. This means that banks will have to do more risk provisioning as the NIRP progresses over time. This can be attributed to the fact that, as described above in the macroeconomic analyses, more and more loans were issued with weaker credit ratings and/or with lower interest rate premiums. So credit risk seems to be rising.

Forborne exposures

Forborne exposures describe loans, that have been deferred by the bank at the customer's request.

Here is the assumption that the key figure would have to increase over the course of the NIRP as well. The correlation test clearly shows that, with a value of 0.796 and a significance level below 0.1%, there is a causal relationship between deposit facility and forborne exposures. This is also evidence of increasing credit risks.

NPL ratio

The NPL ratio is the non-performing loan ratio obtained by dividing the gross carrying amount of non-performing loans and advances by the gross carrying amount of total loans and advances.

The third and final correlation test on the banks' asset quality data would suggest an increase in the NPL ratio with an increasingly negative deposit facility rate. The correlation value of 0.886 also shows a strong connection between the characteristics at a significance level of less than 0.1%. The increasingly negative deposit facility rate is therefore causally responsible for an increase in the NPL ratio. This is also a consequence of increasing lending to weaker credit ratings. The result is somewhat surprising in that these poor credit ratings were able to obtain liquidity at increasingly cheaper rates during the NIRP phase. Apparently, however, the economic difficulties of the borrowers grew faster than the refinancing options became cheaper.

4.1.2 Evaluation Category Credit Indicators

The next larger evaluation category are the bank credit indicators. Here, the characteristics credit to households and credit to other financial institutions are tested. If there is a causal relationship between NIRP (or deposit facility) and bank credit indicators, one can assume that lending increases over time. Due to the increasingly lower income, lending had to be expanded overall in order to support the banks' profitability.

		deposit_facility	credit_to_HH	credit_to_OFI
deposit_facility	pearson correlation	1	-.688**	.900**
	2-sid. conf. interval		<,001	<,001
N		46	46	46

** The correlation is significant at the 0.01 (2-tailed) level.

Credit to HH

The figure credit to HH is the sum of loans granted to private households.

The value increases continuously over the course of the NIRP. The test for correlation with the deposit facility is clearly significant. There is a negative correlation with the value -0.688. With increasingly negative deposit facilities, larger and larger volumes of loans were granted to private households.

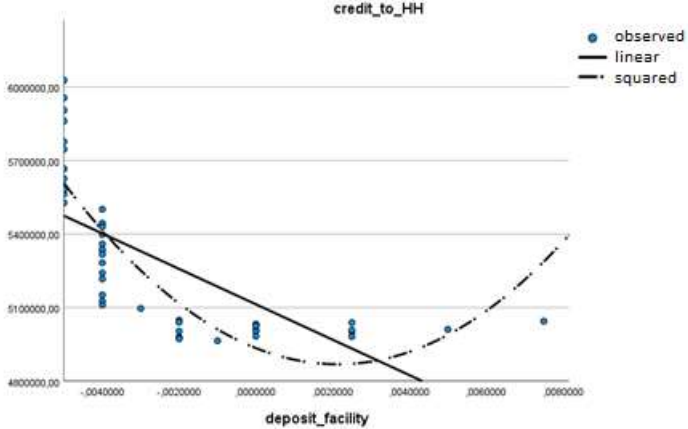
The steadily declining profitability of commercial banks as a result of the NIRP led to increasing liquidity, which the banks were then supposed to bring back onto the market through increasing lending to customers or through the purchase of bonds. The correlation supports this observation. In theory, as the NIRP continued, loans were increasingly given to poorer credit

ratings. This would mean an additional increase towards the end of the NIRP. This can be checked with a quadratic regression. So it should be a parabola.

R	R-squared	adjusted squared	R-	standard error of the estimator
,858	,736	,724		165000,381

The independent variable is deposit_facility.

The quadratic regression also shows a dependency of the variables credit to HH and deposit facility. In particular, with the drop in the deposit facility to -0.4%, lending increased significantly.



Credit to OFI

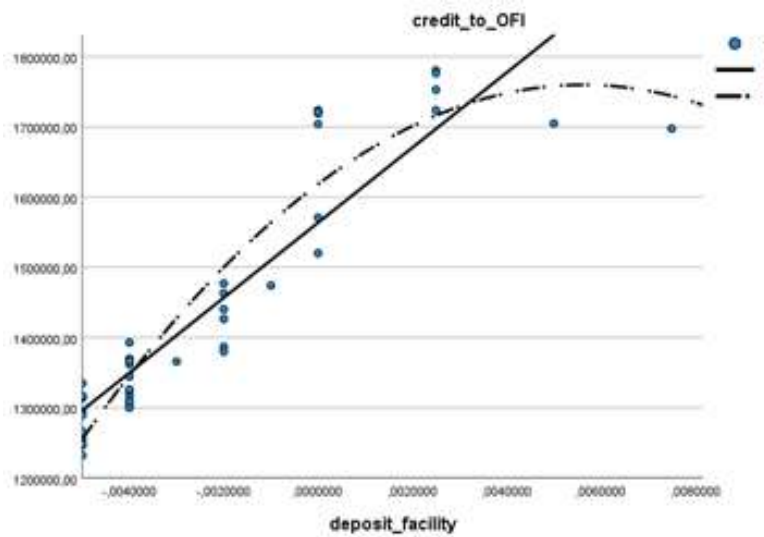
The metric credit to OFI means the sum of loans granted to central banks, corporate banks, insurance companies, etc.

The result for the OFIs is even clearer into the opposite way. With a value of 0.900, there is a very strong correlation between the deposit facility and lending to OFIs. This means that when the deposit facility rate drops, the credit to OFI drops very sharply. This is in contrast to the credit to HH. For the further, more precise, interpretation, the quadratic relationship is first examined.

The quadratic regression test shows a result of 0.882. This also shows a very strong correlation between the characteristics credit to OFI and deposit facility. Beyond the purely linear relationship, there is a delay in the effect of the interest rate being lowered into negative territory. While lending to OFI initially increased slightly, despite the reduction in the deposit facility, there was a disproportionate decrease when it entered negative territory. The reason is that the majority of financial institutions were able to refinance themselves more cheaply on the capital market than on the interbank market.

R	R-squared	adjusted squared	R-	standard error of the estimator
,942	,887	,882		61112,396

The independent variable is deposit facility.



4.1.3 Evaluation Category Banking Structure

The third test variable relates to the banking structure. Here, the characteristics number of banks and total assets were tested. If there should be a connection between the deposit facility and the characteristics mentioned, the number of banks would have to shrink because the cost pressure is becoming too high. The development of the total assets is questionable, possibly due to the increasing lending, a balance sheet extension and thus an increase in the total assets can be observed.

		deposit_facility	number_of_banks	total_assets
deposit_facility	pearson correlation	1	,889**	-,594**
	2-sid. conf. interval		<,001	<,001
	N	30	30	30

** The correlation is significant at the 0.01 (2-tailed) level.

Number of banks

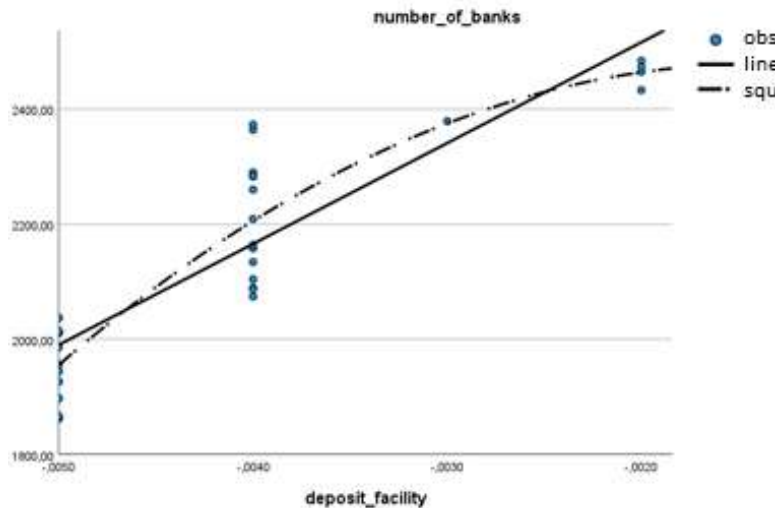
The number of banks shows the pure number of institutes.

At 0.889, the value of the correlation test shows a strong connection. This means that the number of banks decreases as the NIRP increases. There is therefore a linear relationship, which is probably due to the fact that the cost pressure on banks is increasing. As a result, there are mergers that promise cost effects through economies of scale and economies of scope.

In addition to the linear relationship, the question arises as to whether there was a delayed effect here after the banks realized that the NIRP lasted longer. Therefore, the quadratic relationship was also checked here. Although there is a strong quadratic relationship, the parabola is very flat. We can therefore rather speak of a continuous, linear reduction here.

R	R-squared	adjusted squared	R-	standard error of the estimator
,913	,834	,822		81,575

The independent variable is deposit_facility.



Total assets

The total assets show the sum of total assets of Euro-area-banks. The number corresponds to balance sheet total.

The value of the correlation between total assets and deposit facility shows a linear connection at -0.594, but this is considerably weaker than all previous measurement results. The lowering of the deposit facility leads to an increase in assets. This is due to the massive liquidity.

Here, too, the quadratic relationship is checked. At 0.330, this shows no significant value.

R	R-squared	adjusted squared	R-	standard error of the estimator
,594	,353	,330		1317085144,734

The independent variable is deposit_facility.

4.1.4 Evaluation Category Credit Exposure

The fourth major evaluation block is the credit exposure. This is the data that shows what proportion of lending is actually at risk. Here the characteristics debt securities, loans and advances - collateralized by immovable property, and advances - other collateralized loans, exposures in default, exposures secured by mortgages on immovable property, plus of which SMEs positions, exposures to Corporates and SMEs and exposures to Retail, plus of which SMEs positions tested.

		deposit_facility	debt_securities	loans_collateralized_immovable_prop	loans_other_collateralized
deposit_facility	pearson correlation	1	.066	-.772*	-.700*
	2-sid. conf. interval		.729	<.001	<.001
	N	30	30	30	30

*The correlation is significant at the 0.05 (2-tailed) level.

** The correlation is significant at the 0.01 (2-tailed) level.

Debt securities

Those means security, for which the investor usually receives interest. With a debenture, the investor cedes a specified amount to the issuer of the debenture for a period of time. Buying such bond, means to provide the issuer a long-term loan.

There is no evidence of a Pearson correlation here. That means there is no linear relationship. The drop in the deposit facility will not result in a significant increase or decrease in debt securities. However, the 2-tailed significance test shows a directional relationship. The amount of debt securities held by banks increases over the course of the NIRP. However, a causal relationship cannot be proven.

Loans and advances - collateralized by immovable property

This key figure means the sum of loans, granted by Euro-area-banks collateralized by immovable property.

With a value of -0.772, there is a strong negative relationship between the features deposit facility and loans and advances - collateralized by immovable property. The lowering of the deposit facility led to an increase in lending, as already described more often. This is also reflected in loans secured by immovable property, i.e. real estate. A significant increase can be observed in Germany in particular.

Loans and advances - other collateralized loans

This figure means the sum of loans, granted by Euro-area-banks collateralized by other property.

Here, as well, a connection with the deposit facility rate can be established. At -0.700, this is also relatively strong. Here, too, the general lending policy of the banks in the phase of the NIRP is the driver for the expansion.

		deposit_facility	exposures_in_default	exposures_on_immovable_property	exposures_to_corporates	exposures_to_retail
deposit_facility	pearson correlation	1	-.365	-.344	.605	-.504
	2-sid. conf. interval		.199	.229	.065	.066
	N	14	14	14	14	14

** The correlation is significant at the 0.01 (2-tailed) level.

Exposures in default

The exposures in default are the open risk positions of financial instruments, which are in default.

According to the theory of increasing lending to weaker credit ratings at low interest rates, there should actually be a significant increase in loan defaults during the NIRP period. However, the macroeconomic data analyzes of this article have not been able to establish a causal relationship. And the analysis of the banks' microeconomic data also shows manageable results here. With -0.365 there is a connection with the deposit facility. However, the level of significance is not sufficient due to the small sample. In addition, the connection is not particularly pronounced compared to the previous connections. This confirms the macroeconomic analysis. However, it should be noted that borrowers were also increasingly able to refinance themselves more cheaply. The repayment of the loans was always cheaper, the debt service was relieved. We shall see whether the current economic developments lead to higher loan defaults and whether the banks' offensive lending policy takes revenge. The current numbers and harbingers at least suggest that there are some problems for the banks.

Exposures secured by mortgages on immovable property, plus of which SMEs positions

This figure means the open risk positions of financial instruments, secured by mortgages. There are no further assessable collateral, but market value of houses should possibly cover exposures partially

Here, too, the value -0.344 shows a connection, which, however, cannot be confirmed by the level of significance. However, a look at the raw data shows an increase. With more lending, the value of the exposures must almost inevitably increase. As a result, the number of loans that are secured, but the collateral is not sufficient to fully cover the loan, also increases. Here, too, more and more (risky) loans were granted.

Exposures to Corporates and SMEs

The exposures to Corporates and SMEs are open risk positions of financial instruments, provided to Corporates.

With a value of 0.505 , there is a clear connection here. However, the level of significance is not sufficient due to insufficient data. However, a look at the raw data shows an increase.

Exposures to Retail, plus of which SMEs positions

This means the open risk positions of financial instruments, provided to households and SMEs.

In exposures to retail the level of significance is not sufficient as well. Nevertheless, the raw data show an increase in exposures in retail. The reasoning is the same as for the two previous evaluation categories: With more lending, the exposures in the individual risk categories also increase.

A real increase in actual risks cannot be demonstrated in the category of credit exposures. This is in line with the macroeconomic data. Significantly more loans were granted and these were also granted more offensively with more risks. However, an increase in credit risks cannot be proven. The increasing diversification and the improvement of the existing business over time due to improving ratings mean that initially more risky lending becomes increasingly profitable

over the course of the NIRP. However, this can still take revenge in a changing economic (interest rate) environment.

4.1.5 Evaluation Category Debt and Credit

The next larger evaluation category is called debt and credit. Data is available here for the characteristics credit to households, credit to private sector and credit to non-financial-corporates. The credit to households feature has been previously tested and described. There is a clear connection here with the deposit facility. The other two characteristics are now being interpreted for the first time.

		deposit_facility	credit_to_HH	credit_to_private_sector	credit_to_nonfinancialcorp
deposit_facility	pearson correlation	1	-.702**	-.899**	-.899**
	2-sid. conf. interval		<.001	<.001	<.001
	N	49	49	49	49

Credit to private sector

This figure means the sum of loans granted to private sector. The characteristic expression is significant. With a value of -0.899, there is a very strong linear relationship between deposit facility rate and credit to private sector. This means that lending to individuals increased significantly as the deposit facility rate increased. This has already been described many times. The connection is now proven to be causal.

Credit to non-financial-corporates

This describes the sum of loans granted to non-financial-corporates. There is also a very strong causal relationship for loans to non-financial corporates at -0.899. This is identical to the credit to private sector and the justification is also identical. Due to the increasing pressure on profitability, more and more loans were granted by the banks.

4.1.6 Evaluation Category Domestic Exposures

The following evaluation category has only one characteristic that was supplied with data: It is the domestic exposures with the characteristic exposures in foreign currency. This means the open risk positions of financial instruments in foreign currency.

		deposit_facility	exposures_in_foreign_currency
deposit_facility	pearson correlation	1	.896**
	2-sid. conf. interval		<.001
	N	49	49

There is a significant, very strong positive connection between the exposures in foreign currency and the deposit facility. This means that lending in foreign currencies has fallen

sharply. The background is two-sided. On the one hand, foreign borrowers have received fewer and fewer loans. On the other hand, borrowers within Europe have also taken out fewer foreign currency loans.

4.2 Summary and Overview of Quantitative Credit Risk Analysis

The results of the quantitative analysis of credit risks are summarized and evaluated below in a table. The following interpretation matrices are used for this.

The usual interpretation of the strength of the correlation is:

- 0 = no linear relationship
- 0.3 = weakly positive linear relationship
- 0.5 = moderate positive linear correlation
- 0.8 = strong positive linear correlation
- 0.3 = slightly negative linear correlation
- 0.5 = moderate negative linear correlation
- 0.8 = strong negative linear correlation

Since there are often connections between the deposit facility as a measure of the NIRP and the individual dependent variables, the author has adjusted the usual scaling as follows:

n.s.= test is not significant

between -0.5 and 0.5 = no linear relationship 0

Positive Correlation: The higher, or the less negative, the deposit facility, the higher the dependent attribute.

- >0.5 = medium intense linear correlation +
- >0.7 = strong positive linear correlation ++
- >0.9 = very strong positive linear correlation +++

Negative Correlation: The lower, or rather the more negative, the deposit facility, the higher the dependent attribute.

- <-0.5 = medium intense linear correlation -
- <-0.7 = strong negative linear correlation --
- <-0.9 = very strong negative linear correlation ---

In case of Squared Correlation the scaling is as follows:

n.s.= test is not significant

- between -0.5 and 0.5= no relevant squared relationship 0
- >0.5 = medium intense squared correlation +
- >0.7 = strong positive squared correlation ++
- >0.9 = very strong positive squared correlation +++

Evaluation category	attribute	Linear correlation	Squared correlation
Asset Quality	Loan-loss-provision-ratio	--	
	Forborne exposures	++	
	NPL ratio	++	
Bank Credit Indicators	Credit to HH	-	++
	Credit to OFI	+++	++
Banking Structure	Number of banks	++	++
	Total assets	-	
Credit Exposure	Debt securities	n.s.	
	Loans and advances - collateralized by immovable property	--	
	Loans and advances - other collateralized loans	--	
	Exposures in default	n.s.	
	Exposures secured by mortgages on immovable property, plus of which SMEs positions	n.s.	
	Exposures to Corporates and SMEs	n.s.	
	Exposures to Retail, plus of which SMEs positions	n.s.	
Debt and Credit	Credit to private sector	---	
	Credit to non-financial-corporates	---	
Domestic Exposures	exposures in foreign currency	++	

Increasing credit risks can be seen in various areas. Particularly noteworthy is the asset quality of the banks, which suffers as the NIRP increases.

There is evidence that lending has also increased significantly in relation to the NIRP. As a result, significantly more risks were demonstrably taken on in the credit exposures. In this context it is interesting that the NPL ratio increases significantly in relation to the NIRP. Credit risks are thus demonstrably built up.

In summary, the following results stand out:

- Banks took on significant additional risks during the NIRP, but these have not materialized yet. However, the risk is latently threatening in the event of a rapid rise in interest rates.
- The effect occurred with a delay if you look at the quadratic relationships and in particular the development of the CIR. At the start of the NIRP, banks initially bolstered profitability by cutting costs. When there was no more potential here, returns were supported by massive further lending and maturity transformation. This leads to the third finding that is particularly noteworthy.
- The banks were causally forced to increase maturity transformation disproportionately as a result of the reduced profitability. This leads to increasing liquidity risks.

5 Conclusion

The hypothesis, of whether ECB's NIRP leads significantly to increasing credit risks for commercial banks in supervisory risk evaluation, can be accepted for the microeconomic view of credit risks. Of course, an increase in risk cannot be demonstrated in all risk categories. In some, however, it is so significant, that the research question can be answered with “ ECB's NIRP affect the banks' credit risks casually”.

The study is limited by the fact that complete data is not available for all areas of interest in the area of credit risk. You have to work with the available raw data. However, these provide sufficient information to describe a binding statement regarding the connection between credit risks and NIRP.

Another limitation is that no differences between the countries of the euro area can be identified. A differentiated data situation could reveal differences between individual countries or regions (e.g. northern and southern states). Here, too, access to the raw data is unfortunately limited.

Further research into the area of credit risk in times of NIRP could relate to p/l statement indicators, as well as key figures like leverage ratio or loan-to-deposit-ratio. The author will carry out these investigations as part of a comprehensive analysis in his PhD thesis.

It would also be interesting to see whether the credit risks are put into perspective again in the current phase of rising interest rates.

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Macroeconomic development of tax revenues in Germany

Matthias Buschhaus

Abstract

This paper examines the macroeconomic development of tax revenues in Germany and their relationship to economic growth. In doing so, the developments identified are related to the real economy as well as to tax regulations and changes in German legislation.

In particular, the database of the German Federal Statistical Office and the European database Eurostat are used as a data basis. With regard to the tax classification, the study draws on highly regarded commentaries on individual tax laws in the German tax field as well as on encyclopaedias on tax law.

As a result, it is found that a slump in economic growth as well as in tax revenues is discernible, especially in 2009 and 2020. In addition to known causes such as the financial crisis and the Covid-19 pandemic, this can also be attributed to certain tax reforms and legislation.

With regard to the reformed taxation for German partnerships, which will apply from January 1, 2022 and can optionally be exercised by qualified partnerships, no macroeconomic effects can be identified on the basis of the current economic indicators.

Keywords

Taxes, GDP, Tax revenue, Germany, corporation, partnership

JEL Classification

E62, H21, H61

1 Introduction

The Tax theory is an important factor in the macroeconomic analysis of an economic area. This is illustrated in particular by the structure or subdivision of each economic sector in the national economy. Therefore, a closer look at the macroeconomic effects of tax revenues appears to be particularly informative, so that insights can be gained with regard to the connection to macroeconomic indicators such as gross domestic product ("GDP").

Francois Quesnay's circular flow model - the so-called Tableau Economique - will serve as a basis for this. Within the framework of this circular flow model, the economic area under consideration was divided into three sectors and the individual connections or payment flows were analysed with regard to their effects on the overall economy. A distinction was made between three economic classes, which were subdivided into farmers and tenants, craftsmen and traders, and landowners (Mikroökonomie, Prof. Dr. Jörg Beutel, 2006, 1.2.1 Francois Quesnay, p. 13).

Admittedly, the economic classes mentioned can no longer be fully transferred to today's macroeconomic counterparts. Nonetheless, the system of exchanging the respective economic sectors of the circular flow model serves as a basis for classification and for understanding macroeconomic interdependencies. In particular, private households, companies, asset formation, the state (public budgets) and foreign countries are currently considered the most important economic sectors in the current circular flow model. Consequently, several economic

sectors are affected with regard to the link between tax revenue and GDP. Nevertheless, the "state (public budgets)" can be emphasised in particular, as taxes represent one of the highest sources of income for the state, which is consequently reinvested in the purchase of goods and services to improve prosperity and infrastructure (Makroökonomie, Geld und Währung, Prof. Dr. Lothar Wildmann, 2010, 2.2.2.3 Der Staat – Aufgaben und Ausgaben, p. 21).

However, taxes and the associated increases respectively decreases also have an impact on the consumption and wealth of the respective households. This includes both private households and companies. Insofar as certain consumption-oriented transactions are made less favourable by taxation, this inhibits consumption expenditure, which in turn leads to less wealth and thus to a reduced GDP (Finanzpolitik und Unternehmensentscheidungen, Bengt-Arne Wickström, 2010, 2. Das Vermeiden von Anreizen zu Einkommensumschichtungen und von Klienteleffekten sowie die Realisierung von Finanzierungs- und Gewinnverwendungsneutralität, p. 136).

In addition, indirect taxes (e.g., value added tax) should also be considered as part of GDP. Since indirect taxes are directly linked to the consumption of the respective economic sector, they are therefore included in the taxes on production and imports. This also illustrates the factor that tax revenue has in relation to GDP (Gesamtwirtschaftliche Steuer- und Abgabenbelastung nicht übermäßig hoch, Stefan Bach, 2013, p. 5).

The German economy is based in particular on small and medium-sized companies, which are often managed in the form of partnerships and corporations. Based on these links between GDP and tax revenue, the following section will provide insights into the macroeconomic effects of the taxation differences between corporations and partnerships. In doing so, the effects on the overall economy of tax revenue will be analysed. In addition, the option for partnerships to be taxed like corporations, which will apply from 1 January 2022, will be examined. In particular, data from the German data collection of the Federal Statistical Office "DESTATIS" will serve as a basis for this.

Since tax law in Germany is fundamentally very complicated and characterized by many exceptions, and since the taxation regime between partnerships and corporations differs at its core, the question of how the interplay between state revenues and adequate tax rates for companies has developed in recent years appears to be a difficult one. At first glance, finding a healthy middle ground in the fundamentally opposing views may seem difficult. On the other hand, it is precisely the analysis between a decisive location factor for companies and one of the largest sources of revenue for the treasury that appears to be highly revealing.

Therefore, the following research questions need to be answered within the scope of this analysis:

How can tax revenue in Germany be assessed from a macroeconomic point of view over the last twenty years? Are there any discernible macroeconomic effects of the corporate taxation option for partnerships in Germany that will apply from 1 January 2022?

In order to answer these research questions, the current state of the literature was presented at the outset to enable a literary classification. In particular, it became clear that so far no direct connection has been drawn between macroeconomic developments of the last twenty years and related tax innovations.

In the next chapter, hypotheses were formulated according to the state of knowledge to date in order to answer the above-mentioned research questions. In particular, the corporate law events that have occurred in recent years and also temporal factors were taken into account.

Subsequently, the methodology and the evaluated data were described. In particular, reference was made to data from the empirically recognized data sources of the Federal Statistical Office of the Federal Republic of Germany and the European database Eurostat. In addition, legal commentaries and economic papers on German tax policy were examined in order to put the economic developments into a legal-dogmatic context.

In the following, the data from the above-mentioned data sources are described and put into perspective. In particular, it becomes clear that the years 2009 and 2020 can be classified as significant. In a European comparison, the German development is significantly better than in other European member states. In principle, however, the overall development of GDP is similar.

The next chapter covers the interpretation of the data. In particular, the significant years 2009 and 2020 can be linked to the global economic crisis and the Covid 19 pandemic, respectively. With respect to the developments of the individual tax types and the tax legal bases, the developments of the tax revenues may well be in the context of the 2009 tax reform or the new laws prompted by the pandemic.

The final chapter summarizes the lessons learned as well as provides a definitive answer to the research question.

This paper extends the literature with macroeconomic classification of tax revenues in the context of a comparison of the last two decades. In particular, it highlights the influence of tax revenues on the government, which can further influence this factor through tax reforms. In addition, an initial conclusion is drawn with regard to the option for partnerships that has been in effect since 1 January 2022, which may revolutionize German tax law from the ground up.

2 Theoretical Background

The levy of taxes represents one of the largest expenses of medium-sized companies. Therefore, in addition to the analysis and structuring of individual business transactions, it is always advisable to find in particular the optimal legal form for the respective company purpose.

In this context, taxes affect on the one hand the current budget or the liquidity of each company. On the other hand, they also have an impact in the context of fundamental questions such as the choice of location and precisely that above-mentioned choice of legal form.

In addition, the budget of the individual state also benefits from the tax levies as one of the main sources of revenue, so that from the executive or legislative branch there is also an enormous interest in the legality of the tax assessment and its collection. Thus, the payment of taxes could also be described as a "tribute to civilization," since the state no longer finances itself through war booty, compulsory labor, expropriation or through monopolies, but rather the people of the state contribute to the financing of the state through tax and duty payments (Schober, Beck'scher Onlinekommentar Abgabenordnung, 2023).

In order to ensure an efficient analysis and accurate classification, a definition should first be found of what tax or its fringe benefits are in the first place, what types of taxes there are and how they are to be classified within the framework of tax theory.

In the context of the German fiscal system, taxes according to Section 3 (1) of the German Fiscal Code (AO) are monetary payments that do not represent a consideration for a special service and are imposed by a public-law community to generate revenue for all those who meet the criteria to which the law attaches the obligation to pay. In this context, the generation of revenue may constitute a secondary purpose.

In this context, it should be noted that German tax law was for many years determined in particular by the so-called separation principle for corporations and the so-called transparency principle for partnerships. Under the separation principle, a strict distinction is made between the level of the corporation and the level of the respective shareholder (Teufel, Unternehmenssteuerrecht, § 2 Besteuerung der Kapitalgesellschaft und Ihrer Gesellschafter, 2018).

This means that the taxable income at the level of the corporation is initially subject to taxation irrespective of the person of the respective shareholder. The income of the corporation is subject to a corporation tax rate of 15% plus the solidarity surcharge of 5.5% and trade tax, which depends on the assessment rates of the respective municipality and can also be estimated at around 15%. Furthermore, in the case of any profit distributions by the corporation to its shareholders, additional taxation is levied at the time of inflow. At the level of the shareholder, the profit distribution is generally subject to the final withholding tax rate of 25 % plus the solidarity surcharge of 5.5 %. Nevertheless, certain circumstances may arise under which the profit distribution is subject to the standard tax rate. One could therefore speak of a double taxation of profits at the company or shareholder level. Further characteristics of the separation principle are, in particular, the tax recognition of the service relationship between the company and the shareholder as a separate tax subject in each case, as well as the fundamental prohibition of offsetting profits and losses between the shareholder and the company. Nevertheless, every corporation has the option of retaining profits in order to prevent a distribution and the associated tax burden at the shareholder level (Jacobs & Scheffler & Spengel, Unternehmensbesteuerung und Rechtsform, 2015).

In contrast, the transparency principle applies to the income generated by a partnership. Here, the result of the business year of the partnership as well as the equity capital is literally "transparently" attributed to the partners of the partnership. Thus, with the exception of trade tax, the tax subject is exclusively the partners of the partnership, so that the taxable income generated by the partnership is subject to the standard income tax rate applicable to the respective partner on a pro rata basis (Kahle, Beck'sches Handbuch der Personengesellschaften, § 7 Besteuerung von Personengesellschaften, 2020).

In the first stage, the taxable profit of the partnership is determined separately and uniformly and allocated to the partners on a pro rata basis, while in the second stage the profit of the partnership attributable to the respective partner is offset against other income or potential special expenses, extraordinary expenses and other tax allowances. In addition, so-called special remunerations from the company to the partner as well as further income or expenses incurred by the respective partner in connection with the participation in the partnership are included in the separately and uniformly determined result of the partnership. Special remunerations are, according to the conclusive list in the sense of § 15 (1) sentence 1 number 2 sentence 1 2nd HS EStG, remunerations which the partner receives in the service of the company or for the granting of loans or the transfer of assets. Since the income to be taken into account for tax purposes is taxed at the level of the shareholder at the standard tax rate, it may be subject to a tax rate at the top regardless of whether the profits or losses actually accrue to the shareholder, up to 45% (Grashoff, Aktuelles Steuerrecht, 2012).

Due to the aforementioned complex theoretical differences and their enormous importance for the German treasury, the analysis of the development of tax revenues and the associated economic performance appears highly informative.

3 Literature Review

Due to the above-mentioned interconnection between tax revenue and GDP, various empirical studies exist on the analysis and connection of these economic determinants. In particular, Kalas, Todorovic and Dordevic (Panel estimating effects of macroeconomic determinants on tax revenue level in European Union, 2020) discussed the effects of macroeconomic determinants on the level of tax revenue in the European Union in the years 2006 to 2018. The result of this study was in particular that an average increase in GDP is accompanied by an increase in total tax revenues. Therefore, it was concluded that in order to increase the overall level of taxation, individual Member States should push for a growth in the rate of GDP.

The same findings were also drawn by Andrasic, Kalas, Mirovic, Milenkovic and Pjanic (Econometric modelling of tax impact on economic growth: Panel evidence from OECD countries, 2018) in their empirical evaluation of tax effects on economic growth in 35 OECD countries regarding the period from 1996 to 2016.

In addition, the link between the tax level and GDP was also placed in relation to other macroeconomic structures. For example, Calinovici (Is there any effect on economic growth and human development on fiscal policy implementation, 2021) examined economic growth with regard to government revenue and government expenditure. Calinovici was also able to sum up that the implementation of fiscal policy and thus in particular government and tax revenues have an immense influence, especially on economic growth.

With regard to the Covid 19 pandemic, studies were also carried out on the effects on tax revenues in the European Union. Tibulca (The impact of the COVID-19 pandemic on tax revenues in the EU, 2022) discussed the given data for the years 1995-2019 and created models for the purpose of forecasting tax revenues in the years 2020 to 2022. According to Tibulca, a decline in tax revenues in 2020 and 2021 is to be noted, while a slight recovery can be forecast in 2022.

With regard to the differences in the taxation of corporations and partnerships in Germany, various publications have already been published. Schreiber (International Company Taxation, 2012), for example, has already explained in detail the respective differences between the taxation regimes.

Bakari, Ahmadi and Tiba (The Nexus among Domestic Investment, Taxation, and Economic Growth in Germany: Cointegration and Vector Error Correction Model Analysis, 2020) examined the link between the taxation system in Germany and potential economic growth in even greater detail. However, the authors focused more on the impact of domestic investment taxation on economic growth.

The macroeconomic effects of legislated tax changes in Germany were also analysed by Hayo and Uhl (The macroeconomic effects of legislated tax changes in Germany, 2013). They found a considerable reduction in products, especially when the tax rate was increased.

The legal differences in the taxation of partnerships and corporations were also discussed from a theoretical perspective by Rosengarten, Burmeister and Klein (Mergers and Acquisitions in Germany, 2020), among others. The differences in the taxation regime become clear. Nevertheless, no effects on macroeconomic developments are analysed.

With regard to the new regulation or taxation option for partnerships introduced on 1 January 2022, the main reference with regard to macroeconomic consequences can be made to the explanatory memorandum and the explanatory memorandum of the draft bill of the German Bundestag (German Bundestag, 19th legislative period, printed matter 19/28656, 19.04.2021). In particular, the projected budget expenditures are to be taken into account, which were

basically estimated with a reduction of tax revenues in the amount of EUR 500 million in 2022 and the four following years.

Following on from this, this paper will examine the macroeconomic effects of the taxation regime in Germany over the last twenty years after the end of the first year, as well as an assessment of the effects of the corporate taxation option to date.

4 Hypothesis

Since economic growth as well as the events triggering taxation have been shaped by certain social circumstances such as the global economic crisis or the Covid 19 pandemic in recent years, the hypothesis is put forward at the outset that tax revenue has developed in parallel with economic growth.

With regard to the forms of taxation, the author suggests that the tax revenue from the taxation of partnerships comprises a larger share of the total tax revenue than the tax levies of corporations. This is justified in particular by the lower corporate tax rate in Germany as well as tax exemption provisions in the Corporate Income Tax Act.

Finally, with regard to the second research question, it is hypothesised that the corporate taxation option has not really had a causal effect on the tax revenue and tax ratio of the Federal Republic of Germany. Since many conditions and restrictions are attached to the option to change the taxation regime, both at the time of exercise and to future decisions, an active change of the proven taxation regime by partnerships in Germany seems unlikely in the above-mentioned troubled times in the context of the Covid-19 pandemic and the Ukraine war.

5 Methodology

The research in this paper is based on data from the Federal Statistical Office. These are supplemented by information from the European database "Eurostat". The data needed to answer the above research question and to investigate the hypotheses will be analysed using a specific research design. It is precisely these official databases that are used by the Federal Republic of Germany as well as by the EU governments for the collection of data from many areas, so that their accuracy cannot be doubted.

In the context of data collection by the Federal Statistical Office of the Federal Republic of Germany, one data set in particular is of special relevance. This is the statistic on tax revenue (tax receipts).

It is precisely these statistics that serve as the basis for budget planning as well as tax planning and estimating the effect of changes in tax law. The data are collected by the municipalities/associations of municipalities as well as by the chief tax offices and finance ministries of the Länder and forwarded to the Federal Statistical Office. With regard to the classification of these statistics, it should be noted that tax revenues in particular are not listed in the period in which they accrue to the territorial authorities. Rather, their statistical consideration takes place in the year of economic affiliation, which is also referred to as assessment (Destatis, Revenue from taxes: Germany, years, types of taxes, Code: 71211). Furthermore, these data can be used to distinguish between the spatial separation, i.e. the distribution in Germany as a whole or the distribution to the individual federal states, the temporal separation between years, months and quarters as well as the factual separation between the individual types of taxes (Destatis, Variables, Code: 71211).

For the purposes of classification and position of tax revenue in the German economic area, the figures for the last twenty years of total tax revenue and the following types of tax before tax distribution were examined within the framework of the statistics on tax revenue: Wage tax, assessed income tax, non-assessed taxes on income, final withholding tax, corporate income tax and turnover tax. The data are supplemented by the trade tax revenue, which is presented in a separate data set. In the analysis of trade tax revenue, the cash tax revenue is shown (Destatis, Average assessment rates of non-personal taxes: countries, years, type of non-personal taxes, Code: 71231).

The selection of the above-mentioned tax types was made in particular to cover the numerical development of the tax types with the largest tax revenues and to answer the research question in the best possible way. Data from 2002 up to and including the third quarter of 2022 were analysed. At the time of finalising this paper, data for the fourth quarters of 2022 had not yet been published.

In order to create a target-oriented analysis and to form an answer to the research question formulated at the beginning, the data on tax revenues are also to be placed in connection with the data on economic activity in Germany. For this purpose, the data on the national accounts of the Federation (Destatis, National accounts of the Federation, Code: 81000) are used in particular. These can be subdivided into a wide variety of parameters. In the author's opinion, the national accounts of the Federation "National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, years" contain the most information, so that these data are set in relation to tax revenue. A reconciliation is calculated from GDP via gross national income to disposable income of the national economy (Destatis, National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, years, Code: 81000-0005). Gross national income includes GDP minus primary income paid to the rest of the world plus primary income received from the rest of the world. This corresponds to the primary income received by domestic units. After deducting depreciation, the corresponding net national income results (Destatis, Variables, Code: 81000, GNI001). National disposal income is the sum of the disposable income of the institutional sectors, which corresponds to national income minus current transfers such as taxes on income and wealth to the rest of the world, plus current transfers from the rest of the world (Destatis, Variables, Code: 81000, EKM007).

In addition, the values of real GDP are also presented for better comparability and classification of macroeconomic development. This is also based on data from the Federal Statistical Office. However, the calculation of the price-adjusted data is carried out in a complex manner, as since 2006 the development of real GDP and related data is no longer shown in constant prices of a fixed base year. The reason for the change in approach was that the representativeness of the data became increasingly poorer the further the respective year was from the base year. Accordingly, the revised presentation of real GDP has resulted in an annually changing price base since 2006. To ensure year-to-year comparability in this context, annual measures (growth factors) are formed and chained together. Real GDP is therefore referred to as price-adjusted GDP with chained volume data. This eliminates the need for the periodic change to a more recent price base year that used to be made. It should also be emphasized that the change in calculation is based on the 1997 Stability and Growth Pact, which entails consequences and exemptions in the event of a breach of the government deficit target (IFO Schnelldienst, Institute for economic research, Preisbereinigtes Bruttoinlandsprodukt: Zur Veröffentlichungspraxis im Gemeinschaftsgutachten, Wolfgang Nierhaus, 09/2008). In this context, it should finally be added that the growth rate of real GDP can certainly be considered (the data on the growth rate are listed in identical amounts by Eurostat), whereas with regard to

the total values of real GDP, it must be noted that the method stands in 2015 were adjusted to the ESA 2010. This means with regard to the analysis of the total values, it must be taken into account that the consumer index in 2015 is 100% (Destatis, National accounts - Gross value added, gross domestic product (nominal/price-adjusted): Germany, years, Code: 81000-0001).

In the national accounts, the economic activities of all economic units with permanent residence or domicile in the economic territory are recorded. This is also referred to as the domestic concept. The aim of the statistics is to provide a sufficiently structured, quantitative overall picture of economic activity in Germany. The data and results of the national accounts are based on all suitable current economic statistical surveys that are available when the respective statistics are compiled. Since the data are regularly subjected to international audits, for example by Eurostat, the European Court of Auditors as well as the International Monetary Fund, they can be regarded as having a qualitative value (Destatis, Information about the Statistics, Code: 81000).

Data from 2002 up to and including the fourth quarter for the year 2022 were analysed.

Finally, the data of the European database will also be part of this analysis or its data and effects will be reviewed in order to ensure a European comparison. For this purpose, the statistics "Gross domestic product at market prices" will be examined. GDP, as the value of all goods and services produced minus the value of their production, is a significant indicator of economic activity in the European Union (Eurostat, Gross domestic product at market prices, code: TEC00001). In particular, the data for the years 2010 to 2021 were analysed. With regard to the previous years, certain reports published by Eurostat were used.

6 Statistics

6.1 Statistics on National accounts of the Federation

In order to be able to classify the above-mentioned statistics on tax revenue from a macroeconomic perspective, the first step is to analyse the overall economic development in Germany and the data on GDP in recent years.

Within the framework of the analysis of the national accounts, the data developments in recent years run parallel with regard to all of the above-mentioned variables. In general, there has been an enormous increase in the absolute figures over the last twenty years. For example, gross national income rose from approximately EUR 2.174 billion in 2002 to approximately EUR 3.729 billion (preliminary figure) in 2022. This represents an increase of more than 70% from the original 2002 figure. This breakout is also reflected when examining the data on net national income, with an increase since 2002 of approximately 68% to approximately EUR 3.024 billion (preliminary figure). The situation is similar with the data on national disposal income. In this respect, an increase from EUR 1.771 bn in 2002 to EUR 2.971 bn (preliminary figure) in 2022 can be seen. This corresponds to an increase of approx. 67% (Destatis, National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, years, Code: 81000-0005).

National accounts of the Federation									
Germany									
Specification	Unit	2002	2008	2009	2010	2019	2020	2021	
Gross domestic product	EUR bn	2,198.120	2,546.490	2,445.730	2,564.400	3,473.260p	3,405.430p	3,691.750p	
+ Primary income from the rest of the world	EUR bn	108.797	198.253	183.869	200.710	237.802p	204.940p	234.626p	
- Primary income to the rest of the world	EUR bn	132.116	174.078	128.725	149.270	120.915p	104.682p	106.878p	
= Gross national income	EUR bn	2,174.801	2,570.665	2,500.874	2,615.840	3,590.147p	3,505.697p	3,729.498p	
- Consumption of fixed capital	EUR bn	375.690	440.932	451.997	462.023	640.366p	661.662p	704.931p	
= Net national income	EUR bn	1,799.111	2,129.733	2,048.877	2,153.817	2,949.781p	2,844.035p	3,024.567p	
+ Current transfers from the rest of the world	EUR bn	41.874	44.294	42.188	44.521	80.603p	83.950p	88.673p	
- Current transfers to the rest of the world	EUR bn	69.773	79.186	74.200	80.381	126.214p	133.968p	141.326p	
= National disposable income	EUR bn	1,771.212	2,094.841	2,016.865	2,117.957	2,904.170p	2,794.017p	2,971.914p	
Memorandum item: Saving of the national economy	EUR bn	123.208	249.139	147.534	203.071	395.551p	332.502p	400.576p	
Memorandum item: Net lending / net borrowing	EUR bn	37.057	140.936	142.986	149.850	261.075p	229.033p	260.923p	

* FY2019-2021 figures: Preliminary

Source: Destatis, National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, years, Code: 81000-0005.

In contrast, it can be noted that national disposable income has increased in all years except 2009 and 2020. However, those years were marked in particular by the global economic crisis (2009) and the effects of the Covid 19 Pandemia (2020). Nevertheless, it can also be summarised that in the respective year following the two recessionary years - 2010 and 2021 - a significant increase is immediately recorded, which exceeds the value of the national disposable income of the pre-crisis years 2008 and 2019 in each case. The downturn was therefore quite short-lived.

With regard to the (provisionally) published data for 2022, there is a small downturn in the first quarter of 2022 compared to the last quarter in 2021. In this context, gross national income fell in absolute terms by approximately EUR bn. 15 and national disposal income by around EUR bn. 20. After a further downturn in gross national income and national disposal income in the second quarter of 2022, the third quarter of 2022 developed much more positively. For the first time in the last twenty years, gross national income exceeded the threshold of EUR bn. 1,000 in one quarter. National disposable income also rose again, reaching its second highest level in the last twenty years, behind the record quarter four in 2019. This increase continued in the fourth quarter, so that nominal GDP for the first time broke the above-mentioned barrier of EUR bn. 1,000. (Destatis, National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, quarters, original and adjusted data, Code: 81000-0006).

The figure above also shows the values for GDP. With regard to this data, the downturn in the years 2009 and 2020 and the subsequent increase become clear. The European comparison in particular can provide further clues.

With reference to the data on real GDP, various apparent developments are also worth highlighting. In principle, the development is identical to that of nominal GDP, as the values of real GDP also increase in a total view of the period from 2002 (EUR 2,593,436 billion) to 2022 (EUR 3,264,340 billion). In addition to the slumps in 2009 and 2020, which accompany the values of both nominal and real GDP, it is particularly striking that real GDP additionally develops recessionarily in 2002 and 2003, in contrast to nominal GDP. In total figures, this means that after a marginal decline in real GDP from EUR 2,598,581 billion in 2001 to EUR 2,593,436 billion in 2002, this was followed by a further reduction to EUR 2,575,279 billion in 2003.

An intensive examination of the data also reveals further differences. In this context, it is worth mentioning, for example, the year 2010, which, in contrast to the values of nominal GDP, does not exceed the values of 2008, after both nominal and real GDP slumped in 2009. This means that price-adjusted GDP was still EUR 2,832,807 billion in 2008 and, after being reduced to EUR 2,671,512 billion in 2009, only rose to EUR 2,783,178 billion in 2010.

A look at the respective growth rates also confirms the overall trend described so far. Nevertheless, certain years stand out, particularly when examining real GDP. In the first decade of the new millennium, the growth rate of real GDP was very volatile. After a negative development in 2002 and 2003, there was an increase of 3.8% in 2006 in particular. After the crisis year, real GDP fell by 5.7% year-on-year, the two subsequent years 2010 and 2011 saw a recovery of 4.2% and 3.9% respectively. In the period that followed, i.e. in particular between 2014 and 2022, the growth rate settled at between 1% and 3%, accompanied only by the slump in 2020 of -3.7%.

In addition, the comparison between the growth rate of nominal and real GDP is also revealing. When observing these values, it can generally be said that the growth rate of real GDP is between 1 and 2 percentage points lower than the growth rate of nominal GDP. This also applies to the crisis years 2009 and 2020. Nevertheless, the development of certain years is also striking here. This is because in recent years in particular, the discrepancy between the nominal and real growth rates based on preliminary data from the Federal Statistical Office has become more apparent. For example, in 2019, a difference in the growth rate of more than 2.0 percentage points was measured for the first time in the period under review. This development continued after a slight approximation in 2020, as in 2021 the difference increased to about 2.2 percentage points. In contrast to the already recognized increase in the difference in growth rates between nominal and real GDP in the years up to 2021, by far the largest increase was recorded in 2022, with a difference of up to 5.2 percentage points (Destatis, National accounts - Gross value added, gross domestic product (nominal/price-adjusted): Germany, years, Code: 81000-0001).

Insofar as one compares the GDP with the European average, it can be seen that Germany is clearly above the European average. This applies both to the member states of the European Union and to the pure euro states. In general, parallel to the national data, a downturn in GDP is also evident in 2009 and 2020, both for the European average and for the individual states (Eurostat, Gross domestic product at market prices, Code: TEC00001; Eurostat, File: Real GDP growth, 2004-14 (% change compared with the previous year; average 2004-14) YB15-en.png). Nevertheless, this downturn is followed by a correlated increased GDP growth rate in all Member States of the European Union (Eurostat, Real GDP growth rate - volume, code: TEC00115).

6.2 Statistics on tax revenue

With regard to tax revenue, it can be noted, especially for "total tax revenue", that the trend is identical to the development of the macroeconomic data described. This means that, on the one hand, total tax revenues in the total overall view have increased significantly - by more than 85% - from 2002 to 2021 and, on the other hand, in the two recessionary years 2009 and 2020 a decline in total tax revenues was also recorded. In addition, in both of the following years of the recessionary years, i.e. 2010 as well as 2021, an immediate increase could be seen. In contrast to the year 2021, in which the amount of tax revenues exceeded the value of the pre-crisis year 2019, the increase in tax revenues in 2010 was relatively smaller, so that total tax revenues were lower than in the pre-crisis year in 2008. Nevertheless, the rapid increase in total tax revenues in 2021 of almost EUR thou. 100,000,000 should be emphasised.

With regard to the individual types of tax, it can be stated at the outset that there was by no means such a linear development as with the total tax revenue or the economic values. Rather, in various years, decreases and increases can be recorded irregularly. This can be observed, for example, in the years 2003 and 2004, when the wage tax as the largest source of revenue decreased, while the tax revenue generated by the corporate income tax increased.

Nevertheless, especially in the crisis years already mentioned, significant tax revenue reductions can also be seen at the level of the individual tax types. For example, the tax revenue from corporate income tax has been reduced by more than half. Employees, who are affected by wage tax, also received lower wages, so that less wage tax was paid. In contrast, turnover tax, as a transaction or indirect tax, increased by approx. 11,000,000. In contrast to the total tax revenue, there was no immediate increase in each individual tax type after 2009. This particularly affected wage tax, which continued to fall in 2010.

In 2020, significant reductions were also recorded at the level of the respective tax types. In the process, tax revenue from corporate income tax fell by about one third to EUR thou. 24,000,000. Parallel to this, wage tax revenue also developed in a recessive manner, so that a reduction in 2020 of EUR thou. 10,000,000 could be recognised in 2020. Unlike in 2009, turnover tax revenue was also affected in 2020, so that the German treasury also had to lament a reduction in turnover tax revenue of approx. 7%.

However, the above-mentioned findings on total tax revenues can be linked to a uniform increase in all tax revenues examined here with regard to the year 2021. In particular, corporate tax revenues will increase by more than two thirds in 2021 compared to the previous year (Destatis, Revenue from taxes: Germany, years, types of taxes, Code: 71211).

Statistics on tax revenue									
Germany									
Revenue from taxes (EUR 1000)									
Types of taxes prior to distribution	2002	2003	2004	2008	2009	2010	2019	2020	2021
Tax revenue, total	441,628,589	442,166,627	442,761,181	561,182,025	524,000,434	530,586,956	799,308,178	739,703,671	833,189,240
Wage tax	132,189,841	133,090,156	123,895,370	141,895,371	135,165,057	127,904,117	219,660,080	209,286,402	218,407,146
Assessed income tax	7,540,679	4,568,069	5,393,537	32,684,657	26,429,926	31,178,898	63,711,135	58,982,146	72,342,197
Non-assessed taxes on yields	14,023,582	9,000,967	9,918,784	16,575,279	12,474,044	12,982,358	23,485,476	21,498,057	27,393,876
Final withholding tax	8,477,884	7,632,356	6,772,565	13,459,252	12,442,160	8,709,125	5,146,445	6,763,337	10,029,174
Corporation tax	2,864,145	8,275,190	13,123,323	15,868,087	7,173,093	12,041,036	32,013,249	24,267,689	42,123,946
Turnover tax	105,462,771	103,161,725	104,715,368	130,788,980	141,907,257	136,459,248	183,112,738	168,699,931	187,631,073

Source: Destatis, Revenue from taxes: Germany, years, types of taxes, Code: 71211.

In the first two quarters of 2022, compared to the fourth quarter of 2019, a slight reduction of EUR thou. 16,500,000 compared to the first quarter of 2019. Nevertheless, the average tax revenue for the first two quarters of 2022 (i.e. EUR 897,087,482) is higher than in 2021. This nevertheless assumes constant ratios in the last two quarters of 2022. In terms of the individual tax types, tax revenues also stagnate in the same range and do not provide any conspicuous features. Only the downturn from the fourth quarter of 2021 to the first quarter of 2022 can be seen in wage tax in particular, with a reduction of approximately EUR thou. 7,000,000.

Statistics on tax revenue								
Germany								
Revenue from taxes (EUR 1000)								
Types of taxes prior to distribution	2021				2022			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Tax revenue, total	189,325,424	191,931,092	211,363,669	240,569,055	224,006,239	224,537,502	205,543,486	...
Wage tax	50,853,943	50,782,826	53,857,237	62,913,140	56,205,953	60,363,075	43,430,526	...
Assessed income tax	17,826,363	14,346,576	17,972,862	22,196,397	20,914,830	17,193,513	17,598,188	...
Non-assessed taxes on yields	4,260,475	8,464,609	6,773,031	7,895,762	5,149,137	11,582,681	9,427,588	...
Final withholding tax	3,237,788	2,050,338	2,163,104	2,577,944	2,796,714	1,436,250	1,211,635	...
Corporation tax	10,202,867	8,860,413	9,852,797	13,207,869	11,177,925	11,246,499	10,723,745	...
Turnover tax	45,403,141	43,399,496	49,051,831	49,776,605	54,234,153	46,754,710	49,323,059	...

Source: Destatis, Revenue from taxes: Germany, quarters, types of taxes, Code: 71211.

A slight downward trend can be seen in the third quarter, as total tax revenues, for example, fell by around EUR 15,000,000 billion. While almost all individual tax types recorded a decrease in the context of this overall development, a slight increase can be seen with regard to the assessed income tax and the sales tax. Compared to the previous year, this development can be classified as significantly more recessive when broken down to the individual quarters, as total tax revenues increased significantly in quarter three in 2021. Nevertheless, the same trend as in the previous year can be observed for sales tax, for example, as quarter two in particular also saw a slight decline, followed by an increase in quarter three.

The trade tax revenue as so-called real tax revenue is to be examined separately. It is paid directly to the individual municipalities and depends on the assessment rate set by the respective municipality. The development of trade tax revenue correlates with the analysed development of the other statistics. In general, there has been an increase in trade tax revenue since 2002. Nevertheless, the development of trade tax revenue did not rise consistently as with total tax revenue (with the exception of the years 2009 and 2020), but also experienced minor fluctuations in the other years (Destatis, Average assessment rates of non-personal taxes: countries, years, type of non-personal taxes, Code: 71231).

7 Interpretation

Within the framework of the analysis of the (partly preliminary) data, it becomes clear that in particular GDP and national disposal income as well as domestic tax revenue in the Federal Republic of Germany have increased to a considerable extent since 2002 up to and including 2022. It can therefore be concluded that there is a correlation between economic activity and tax revenue (Bakari, Ahmadi and Tiba, The Nexus among Domestic Investment, Taxation, and Economic Growth in Germany: Cointegration and Vector Error Correction Model Analysis, 2020).

Furthermore, further revealing conclusions can be drawn from the analysis of the data on real GDP or from the comparison between real and nominal GDP with regard to tax revenues.

The first conspicuous feature in the context of this comparison is particularly evident in 2002 as well as 2003, since in these years, in contrast to the values of nominal GDP, a real decline was recorded. This is consequently due to the reduction in the inflation rate (deflation) in these two years. From an economic perspective, this was due to declining investment in the

equipment and construction sectors and low business expectations since 1993. Other factors affecting real GDP development were the potential conflict between Iraq and the U.S. and unequal conditions in the labor market or structural rigidities (European Parliament, Directorate-General for Research, Hanna Dahlberg and Agnieszka Ruminska, Econ 515 EN/Rev.2, The German Economy). Tax implications or anomalies cannot be observed in this context on the basis of the above-mentioned data.

Nevertheless, a reduction can be observed in all developments in the years 2009 and 2020. In all other years, however, there is always an upward trend in terms of both economic indicators and total tax revenue. The decline in the two crisis years mentioned can be attributed in particular to the global economic crisis in 2009 and the Covid 19 pandemic in 2020.

Particularly when looking at the years 2008 to 2010, it is noticeable that after the decline in 2009, with regard to the economic key figures, such a strong increase was recorded in 2010 that the value from the pre-crisis year 2008 was exceeded. This was not achieved with regard to tax revenue, so that the increase in tax revenue in 2010 was sluggish. The fact that both the economic indicators and the tax revenue in 2021 were higher than in the pre-crisis year of 2019 suggests that the consequences of the global economic crisis were more drastic than those of the Covid 19 pandemic, especially for the tax money collected by the German treasury.

In addition, however, research should also be conducted into tax system-related reasons with regard to the decline in GDP as well as tax revenues. Conversely, the question therefore arises as to whether there were tax reforms or other relevant interventions or events in the Federal Republic of Germany in the significant years that could be responsible for the significance.

In this context, the 2008/2009 corporate tax reform should be mentioned in particular, as well as the various Covid-19 tax aid laws, which are partly responsible for a shift in revenues in the individual tax code. Furthermore, these reforms can also be identified as the cause of the significant upswings in the years following the respective downswings in 2009 as well as in 2020.

As part of the 2008/2009 corporate tax reform, various groundbreaking innovations were introduced into German tax law. In particular, it should be noted that the tax rate for corporations was significantly reduced. As a result of this corporate reform, the corporate tax rate was reduced from 25% to 15%. The intention of the legislator was to make Germany a more attractive location for corporations. In connection with the financial crisis in 2009, however, it does not seem surprising that tax revenues also decreased at the beginning, as in 2008 and 2009. In this respect, this tax reform could also be a reason why corporate tax revenues in 2009 are less than one third of what they were in 2007 (Derivatives & Financial Instruments. IBFD, Jürgen Hartmann, Vol. 9, Iss. 5., Germany: 2008 Tax Reform Act).

The corporate tax reform also had a major impact on the final withholding tax. This is because up to and including 2008, the tax revenues listed in the above table exclusively included the so-called interest income tax (Destatis, Withholding Tax, Information about the attribute, Code: STEUERARTG40), which represented a kind of prepayment on the private income tax and was withheld in the amount of 30% of the interest income (Gabler Wirtschaftslexikon, Kapitalertragsteuer, Steffen Minter). However, since January 1, 2009 and the aforementioned corporate tax reform, a compensatory tax rate has been introduced for all capital income, which is a uniform 25%. A reduction in tax revenue in this context can therefore also be attributed to this change in tax law.

With regard to payroll tax and value-added tax, the corporate reform did not contain any significant changes that would indicate an impact of the above-mentioned developments.

With regard to the year 2020 and the social as well as macroeconomic consequences of the Covid 19 pandemic, the German legislator also reacted promptly and attempted to relieve the individual tax subjects in Germany through laws on the tax relief measures to cope with the Covid 19 pandemic. Since June 19, 2020, four such laws have been enacted to date, of which the first two laws in particular brought about the greatest changes to the previously applicable tax system. In particular, under the first law of June 19, 2020, certain parts of employees' wages were qualified tax-free and the sales tax rate on restaurant services was reduced (Federal Law Gazette Volume 2020, Part I No. 30, Bonn, June 29, 2020). In the second Covid-19 law of June 29, 2020, various options were implemented to reduce tax payments and provide relief to business entities. These include, for example, higher depreciation and the more extensive option to offset losses (Federal Law Gazette Volume 2020, Part I No. 31, Bonn, June 30, 2020).

Building on this, the slight decline in tax revenues in quarter three of 2022 can be attributed to the fourth Covid-19 law. In particular, further tax exemptions for employees were introduced as part of this further law. In addition, the application of certain types of depreciation and other tax deferral provisions were extended. These elements of the law in particular may have a reducing effect on tax revenues in the short term (Federal Law Gazette Volume 2022, Part I No. 20, Bonn, June 19, 2022).

In summary, it seems fundamentally consistent that tax revenue is reduced to the extent that the legislature's tax subsidies are considered. Thus, in addition to the precarious economic losses, the benevolent tax policy of the German state is also the basis for the decline in tax revenues. One could therefore describe the interplay between tax revenues and the overall economy or macroeconomic conditions as mutually significant or interdependent.

However, if one takes another look at the individual tax types, it can be stated that the thesis cannot be confirmed by each tax type. This is because the tax revenues vary here partly independently of the annual figures or the total tax revenues, so that in this respect no statement can be made with regard to the specific tax type in connection with the business management ratios mentioned. A deeper understanding of taxation is therefore necessary for the classification.

In particular, it must be borne in mind that German tax law was determined for many years by the so-called separation principle for corporations and the so-called transparency principle for partnerships. Under the separation principle, a strict distinction is made between the level of the corporation and the level of the respective shareholder. Taxation therefore takes place at two levels - i.e. at the level of the corporation itself and, in the case of exemplary profit distribution, again at the level of the shareholder (Teufel in: Lüdicke/Sistermann, Unternehmenssteuerrecht, § 2 Besteuerung der Kapitalgesellschaft und Ihrer Gesellschafter). In contrast, the transparency principle applies to the income generated by a partnership. Here, the result of the business year of the partnership as well as the equity capital is literally "transparently" attributed directly to the partners of the partnership (Kahle, Beck'sches Handbuch der Personengesellschaften, § 7 Besteuerung von Personengesellschaften, 2020).

Within the framework of the data analysis, it is particularly apparent that wage tax is the largest source of revenue for the German treasury. Basically, according to the statements on the principle of separation and transparency, one could keep in mind that only the assessed income tax, which is proportionally due on the directly attributed profits of the partnerships, as well as the corporate income tax with regard to the profits taxed at the level of the corporations and the withholding tax with regard to the profit distributions taxed at the level of the partners are relevant.

However, a deeper understanding of taxation makes it clear that other types of tax are also relevant, since the respective partners can, for example, be employed by their corporation as

managing directors within the framework of the separation principle, they are therefore also liable to age tax and thus indirectly achieve a different type of income due to this choice of legal form than, for example, partners in a partnership (Seer, Der unternehmerische Kapitalgesellschafter, 2010). Therefore, the wage tax can very well be meaningful with regard to the differences in taxation between corporations and partnerships.

Since the assessed income tax also includes the tax for persons who do not participate in partnerships, it cannot be concluded that the tax revenue of partnerships has always been higher than that of corporations. Nevertheless, with regard to the option on corporate taxation from 1 January 2022 formulated at the beginning, it can be examined whether there has been a rapid change in circumstances since 2022 and whether the option has therefore had an impact on GDP or national disposal income.

According to the findings described, however, there are no conspicuous changes in 2022. Rather, total tax revenues have decreased compared to the last quarter in 2019. A direct impact of the corporate tax option on tax revenue or on the overall economy is therefore not discernible on the basis of the analysed data.

8 Critical remark and conclusion

The economic years 2009 and 2020 had an enormous impact on social circumstances, which was reflected in particular in the overall economy and state measures.

In principle, it seems conclusive that the developments in economic activity run roughly parallel to the tax revenues of the German state. After all, the better the macroeconomic conditions unfold, the higher the probability of rising investment and income. According to the German Federal Statistical Office, the economic indicators that have risen since 2002 in the analysis conducted here lead causally to higher tax revenues, so that the treasury has benefited indirectly from the rising economic development.

The hypothesis formed at the beginning regarding the overall development of tax revenue in connection with economic growth can therefore be confirmed in principle. Nevertheless, on the basis of the analysis carried out for the period 2002-2022, this can only be stated for the total tax revenue. With regard to the individual tax types, a more intensive examination of the effects and mutual effects per tax type and economic segment is required. Therefore, it can be stated that research within the framework of a pure paper or a term paper is not sufficient for a detailed analysis of the individual tax types and could rather serve as a topic for a dissertation or thesis. The purely legal focus of German tax law must be examined in detail in this context in order to analyse an accurate assessment of the macroeconomic impact of the individual types of tax. Nevertheless, it can be stated that certain tax reforms and laws can certainly be identified as the basis for the volume or decline in tax revenues. In particular, the corporate tax reform of 2008 and the Covid-19 legislation from 2020 should be mentioned here. In the broadest sense, a mutual interdependence can be identified, as the level of tax revenues reacts to the financial performance of the macroeconomic area and, conversely, the state, as an economic sector, can exert subsidies and thus influence on the tax system as a result of any tax developments.

Furthermore, the provisional values for the years from 2019 of the statistics "National accounts - GDP, gross national income, national disposable income, net lending/net borrowing of the national economy: Germany, years" should be emphasised, so that the development may have to be subjected to retrospective changes in the next periods. Nevertheless, from the author's point of view, no change is to be expected in the core, so that the confirmation of the hypothesis remains highly probable. The research question regarding the development of tax revenue from

a macroeconomic perspective can therefore be answered with a correlative development to economic growth, which, however, cannot be broken down to individual tax types.

With regard to the research question related to the option for corporate taxation for partnerships that will apply from 1 January 2022, it can be confirmed that no discernible development is evident. In particular, there are no conspicuous features in the comparison of corporate income tax and capital gains tax to assessed income tax that would allow conclusions to be drawn about the aforementioned option. The hypothesis for research question two can therefore be confirmed.

Nevertheless, a connection between the change in tax revenue due to the aforementioned option and macroeconomic indicators is difficult to discuss on the basis of the figures, some of which are provisional and not fully published for 2022.

In summary, the development of tax revenue from corporations and partnerships remains a significant issue for the German treasury. Whether the state will have to consult tax surpluses or shortfalls due to the corporate taxation option should become apparent in the coming periods.

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Selected aspects of the Consumer Credit Act

Lenka Dupáková³

Abstract

This article deals with selected aspects of the Consumer Credit Act that came into effect on 1 December 2016. Consumer lending is a dynamically developing phenomenon in the Czech Republic and follows the global trend. With the development of consumer lending, its regulation has also developed, both at European and national levels. Regulation has tried to keep pace with problematic phenomena and practices in the market, but has not always been successful at that. The effort to cultivate the environment of consumer credit provision eventually resulted in a new Consumer Credit Act. In addition to describing the changes introduced by the new Consumer Credit Act, this article also includes a brief excursion in history, an evaluation of the problematic aspects of the new legislation, and an analysis of the fulfilment of the Act's objectives against the original assumptions from the perspective of more than two years of its application.

Keywords

consumer, consumer credit, Consumer Credit Act

INTRODUCTION

The topic of consumer protection in the financial market is highly topical and the legal environment at EU and national levels is undergoing numerous changes aimed at increasing consumer protection and harmonizing the legal environment in individual Member States. Given the need to transpose Directive 2014/17/EU of the European Parliament and of the Council on credit agreements for consumers relating to residential immovable property and amending Directives 2008/48/EC and 2013/36/EU and Regulation (EU) No 1093/2010 (hereinafter referred to as "MCD")⁴ the Government of the Czech Republic decided to adopt a new act that will not only transpose the above-mentioned Directive, but also Directive 2008/48/EC of the European Parliament and of the Council on consumer credit agreements (hereinafter referred to as the "CCD"),⁵ replacing the contemporary legal framework provided by Act No. 145/2010 Sb. on consumer credit and amending certain other acts.⁶

The article is divided into an introduction, four chapters, and a conclusion. The first chapter maps the basic topics that are associated with the issues discussed, such as the concept of consumer and his/her protection in the financial market, as well as the legal regulation of credit agreements in general. The second chapter reflects the EU regulation of consumer credit, which is followed by the third chapter describing the market situation before adoption of the new Act No. 257/2016 Sb., on consumer credit (hereinafter referred to as the "Consumer Credit Act" or "the New Act" or the "CCA") focusing on problematic phenomena occurring in the market. The fourth chapter describes the actual regulation according to the Consumer Credit Act. The article is concluded by an evaluation of problematic aspects of the new legislation and by an

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⁴ MCD - Mortgage Credit Directive.

⁵ CCD - Consumer Credit Directive.

⁶ Another act repealed was Act No. 43/2013 Sb. amending Act No. 145/2010 Sb., on consumer credit and amending certain other acts.

analysis of fulfilment of the objectives of the Act against the original assumptions, including the *de lege ferenda* considerations on future regulation of consumer credit in the Czech Republic.

1 CREDIT AGREEMENT AND CONSUMER PROTECTION IN THE FINANCIAL MARKET

The legal regulation of credit pursuant to Act No. 89/2012 Sb., the civil code (hereinafter also referred to as the “CC”), was taken over, without any major changes, from Act No. 513/1991 Sb., the commercial code.⁷ By a credit agreement under the Civil Code, a credit provider undertakes to provide a credit recipient with funds up to a specific amount at the credit recipient’s request and for the credit recipient’s benefit, and a credit recipient undertakes to return the funds provided and pay interest.⁸ The fundamental distinction between a credit agreement under CC and a consumer credit under the Consumer Credit Act is the (im)possibility to subordinate the given contract as a particular contract type. Unlike the credit agreement according to the CC, which is a separate contract type, the consumer credit agreement is an indeterminate contract type. Consumer credit can be concluded as a credit, a cash loan, a deferred payment or a similar financial service with a consumer as the other party.⁹

Apart from the object of the legal relationship, the essential elements of a credit agreement are the subjects of the legal relationship, namely an entrepreneur on the part of the provider or intermediary (broker) on one side, and a consumer on the other side. A consumer is legally defined in § 419 of the CC as any individual who, outside his or her trade, business or profession, enters into a contract or has other dealings with an entrepreneur.¹⁰ The Consumer Credit Act does not provide a special definition of consumer, and therefore the definition of consumer provided in the CC shall apply. This limitation of scope to consumers only takes into account their specific position. However, the exclusion of entrepreneurs or persons doing business on the basis of a trade license from the general scope of the act does not deprive them of their protection under the law if they act as consumers in given legal relationship. Nevertheless, a problem may be posed by a situation where consumers are manipulated to obtaining a trade license without an actual need for one, and subsequently granted a credit outside the legal regulation of the Consumer Credit Act. There are currently expert discussions underway on this issue.

An entrepreneur, as a professional in his activity, has much deeper knowledge of the product offered compared to the consumer, and by his or her very nature will be an expert as compared to the consumer. This leads to information asymmetry in favour of the entrepreneur. The more complicated product is the object of the service, the greater asymmetry can be observed. Furthermore, in the case of a large number of services, the contractual freedom of the consumer (quite logically due to often huge numbers of consumers – customers) is substantially limited, in particular in terms of it being impossible for them to influence in fact the wording of the contract with the entrepreneur. For complicated services, such as financial services, the

⁷ Explanatory memorandum to the CC, special part on §§ 2395-2400 of the CC, p. 516. Prague: Ministry of Justice of the Czech Republic. Available from <http://obcanskyzakonik.justice.cz/images/pdf/Duvodova-zprava-NOZkonsolidovana-verze.pdf> (as of 1. 1.2020).

⁸ Cf. § 2395 of the CC. The provisions of the CC in this article are provided in the semi-official translation available from <http://obcanskyzakonik.justice.cz/images/pdf/Civil-Code.pdf> (as of 1. 1.2020).

⁹ Cf. § 2 (1) of the CCA.

¹⁰ A legal person cannot be a consumer. Cf. judgements of the European Court of Justice in cases C-541/99 and C-542/99.

consumer is usually in a “take it or leave it” situation.¹¹ Moreover, due to the size of the contractual documentation, consumers often resign on becoming more familiar with the terms of the contract, because they doubt that they would fully understand them or be able to compare them with other equivalent products. However, it cannot be denied that low financial literacy of consumers also plays a role.

The above-described imbalance in positions when concluding contracts by consumers logically results in regulatory intervention by the state, aiming at moderating the position imbalance. Consumer protection has many sub-areas with certain specificities. Consumer protection in the financial market is basically based on two basic premises.

- 1) Financial liabilities often reach high values, thus significantly affecting consumer’s life, and poor choice of product or counterparty causes irreversible financial and non-financial consequences for the consumer.
- 2) The long-term nature of some financial products further limits the ability of the consumer to modify the product in the course of his or her lifetime without suffering a financial loss. The possibility of conducting a trial-and-error behaviour in the financial market is limited due to the fact that the products are often of long-term nature and comprehensive.

The aforementioned premises do not apply to all financial market products absolutely, but they are largely fulfilled in case of consumer credit in particular.

2 DIRECTIVES GOVERNING THE CONDITIONS OF CONSUMER CREDIT AND THEIR TRANSPOSITION INTO THE LAW OF THE CZECH REPUBLIC

It should be noted at the outset that the list of directives set out and described below is not an exhaustive excerpt of the rules affecting the conduct between the consumer and the provider of consumer credit or an intermediary. European Union law has a greater number of legal rules that affect the consumer-entrepreneur relationship, albeit in a more general context.¹²

Directive 87/102/EEC for the approximation of the laws, regulations and administrative provisions of the Member States concerning consumer credit may be regarded as the primary impulse for the regulation of consumer credit at EU (in 1987, EC) level. There were essentially two reasons for adopting this directive. The directive was intended to lay down a basic uniform framework for the terms and conditions of consumer credit across the European Economic Community while setting a minimum standard of consumer protection. Specifically, it was the requirement of written form of credit agreements. For the first time, the Directive also included the term “Annual Percentage Rate of Charge (APRC)” as a benchmark for comparing the parameters of individual credit offers.

Directive 87/102/EEC was transposed into Czech law by Act No. 321/2001 Sb. on certain conditions for concluding consumer credit agreements (hereinafter "Act No. 321/2001 Sb."). That act, although it was possible under Directive 87/102/EEC, did not afford the consumer any special protection beyond the Directive. Although the positive definition of consumer credit under Act No. 321/2001 Sb. enumerated exhaustively the types of contracts that could fulfil the

¹¹ Contracts of adhesion according to §§ 1798ff of the CC.

¹² Cf. e.g. the Council Directive 93/13/EEC on unfair terms in consumer contracts.

character of consumer credit, this list was interpreted, also by later case-law, as indicative.¹³ The scope of Act No. 321/2001 Sb. did not cover credit loans below CZK 5 000 and above CZK 800 000, neither certain other contractual modifications.¹⁴ Directive 87/102/EEC and Act No. 321/2001 Sb. did not cover the issue of consumer credit comprehensively, but it was the first step towards harmonization of legal orders and of consumer protection. Precisely because harmonization was based on the principle of minimal harmonization, it proved to be insufficient in terms of the development of the internal market or cross-border transactions. At the same time, many Member States did not increase the level of consumer protection compared to the minimum requirements of Directive 87/102/EEC.

In response to the shortcomings of Directive 87/102/EEC, the CCD was presented in 2002,¹⁵ entering into force in 2008. The CCD was already fully harmonized, thus increasing the legal certainty of operators in the European consumer credit market. At the same time, full harmonization made cross-border business of providers from different Member States possible, in line with the requirements of the internal market. The CCD was transposed into Act No. 145/2010 Sb., on consumer credit (hereinafter referred to as the “Old Consumer Credit Act”) and subsequently also into the currently effective Consumer Credit Act.

The scope of the CCD is defined both positively and negatively. A credit agreement according to the CCD is “*an agreement whereby a creditor grants or promises to grant to a consumer credit in the form of a deferred payment, loan or other similar financial accommodation, except for agreements for the provision on a continuing basis of services or for the supply of goods of the same kind, where the consumer pays for such services or goods for the duration of their provision by means of instalments;*” on the contrary, the CCD does not affect credit agreements secured by immovable property,¹⁶ nor with a principal of less than EUR 200 or more than EUR 75 000.¹⁷

The main changes introduced by the CCD include the requirement to assess consumer creditworthiness. This requirement made it necessary for creditors to make an expert judgement as to whether it is in the financial capacity of the consumer to repay the credit loan. The purpose of this measure was to prevent irresponsible lending on the part of both creditors and consumers. In addition, the consumer had the possibility to withdraw from the credit agreement within the fourteen days following the signing of the credit agreement, which was intended to enable the consumer to have a “step back” in the event of a change in his or her decision. The last of many changes to be mentioned here is the obligation of Member States to set up an out-of-court body to resolve consumer disputes arising in the context of provision and brokering of consumer credit. This task is performed by the Financial Arbiter in the Czech Republic.

In 2014, the CCD Directive was supplemented by the MCD Directive. Given the systemic importance of the mortgage credit market – its problems may directly jeopardize the financial stability of many states – the MCD responded to the EU-wide problem of fragmentation of the legal framework governing mortgage provision and brokering.

¹³ The provisions of § 2 (a) of the Act No. 321/2001 Sb.: “*For the purposes of this Act, “consumer credit” means a provision of funds or a deferred payment, for example in the form of a credit, loan, or purchase of a leased item, for which the consumer is obliged to pay.*”

¹⁴ E.g. mortgage loans, interest-free loans, etc.

¹⁵ CCD - Consumer Credit Directive.

¹⁶ Act No. 145/2010 Sb. on consumer credit excluded consumer loans for housing from its scope more narrowly. Consumer loans whose purpose was to finance housing and were secured by a lien on immovable property were excluded. The reason for the reduced scope was the envisaged early adoption of the directive on consumer credit for house purchase; that was, however, only adopted in 2014.

¹⁷ The list is not complete, cf. Article 2 (2) of the CCD.

The MCD, just like the CCD, includes the obligation to inform the consumer, as well as the obligation to assess the creditworthiness of the client. The creditworthiness of a client cannot be assessed solely on the basis of sufficiently securing the credit using the “loan to value” indicator,¹⁸ but on the contrary, through the lens of the real ability of the consumer to repay the loan depending on his or her income and expenditure. Furthermore, the MCD prohibited the provision of consumer credit as a set of services where such services are not severable from the provision of consumer credit, thus reducing the “bundling” practice. The standard of negotiation between the consumer and the credit broker has also become an important subject of interest in the MCD, both as regards the regulation of advisory services, and as regards the performance of the activity itself, as well as the regulation and supervision of these entities.

Adoption of the MCD and its transposition deadline¹⁹ was one of the main impulses for the creation of the new Consumer Credit Act, transposing not only the MCD, but also the CCD. The CCD had already been transposed at the time of drafting of the new act, but due to the need to respond to certain problematic phenomena occurring in the consumer credit market, the legislation was also amended with regards to the CCD. The following chapter briefly describes the situation in the consumer credit market that had existed before the new Consumer Credit Act was adopted.

3 THE SITUATION IN THE CONSUMER CREDIT MARKET BEFORE ADOPTION OF THE ACT NO. 257/2016 SB. ON CONSUMER CREDIT AND A DESCRIPTION OF NEGATIVE PHENOMENA

The entire consumer credit market can be divided into banking and non-banking markets. The banking market was primarily dominated by banks, with marginal credit cooperatives. The non-banking market was much more diverse back then, with large credit companies as well as small providers and other business entities with derived activities operating within it.²⁰ Non-banking entities were conducting business on the basis of a registered trade entitled “*providing or brokering consumer credit*.” As we can see, the earlier regulation did not distinguish between brokering and providing consumer credit. According to the Ministry of Industry and Trade data, the number of authorizations issued before the new Consumer Credit Act entered into force had been in tens of thousands. Such high number was possible mainly because of the simplicity of acquisition of the regulated trade authorization in question.

From the regulatory point of view, it was possible to observe two basic groups of credit products. Consumer credit loans regulated by Act No. 145/2010 Sb. on consumer credit, and housing credit loans that had not been regulated before the new Consumer Credit Act. The total volume of provided consumer loans (loans on consumption) amounted to approximately CZK 260 billion, while non-bank credit loans accounted for CZK 70 billion. Consumer debt totalled over CZK 1,400 billion (including housing credit loans). Over 99% of the volume of consumer credit provided was in CZK. The share of failing bank credit loans had been fluctuating between 3% and 5% in the long term, with an improving tendency. There had been a similar trend in the non-banking market, where the share of failing credit loans was around 8%. There is a logical justification for this, as in the non-banking market, credit loans are usually granted to more

¹⁸ The “loan to value” indicator compares the value of the property with the amount of the credit provided.

¹⁹ Member States were required to transpose the MCD by 21 March 2016.

²⁰ Leasing companies, factoring and forfaiting companies, and non-bank mortgage providers.

risky clients and, at the same time, some providers had insufficiently assessed the creditworthiness of the borrowers, both unintentionally and in some cases deliberately.²¹

As the CCD focused primarily on product regulation, a complicated distribution scheme developed over time, with different rules applying to each distribution channel and consumers losing sight of the relationships and responsibilities of individual distribution entities. For the same reason, there was also regulatory arbitrage with negative consequences for both consumers and entrepreneurs who were forced to ensure compliance of their activities with more legislation. Providers were then subject to the authorization by and supervision of several different institutions, from trade licensing offices through the Czech Trade Inspection to the Czech National Bank. One frequent phenomenon was “cross-selling,” where within one conglomerate the product of one entity (e.g. a bank) was “re-sold” by another entity (e.g. a building society). In the context of this cross-selling, different distribution rules applied to the providers or brokers of the, in fact, same product, which was undoubtedly undesirable in competition.

The phenomenon of so-called “predatory loans” was identified as one of the main problems in the consumer credit market. In its Resolution No. 367/2014, the Chamber of Deputies expressed the opinion that *“predatory and usury practices in the non-bank credit provider market are a very serious negative socio-economic phenomenon that threatens many citizens”* and also called on the government *“to draft and submit to the Chamber of Deputies a legislative proposal that would significantly tighten the conditions for entering into business in the area of providing credit (not only consumer credit) by non-bank providers and introduce effective supervision of their activities.”* Specifically, it was a collection of several problematic phenomena that, in their common consequence, created negative conditions for a comprehensive and sustainable environment for consumer credit provision.

Given that the requirements imposed by authorizing authorities (trade licensing offices) on non-banking entities interested in providing or brokering consumer credit were absolutely minimal, untrustworthy and non-professional entities also entered the market. Some of these entities then used regulatory arbitrage, focusing on providing credit loans below CZK 5,000 or providing credit loans only to self-employed persons. Consumers were then forced to obtain trade licenses, and providers thus circumvented the regulatory requirements. A very important, and neglected, obligation of providers was to assess the creditworthiness of the applicant – it was either not observed at all, or only inconsistently. It was also common to distort the costs of the product and to abuse the distress of debtors. Given the enormous number of market players and the unclear responsibility of the individual actors in the distribution chain, the supervision of the distribution of consumer credit, although existing, was not very efficient. Authorization and supervision activities were entrusted to non-specialized public authorities (trade licensing offices and the Czech Trade Inspection). This institutional anchoring had little chance of contributing to the regulation or at least partial cultivation of the environment.

4 ACT NO. 257/2016 SB. ON CONSUMER CREDIT

The dismal environment for consumer credit provision and the need for transposition of the MCD Directive led to the preparation of a completely new piece of legislation to regulate the issue comprehensively. As both the CCD and the MCD use the method of full harmonization, the wording of the act had been to a large extent predestined by their wording.

²¹ These providers primarily focused on creating sanctions, which constituted an important part of their profits.

4.1 Scope of the Act

The Consumer Credit Act regulates the activities of entities authorized to provide and broker consumer credit, mutual rights and obligations of individual entities, and the powers of administrative authorities in the market segment.²²

The definition of consumer credit in § 2 of the Act defines the term as deferred payment, cash loan, credit loan or similar financial service provided or brokered to the consumer. If compared to the definition in Act No. 145/2010 Sb., the new act did not bring about any fundamental change and the definition is consistent. However, there is one fundamental change: the regulation of consumer credit intended for housing, which is a subset of consumer credit and can take several forms:

- a) secured by an immovable property or a right *in rem* in immovable property;
- b) intended for:
 1. acquisition, settlement, or maintenance of rights in an immovable property or parts of an immovable property,
 2. construction of an immovable property or part of an immovable property,
 3. payment for the transfer of a cooperative share in a housing cooperative, or acquisition of participation in another legal entity for the purpose of obtaining the right to use an apartment or a family house,
 4. change of a building according to the Building Act, or connecting it to public utilities,
 5. payment of the costs of obtaining a cash loan, credit loan or other similar financial service for the purposes referred to in points 1 to 4, or
 6. repayment of the credit loan, cash loan or other similar financial service provided for the purposes referred to in points 1 to 6, or
- c) provided by a building society under the Building Savings Act.

The predominant purpose is decisive in determining whether it is a consumer credit other than for housing or a consumer credit for housing, and if that cannot be ascertained, the consumer credit is considered to be other than for housing.

Setting the conditions of the Act involved one significant challenge: to determine whether it would be a consumer loan for housing even if the object of collateral is a property other than one intended for housing. There had been no pre-existing definition of the term “property intended for housing” in the Czech legal system, and it is not unambiguous – both the occupancy permit and the consumer's intention play a certain role (buying the property for housing, recreation, investment, a combination of the previous, etc.). The legal status of credit loans granted for the purpose of acquiring immovable property or secured by immovable property constituting a part of the housing that, however, cannot be defined as a property intended for housing, such as a garage or a garden that form one whole with the land plot and family house, could also be problematic. Fortunately, the MCD allows Member States to extend the scope to other properties, which was subsequently confirmed by the representatives of the European Commission, and the issue has been regulated in the Czech legal system in that sense.

²² The Act is divided into 14 parts and 179 sections. Previous consumer credit acts had 16 and 29 sections respectively.

However, the positive definitions of the Act are limited by § 4 of the Act. The main exceptions to the scope of application are credit loans financing capital market transactions and credit loans provided in pawnshops. Furthermore, the negative definition excludes from the scope of the Act the provision of occasional information within the provision of professional legal advice (advocacy), within the activity of insolvency trustees, etc. In general, the negative definition of the scope is much narrower than it had been in Act No. 145/2010 Sb. The abolition of financial limits²³ and the inclusion of consumer housing credit loans in statutory regulation can be seen as fundamental extensions of the scope. In particular, the abolition of financial limits was a highly discussed topic because of the “gold-plating.”²⁴ Given that abolition of financial limits is not prohibited by the CCD, and at the same time there had been considerable regulatory arbitrage linked to the lower limit, it was decided to abolish both the lower and the upper limits on the amounts of consumer credit.

Since there are certain financial products whose existence would be jeopardized or at least complicated by their inclusion in the Act, but, on the other hand, their complete exclusion could cause harm to consumers, a special category was created by § 5 of the Act, stipulating a “limited application” on selected products. In case of these products, only selected provisions of the act are applied. According to the number of paragraphs of § 5, we can distinguish three or four categories of limited application.²⁵ These categories differ according to the list of provisions that apply to the product. Limited application products include, for example, operating leasing, employee loans and interest-free loans. Consumer credit loans according to § 6 of the Act are a special category.

The last area discussed in relation to the scope of application was personal scope – whether the law should regulate the provision of consumer credit loans only to consumers or also to small entrepreneurs / self-employed persons. On the one hand, in terms of knowledge of the law and possibility of defence against unfair business practices of distributors, they are in a position similar to that of consumers, and some consumers are forced to apply for a trade license due to regulatory arbitrage; on the other hand, due to the wide range of persons covered by the definition of “small entrepreneur,”²⁶ such extension might not be appropriate. In the end, the regulator decided, following a public consultation, to leave the scope of application only on consumer credit loans provided to consumers. The main reasons include an increase in administrative demands for creditors, which would be ultimately passed on to consumers, and different ways of risk assessment and subsequent monitoring by entrepreneurs and consumers. Nevertheless, personal scope of application will be a topic for evaluation of the benefits of the Act and its possible amendments.

4.2 Assessment of creditworthiness

One important part of the act is the regulation concerning the assessment of consumer creditworthiness and the related provision of advice to consumers. When assessing the creditworthiness of a consumer, the provider does not have all the necessary information regarding the consumer's financial situation. Therefore, the consumer is obliged to provide all

²³ Act No. 145/2010 Sb. was not used for loans up to CZK 5,000 and over CZK 1,880,000.

²⁴ Extending the contents of EU legislation by national authorities to include additional obligations that bring new regulatory burdens beyond the original requirements.

²⁵ The lists of applied sections for § 5(1) and § 5(3) are identical - §§ 1-4, §§ 122-124 and § 168.

²⁶ According to § 2 of Act No. 47/2002 Sb., on support for small and medium-sized enterprises, and according to the EU law, a “micro-enterprise” is an entrepreneur who employs less than 10 persons and whose annual turnover or balance sheet total does not exceed EUR 2 million.

necessary information to the provider²⁷ to an appropriate extent. The provider or broker is obliged to verify the information provided in an appropriate manner. It should be noted that only on the basis of complete and truthful information is the provider able to professionally assess the creditworthiness of a consumer. If the consumer communicates incomplete or false information, the provider may terminate the credit agreement, unless it is a mortgage credit loan where the provision of incomplete, but not false, information is tolerated if not done knowingly.

As regards the provision of advice by distributors, the legislation respects the aspect of professional care. Provision of advice is not a prerequisite for provision of consumer credit, but if it is provided, certain standards must be respected. It is necessary to realize that, in comparison to the lay consumer, the distributor is an expert in the field and therefore there is a clear need to avoid manipulating the consumer from the distributor-expert position. The advice shall be provided on the basis of an analysis of the consumer financial situation, his or her requirements, objectives and needs, as well as the risks to which he or she is subjected. The advice must be provided on the basis of subsequent analysis of a certain amount of credit products. Providing a record of the advice given to the consumer is essential.

The assessment of creditworthiness itself is quite similar to the previous legislation, although it is expressed in the act by different wording. The provider shall, on the basis of the information provided by the consumer which the provider may verify, compare the revenue and expenditure of the consumer, taking into account the consumer's payment history to date. If the provider concludes that "there are no reasonable doubts about the consumer's ability to repay the consumer credit," the credit may be provided. The burden of proof concerning the correct assessment of creditworthiness is then, in private litigation, borne by the provider. However, the new legislation introduces two important changes that clearly aim at protecting consumers from "predatory lending." When assessing the creditworthiness, the consumer's property cannot be calculated unless the consumer credit agreement implies that the consumer credit is to be repaid in whole or in part by proceeds from sale of the consumer's property, or if the applicant's financial situation is such that he or she will be able to repay the credit loan regardless of his or her income. Thus the provider cannot rely solely on the fact that the consumer owns sufficient property assets to draw on in the event of default if the consumer has insufficient income.²⁸ The second major change is the consequence of relative invalidity of the consumer credit agreement if the creditworthiness assessment obligation was breached. Under previous legislation, the contract was invalid, but the drawn principal became due when the contract was declared invalid, which had negative impacts on consumers who did not have the means to repay the principal at once. The new legislation thus states that the consumer is obliged to return the provided principal of the consumer credit within a period commensurate with his or her possibilities. In the event of a dispute over the length of time, it shall be determined by a court. The aim of this mechanism is to give the consumer some time to solve his or her financial problems, and it is a significant shift in terms of protecting his or her ability to adequately address the situation, for example by monetizing the pledged property assets. This mechanism also applies to contracts under the old legislation, if there was a substantial increase in the amount drawn after the new legislation had become effective. In addition to the aforementioned private-law sanction, a public-law sanction for misdemeanour may also be imposed on the provider in the amount of up to CZK 20 000 000, which corresponds to the statutory minimum capital of a provider. Sanctions for failure to assess creditworthiness can, in extreme cases, be stifling.

²⁷ Or via a broker.

²⁸ It is only acceptable to rely on "sufficient" property assets of the debtor if the debtor's property assets are so extensive that there is no doubt about repayment of the loans.

4.3 Annual Percentage Rate of Charge (APRC)

The annual percentage rate of charge is currently the most significant indicator of costs of a credit loan. It takes into account all known costs incurred by the consumer within the credit relationship.²⁹ In addition, APRC takes into account the time value of money, as there is a difference between a gradual and one-off repayment of a credit loan in terms of the value of money. APRC calculation itself is very complicated and there is no need to detail it here. With regard to APRC as the main indicator of “merits,” two main problem areas can be observed. The first one concerns the fact that APRC itself does not take into account other provisions of the contract, thus a cheap credit loan can be a veil for other provisions, unfavourable for the consumer. Another, and probably more fundamental, problem is the low financial literacy of consumers who either are not familiar with APRC or are unable to assess it properly. Despite the above criticism, APRC remains one of the best indicators of credit quality.

The “APRC ceiling” also warrants some attention before concluding this article. There are recurring tendencies to establish the maximum possible APRC for specific types of consumer credit. These tendencies are based primarily on the idea that certain interest rate or APRC is already immoral and such interest rate or costs should not be used for lending to consumers, or even that such activity should be marked as usury.

As mentioned above, APRC is no panacea for assessing the merits of a credit loan. Particularly in the case of short-term loans, APRC increases to hundreds, thousands, and tens of thousands %, and it is precisely because of their short-term nature. For consumers, then, this indicator loses any information value, see the table below.

Loan with an interest rate of 10 % p.a., payable in a single instalment at maturity + a contract conclusion fee of CZK 100³⁰

Credit Amount	maturity 1 day		maturity 1 week		maturity 1 month		maturity 1 year	
	paid	APRC	paid	APRC	paid	APR C	paid	APR C
CZK 1,000	CZK 1,100.3	53687092 2%	CZK 1,101.9	26372 %	CZK 1,108.3	291%	CZK 1,200.0	22%
CZK 3,000	CZK 3,100.8	26146481 %	CZK 3,105.8	544%	CZK 3,125.0	66%	CZK 3,400.0	14%
CZK 5,000	CZK 5,101.4	176060%	CZK 5,109.6	216%	CZK 5,141.7	41%	CZK 5,600.0	12%
CZK 10,000	CZK 10,102.7	4231%	CZK 10,119.2	86%	CZK 10,183.3	25%	CZK 11,100.0	11%
CZK 20,000	CZK 20,105.5	589%	CZK 20,138.5	43%	CZK 20,266.7	17%	CZK 22,100.0	11%
CZK 50,000	CZK 50,113.7	129%	CZK 50,196.2	23%	CZK 50,516.7	13%	CZK 55,100.0	10%

²⁹ Interest, commissions, taxes, fees, property valuation costs, compulsory insurance, etc.

³⁰ Source: Ministry of Finance of the Czech Republic

It should also be stressed that in the Czech Republic the price of credit loans is indeed limited, by case law. According to that case-law, a “gross disproportion” within the meaning of the definition of usury (§ 1796 of the Civil Code and § 218 of the Penal Code) is an annual rate of interest which is several times (usually at least 3-4 times) higher than the usual interest rate demanded by banks.³¹ This is in principle consistent with the case law of civil courts, whereas an interest rate is contrary to good morals if it is almost four times higher than the market rate – see the Supreme Court decision³² in which the annual interest rate of 60% was seen as inconsistent with good morals in a situation where the market interest rate ceiling was around 15.5%. It can be stated that the vast majority of legally offered and provided consumer credit loans can be found below these cost limits.

Another inaccuracy concerns putting an equality sign between usury and high costs of credit. Relatively higher interest rates on credit loans provided by non-bank providers have objective economic reasons. Non-bank providers do business with a higher risk which they must take into account in the price of the credit loan. If a consumer is in good financial condition, he or she has no reason to use the services of a non-bank provider. If a consumer is too risky for a bank, he or she can use the services of the non-banking market. In this sense, the non-banking market is linked to the banking market, complementing it.

Usury is, on the other hand, an illegal practice, the assessment of which is, by its very nature, always individual, because the condition of abuse of the debtor's distress must be fulfilled and, furthermore, it does not have to be related to provision of a credit loan at all. Consumer credit is often not the cause, but only a consequence of serious events in human life when the life-time situation changes due to death of a partner, illness, divorce, etc. The consumer then gets into financial difficulties because he or she is unable to properly make payments that are ordinary in civil life. Such a consumer is too risky and uncreditworthy for banks, and is therefore forced to contact non-bank providers who can take this risk into account in the price of credit loans. These are the main channels through which existing debts grow to such proportions that the uncreditworthiness of a given debtor causes him or her to fall into the arms of real usurers. Providing a credit loan to an over-indebted person – a practice typical for the segment of illegal consumer credit providers – is, however, primarily a breach of the legal obligation to conduct a proper credit assessment, not a manifestation of absence of price regulation.

Capping of APRC will not lead to disappearance of the expensive credit market, but only to its shift into the grey zone, as the need for consumers to lend money, albeit expensively, will logically not disappear by this capping alone.

4.4 Authorization and supervision

One of the main systemic changes in the new act is the unification of the authorization procedure and supervision under the auspices of the CNB. Fragmentation in previous legislation was very problematic, as different providers and brokers were authorized and subsequently supervised by different entities, see the table below.

³¹ Cf. decision of the Supreme Court of 11 April 2012, case No. 3 Tdo 225/2012, as No. 23/2013 Sb. rozh. tr., according to which an annual interest of 65% and, depending on the circumstances, even less, does represent a gross disproportion; and the decision of the Supreme Court of 31 July 2013, case No. 4 Tdo 416/2013, according to which an annual interest of 44.1% represents a gross disproportion .

³² Cf. decision of the Supreme Court of 15 December 2004, case No. 21 Cdo 1484/2004.

Type of subject	Scope of activity of the supervisory authority – old regulation	
	issuing authorizations	supervision of activities
bank providers of consumer credit	CNB	CNB
non-bank providers of consumer credit	Trade Licensing Offices	CTI
non-bank consumer credit providers also providing some other financial services (e.g. payment services)	CNB and TLOs	CNB

The integration of supervision within the CNB is a long-term continual process. It aims at effective and expert supervision that can be legitimately expected from the CNB. Paradoxically, although virtually all market players agreed that the best subject for comprehensive market surveillance of consumer credit, including credit loans provided without authorization, was the CNB, it itself had the most conservative attitude to that arrangement. The CNB's argument that credit institutions do not accept deposits from the public and thus their possible bankruptcy does not pose a systemic risk to the financial market can hardly be opposed, but the Czech legal environment features no better-equipped institution in terms of relevant expertise than the CNB. Creating a brand-new institution would be extremely inefficient. A similar system of consumer credit market surveillance is applied in 7 other EU Member States.

The transfer of supervision under CNB was coupled with re-registration obligation for non-banking entities that had provided and brokered credit loans under a trade license before the act came into effect. After the act came into effect, entities had until 1 March 2017 to apply for authorization at the CNB. If they failed to do so, their authorization to provide and broker consumer credit was cancelled. On the other hand, those who did apply were subject to a “transition period” during which the CNB had to make a decision on their application. In case of entities that had not obtained the CNB authorization before 31 May 2018, their previous authorization was definitively cancelled. This mechanism has fully fulfilled its purpose, as out of several tens of thousands of non-bank providers and brokers³³ only 87 entities received the CNB authorization in the end.³⁴ It can be concluded that 87 non-bank consumer credit providers is a quantity that can be supervised safely and well.

5 CONCLUSION

The adoption of the new regulation on providing and brokering consumer credit pursued two main objectives. The first was purely practical, namely the transposition of the MCD Directive. The second, more specific reason was solving domestic problems in the area of consumer credit distribution. The new Consumer Credit Act was intended to respond to 7 major problems of domestic consumer credit, mainly within the non-banking sector. These included primarily the following:

³³ Under the Trade Licensing Act authorization, it was not possible to distinguish whether they were providers or brokers.

³⁴ Online at

https://apl.cnb.cz/apljerrsdad/JERRS.WEB15.BASIC_LISTINGS_RESPONSE_3?p_lang=en&p_DATUM=29.06.2018&p_hie=HI&p_rec_per_page=25&p_ses_idx=339

1. lack of clarity in the consumer credit market, large scale of the grey zone of providers and brokers, unclear responsibility of individual actors in the distribution channel – and hence supervision that was hard to perform also in terms of capacities;
2. weak requirements for entry of entities into the sector, untrustworthy and unprofessional nature of those involved in distribution;
3. performance of permitting and supervision activities by non-specialized public authorities (trade licensing offices, Czech Trade Inspection);
4. abuse of the social distress of debtors, a business model based on lender speculation expecting default of the debtor (disproportionate contractual sanctions), and the resulting implications for public budgets;
5. non-compliance or inconsistent compliance with the obligation to verify the borrower's creditworthiness;
6. unfair (deceptive, aggressive) commercial practices – distorting the costs of credit products, pre-contract payments, etc.;
7. regulatory arbitrage with regards to a) consumer-business relationships and b) the lower value limit of the CCA, which is now set at CZK 5,000.³⁵

More than three years after the act came into effect, it is now time to look back at what the act has actually managed to change so far.

In particular, the non-bank consumer credit market could have been described with some exaggeration as a “jungle.” There used to be tens of thousands of entities operating here, which could not be further classified because of the nature itself of the definition of “providing and brokering consumer loans” as registered trade. Effective supervision of such a large number of subjects was virtually impossible. This situation was primarily due to low entry requirements for the sector, which allowed dishonest and unprofessional entities to also operate in the market, and consequently to the absence of effective supervision cultivating the market. The new act responds satisfactorily to all three problems described above. The act makes a clear distinction between a consumer credit provider and a consumer credit broker, imposing on each of them appropriate conditions for entering the market and operating in it, including clear inclusion in the distribution chain. Emphasis is placed on expertise and credibility of distributors, and all providers must be legal persons with sufficient capital and staff, assessed by the CNB as a supervisory body which also controls the market entry of distributors. Consumer credit brokers are clearly categorized and their responsibility is logically derived from their position in the distribution chain. An important element of the cultivation of environment was the reduction of consumer credit providers from several tens of thousands to 87.

The new legislation theoretically liquidates the aforementioned business model in which providers relied on the debtor's default and penalties were major part of their income. This is due to the mandatory limitation of contractual sanctions that the provider can apply. On the other hand, the legislature did not place a statutory limitation on the maximum interest rate or APRC and left this to judicial interpretation, as exceeding a certain level of interest or APRC violates good morals or, when other conditions are fulfilled as well, constitutes usury. This variant of arrangements was adopted on the basis of a broad discussion that showed, in particular, that a “capping” would probably only move “expensive” credit loans to the grey zone outside the effective control of state power, which was not desirable.

³⁵ Final Regulatory Impact Assessment (RIA) report on Draft Consumer Credit Act, p. 16.

On the other hand, the main emphasis of this law is on responsible provision of consumer credit through the obligation to assess the creditworthiness of the consumer. It is primarily the provider who is a professional in given situation and who should be able to assess, on the basis of information received from the consumer, whether the consumer can afford the loan or not. Motivation for effective assessment of consumer creditworthiness is especially provided by the sanctioning provisions of the act, which in case of absent or insufficient assessment of consumer creditworthiness provide for relative invalidity of the contract; the consumer is then only obliged to return the principal to the provider, within a period that is appropriate to his or her capabilities.

Although it may be difficult to prevent unfair, deceptive, and aggressive commercial practices or misrepresentation of the costs of credit products, the law clearly regulates the information obligations of providers and brokers *vis a vis* consumers as well as the rules for their conduct so as to guarantee sufficient consumer protection. Moreover, these measures are supported by relevant sanctions for infringements, which are intended to act both preventively and repressively.

It is clear that the new act undoubtedly brought about an end to the regulatory arbitrage concerning the lower limit of consumer credit under previous legislation. Newly, the consumer credit rules apply without exception to any amount of consumer credit. On the other hand, the new legislation partially fails to cover the other regulatory arbitrage, namely the one concerning provision of credit to self-employed persons. The MCD allowed residential credit to be partly used for business purposes as well, but this purpose could not prevail.^{36,37} On the basis of public consultations it was decided that credit loans granted to small businesses / self-employed persons would be excluded from the scope of the Act. This adjustment has its logic in that the assessment of credit risk for entrepreneurs requires different tools and different follow-up monitoring. Furthermore, housing is a need of a consumer, not of an entrepreneur, and extending the scope of the legislation to entrepreneurs would increase the administrative costs of providers who would pass them on to consumers within an overall price increase.³⁸

Since 2018 and especially in the spring of 2019, a discussion on the scope of the act has been opened once again, namely on the possibility of extending the scope to include entrepreneurs / self-employed persons. The main place of discussion was the Chamber of Deputies Subcommittee on Consumer Protection. There are basically two theoretical reasons for extending the scope of the act.

The first one is the effort to reduce circumvention of the regulation via quasi-business credit loans. It is interesting to note that, although the Financial Arbiter records several dozen proceedings concerning a dispute over the nature of the credit relationship, since the act has come into effect the Czech National Bank has not received a single complaint concerning this issue. It should also be noted at this point that the fact that a credit agreement is designated as a business credit agreement, that the headline of the agreement includes a business identification number, or that the text of the contract refers to a business credit, does not in itself mean that the credit is a business credit (and therefore outside the scope of the regulation). The nature of

³⁶ For example, one might consider buying a residential property that includes a small business workshop.

³⁷ Recital 12 of the MCD: *"The definition of consumer should cover natural persons who are acting outside their trade, business or profession. However, in the case of dual purpose contracts, where the contract is concluded for purposes partly within and partly outside the person's trade, business or profession and the trade, business or professional purpose is so limited as not to be predominant in the overall context of the contract, that person should also be considered as a consumer."*

³⁸ Final Regulatory Impact Assessment (RIA) report on Draft Consumer Credit Act, p. 44.

the credit is not defined by formalities, but rather by the objective nature of the credit. It cannot therefore be concluded that sole traders or small businesses remain in a legal vacuum.

The second area underpinning a possible extension is the transfer of the consumer protection standard for consumer credit also to small entrepreneurs and sole traders who are virtually in the same position as consumers in terms of their knowledge of law and options for defence against unfair business practices of creditors. This issue has been widely discussed by the Ministry of Finance, also with non-profit organizations. As a result of this discussion, it was agreed that extending the scope of the Act to both sole traders and small businesses is not an appropriate solution. Considerations then aimed at extending certain elements of the law to sole traders, not small entrepreneurs, based on the expert discussion that is still ongoing.³⁹

A separate chapter of consumer lending is the use of notarial deeds for direct enforceability pursuant to §§ 71a and 71b of Act No. 358/1992 Sb., the notarial tariff. This practice is not prohibited and allows the creditor to avoid the often lengthy process of ordinary court trial, thereby severely limiting the consumer's ability to procedurally counter enforcement. At the same time, consumers are faced with either agreeing to a direct enforceability or not receiving the credit loan, which may prove problematic in a difficult life-time situation, especially when the costs of drawing up a notarial record are borne by the consumer. Thus, *de lege ferenda* it might be worth consideration to modify the conditions for use of notarial deeds pursuant to §§ 71a and 71b of Act No. 358/1992 Sb., the notarial tariff, in the context of consumer credit.

If we are to assess how the new legislation has met the initial objectives, it can be concluded that, to a large extent, the objectives should be met. Undoubtedly, the MCD was transposed, and the new legislation also managed to respond to the majority of problems occurring in the consumer credit market of the Czech Republic. It can be argued, of course, that until 31 May 2018 virtually anyone who applied to the CNB for authorization could provide credit loans, but the final reduction to 87 non-bank entities is an undeniable shift. An important caveat to this article is the remark that, with minor exceptions, the new act was not intended to regulate the settlement of existing debts incurred before it entered into force; that challenge should be faced by enforcement law or bankruptcy law. The Act No. 257/2016 Sb. on consumer credit was intended to establish fair conditions in the consumer credit market *pro futuro* and to ensure sufficient consumer protection against “predatory” practices – and this, in my opinion, has been achieved.

Authors' CV

Lenka Dupáková graduated from the Faculty of Law of Charles University in Prague and the Faculty of Business Administration of the University of Economics, she also studied at the University of East Anglia in Norwich, England. She works at the Ministry of finance, where she came from a large domestic bank, where she dealt with the restructuring of international companies. Before that, she worked in an international law firm in the field of banking and financial transactions. Since 2010, he has been lecturing at the Faculty of Law of Charles University. In 2021 and 2022 she worked at the Permanent Representation of the Czech Republic in Brussels.

³⁹ Non-profit organizations (Člověk v tísni, Poradna při finanční tísni, Sdružení českých spotřebitelů, dTest, Asociace občanských poraden) agreed on applying the following elements of the act to sole traders: general rules of conduct, limitation of payments prior to provision of credit, assessment of creditworthiness including the invalidity of the contract in case of failures in this respect, assessment of information contained in advertisements, of information contained in the credit agreement, prohibition on the use of a bill of exchange or check, rules on the ratio between the value of the security and the value of the credit, prohibition on using a telephone number with expression of the price, limitation on bounded provision of credit, limitation on risks arising from credit in other currencies, early repayment, limitation on default penalties, contents of the credit brokering agreement.

How do Machine Learning and Big Data affect the insurance sector?

Linus Holzmann

Abstract

This paper deals with the question of how big data and machine learning are affecting the insurance sector. The hypothesis underlying the paper is that insurance companies can gain a competitive advantage over their competitors through leveraging big data by using machine learning. Big data, characterized by its high volume, velocity, variety, value, and veracity, has emerged as a valuable resource for insurers. Machine learning, a subset of artificial intelligence, enables the extraction of insights and patterns from such vast datasets. Based on a comprehensive literature review of scientific articles from highly relevant journals, the paper elaborates potentials of big data and machine learning for insurers. The combination of big data and machine learning offers several potential applications for insurers, including risk assessment, claims settlement, fraud detection, pricing, and customer retention. It could facilitate individualized policyholder profiling, personalized insurance solutions, efficient claim management, and improved risk management. Based on the potential analysis of big data and machine learning for insurers some possible competitive advantages will be derived, and their feasibility discussed in view of today's circumstances. The key results are that leveraging big data through machine learning can offer competitive advantages such as loss prevention, increased profits, efficiency gains, cost reduction, and customer satisfaction, but practical obstacles hinder insurance companies from fully realizing these advantages. These obstacles include inadequate software systems, decentralized data storage, and poor data quality. Additionally, factors such as untransparent algorithms, ethical concerns, and legal infrastructure also limit the ability of insurers to gain a clear competitive advantage. The hypothesis can only be confirmed if the technical circumstances permit it, including having a supportive technical infrastructure for leveraging big data. Additionally, access to high-quality and unbiased data, as well as the necessary expertise and knowledge, are essential for validating the hypothesis.

Keywords

big data, machine learning, insurance, digitization, predictive analytics, risk management, risk assessment, competitive advantage

JEL Codes

G22, O3

1 INTRODUCTION

"Data is the gold of the 21st century" - this widespread statement, which can almost be classified as common sense, seems to be on everyone's lips in view of the progressing digitalization. The use of a wide range of digital devices and the tracking of personal data are making people more and more transparent. Digitization, Big Data, artificial intelligence and machine learning are expected to fundamentally transform almost every sector of the economy and are also impacting the financial sector. Technological changes and rapidly increasing competition are changing the environment for financial service providers (Riikinen et al., 2018; Ostrowska, 2021). However, big data has been a popular term for more than 10 years now and has since been

treated as being the game changer. Already McAfee and Brynjolfsson (2012) claimed that big data would exceed all data potentials and analyses of the past. Companies and decision-makers can make more accurate predictions and better decisions based on the information available thanks to big data.

This paper addresses the question of how Big Data (BD) and Machine Learning (ML) are influencing one of the most common financial institutions: insurance companies.

InsurTechs, which seek to transform the insurance industry with innovative technologies and business models, are putting pressure on traditional insurance companies. But also companies from other industries are actively looking for growth opportunities by leveraging their customer data sets. In response, insurance companies are changing their competitive priorities and securing their raison d'être by investing in modern technologies (Riikkinen et al., 2018). In the course of the rapidly advancing digitalization, a broad mass of data sources became accessible. As a result, the financial industry has accumulated a huge amount of market and personal data. Modern, algorithm-based technologies such as machine learning bring new opportunities to use customer data in a way that benefits not only the insurers but also creates value for the customers (ibid.).

The economic framework of insurance companies is basically very simple: contributions from policyholders who have nothing to claim are used to cover the costs of other insurance claims within the community of the insured. Reliable and conscientious risk management, such as the risk assessment of claims, the sufficient formation of capital reserves, and the pricing and design of insurance offers, are of paramount relevance in order to provide binding contracts over an uncertain future (Arisov et al., 2019). Big Data could provide an opportunity for insurance companies take a look into the future.

According to Ostrowska (2021) the access to data sources and their smart evaluation will be the key success factors in the insurance industry. Moreover, the author states that the possibility to take a look in policyholder's minds and lives means a competitive advantage for insurers using big data (ibid.) McAfee and Brynjolfsson (2021) add that the use of real time information makes companies more agile than their competitors. Based on these statements and a broad literature review the following hypothesis can be derived:

Insurance companies that use big data and machine learning can gain a major competitive advantage over their competitors due to more accurate risk assessment and better risk management.

This paper is structured as follows: The first section aims to provide a fundamental understanding about the business model and risk management of insurance companies. The second section serves to clarify the terms "big data" and "machine learning" in order to define precisely what is meant by these terms. The core of the paper is a subsequent analysis of the potential that Big Data could mean for insurance companies. Finally, the hypothesis will be answered based on a discussion of potentials and challenges arising from big data and machine learning.

2 THEORETICAL BACKGROUND

2.1 The insurance business

The insurance business is based on the principle of collective risk compensation. This consists of the fact that the aggregation of many individual risks can reduce the overall risk of the insurance transactions (Huggenberger & Albrecht, 2022; Arisov et al., 2019). From a policyholder's perspective insurance means the transfer of risk to the insurance company. From

an insurance company's perspective, the business is all about risk pooling (Huggenberger & Albrecht, 2022; Barry. & Charpentier, 2020). The aim behind the aggregation of individual risks is to reduce the variability of the occurrence of claims and to reduce particularly severe claims (ibid.).

In the insurance business, insurance contracts are closed in anticipation of an uncertain future. To be able to anticipate the future, insurance companies have to make assumptions based on statistical probabilities (ibid.). This means that a large number of relevant variables that could have an influence on the probability of occurrence of possible claims have to be examined. The basis for a risk classification is formed by the potentially occurring causes of loss. These represent risk factors (Albrecht, 2017). The problem with this is that statements about the probability of occurrence of claims can only be made on the basis of data from the past. The reliability of these data is of utmost importance to the insurer, as they quantify the respective risk of occurrence of a claim (Arisov et al., 2019). The insurer therefore has a great interest in having access to large-volume, reliable data in order to better assess risks.

A more precise risk assessment enables the insurer to better estimate the premiums for its insurance products (Cappiello, 2020). The ideal premium is determined by weighing the risk of a claim against maintaining competitiveness with other insurers. However, the premium rate is not set generally for an insurance product, but is based on the risk classes into which the insurer categorizes the policyholders, as the risk of loss can vary greatly in view of their heterogeneity. Within the risk classes, each case is given a specific weighting, which ultimately determines the premium.

The heterogeneity and individuality of potential policyholders is what causes an essential concept of the insurance industry: the principle of utmost good faith. It is based on the assumption that there is an information asymmetry between the insurer and the person seeking for insurance coverage, since the applicant has a lot more information about his individual risk. Information about the individual risk are important for fair contracting. The insurance company depends on the information that the applicant provides in his risk declaration when deciding about to insure a risk or not. Therefore, the obligation for both parties to act in utmost good faith was applied (Ostrowska, 2021).

2.2 Definition of big data and machine learning

Big data is like teenage sex: everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it.”
Dan Ariely

The statement by the US-Israeli professor of psychology Dan Ariely – quoted from Billot et al. (2018) – illustrates that the term "big data" is commonly used and yet no one really knows what it means and how to take advantage of its potential.

The authors De Mauro, Greco and Grimaldi (2016) strive for a consistent definition of the term Big Data. Previously, Big Data was a broad, popular term. The previous attempts of definition can be classified into four categories, depending on which aspect of Big Data they highlighted the most. The four core aspects of previous definitions focused on Data Attributes, Technology Requirements, Crossing Thresholds, and Social Impact.

One of the most common definitions focuses on the data attributes of Big Data. Laney (2001) summarized the data attributes in terms of the three Vs. These are data Volume, Velocity, and Variety. Volume stands for the enormous amount of data. Velocity stands for the speed with which the data volumes are generated and transferred. Variety means the range of data types

and sources (Laney, 2001; McAfee & Brynjolfsson, 2012). More recent definitions add two more Vs to the three dimensions: Value and Veracity. Value aims at the cost advantage of companies when decision makers can make more valid decisions based on information from big data (Sukumar et al., 2015). Veracity reflects the truth content of big data and thus represents the data quality (ibid.)

Other definitions focus on the technological requirements to be able to process and evaluate the enormous amount of data (De Mauro et al., 2016).

Similar approaches define Big Data in terms of crossing thresholds: Definitions following this approach deal with the impossibility of processing the data using conventional database systems due to its volume and complexity (De Mauro et al., 2016). According to Manyika et al. (2011), Big Data can be defined as a volume of data whose scale, distribution, diversity and transience require new analytical techniques and infrastructures. For using Big Data, therefore, new types of data storage and analysis systems are being used that operate parallel on up to hundreds or thousands of processors or servers.

Social Impact: Definitions such as that by Boyd and Crawford (2012) define Big Data as "a cultural, technological, and scholarly phenomenon", based on a maximization of computing power and algorithmic accuracy and the identification of patterns in large data sets.

Based on all of these different approaches of definition the authors De Mauro, Greco and Grimaldi (2016) define Big Data as follows:

"Big Data is the Information asset characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value."

Analogous to the availability of larger data sources, statistical methods and improved computing power, machine learning and artificial intelligence (AI) have evolved. Machine learning is said to revolutionize entire industries and sectors (Lantz, 2021). Even though artificial intelligence is difficult to define, it is evident that machine learning is a subset of artificial intelligence. A large majority of people think that AI and ML are the same thing because they strongly believe that ML is the only viable way to achieve the goals of AI (Rebala et al., 2019). Machine learning is a field of informatics that deals with algorithms and techniques for automated solution of complex problems that are difficult to solve with conventional programming methods (ibid.). Machine learning enables IT systems to detect patterns and regularities based on large existing data sets and algorithms. The knowledge gained from the data can be generalized and used for new problem solutions or for the analysis of so far unknown data. ML is used to build models by learning from existing data sets to make predictions about the occurrence of future events.

For the sake of understanding immense datasets and extracting relevant information, ML contributes by three particularly common application tasks: classification, clustering and prediction. By machine learning Data can be classified into a specific set of categories. Moreover, a large set of data points can be clustered according to some data attributes. The difference to classification is that the amount of clusters is not defined in advance. The opportunities of prediction might bring be the most advantages for insurers. Based on historical data, models can be set up by machine learning to forecast future events (ibid.).

2.3 The potential of big data and machine learning

As described above, in the insurance business, contracts are closed with regard to an uncertain future (Arisov et al., 2019). Only data from the past can be used to make assumptions about the

probabilities of potential claims occurring. The more comprehensive and reliable this information is, the better. In particular, the lack of availability of personal data has posed challenges for insurers. The amount of data available about individuals has increased dramatically since the widespread use of various web applications, mobile devices, social networks, smartwatches, fitness trackers as well as sensory devices and smart home solutions (Alamir et al., 2020; Choi, Lambert, 2017; McAfee & Brynjolfsson, 2012). However, it is not just the mere amount of data that plays a major role for the insurer but also the range of diversified data from various sources, which, when linked together, can bring novel information to the surface (Lehrer et al., 2018).

Machine learning plays a crucial role in translating this available data into information that insurers can use in many ways: Applications of machine learning in the insurance industry include claims settlement, fraud detection, risk analysis, pricing, audit, marketing, customer retention, and customer segment analysis (Alamir et al., 2020).

Thanks to telematic systems there is a high availability of real time data, which is related to policyholder's behavior and gives insights into policyholders lives (Eling & Kraft, 2020; Ostrowska, 2021; Barry & Charpentier, 2020). Based on big data, heterogeneous personal data can be linked together to create a specific policyholder profile (Alamir et al., 2020). Such individual and detailed policyholder profiles could represent an important competitive factor, as they make it possible to quantify the individual risk of a claim and to react proactively by setting the insurance premium. The possibility of individual pricing of insurance products and, moreover, the generation of completely new insurance solutions belongs to the key potentials of big data: With the availability of data, insurers can provide services in real time and develop and custom price new insurance products (Cappiello, 2020). Insurers can use machine learning to identify individual risks related to the policyholder on the basis of personal data such as recognized action patterns or health data instead of general proxies and quickly make offers adapted to these (Silvello et al. 2019). For example, thanks to telematics solutions in vehicles, data on drivers' driving behavior can be recorded and transmitted to the insurance company (Arumugam & Bhargavi, 2019; Eling & Kraft, 2020). Based on this information, individual insurance premiums can be adjusted to the policyholder's personal driving behavior (Barry & Charpentier, 2020). This is called the pay-how-you-drive model (PHYD) and belongs to the most popular cases of usage-based insurance (Arumugam & Bhargavi, 2019; Eling & Kraft, 2020; Ostrowska, 2021).

The higher the correlation between the available data and the risk, the higher the validity of the data. The more valid the data, the more accurate the risk assessment and the more accurate the pricing of insurance products (Arisov et al., 2019). Instead of the usual classification of policyholders into different risk groups, Big Data enables the personalization of insurance solutions and prices (Lehrer et al., 2018, Ostrowska, 2021; Röschmann & Erny, 2022). The principle of collective risk equalization outlined at the beginning thus becomes replaced by insurance management customized to the individual. Also the principle of utmost good faith seems to become less relevant the lower the information asymmetries between insurers and applicants become (Ostrowska, 2021). The individual is therefore not assigned to a more or less general risk class, but is screened on the basis of his or her personal data. Big data and machine learning thus form the basis for the individual structuring of insurance policies (Alamir et al., 2020; Cappiello, 2020, Ostrowska, 2021; Röschmann & Erny, 2022). The availability of entirely new data sources even makes it possible to establish completely new risk categories (Ostrowska, 2022).

Due to the possibility of using machine learning techniques to identify low-risk customers based on personal profiling and behavioral data, big data enables insurers to offer them a simplified underwriting process. This not only improves operational efficiency, but also the customer experience (Schoenauer, 2022; Ostrowska, 2021).

In the event of occurring damages the evaluation of insurance claims is a complex process in the insurance industry, as information from diverse customer documents must be analyzed. With the help of machine learning, document types can be classified automatically and relevant sections in documents can be identified. Machine Learning thus also supports the efficiency of claim management (ibid.).

Summarized this means that not only insurance premiums and solutions can be adjusted to the personal behavior of policyholders, but policy and claim management also become a lot more efficient (Cappiello, 2020). Moreover, the authors Jaspersen, Ragin and Sydnor (2021) made clear that it is also possible to use data on former insurance decisions to predict decisions under somewhat different economic conditions, which helps insurers to create insurance solutions fitting with customer's demand.

The information provided by big data about customer habits and needs can also lead to higher customer loyalty and reasons for potential customer churn can be identified and eradicated (ibid.). Moreover, if insurers can provide better service to their customers, for example by reducing excess risk, by better linking risk and coverage, or by reducing costs through automation of internal processes, this will have a positive impact on customer loyalty (Alamir et al., 2020; Bauer et al., 2021). Even establishing completely new insurance business models like "on-demand insurance" are perspective possible (Röschmann & Erny, 2022).

Another big potential for insurance companies is the improved and data driven risk management. Machine learning is widely seen as a game changer for insurers, as the information can be used to make targeted predictions about potential loss risks. Both income from insurance premiums and incurring costs can be predicted with the help of machine learning. Based on this information, insurers can estimate how much liquid capital reserves they need to retain (Fang et al., 2016). The proactive management that becomes possible as a result gives insurers planning certainty.

It is also important that the personal data can also be retrieved instantaneously in synchronized form at any time. Due to this immediate retrievability of constantly updated data, waiting times until a contract can be concluded can be minimized to a few minutes or even seconds. In addition, the available data increases transparency in the insurance business, since insurance conditions or possible rejections of an insurance transaction can be clearly justified on the basis of the available information (Greineder et al., 2018).

In addition, thanks to ML and the risk analyses based on it, costs can be avoided thanks to the non-occurrence of claims. The authors Breidbach and Maglio (2020) assume an evolution of the business practice of insurance companies from "detect and repair" to "predict and prevent", meaning that insurers not only can predict future claims payments based on historical data, but they can prospectively prevent them. For example, in the event of water leaking due to a leak in the pipe, this unusual event can be identified by a sudden change to the data and appropriate countermeasures initiated. It is also conceivable to provide assistance services such as an automatic call to a skilled craftsman (Schoenauer, 2022).

There is also great potential in the data-driven detection of criminal acts carried out by using artificial intelligence: Insurance fraud is one of the main problems of any insurance company. According to a recent Infas-Quo study commissioned by the German Insurance Association (GDV), fraudulent intent is involved in 10% of all claims for damages (German Insurance

Association, 2020). With the help of machine learning, damage claims can be examined and fraudulent intent can be indicated (Alamir et al., 2020; Riikinen et al., 2018; Gepp et al., 2018, Ostrowska, 2021). Machine learning-based fraud detection automatically links and analyzes a wide variety of internal and external data and examines them for fraud patterns. This works completely automated in the background. The administrator is only presented with the dubious claims when the artificial intelligence suspects fraud on the basis of the data (Schoenauer, 2022).

3 METHODOLOGY

This paper is based solely on a literature review, which involves a comprehensive review of published research and articles related to the use of big data in the insurance sector. The literature review methodology was selected because it provides a comprehensive and objective analysis of existing research in this field. The literature search was conducted using various academic databases, including Google Scholar, Web of Science, etc. The search was conducted using relevant keywords such as "big data", "insurance", "data analytics", "predictive modeling", and "machine learning". Moreover, the author mainly considered articles from peer reviewed journals with an impact factor.

The main focus of this paper is to explore the potential benefits of big data in the insurance sector, and the challenges associated with its implementation. The literature review identified several key themes related to the use of big data in insurance, including risk management, fraud detection, customer segmentation, pricing, underwriting, and claims management. Overall, the literature review provides a comprehensive overview of the current state of research on the use of big data in the insurance sector from which the author derived the answer of the underlying research question.

4 RESULTS AND DISCUSSION

The objective of this paper was to find out how big data and machine learning affect the insurance sector. Based on a literature review the hypothesis postulated in the beginning of this paper was that insurance companies can gain a competitive advantage over their competitors by using big data and machine learning due to more accurate risk assessment and better risk management. While the previous chapter dealt with the potentials of big data and machine learning in general, this chapter aims at the concrete verification or falsification of this particular hypothesis. To this end, the concrete competitive advantages resulting from the potentials are elaborated and discussed against the challenges that big data poses for insurance companies.

With regard to the risk assessment, the previous potential analysis shows that the information that can be obtained from Big Data enables insurers to analyze risks much better. Thanks to Big Data, insurance companies can create an individual risk profile for their policyholders, which leads to a better risk pooling and the reduction of information asymmetries between insurers and policyholders and thus to more transparency in the insurance industry (Alamir et al., 2020; Cappiello, 2020; Schoenauer, 2022; Eling & Kraft, 2020). This individual risk profile can be created on personal data and information about personal habits and behavior of potential clients (ibid.). Ostrowska (2021) states that insurers can obtain a full risk profile based on the information of smart devices alone. The uncertain future thus becomes more predictable and the probability of a loss occurring more quantifiable. Despite the individual risk assessment, processes can also be automated to a large extent using machine learning algorithms (Alamir et

al., 2020). The competitive advantages that can be derived from the effective use of big data are diverse. A more accurate, behavior-specific risk assessment enables the structuring of needs-based insurance products (Alamir et al., 2020; Cappiello, 2020; Schoenauer, 2022)). Customers with a particularly favorable risk profile can be granted an simplified underwriting process and the insurance contracting process can be streamlined (Schoenauer, 2022). Shortened sales cycles and increased operational efficiency due to the higher, algorithm-based degree of automation can mean clear cost savings for insurance companies. On the other hand, needs-based insurance solutions and streamlined, uncomplicated processes lead to higher customer satisfaction and loyalty. The most important factor about a more accurate risk assessment is that it forms the basis for improved risk management.

According to the previous potential analysis, insurers have three levers to minimize their risk: Pricing, fraud detection and claim anticipation. Because of the more accurate risk assessment of the client-specific occurrence of a claim, insurers can minimize the risk of loss in the event of a claim by adjusting the amount of the premium to cover the risk (Ostrowska, 2021; Lehrer et al., 2018). In addition, as previously stated, insurance fraud is a major problem and a significant cost factor for financial institutions (Gepp et al., 2018). With the help of intelligent algorithms and an appropriate data basis, fraudulent intent can be detected, predicted and prevented automatically to a large extent (Gepp et al., 2018; Riikinen et al., 2018; Ostrowska, 2021). The claim processor is presented only with consolidated cases that the system classifies as fraudulent (Schoenauer, 2022).

Early claim anticipation enables insurance companies to intervene at an early stage and thus prevent the actual occurrence of a claim (Eling & Kraft, 2020, Schoenauer, 2022). The competitive advantages that can be derived from this are profit and efficiency increases as well as cost reductions. By balancing the risks through adjusted premiums, claims settlements can be better compensated, which leads to profit increases for the insurance companies. Again, the ML-related degree of automation in claims processing and early detection of fraudulent intent means increased efficiency and thus reduced operating costs (Schoenauer, 2022). Cost avoidance through the absence of payments for fraudulent claims, as well as cost avoidance through claims prevention, both represent obvious competitive advantages. Again, due to transparency, individual insurance policies, and fast processing of insurance claims, insurance companies can enjoy higher customer satisfaction and thus less customer churn (Alamir et al., 2020; Bauer et al., 2021). Given all these advantages, Bauer et al. (2021) postulate that a higher level of digitalization is associated with an insurer's higher market valuation.

If only the potential is taken into account, the hypothesis that the use of machine learning and big data means clear competitive advantages for insurance companies could be clearly verified. However, the technical and data related status quo as well as the challenges posed by digitization must also be considered to make a well-founded statement:

The above advantages sound very promising, but the advantages that Big Data and Machine Learning bring with them also require a certain amount of action. Given the widespread status quo, many of the potentials and advantages appear to be rather futuristic. According to the definition of big data presented previously and on which this paper is based, big data involves masses of data that are too voluminous, heterogeneous and volatile to be analyzed by classic data processing methods (De Mauro et al., 2016). Barry and Charpentier (2020) noted that there is a tension between the vision of individual risk assessment due to big data and the state-of-the-art risk assessment tools. This clearly implies that insurers must rely on novel, ML-driven analysis technologies to extract meaningful information from the mass of data in a structured way. Such analysis technologies in a suitable form for insurance companies are, on the one hand, difficult to obtain and, on the other hand, require an enormously high implementation effort (Schoenauer, 2022). Furthermore, there are not only technical but also personnel

requirements since highly specialized data scientists are required to analyze the data and gain relevant information, while IT departments have to work hard on the integration of relevant data (McAfee & Brynjolfsson, 2012).

Due to the fast-moving and heterogeneous nature of the data, analysis algorithms must also be adapted on a regular basis. Even the data on its own does not bring insurance companies any added value, even after the costly implementation of ML-based predictive analytics methods, as long as the various data are not constantly updated, synchronized and linked with each other (Schoenauer, 2022; Cappiello, 2020). This is the only way to gain valuable information.

Lauterbach (2019) distinguishes between three main issues with artificial intelligence and machine learning: Biases in data and algorithms, transparency in AI models, and general ethical issues.

According to the authors Breidbach and Maglio (2020), the quality of big data sets is almost fundamentally of insufficient quality, due to a lack of currency, accuracy, and completeness. Often, the context-free combination of heterogeneous data sets provides biased information. In addition, the data is usually not resistant to manipulation (Breidbach & Maglio, 2020; Lauterbach, 2019). Without taking contextual metadata into account, big data cannot function as a reliable basis for decision-making (Breidbach & Maglio, 2020).

Regarding automated and algorithm-based decision making and claims processing, Breidbach and Maglio (2020) also note ethical factors to consider as for example, the limited reliability of algorithms, the lack of human involvement, and the inability to ensure accountability for algorithm-based decisions are problematic from an ethical standpoint. Due to the opacity of algorithmic decisions, the supposed creation of transparency by machine learning is also questioned (Breidbach & Maglio, 2020; Lauterbach, 2019).

Another important limitation is data protection. Due to the permanent collection of personal data through a wide variety of data sources, people are becoming increasingly transparent. Nevertheless, policyholders must consent in some way to their personal data being collected and analyzed. In view of the increasing awareness of data security, policyholders only consent to the use of data if this is advantageous to them on the one hand, and on the other hand, it is ensured that the data is stored in a way that protects it from third parties and potential misuse (Cappiello, 2020).

Summarized, the key results are that leveraging big data by machine learning could bring several competitive advantages due to more accurate risk assessment and better risk management, but from practical point of view there are still mostly technical circumstances preventing insurance companies from gaining these advantages. The potential competitive advantages from big data and machine learning are loss prevention, profit increase, efficiency gains, operational cost reduction and customer satisfaction. Practically there are some circumstances that harm the potentials of big data and machine learning. Often, it is inadequate software systems, decentralized data storage and poor data quality that prevent the potential of Big Data from being unleashed (Bauer et al. 2021; Schoenauer, 2022). Moreover, poor data quality, untransparent algorithms and ethical issues prevent insurers to gain a clear competitive advantage.

Under these circumstances, the hypothesis underlying this study could only be affirmed under the proviso that the technical and legal infrastructure permits the use of big data, the availability of high quality and unbiased data is given, and that the necessary know-how is available.

5 CONCLUSION

The aim of this paper was to investigate how big data and machine learning affect insurance companies. In particular, the paper investigated the hypothesis that *Insurance companies that use big data and machine learning can gain a major competitive advantage over their competitors due to more accurate risk assessment and better risk management*. To this aim, the various potentials and advantages that the use of digital data sources and intelligent analysis methods involve were examined. In conclusion, digitalization in the form of big data and artificial intelligence such as machine learning has the potential to revolutionize the insurance industry but poses major challenges and exerts considerable pressure.

Perspectively, the use of Big Data through Machine Learning could have a great impact on the management of insurance companies. The application areas highlighted in this paper include risk management, portfolio and price management, as well as auditing, insurance fraud defense, and customer analytics. Summarized, the authors Choi and Lambert (2017) classify the benefits of Big Data into the categories of risk assessment, risk management, and risk communication. Due to more accurate risk assessment and better risk management competitive advantages like loss prevention, profit increase, efficiency gains, operational cost reduction and customer satisfaction can be gained theoretically.

Especially due to technical conditions, outdated system software, poor data quality and ethical concerns many of these advantages are still unachievable. Further big challenges are the combination and cross-source linkage of heterogeneous data, handling the immensity of the data volume, the complexity of the evaluation and the high implementation effort of ML-based analysis systems. The need for permanent synchronization of the data as well as the legal and customer requirements for data protection are also major challenges.

Therefore, the hypothesis underlying this study could only be confirmed if the technical and legal infrastructure, high quality and unbiased data is as well as the necessary know-how is available. Considering all the presented problems, big data cannot be used sufficiently for gaining a competitive advantage at present and the hypothesis cannot be affirmed.

As further research, it could be investigated in more in detail what the status quo is among insurers to develop a practical implementation strategy based on it. Another exciting research area is the examination of insure-tech startups that are emerging with the increasing availability of data, to find out how they will influence the insurance market and what market power they will have in the future. Due to the poor use of machine learning and big data by now there is also a lack of quantitative analyses dealing with the benefits of big data in the insurance sector.

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The effects of Private Equity and Venture Capital on economic growth, innovation, productivity, competitiveness, and employment

Linus Holzmann & Jenna Huppertz

Abstract

In view of the booming and so far strongly growing private equity and venture capital market in high-growth and stable economies such as Germany, it is worthwhile to consider the macroeconomic impact of private equity and venture capital. For this reason, this paper is dedicated to a literature review-based analysis of the impact of private equity and venture capital on economic growth and employment. It was found that private equity has a positive impact on the innovativeness, productivity and competitiveness of the economy and thus stimulates economic growth. In terms of employment, a scientific tenor is found according to which private equity causes a decrease in employment due to productivity increases, while venture capital clearly contributes to job creation due to the financing of early-stage companies. A study of the buy & build strategies of PE firms in turn finds differences in the impact on employment depending on the acquisition type.

Keywords

private equity, venture capital, economic growth, innovation, productivity, competitiveness, employment

JEL Classification

E2, G0, O1, O4

1 INTRODUCTION

The German private equity and venture capital market is still lagging far behind the USA, which is considered as the pioneer of the private equity market. However, looking at the developments in the DACH region over the last 10 years, it is evident that both PE and VC activity has increased enormously. While the number of PE deals in 2011 was 381, the year 2021 counted about 780 PE deals, of which about 80% took place on the German market (Mondesir et al., 2020). The total deal volume in 2011 was just under EUR 27 billion. Projections from September 2021 suggest a deal volume of almost EUR 88 billion in 2021 (ibid.). So, while the number of PE deals has roughly doubled in recent years, deal volume has increased by a factor of three.

The increase in VC activity is even more substantial. In 2011, 438 VC deals were counted in the DACH region. In 2021, according to projections from September 2021, there should already have been over 1,300 VC deals in 2021 (ibid.). However, the deal volume has increased even more drastically and almost exponentially. In 2011, the total deal volume was EUR 1.3 billion. In 2021, the volume was estimated to be around 15 billion euros (ibid.). The number of annual deals has therefore roughly tripled, while the total investment volume has increased by a factor of 11.5.

Germany is the strongest economy in Europe. After the pandemic-related GDP decline of 5% in 2020 (Federal Statistical Office of Germany, 2021)¹, GDP grew again by 2.7% in 2021 (Federal Statistical Office of Germany, 2021)². The unemployment rate was at a historically

low level between 5% - 6% (Federal Statistical Office of Germany, 2022). As a high-growth, high-export and highly innovative business location, Germany represents an attractive investment location for private equity companies, which is expected to lead to a significant increase in PE activities in the long term.

In view of the current dramatic events in world politics, this predicted increase cannot be confirmed at this time. The ongoing war in Ukraine has also severely disrupted the so far booming PE sector. The longer the war continues, the more negative the consequences for sales processes and the greater the uncertainty regarding the development of the overall economy. Likewise, the ability to plan important expense positions and margins suffers, which also makes private equity investments more difficult. It is difficult to predict how long the expected hesitation of PE investors will last. However, it can be assumed that the Russian offensive war in Ukraine, with all its economically inhibiting effects, also represents a clear exceptional economic situation in the eyes of most PE investors.

Given the anticipated recovery of the PE industry it is therefore worth examining the macroeconomic impact of private equity and its sub-segment venture capital on the economy. As mentioned, PE investors prefer to invest in markets characterized by a high degree of internationalization, steady economic growth and a solid employment level.

The aim of this study is to answer the following research question:

How do private equity activities influence the most important macroeconomic indicators: economic growth and employment.

The paper is organized as follows: First, a basic understanding of the terminology is established, in which private equity and venture capital are distinguished from each other and their investment profiles are outlined. The main part of the paper consists of a macroeconomic analysis, based on an extensive literature review, of the impact of private equity on economic growth and employment in the appropriate order.

For the analysis of economic growth, the extent to which private equity activities in the form of buy & build strategies affect corporate sales growth was first analyzed at the corporate level. For this purpose, the results of a study are presented which finds a positive or slightly negative effect of private equity on sales growth, depending on the acquisition type. In addition, private equity affects three different determinants of economic growth: innovation, productivity and competitiveness. For each of these three determinants, private equity was found to have a positive impact.

Private equity investors stimulate innovation by investing capital in mostly young companies with a focus on research and development: Through efficiency-enhancing investments, better allocation of resources and professionalization of management, companies can increase their productivity through PE participation and thus make a greater contribution to economic growth. Higher productivity, in turn, also improves the competitiveness of the economy. Particularly in globalized, market-based economies, economic growth and increased exports go hand in hand.

With regard to the impact of private equity on employment, it was observed that an absolute majority of empirical studies found a negative impact of private equity on employment. However, a recent study, which among other things focused on the buy & build strategies of private equity investors, produced more differentiated results, suggesting that the impact on employment depends on the type of acquisition. When differentiating between platform companies, add-on companies and stand-alone companies, it was found that private equity at least has a positive influence on the employment level of platform companies.

2 THEORETICAL BACKGROUND

2.1 Definition of Private Equity and Venture Capital

The term "private equity" in a broader meaning is used as a generic term for the financing of private companies with equity or equity-like capital and thus stands for an entire investment segment (Jesch, 2004). Private equity is capital provided by private or institutional investors, which specially constituted investment funds - so-called private equity funds - use to purchase shares in private companies with the aim of selling them at a profit after a certain period of time (Achleitner, 2018).

In the past, private equity and venture capital were often used synonymously and frequently referred to in a generalized way as ownership capital, although this term does not clearly distinguish it from a stockholder's stake in a company and barely captures its smart-money approach (Jesch, 2004).

In turn, various sub-segments are subsumed under the general term: from providing risk and growth capital to classic buy-out financing and mezzanine financing. Venture capital is thus a sub-segment of private equity (Frommann & Dahmann, 2005).

On a more differentiated level, private equity and venture capital can be distinguished from each other, as different investment intentions are pursued and different stages of companies are financed. In the following, the two terms will be differentiated from each other.

For differentiation, mainly the maturity level of the companies VC and PE funds are targeting is decisive, as it is also illustrated in figure 1.

Private equity in the narrower sense primarily serves to finance established companies from mature lifecycle stages. These include financing phases such as just before an IPO. Majority shareholdings in the context of a leveraged buyout or management buyout and even total sales, for example in the course of succession planning, are also common examples of private equity financing (Jesch, 2004).

Venture capital, on the other hand, is usually invested in young, innovative private companies with clear development and growth potential. VC investments are characterized by a higher risk-return profile due to the lower maturity of the financed companies. Venture capital is referred to as risk and growth capital (Frommann & Dahmann, 2005).

Private equity in general, but venture capital in particular, are often described as so-called smart money, as PE and VC companies not only provide capital, but also offer knowledge, know-how and valuable industry contacts (ibid.).

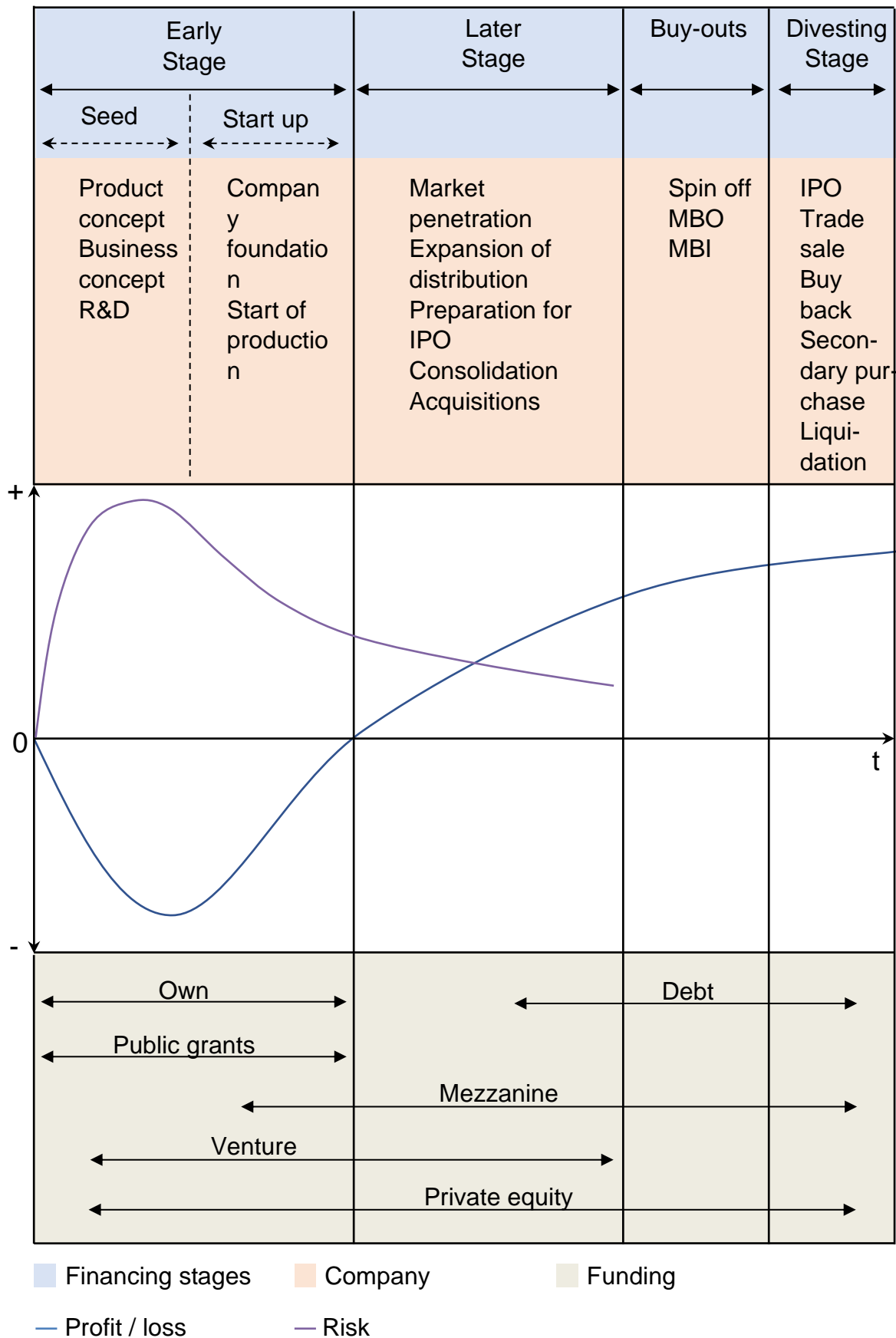


Figure SEQ Figure * ARABIC 1: Phases of corporate financing - own illustration based on Frommann & Dahmann (2005)

2.2 The macroeconomic effects of Private Equity and Venture Capital

The objective of this paper is to analyze the macroeconomic relevance of private equity for the economy. Macroeconomics is concerned with determining economic developments, relationships and interrelationships. Among the most important macroeconomic indicators are economic growth and the level of employment. The following chapters examine the impact of private equity on these macroeconomic indicators based on a literature review.

2.2.1 Impact of Private Equity and Venture Capital on economic growth

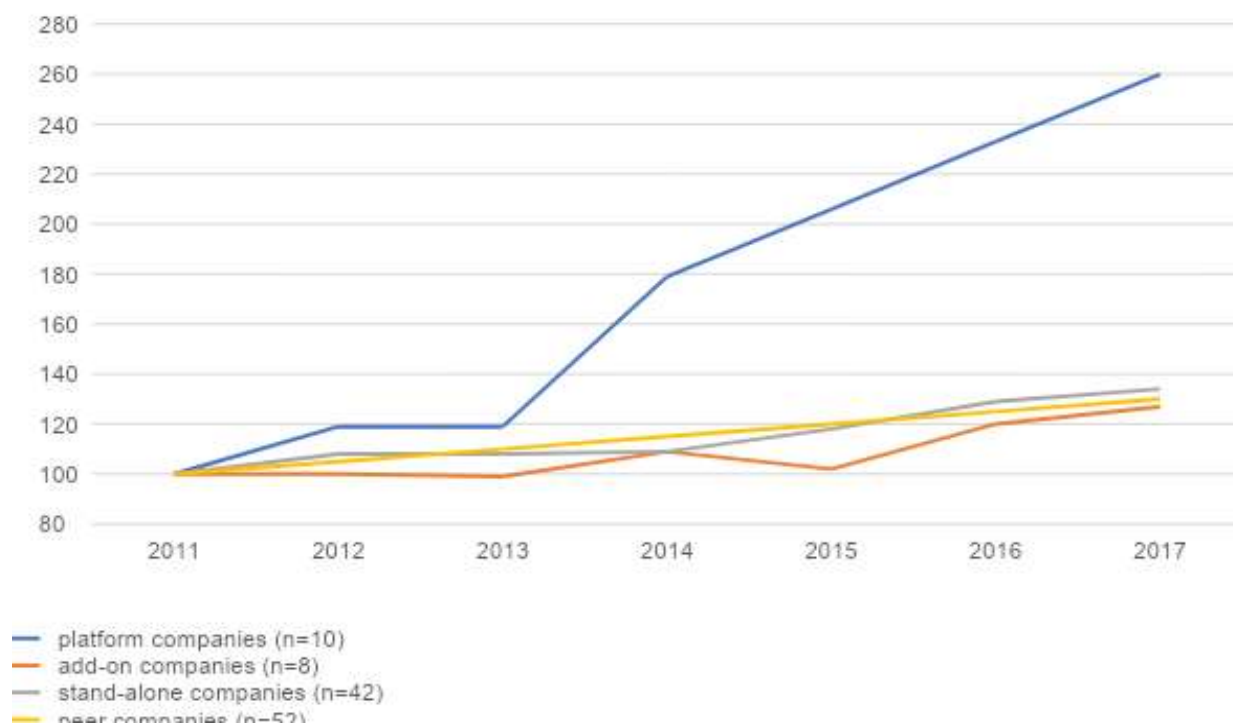
At the corporate level, private equity funds influence the growth of companies simply by virtue of their different management and restructuring strategies. In the 1980s, for example, leveraged buyout models were aimed in particular at corporate restructuring with the aim of globalization and job relocation (Scheuplein, 2020). A particularly relevant strategy of private equity investors, which developed in the USA at the beginning of the 2000s, but has now also found its way into the German and European market, is the so-called buy & build strategy (ibid.). In this acquisition strategy, company growth is driven by strategic acquisitions. In most cases, a larger company with a particularly profitable business model serves as a platform, to which a large number of smaller companies are added for scaling and expansion. Buy & build strategies are used in particular in industries with the potential for market consolidation, which is usually the case in markets characterized by a few large players and a broad mass of smaller companies. Financial investors can usually react more agile to emerging potentials, such as the introduction of a new technology, or a regulatory change that suddenly allows access to market players from outside the industry (ibid.). In Germany, the number of buyouts in the healthcare sector increased rapidly between 2017 and 2018, after it was allowed that investors who were not medically specialists could also take over healthcare facilities. Most of these buyouts involved buy & build strategies (ibid.).

In order to measure the growth effect of such buy & build strategies, a distinction must be made between platform companies – mostly larger and profitable companies to which other companies are added for expansion –, add-on companies – usually smaller companies meant to be integrated into the platform companies –, and stand-alone companies – independent companies that are not involved in buy-and-build strategies – since an add-on strategy almost automatically leads to increases in revenue and employees. In the study by Scheuplein (2020), the platform companies, the add-on companies and the stand-alone companies were compared with independent peer companies.

The data basis for the study was the Private Equity Monitor 2013, according to which 156 companies were acquired by a PE company in 2013. From this population, a sample of 103 companies was filtered out for which sufficient company data was available in the observation period from 2011 to 2017. These were in turn compared with 103 peer companies that were similar to the sample companies in terms of industry affiliation, revenue and number of employees.

To examine the growth in revenue, an index was formed, with the revenue level from 2011 set as an index of 100. For this examination in total 60 companies from the sample were chosen and compared to 52 suitable peer companies.

It was found that the platform companies experienced significantly stronger growth than the peer companies, while the add-on companies even grew at a slightly slower rate than the peer companies. The stand-alone companies who were bought out by a PE investor but were not part of buy & build strategy grew a little bit stronger than the peer companies (Scheuplein, 2020).



Even beyond buy and build strategies, relevant studies show a positive effect of venture capital and private equity on company growth:

In a comprehensive study spanning from 1995 to 2009, researchers Paglia and Harjoto (2014) delved into the influence of Private Equity (PE) and Venture Capital (VC) financing on the progression of small to medium-sized standalone business entities. Drawing data from the Institute for Exceptional Growth Companies (often referred to as IEGC or NETS), the analysis centered on the ramifications of a singular round of PE or VC investment on the organic growth of sales within these establishments. While both PE and VC investments were found to bolster net sales, their effects varied in intensity and duration. PE investments, although exhibiting a more subdued immediate impact, sustained their growth-enhancing effects for a period of three years post-investment. In contrast, VC investments provided a more immediate and pronounced boost to growth, but this heightened effect tapered off just a year after the initial financial infusion.

A study by Frontier Economics (2013) examined the impact of private equity on the economic growth of the national economy as a whole. According to this study, private equity influences three different determinants that affect economic growth: innovation, productivity, and competitiveness. These three determinants mentioned are in turn closely intertwined.

Private equity investors promote innovation by investing capital in mostly young companies with a research and development focus. The increased innovative power and possibly the structural change caused by disruptive innovations in turn increase productivity (Frontier Economics, 2013).

Increases in productivity are directly reflected in economic growth. PE participation is usually accompanied by certain control rights, which means that PE involvement often contributes to a professionalization of the management and an improved allocation of resources. The capital provided can be used, for example, to purchase certain equipment that increases labor productivity. Through efficiency-enhancing investments, improved resource allocation and

more professional management, companies can increase their productivity as a result of PE participation and thus make a greater contribution to economic growth (ibid.).

Increased productivity, in turn, also improves the competitiveness of the economy as a whole. Especially in globalized, market-based economies, economic growth and increased exports go hand in hand. Private equity can, for instance, enable established companies to expand into international markets (ibid.).

The following sections take a closer look at the determinants of economic growth and how they are affected by private equity.

2.2.2 Private Equity as a driver of innovation

Megatrends such as digitization and globalization pose major challenges to the German economy. Digital technologies are putting entire industries under pressure. Previously proven business models and value chains must be transformed in order to remain competitive. In key technologies such as artificial intelligence, blockchain and autonomous driving, Germany is in danger of missing out on world leadership.

Consequently, Germany needs numerous, diverse, and far-reaching innovations in terms of new or improved technologies, processes, products and services to remain economically successful and to solve important social problems. Especially in already developed economies, innovation plays an important role for economic growth and for gaining more value from available resources.

While established medium-sized companies and large enterprises primarily create incremental innovations, it is mainly young and developing companies that drive radical solutions and dare to develop disruptive innovations. In light of this, young, risk-affine companies are considered to have a high potential for innovation and renewal and to secure the competitiveness of the German economy in the long term.

In addition to good ideas and teams, startups also need appropriate capital. Since startups usually take major risks and do not generate relevant revenues in the beginning, traditional loan financing is often hardly feasible. As figure 1 shows, there are only few financing instruments available for innovative, R&D-oriented early-stage startups apart from own resources and public grants under certain circumstances. Therefore, venture capital (VC) as a sub-segment of private equity is playing an increasingly important role for the innovation power of the economy. By providing the initial growth capital required, young, innovative, companies are raised to a certain level that enables them to start their business and drive innovation. Private equity enables firms to prioritize their R&D-activities by adding criteria such as probability of success and economic value. This helps reducing financial risks, improving the discovery rate and increasing the relevance of the innovation for the society and economy.

Private equity also acts as a door opener for subsequent funding sources. In addition, the industry contacts provided as well as the extensive know-how of the venture capital investors are an important factor for the further development of the young companies.

Also, established companies seek to drive innovation in competitive markets in order to maintain their profitability and stay competitive. Research-intensive companies such as Intel, Roche or Google invest up to 20% of their annual revenues in research and development. Due to often stagnant and rigid structures and administrative overhead, established companies are often not agile enough to respond to innovative trends promptly. Instead, many established companies invest in promising business ideas of young companies in order to develop continuously. In the form of corporate venture capital, corporates invest in the research and development activities of startups in order to exploit their innovations for their own benefit.

The aim of such a CVC strategy is to defend and consolidate the market position of the parent company by identifying and exploiting new trends as soon as they emerge. Especially in disruptive and agile markets, corporate venture capital activities increase (Klamar & Prawetz, 2015).

The number of registered patents is considered an important key indicator for measuring a country's innovative power. According to a study from the German Private Equity and Venture Capital Association based on statistics from the German Patent and Trademark Office (DPMA), the number of domestic patent registrations and PE/VC investments in innovative and technology-oriented industries are strongly correlated (Frommann & Dahmann, 2005). Also the study of Frontier Economics (2013) confirms that target sectors of PE- and VC funds generate more patents and states that private equity investments and patent activities are highly correlated across European countries. Thus, the role of private equity/ venture capital as an innovation driver can be directly deduced. Moreover, the study postulates that private equity-backed companies deliver greater and more relevant innovation than comparable non-PE-backed companies. In the course of the study the authors triangulated research dealing with the number of patents that can be attributed to PE-backed companies with other sources focusing on the value of these patents. The outcome was that private equity makes a disproportionately strong contribution to innovation (Frontier Economics, 2013). Popov and Roosenboom (2009) estimate that one Euro of private equity funding is up to nine times more efficient in bringing innovation than other types of funding.

According to Lerner et al. (2011) PE-backed firms do not only deliver greater innovation than non-PE-backed companies but also more relevant one, measured by the the number of citations of these patents.

Through disruptive innovations private equity favors a constant structural change of the economy. Markets can be fundamentally changed or newly created on the basis of new products, services and technologies. New companies emerge - existing companies adapt to the new situation or risk being displaced by newcomers; jobs are created - others become obsolete. Some industries gain relevance due to new products, technologies and services, while old-economy industries lose importance. The literature speaks of the principle of “creative destruction” or “creative construction”, both terms which were first coined by the Austrian economist Joseph Schumpeter in 1911. The less dramatic term “creative construction” emphasizes that innovations do not simply displace established technologies and negate their *raison d'être*. In many cases, modern technologies are based on previous technological approaches. For example, the invention of the transistor in 1947 was the basis and condition for the invention of the microprocessor, which was introduced to the market by the company Intel in 1971 and in turn was the cornerstone for the rapid development of the high-tech market since then. Private equity was instrumental in financing the commercialization (Frommann & Dahmann, 2005). The next turnarounds are likely to occur in the VC target sectors of biotechnology, pharmaceuticals and software.

2.2.3 Private Equity as a driver of productivity

Productivity is the efficiency by which an output is generated from a given input such as capital, human resources and materials. Increased productivity makes it possible to achieve a larger output with a constant input.

There are various studies that find that high innovative industries exhibit higher productivity than less innovative industries (Frontier Economics, 2013; Scheuplein, 2020). Davis et al. (2014) compared the productivity of 3,200 industrial target firms operating 150,000 facilities before and after a PE buyout with a carefully selected control group of firms that were similar by industry, firm size, age, and prior growth. The results showed that the target firms exhibited

higher levels of productivity through efficient resource reallocation. In this study, the significant productivity gains were found to be due to the consistent closure of less productive manufacturing plants and the opening of new, highly profitable plants. Kaplan and Strömberg (2009) and Alperovych (2019) also conclude that the operational performance of firms is improved after a buyout. Even in the case of a mere investment by a PE company, it is found that the operating margin significantly increases after the transaction. Specifically, according to the Frontier Economics (2013) study, target companies show between 4.5% and 8.5% higher operating margins in the first three years after the investment. Breaking this down to the individual employee, this translates into a 6.9 percent increase in EBITDA.

The researchers attribute the increase in overall economic productivity to the broader financing options available to PE-backed companies, as well as the operational support and overall increased performance that PE-backed companies experience. The provision of private equity, often referred to as venture capital, enables financed companies to pursue higher-risk opportunities that may turn out to be very profitable. Nevertheless, despite supposedly riskier activities, PE-financed companies are up to 50% less likely to default than non-PE-financed companies.

Alperovych et al. (2015) conducted a study in the Belgian market to find out whether it has an impact on productivity whether the investing VC fund is a privately managed fund or a government fund. The authors conclude that it does indeed make a significant difference, as companies funded by a private venture capital firm show significant efficiency gains and a clear increase in productivity, while companies that received funding from a government VC fund show significant productivity losses. It is important to note that this is a study of the Belgian market and therefore such conclusions cannot necessarily be drawn for other economies. Nevertheless, the results show that the productivity gains do not only come from the mere provision of capital.

2.2.4 Private Equity as a driver of competitiveness

The basic condition for economic growth is the improvement of the competitiveness of an economy in the national as well as international context. In other words, if you stop improving, you stop being good.

The World Economic Forum describes the linkage between competitiveness and economic growth as the set of interactions between a country's institutions, policies, and productivity determinants.

The Frontier Economics (2013) study distinguished between two different dimensions of competitiveness. On the one hand, international competitiveness was examined and, on the other, how the availability of venture capital affects economic competitiveness. First, the impact of private equity on enabling companies to internationalize will be examined.

International competitiveness means that an economy is capable of selling products or services in an internationally competitive market. Especially young and small companies have difficulties to gain an international position due to a lack of human and financial resources (Frontier Economics, 2013). PE creates the basic conditions for companies to expand into international markets and thus increase the export performance of the national economy. Once again, the experience of private equity investors is crucial. The investors offer both strategic and operational support to open up new, international markets.

Lockett et al. (2008) investigated whether and in what way PE firms boost the internationalization activities of the companies they finance. They found that value-added activities are most effective for young companies to increase their export efforts. Lutz and George (2012) also confirm that managerial and strategic resources of PE firms enhance the

internationalization of young companies. For more advanced, mature firms, monitoring activities by PE investors contribute most to successful internationalization (Lockett et al., 2008).

The second dimension of competitiveness according to the Frontier Economics (2013) study is the financing of risky young companies. The World Economic Forum, which publishes the annual Global Competitiveness Report, has developed an index according to which different countries are evaluated and ranked in terms of their competitiveness. One of the variables explicitly relates to the availability of venture capital, as it is an instrument for financing young, innovative companies with a high risk profile (Frontier Economics, 2013). Such companies, in turn, introduce novel processes and technologies to the market, which increase the intensity of competition and thus lead to productivity gains. The business creation effect goes beyond the number of companies financed, as a VC investment in an innovative company encourages many more new competitors, imitators or other innovative companies to enter the market (ibid.).

2.2.5 Impact of Private Equity and Venture Capital on employment

When considering the impact of private equity on employment, it is again worth differentiating between venture capital and private equity in the narrower sense. While the positive effects of venture capital on the job creation of young, innovative companies, which would not be financially able to hire employees at all without an appropriate funding, are obvious and appear undisputed, the employment effects of private equity investments require closer examination.

The employment effect of private equity investments in the form of buyouts, in turn, has been the subject of numerous empirical studies, especially since the mid-2000s. In general, these studies have compared existing or survey-based employment data from PE managed companies with that of a peer group. It can be concluded that an absolute majority of these studies find a negative effect of private equity on employment levels (Scheuplein, 2020).

The study by Davis et al. (2014), which examined a dataset of over 3,200 American portfolio companies and compared them with a representative peer group, is of particular relevance. It was observed that compared to the peer group, employment decreased by 3.2% in the first two years after the buyout and by 6.4% in five years after the buyout. The results could also be replicated in a more recent study by the authors Cohn, Nestoriak, and Wardlaw (2021). One could argue that the results depend on the respective investment strategies of the private equity funds as well as the geographic economy. For this reason, authors Antoni, Maug, and Oberberger (2019) devoted themselves to an investigation of the employment effects of private equity in the German market, mirroring Davis' methodology using a sample of 511 buyouts of German companies. The authors find that during the observation period from 2002 until 2008, employment levels fell by an average of 8.9% compared to the peer group (ibid.).

Paglia and Harjoto (2014) found in their empirical study that PE financing doesn't have an immediate effect on employment growth rates of establishments in the financing year. Yet, they found evidence that PE financing boosts the employment growth rates of establishments for the subsequent three years after receiving the funds. Their research indicates a marked positive influence of PE financing on employment expansion in establishments following their funding phase, when contrasted with their growth before receiving such funds. Typically, businesses that benefit from PE financing witness a growth acceleration in employment by around 3% (ranging from 2.94% to 3.03%) in the three years succeeding the financing events, compared to the three years before them. It's also evident that as businesses age, their rate of employment growth diminishes, given that mature firms often encounter limited growth avenues.

In contrast, when examining establishments that have secured VC financing, a distinct pattern emerges. These VC-backed entities consistently surpass their non-VC-backed counterparts in terms of employment expansion. Impressively, our data reveals that these VC-endorsed businesses continue to chart an upward trajectory, with a surge of over 32% in employment growth for three years post their capital infusion.

The conflicting scientific research results show that the question of the effects of VC and PE on employment levels has not yet been conclusively resolved and should be investigated further. As already mentioned, it can be argued that the employment effect does not only depend on the respective market, but also on the investment strategies of the private equity companies. As stated in the previous chapter of this thesis, private equity activities since the 1980s have focused on leverage buyout strategies with the aim of reallocating resources and jobs.

Nowadays, buy & build strategies are becoming more and more important. In the following, it will be shown how buy & build strategies affect employment.

For examining the effects on employment within buy & build strategies, again the study conducted by Scheuplein (2020), which was also used to examine the effect of buy & build strategies on company growth will be considered. Of the total of 103 sample companies, sufficient information was available for 77 to investigate the job effect. In the first step of the study, the absolute total number of employees of the 77 sample companies was examined. The absolute number of employees increased from around 55,000 employees to around 73,000 employees from 2011 to 2017. Once again, a distinction was made between platform companies, add-on companies and stand-alone companies. The number of employees at platform companies has risen disproportionately. In 2011, they accounted for 22% of the total headcount. In 2017, the share was 40%. To now investigate an effect of private equity participation, the PE-financed sample companies were compared with a representative peer group. Analogous to the study of company growth, an index was formed, with the 2013 employment levels of both groups assigned to an index value of 100. As Figure 3 shows, employment grew more strongly for the sample companies than for the peer companies, which contrasts with the results of the previous empirical studies.

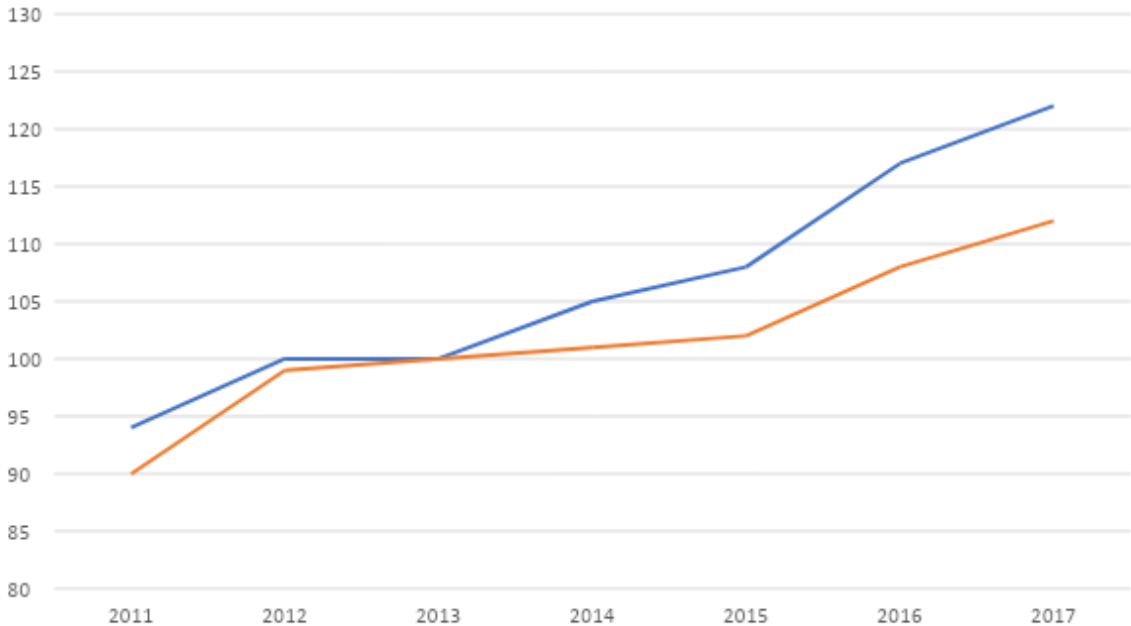
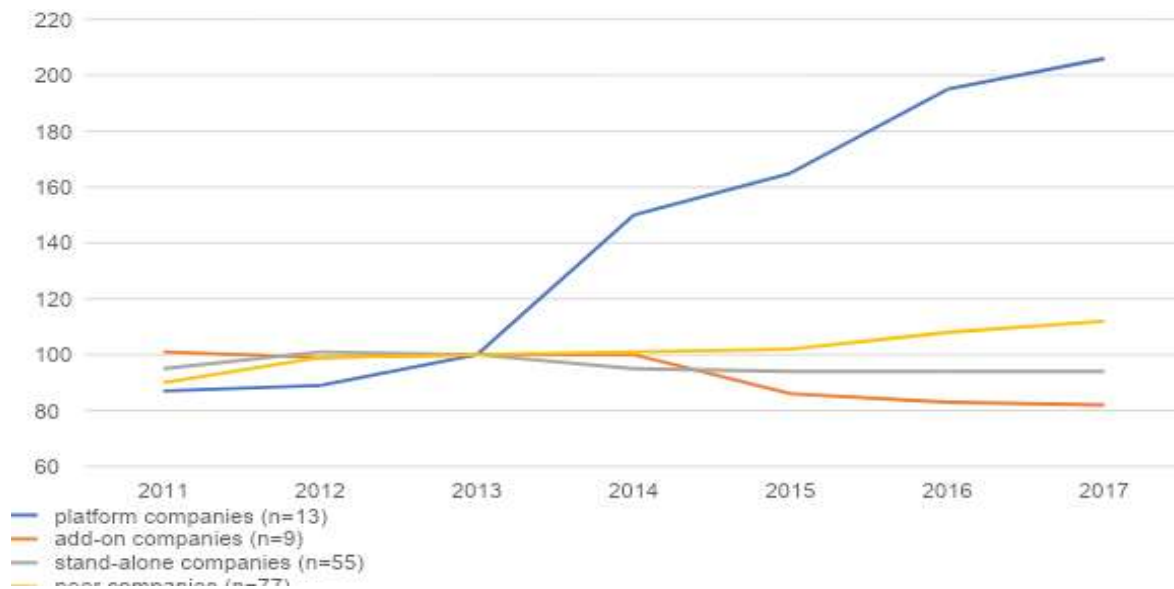


Figure SEQ Figure * ARABIC 3: Total employment of the companies - own illustration based on Scheuplein (2020)

A differentiated analysis of the various acquisition types shows that private equity has a positive impact on the employment level of the platform companies, while the add-on companies and the stand-alone companies fall behind the employment growth of the peer companies (Scheuplein, 2020). This is illustrated in Figure 4.



The enormous deviation of the growth curve of employment levels in platform companies from those of the other acquisition types as well as the comparison companies shows that the effect of private equity on employment depends strongly on the investment strategy and that buy & build strategies positively influence employment growth.

3 RESULTS AND DISCUSSION

The private equity industry is known for its unique and innovative approach to investing. By providing the necessary capital to high growth and high risk companies, private equity can have a significant impact on the economy, including job creation and economic growth.

Private equity impacts economic growth in various ways. One of them is through the buy and build strategy, which involves buying a larger company with a profitable business model and adding smaller ones to it for scaling and expansion. This approach enables financial investors to react more agilely to emerging opportunities such as the introduction of new technology or regulatory changes, resulting in increased revenue and employment in the acquired companies. A study by Scheuplein in 2020 found that platform and standalone companies that were bought out by a PE investor but were not part of the buy and build strategy experienced significant growth in revenue and employment. Private equity also promotes innovation by investing capital in young companies with a research and development focus, resulting in increased productivity and improved competitiveness of the economy.

Private equity-backed companies deliver more innovation than non-PE-backed firms. Private equity also plays an important role in driving innovation in the economy, which is essential to remain competitive in globalized, market-based economies. The German economy faces significant challenges from digitization and globalization, which require numerous and diverse innovations in new or improved technologies, processes, products, and services. Established medium-sized companies and large enterprises primarily create incremental innovations, while

young and developing companies mainly drive radical solutions and dare to develop disruptive innovations. Private equity enables firms to prioritize their R&D activities, reducing financial risks, improving the discovery rate, and increasing the relevance of the innovation for society and the economy. Private equity also acts as a door opener for subsequent funding sources, provides industry contacts, and extensive know-how of the venture capital investors, which are important for the further development of young companies. Moreover, established companies invest in promising business ideas of young companies to drive innovation and maintain profitability in competitive markets. Research-intensive companies invest up to 20% of their annual revenues in research and development. Due to often stagnant and rigid structures and administrative overhead, established companies are often not agile enough to respond to innovative trends promptly. Corporate venture capital is a form of investment by corporates in the research and development activities of startups to exploit their innovations for their benefit.

Through disruptive innovations, private equity favors a constant structural change of the economy, where markets can be fundamentally changed or newly created based on new products, services, and technologies. This results in new companies emerging, existing ones adapting to the new situation or risk being displaced by newcomers, jobs being created, and others becoming obsolete.

The impact of private equity on employment has been a topic of interest for researchers, and it is important to differentiate between venture capital and private equity investments. Venture capital investments have a positive impact on job creation, especially for innovative companies that lack the financial resources to hire employees. However, the employment effects of private equity investments, specifically buyouts, have been studied extensively since the mid-2000s. The majority of these studies have found a negative effect of private equity on employment levels.

Davis et al. (2014) and Cohn, Nestoriak, and Wardlaw (2021) observed that employment decreased in the first two to five years after a buyout compared to a peer group. Antoni, Maug, and Oberberger (2019) also found that employment levels fell during the observation period from 2002 to 2008 by an average of 8.9% compared to a peer group in the German market. While some studies produce ambiguous results, it is clear that most empirical studies postulate a significant employment loss due to private equity participation.

While many studies and authors postulate a negative employment effect of PE and VC there are also empirical studies like the one from Paglia and Harjoto (2014) find evidence that PE- and VC-participation positively influences employment growth in the three years after the funding event. The employment effect of private equity depends not only on the respective market but also on the investment strategies of private equity companies. Private equity activities since the 1980s have focused on leverage buyout strategies with the aim of reallocating resources and jobs. Nowadays, buy & build strategies are becoming more important. Scheuplein's (2020) study on the effect of buy & build strategies on company growth also examined the job effect. The study found that the absolute number of employees of the sample companies increased by almost 33 % from 2011 to 2017. Private equity participation positively influenced the employment level of platform companies, while add-on companies and stand-alone companies fell behind the employment growth of the peer companies.

All in all, the employment effect of private equity investments in the form of buyouts has been found to be negative in most empirical studies. However, the employment effect depends on the investment strategies of private equity companies. Buy & build strategies positively influence employment growth, especially for platform companies. Therefore, private equity's influence on employment can be both positive and negative, depending on the investment strategies and the type of acquisition.

4 CONCLUSION

The aim of the paper was to analyze the macroeconomic effects of private equity and venture capital. The analysis was based on a broad literature review and focused on two of the most relevant macroeconomic indicators, namely economic growth, and employment. While only positive effects on economic growth were found, the results regarding employment must be considered more differentiated.

The analysis of the effect of buy & build strategies on company growth, measured in terms of sales growth, has shown that it is primarily the platform companies that benefit from private equity. While the sales growth of the platform companies increased much more than the growth of the peer companies, the sales growth of the add-on companies and the stand-alone companies was even slightly weaker than the growth of the peer companies.

Economic growth is determined, among other things, by the degree of innovation, productivity and competitiveness of an economy. By providing capital for high-risk, R&D-oriented projects of mostly still young companies, private equity in the form of venture capital contributes to increasing the innovative strength of the economy. Corporate venture capital is also becoming more and more important as a way for established companies to outsource R&D activities and benefit from new trends and opportunities despite being more rigid. Since PE and VC companies not only provide capital, but also actively intervene in the management of companies with their experience, they also contribute to increased productivity in the form of a more efficient use of resources and the professionalization of management. Through their internationalization efforts and expertise in the expansion PE companies also influence the international competitiveness of the domestic economy.

In terms of employment, numerous studies have found a negative effect of private equity. This can be attributed, among other things, to the restructuring strategies of PE firms. Increased efficiency in the use of resources can lead to job losses. Nevertheless, in their empirical research, Paglia and Harjoto (2014) discovered that PE financing doesn't instantly influence the employment growth rates of establishments during the year they receive financing. However, their findings did indicate that such financing enhances the employment growth rates of these establishments in the three years that follow the funding. Moreover, if we take another look at the buy & build strategies, we can detect a positive employment effect on the platform companies.

It is important to note that many of the relevant scientific studies, which were also used in this literature review, are already several years old. Especially regarding the effect of private equity on economic growth, more recent empirical studies are required. With regard to employment, there are recent empirical studies that examine the effect of PE buyouts on employment, but related studies could also examine the sustainable job effects of private equity and venture capital. The study conducted by Scheuplein (2020) focused on employment effects in the case of buy & build strategies analyzing a sample of 103 deals. There is a lack of recent empirical studies examining the mid- and long-term employment effects within standalone companies, revealing potential for further research.

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Correlation between Central Banks Pandemic Policy and Equity Market Performance in the US and Europe

Alexander Hütteroth

Abstract

Since the beginning of the Covid 19 pandemic, the Federal Reserve (Fed) as well as the European Central Bank (ECB) have pursued a very expansionary monetary strategy to mitigate the economic impact. Inflation fears caused bond yields in the eurozone to rise significantly in 2022. With increasing inflation, a regime change occurred at both central banks in 2022 and the prevailing academic view is that this environment has a negative impact on stock market performance in general and sectors with high growth stocks are particularly affected by interest rate hikes. This paper analyzes the performance sensitivity of the STOXX Europe 600 and S&P 500 single sectors to central bank interest rates from 2020 to 2021 and 2022, assuming that the outperformance was due to central bank policy and that there will be a mean-reversion process with a regime shift. It also discusses the hypothesis that the higher interest rates are at the end of the pandemic, the stronger the mean-reversion process will be. Finally, further research on individual sectors and other possible variables such as inflation is recommended.

Keywords

STOXX Europe 600, S&P 500, mean reversion, interest rates

JEL Classification

F30

1 INTRODUCTION

The Fed and ECB changed the interest rate environment globally in 2022 after two years of Covid 19 pandemic due to increased inflation with rising interest rates. Given this regime change by central banks, the prevailing academic opinion is that this environment will negatively impact the performance of the stock market in general and sectors with high growth stocks (Ghosh et al. 2022). This is based on the theory that rising bond yields rates become more attractive than equities, affecting the global equity market. Future cash inflows also lose value for faster-growing companies as the discounted present value declines. In addition, it will become more expensive for companies to finance themselves with debt (Motley Fool 2021). Inflation in 2022 led to higher bond yields, after which equity markets around the world lost some of their value, led by high growth sectors. This dynamic is primarily due to the rise in bond yields, which are similar to the average dividend yields of equity indices. In addition, it must be taken into account that the high valuations of many high growth companies are based less on current dividends than on the hope of high returns in the future. If these earnings are discounted to the present, the values are significantly lower at higher discount rates. Based on the discounted cash flow method, the interest rate falls even though the fundamentals of the companies have not changed. The impact is particularly strong for individual sectors such as technology (Heyden 2021) and historically less pronounced for traditional companies such as utilities or consumer goods. This leads to the objective of examining the hypothesis that the higher interest rates are at the end of the pandemic, the stronger the mean-reversion process for the highly capitalized sectors of the stock market. This paper analyzes the S&P 500 and the

STOXX Europe 600 performance against the Fed and ECB interest rate policy from 2020 to 2021 and for 2022 with the central bank regime changes. In a first step, the current research status is analyzed via an international literature review. In the second step, the impact on the performance of the highly capitalized technology sectors for both indices is analyzed. The main findings are that the technology sectors outperformed the broad STOXX Europe 600 and the S&P 500 during the pandemic. However, regression analyses for both indices show that there is no linear relationship between interest rates and the sensitivity of the technology sectors. To account for the possible interest rate sensitivity of other sectors, performance data related to interest rate policy are examined. Finally, the question of whether there is a mean-reversion process for these is answered by a regression analysis for performance and interest rate data. Then, the results are compared with the sources listed in the research section. Chapter five concludes with the results.

2 THEORETICAL BACKGROUND

With the beginning of the COVID-19 pandemic in 2020, the Fed as well as the ECB have pursued expansionary monetary policies to mitigate the economic impact. The ECB has kept the policy rate at historic lows and has implemented several programs to support banks and the economy, including the PEPP and TLTRO program. The ECB has also reaffirmed its intention to ease monetary policy further if needed to support the economic recovery. The Fed has also kept the federal funds rate at historically low levels and has implemented a large-scale securities purchase program to increase liquidity in the financial system and lower interest rates. The Fed has also reaffirmed its intention to focus its monetary policy on supporting the economic recovery and to continue ultra-loose monetary policy until at least 2023. There are numerous recent studies on equity markets and interest rates in relation to the Covid 19 pandemic, and some of the most important are reviewed in more detail. The first step is to look at the research for Europe.

The studies show that the broad STOXX Europe 600 index provides a good data base for studies on stock market performance and monetary policy in Europe. Rowles (2020) examines the impact of the U.S. Federal Reserve's interest rate policy on foreign stock markets. The paper empirically shows that a reduction in U.S. interest rates has a positive effect on stock prices in selected countries. The author argues that Federal Reserve policy plays an important role in global asset pricing and that it is important for investors to consider the impact of interest rate policy on different markets and asset classes. Oxford Analytica (2023) refers to considerations by some Central and Eastern European countries to raise interest rates due to high inflation and possible implications for indices such as the STOXX Europe 600, arguing that raising interest rates could slow economic growth and increase pressure on governments blamed for rising prices. Instead, lowering interest rates in some countries in the region could be an option to support growth and mitigate the impact of inflation. Alfieri et al. (2022) examines the impact of European Central Bank (ECB) communications on financial markets before and during the COVID-19 pandemic. The authors use a variety of methods, including event study and content analysis, to examine the effect of communications on equity and bond markets. They find out that ECB communications have a significant overall impact on financial markets, particularly on the stock market. Prior to the pandemic, ECB communications had a greater impact on financial markets than during the pandemic. The authors suggest that market participants were less receptive to ECB communications during the pandemic due to uncertainty about the economic impact of COVID-19. With the ECB's interest rate environment changing in 2022 due to increased inflation, the prevailing academic view in the academic literature for Europe is that this environment will weigh on high-growth equities such as the technology sector and

that this sector will be particularly affected by interest rate hikes (Lange 2022). This leads to the objective of investigating the hypothesis that the higher the interest rates at the end of the pandemic, the stronger the mean-reversion process for the highly capitalized sectors of the STOXX Europe 600.

For the U.S., there are also numerous recent studies on equities and interest rates in relation to the Covid 19 pandemic, and some of the most important are reviewed in more detail.

The studies show that the broad S&P 500 index is a good data base for studies on stock market performance and monetary policy in the U.S. Yilmazkuday (2021) examines the impact of the COVID-19 pandemic on the S&P 500 index. Both direct and indirect effects are considered, including the impact on economic activity, public health, and policy actions. The author finds that the pandemic had a significant and persistent impact on the S&P 500, particularly in 2020, while also examining various scenarios to quantify the impact of the pandemic on the index. Lento et al. (2021) examine the impact of the COVID-19 outbreak on price transmissions in the S&P 500 Index. The authors use the VAR-GARCH method to analyze the direction and strength of price transfers between different sectors of the S&P 500 index during the period of the COVID-19 breakout in 2020. The results show a significant increase in price transfers and increased integration between sectors during the outbreak, especially in the early stages of the pandemic. The authors conclude that the pandemic led to increased volatility and increased correlations between sectors in the S&P 500 Index. A paper by Chebbi et al. (2021) examines the impact of the COVID-19 pandemic on stock liquidity in the S&P 500 Index. The authors use data from January 2019 to December 2020 and conclude that the COVID-19 pandemic had a significant negative impact on stock liquidity. Specifically, firms with higher debt and stock price volatility had a larger decrease in their stock liquidity during the pandemic. With the changed interest rate environment in 2022 due to increased inflation and the Fed's regime change, the literature analysis for the U.S., just as for Europe, shows the prevailing academic opinion that this environment weighs on high growth stocks such as technology stocks and that these sectors are particularly affected by interest rate hikes (Ghosh et al. 2022). Again, this leads to the objective of testing the hypothesis that the higher the interest rates at the end of the pandemic, the stronger the mean-reversion process for the high capitalization sectors of the S&P 500. This paper therefore analyses the performance of the STOXX Europe 600 and S&P 500 sectors and interest rate policies during the 2020-2021 pandemic and in 20202 with the 2022 central bank regime change. In the remainder of the paper, regression analyses for performance of the STOXX Europe 600, the S&P 500, and interest rate data in Europe and the U.S. are conducted and evaluated in relation to the literature review.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

For this paper the performance data of the STOXX Europe 600 and S&P 500 in general and on a sector basis is analysed for two central bank phases of ECB and Fed policy, during the pandemic from 2020 to 2021 and 2022 with the regime shift.

For further research the following descriptive statistical methods are used to evaluate a potential correlation between the central banks pandemic policy and equity market performance:

1. Distribution
2. Boxplot: density distribution and median
3. Simple regression and Pearson correlation

Daily distribution data from 2020 to 2022 are analysed to identify a potential performance impact of the central banks policy on the STOXX Europe 600 and S&P 500. In addition,

Boxplot data are generated on a yearly basis from 2020 to 2022 to analyse density distribution and median information. Finally, simple regression and Pearson correlation data are analyzed which attempts to explain the observed dependent variable performance by the independent variable interest rate. While the Pearson correlation analysis provides information on the strength and direction of the linear relationship between index performance and interest rates.

3.1 Potential interest rate impact on STOXX Europe 600 and S&P 500 performance from 2020 to 2022

In this chapter the potential interest rate impact on the STOXX Europe 600 and S&P 500 data is analyzed for a three-year period until December 2022. The following figure illustrates the historical Fed and ECB interest rates for a 5 Year period. The data shows the massive decrease of the Fed and lower decrease of the ECB with beginning of the pandemic and the regime shift with increasing inflation beginning of 2022.

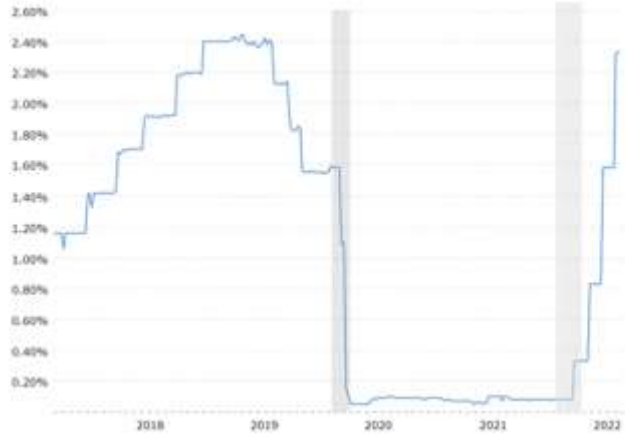


Fig. 1: 5 Years Fed interest rate
Source: macrotrends

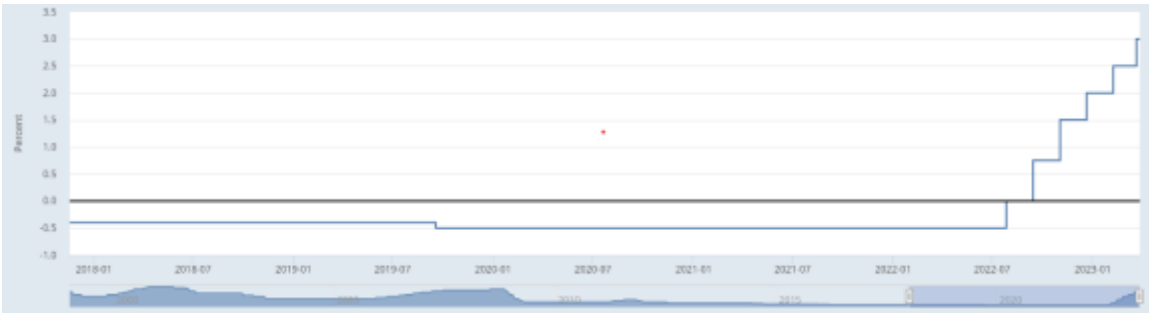


Fig. 2: 5 Years ECB interest rate
Source: macrotrends

Based on these data, the performance of the STOXX Europe 600 and S&P 500 is analyzed for two phases of central bank policy with a three-year breakdown in the following chapters of this paper. The following S&P performance data shows that the performance is higher during the pandemic and lower after the central bank regime shift in 2022 (tradingview 2022), indicating a potential impact of interest rates (Hütteroth 2022).



Fig. 3: S&P 500 performance from Jan 2020 to December 2022

Source: TradingView

The STOXX Europe 600 performance data shows a similar picture like for the S&P500 with higher performance during the pandemic and lower in 2022 with the central bank regime shift (tradingview 2022).



Fig. 4: STOXX Europe 600 performance from Jan 2020 to December 2022

Source: TradingView

In the next step the sector exposure is reviewed with the help of a historical contribution data for both indexes to identify the sector performance for the three years is investigated. Table 1 illustrates the significant performance contribution of the technology and communication services sector during the pandemic in 2020 and 2021. Furthermore, the data shows a significant underperformance of both sectors in 2022 compared to the broad index after the Fed regime shift.

Tab. 1: S&P 500 sector performance from 2020 to July 2022

Sector	2020	2021	2022
S&P 500 Consumer Discretionary Index	33,3	24,4	-32,8
S&P 500 Consumer Staples Index	10,8	18,6	-0,6
S&P 500 Energy Index	-33,7	54,6	65,7
S&P 500 Financials Index	-1,7	35,0	-10,5
S&P 500 Health Care Index	13,5	26,1	-2,0
S&P 500 Industrials Index	11,1	21,1	-5,5
S&P 500 Information Technology Index	43,9	34,5	-28,2
S&P 500 Materials Index	20,7	27,3	-12,3
S&P 500 Real Estate Index	-2,2	46,2	-26,1
S&P 500 Communication Services Index	23,6	21,6	-39,9
S&P 500 Utilities Index	0,5	17,7	1,6
S&P 500 Index	18,4	28,7	-18,1

Source: Author's own according to S&P Dow Jones Indices LLC

Tab. 2: STOXX Europe 600 sector performance from 2020 to 2022

Sector	2020	2021	2022
STOXX Europe 600 Automobiles & Parts (SXAP)	3,71	25,12	-20,08
STOXX Europe 600 Banks (SX7P)	-24,48	34,04	-3,19
STOXX Europe 600 Basic Resources (SXPP)	8,16	20,31	4,27
STOXX Europe 600 Chemicals (SX4P)	8,21	22,68	-16,5
STOXX Europe 600 Construction & Materials (SXOP)	-3,88	31,05	-21,09
STOXX Europe 600 Financial Services (SXFP)	3,92	24,28	-25,19
STOXX Europe 600 Food & Beverage (SX3P)	-7,59	21,63	-14,25
STOXX Europe 600 Health Care (SXDP)	-3,35	23,12	-7,88
STOXX Europe 600 Industrial Goods & Services (SXNP)	4,57	26,66	-20,11
STOXX Europe 600 Insurance (SXIP)	-13,51	15,37	-0,98
STOXX Europe 600 Media (SXMP)	-7,65	31,68	-12,29
STOXX Europe 600 Oil & Gas (SXEP)	-25,81	17,14	24,43
STOXX Europe 600 Personal & Household Goods (SXQP)	3,52	18,14	-12,89
STOXX Europe 600 Real Estate (SX86P)	-11,49	14,84	-40,12
STOXX Europe 600 Retail (SXRFP)	9,37	12,36	-32,59
STOXX Europe 600 Technology (SX8P)	13,87	33,71	-28,43
STOXX Europe 600 Telecommunications (SXKP)	-16,06	11,8	-17,65
STOXX Europe 600 Travel & Leisure (SXTP)	-15,47	3,66	-15,05
STOXX Europe 600 Utilities (SX6P)	7,85	5,43	-11,11
STOXX Europe 600	-4,04	22,25	-12,9

Source: Author's own according to Qontigo

Table 2 illustrates the significant performance contribution of the technology sector during the pandemic in 2020 and 2021. Furthermore, the data shows a significant underperformance of the sectors in 2022 compared to the broad index. Based on the sector performance data analysis the following hypotheses are defined:

H1: The performance of the Technology Sector of the STOXX Europe 600 and S&P 500 is higher during the pandemic and lower in 2022 with the central bank regime shift than for the broad index.

H2: There is a significant correlation between interest rates and the technology sector performance of the STOXX Europe 600 and S&P 500 and the broad index.

H3: There is a mean reversion process with a regime shift interest rate policy after the pandemic.

4 RESULTS AND DISCUSSION

There are several indicators for a potential correlation between interest rate hikes and sector performance discussed in the previous chapters. Based on these, the daily performance of the STOXX Europe 600 & S&P 500 and STOXX Europe 600 Technology & S&P 500 Technology is analysed in this chapter for a potential correlation based on the outperformance identified in the previous chapter. Indices are defined as dependent variables and interest rates as independent variable with the following parameter:

Tab. 3: Examination Parameters US

Variable	Name	Observations	Observations	Observations
		2020	2021	2022
Y1	S&P 500	253	252	144,0
Y2	S&P 500 Technology	253	252	144,0
X	Fed Interest Rate	253	252	144,0

Source: Author's own according to S&P data

Tab. 4: Examination Parameters Europe

Variable	Name	Observations 2020	Observations 2021	Observations 2022
Y ₁	STOXX Europe 600	258	258	257
Y ₂	STOXX Europe 600 Technology	258	258	257
X	ECB Interest Rate	258	258	257

Source: Author's own according to Qontigo & ECB data

4.1 Distribution

In the next step the performance distribution is plotted against the interest rates for the pandemic period for 2020 to 2021 and 2022 with the regime shift of the central banks. The first part of the chapter shows the charts for the S&P 500 and the second part the STOXX Europe 600 charts.



Fig. 5: S&P 500 vs. S&P Technology 2020

Source: Author's own according to S&P data



Fig. 6: S&P 500 vs. S&P Technology 2021
Source: Author's own according to S&P data



Fig. 7: S&P 500 vs. S&P Technology 2022
Source: Author's own according to S&P data



Fig. 8: STOXX Europe 600 & STOXX Europe 600 Technology 2020.
Source: Author's own according to Qontigo & ECB data



Fig. 9: STOXX Europe 600 & STOXX Europe 600 Technology 2021
 Source: Author's own according to Qontigo & ECB data



Fig. 10: STOXX Europe 600 & STOXX Europe 600 Technology 2022
 Source: Author's own according to Qontigo & ECB data

The data shows higher performance for the technology sector of the S&P 500 and STOXX Europe 600 during the pandemic and lower in 2022 after the central bank regime shift which confirms H1. In the next chapter Boxplot data are generated on a yearly basis from 2020 to 2022 to analyse density distribution and median information.

4.2 Boxplot

Boxplots charts are analyzed for the same evaluation periods to confirm the results of the distribution charts. The first part of the chapter shows the charts for the S&P 500 and the second part the STOXX Europe 600 charts.

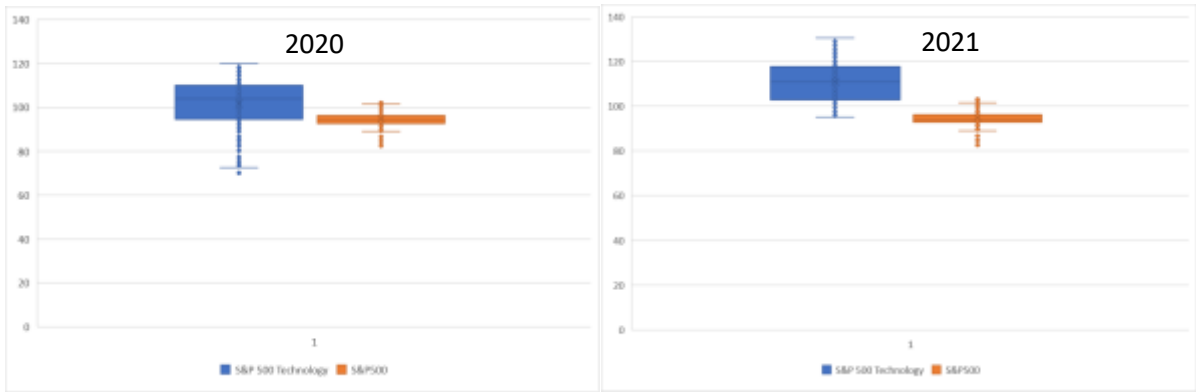


Fig. 11: S&P 500 vs. S&P Technology 2020 & 2021
Source: Author's own according to S&P data

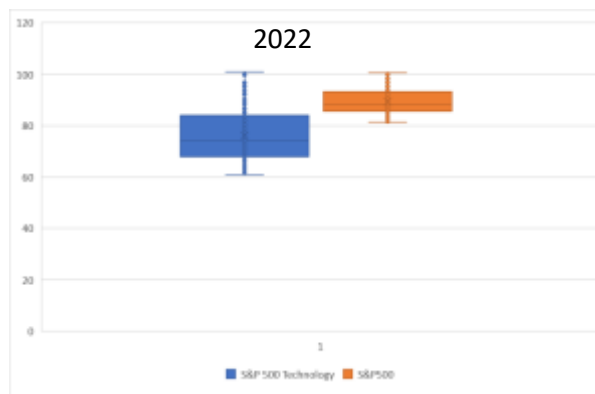


Fig. 12: S&P 500 vs. S&P Technology 2022
Source: Author's own according to S&P data

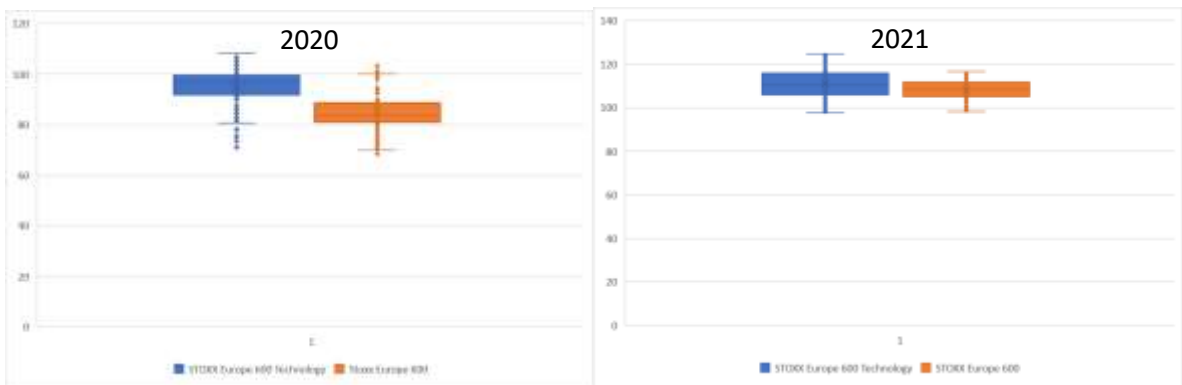


Fig. 13: STOXX Europe 600 vs. STOXX Europe 600 Technology 2020 & 2021
Source: Author's own according to S&P data

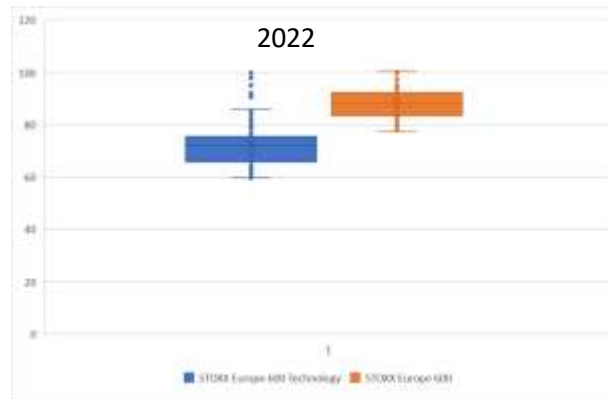


Fig. 14: STOXX Europe 600 vs. STOXX Europe 600 Technology 2022
Source: Author's own according to S&P data

The boxplot charts for 2020 and 2021 show similar result as the distribution charts. The higher median for the confirms the higher performance for the technology sector in 2020 and 2021 than for broad S&P 500 and the STOXX Europe 600 which also confirms H1.

4.3 Regression and Correlation Analysis

H2 will be examined with the help of a regression analysis and Pearson correlation for the index and Fed interest rate data. Data points and periods are the same as for the distribution and boxplot analysis. In the first step, a simple regression analysis for for the pandemic period for 2020 to 2021 and 2022 with the regime shift of the central banks is evaluated. The first part of the chapter shows the charts for the S&P 500 and the second part the STOXX Europe 600 charts.

Tab. 5: S&P 500 & S&P 500 Sectors vs. Fed interest rates 2020 to 2022. Source: Author's own according to S&P data

	2020			2021			2022		
	Regression Statistics			Regression Statistics			Regression Statistics		
	Multiple R	R Square	Pearson	Multiple R	R Square	Pearson	Multiple R	R Square	Pearson
S&P 500 Consumer Discretionary Index	0,047040973	0,002212853	-0,047040973	0,083967142	0,007050481	0,083967142	0,012894576	0,00016627	0,012894576
S&P 500 Consumer Staples Index	0,001865973	3,48185E-06	0,001865973	0,026570493	0,000705991	0,026570493	0,009560876	9,14103E-05	-0,009560876
S&P 500 Energy Index	0,130946325	0,017146940	-0,130946325	0,035620298	0,001268806	-0,035620298	0,050415404	0,00254171	-0,050415404
S&P 500 Financials Index	0,094185974	0,008870998	-0,094185974	0,013021498	0,000169559	0,013021498	0,056630779	0,00320705	0,056630779
S&P 500 Health Care Index	0,042255798	0,001785552	-0,042255798	0,102607865	0,010528374	0,102607865	0,067839928	0,00460226	0,067839928
S&P 500 Industrials Index	0,056436056	0,003185028	-0,056436056	0,024974280	0,000623715	0,024974280	0,057612117	0,00331916	0,057612117
S&P 500 Information Technology Index	0,063243715	0,003999767	-0,063243715	0,073907387	0,005462302	0,073907387	0,027631338	0,00076349	0,027631338
S&P 500 Materials Index	0,086742717	0,007524299	-0,086742717	0,003463586	1,19964E-05	0,003463586	0,006286386	0,00003952	0,006286386
S&P 500 Real Estate Index	0,022765781	0,000518281	0,022765781	0,021298620	0,000453631	-0,021298620	0,044746384	0,00200224	0,044746384
S&P 500 Communication Services Index	0,085964347	0,007389869	-0,085964347	0,028619884	0,000819098	0,028619884	0,032273168	0,00104156	0,032273168
S&P 500 Utilities Index	0,011464372	0,000131432	-0,011464372	0,061929920	0,003835315	0,061929920	0,004631524	0,00002145	-0,004631524
S&P 500 Index	0,048712311	0,002372889	-0,048712311	0,072050297	0,005191245	0,072050297	0,036269952	0,00131551	0,036269952

The regression analysis shows that there is no linear correlation between Fed interest rates and the performance of S&P 500 Technology and S&P 500 in 2020 ,2021 and 2022 which rejects H2 and H3. However, the data shows a linear correlation and Pearson correlation for the Energy and Health Care sector in 2020 and 2021.

Tab. 6: STOXX Europe 600 vs. STOXX Europe 600 Technology vs. ECB interest rates 2020 to 2022

	2020			2021			2022		
	Regression Statistics			Regression Statistics			Regression Statistics		
	Multiple R	R Square	Pearson	Multiple R	R Square	Pearson	Multiple R	R Square	Pearson
STOXX Europe 600 Automobiles & Parts (SXAP)	0,027450284	0,000753518	0,027397034	0,053385662	0,002850029	-0,053282101	0,033058139	0,001092841	0,0330581
STOXX Europe 600 Banks (SX7P)	0,044641449	0,001992859	0,044554850	0,067265562	0,004524656	-0,067135076	0,057628998	0,003321101	0,0576290
STOXX Europe 600 Basic Resources (SXPP)	0,017394743	0,000302577	0,017361000	0,137933176	0,019025561	0,137665604	0,059369895	0,003524784	0,0593699
STOXX Europe 600 Chemicals (SX4P)	0,015931762	0,000253821	0,015908056	0,069332903	0,004807051	0,069198407	0,045256725	0,002048171	0,0452567
STOXX Europe 600 Construction & Materials (SXOP)	0,016413290	0,000269396	0,016381450	0,078799539	0,006209367	0,078646679	0,056561568	0,003199211	0,0565616
STOXX Europe 600 Financial Services (SXFP)	0,030748928	0,000945497	0,030689279	0,041280466	0,001704077	0,041200388	0,052479784	0,002754128	0,0524798
STOXX Europe 600 Food & Beverage (SX3P)	0,015126033	0,000228797	0,015096690	0,024847012	0,000617374	0,024798813	0,008789742	0,000077250	0,0087897
STOXX Europe 600 Health Care (SXDP)	0,015507728	0,000240490	0,015477645	0,050528311	0,002553110	0,050430293	0,011630518	0,000135269	0,0116305
STOXX Europe 600 Industrial Goods & Services (SXNP)	0,028391890	0,000806099	0,028336813	0,033130104	0,001097604	0,033065836	0,068232972	0,004655738	0,0682330
STOXX Europe 600 Insurance (SXIP)	0,022783624	0,000519094	0,022739426	0,044713107	0,001999262	-0,044626370	0,045328662	0,002054688	0,0604269
STOXX Europe 600 Media (SXMP)	0,005987122	0,000035845	-0,005975508	0,030258035	0,000915549	-0,030199338	0,040517737	0,001641687	0,0405177
STOXX Europe 600 Oil & Gas (SXEP)	0,021245064	0,000451353	0,021203851	0,048481313	0,002350438	-0,048387266	0,011261630	0,000126824	0,0112616
STOXX Europe 600 Personal & Household Goods (SXQP)	0,028261062	0,000798688	0,028206239	0,034538609	0,001192915	-0,034471608	0,059352576	0,003522728	0,0593526
STOXX Europe 600 Real Estate (SX8P)	0,022453441	0,000504157	0,022409884	0,091619065	0,008394053	-0,091441336	0,039667684	0,001573525	0,0396677
STOXX Europe 600 Retail (SXRP)	0,035405801	0,001253571	0,035337119	0,100076895	0,010015385	-0,099882759	0,104370836	0,010893271	0,1043708
STOXX Europe 600 Technology (SX8P)	0,057802943	0,003341180	0,057690813	0,014741391	0,000217309	0,014712794	0,077280133	0,005972219	0,0772801
STOXX Europe 600 Telecommunications (SXKP)	0,031885496	0,001016685	0,031823643	0,067885545	0,004608447	0,067753857	0,064587583	0,004171556	0,0645876
STOXX Europe 600 Travel & Leisure (SXTLP)	0,026586576	0,000706846	0,026535001	0,001663306	0,001663306	2,76659E-06	0,040306491	0,001624613	0,0403065
STOXX Europe 600 Utilities (SX6P)	0,023435934	0,000549243	0,023390472	0,129844986	0,016859720	0,129593104	0,019342776	0,000374143	0,0193428

Source: Author's own according to S&P data

The regression analysis shows that there is no linear correlation between ECB interest rates and the performance of STOXX Europe 600 vs. STOXX Europe 600 Technology in 2020, 2021 and 2022 rejects H2 and H3. However, the data shows a linear correlation and Pearson correlation for the Basic Resources and Retail and Utilities sector in 2021 and 2022.

5 CONCLUSION

This research paper examines the impact of central bank interest rate changes in Europe and the U.S. on the market sensitivity of high-growth sectors in the context of the COVID-19 pandemic central bank policy.

The quantitative analysis investigates the relationship between interest rates and equity market performance at the sector level for the S&P 500 and the STOXX Europe 600, exploring the potential significant relationship between changes in interest rate policy and sector performance from 2020 to 2022. The paper provides a differentiated understanding of the historically low interest rates and their role in the economic landscape during this period.

Some previous research concludes that interest rate increases can have a negative impact on equity market returns, as higher interest rates can reduce the attractiveness of investing in equities relative to fixed income. However, other studies argue that the relationship between interest rates and equity markets is more complex and depends on various factors such as the state of the economy, investor expectations, and the specific characteristics of the equity market.

Technology sectors in the U.S. and Europe are of particular interest for this paper based on the literature review. The S&P 500 Technology and STOXX Europe 600 Technology show outperformance relative to the broad index during the pandemic and underperformance in 2022 after the regime change, indicating potential sensitivity of high-growth companies to interest rate changes.

Interestingly, the results of the correlation and regression analyses of this paper do not reveal any clear relationships between the factors examined and the performance of the technology sectors. The prevailing academic view of a direct correlation between interest rates and the performance of the S&P 500 Technology and the STOXX Europe 600 Technology is contradicted in this paper. The analysis shows the complexity of the relationship between the selected factors and that other factors may have an impact on the performance of the technology

sectors. The initial hypothesis of a significant correlation between interest rates and the performance of the technology sectors of the STOXX Europe 600 and the S&P 500 as well as the broad index has therefore not been confirmed. The assumption of a stronger mean-reversion process for the technology sectors at the end of the pandemic is also rejected.

For a broader scope of the paper the potential interest rate sensitivity of other sectors is analyzed. The data shows a linear correlation and relationship for the energy and healthcare sectors in 2020 and 2021 for the S&P500, and a linear correlation and relationship for the basic materials and retail and utilities sectors in 2021 and 2022 for the STOXX Europe 600, suggesting potential sensitivity.

In summary, the results of this paper help provide a better understanding of the relationships between interest rate policy changes, the COVID-19 pandemic, and equity market performance. Although no significant impact on sector performance was found, this suggests that other factors may play a larger role. Further research is necessary to analyze these in more detail and understand their impact on equity markets. The results of this paper can be used by investors to make more informed decisions regarding their investment strategies and business plans.

Overall, the research contributes to the academic discussion on the impact of changes in interest rate policy and the COVID-19 pandemic on equity markets. Although the interest rate analysis does not reveal significant correlations, the index correlation provides the basis for further research.

The paper recommends further research to better understand the underlying mechanisms and relationships and potentially identify other relevant factors, such as inflation, that could affect stock market performance.

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Mr. Hütteroth joined DWS International in March 2020 and he is team lead sales for the Pensions & NPO segment. Prior to his role, Mr. Hütteroth worked as Vice President in the institutional client business at BlackRock. He began his career at Fidelity in Germany.

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9-Euro-Ticket and Introduction of a 49-Euro-Ticket

Wolfgang Kloppenburg

Abstract

The 9-Euro-Ticket - a monthly ticket - was valid throughout Germany between June and August 2022. Passengers did not need any additional tickets for travelling and they could travel on it over all Germany. Traveling was made much easier and encouraged additional passengers to use public transport who otherwise would not have traveled by this transport mean at all. As a replacement for the 9-Euro-Ticket, the so-called Deutschland-Ticket, which costs 49 Euros, was introduced on May 1st, 2023. The article analyzes, using public available data, the development of passenger numbers in the period of the 9-Euro-Ticket, its financing, points out some problems connected with the ticket and development after the end of the ticket. Overall, the 9-Euro-Ticket was a success, as 52 million tickets were sold throughout Germany and passenger figures increased extraordinarily. The transport companies were thus able to compensate for the declining passenger numbers caused by the pandemic, at least for the three-month implementation period. To finance the 9-Euro-Ticket, the federal government increased the regionalization funds by € 2.5 billion and made them available to the federal states based on the so-called "Kiel distribution key" to financially support the transport companies, as the low-priced ticket led to a loss of revenue for the companies.

Keywords

9-Euro-Ticket, Passenger figures, Regionalization funds, 49-Euro-Ticket

JEL Classification

D23, G59, P22, R48

1 INTRODUCTION

In 2022, the German federal government introduced a temporary offer in local public transport (ÖPNV) for the period from June to August in the form of the 9-Euro-Ticket. The reason was to relieve the German citizens because of the increased energy costs, especially due to the Ukraine war. The offer should also be an incentive for car users to switch to public transport in view of the energy price development. The 9-Euro-Ticket was a limited-time promotion in Germany's local public transportation that ran from 1 June 2022 to 31 August 2022 (Bundestag, 2022). It was a 9-Euro monthly ticket, valid all over Germany, and much less expensive than ordinary season tickets. The promotion aimed to both ease the load on habitual travelers and draw in new users of public transportation. The 9-Euro-Ticket should also provide an answer as to whether a fare reduction and a simplified ticketing system can attract additional users to public transport and thus achieve the ambitious climate targets. 52-million 9-Euro-Tickets were sold, making it clear that the product was a success. Additionally, the 9-Euro-Ticket was automatically sent to the roughly ten million season ticket holders for each of the three months (VDV, 2022). From the point of view of environmental protection, this number of passengers contributes to cutting carbon dioxide emissions by 1.8 million tons (VDV, 2022). Notable improvements to air quality in metropolitan areas have also been documented. Researchers at the University of Potsdam (Gohl and Schrauth, 2022) found that air pollution levels fell by up to 7% in response to the introduction of the low-cost ticket.

The aim of the article is to analyze the effect of the ticket on passengers' numbers, point out some problems connected with the ticket, describe how the ticket was financed and discuss the development after the end of the ticket. The article is organized as follows. The second chapter concentrates on the issue of how the ticket influenced the numbers of passengers especially in train and road transport. The third and the fourth chapter summarize some problems connected with the ticket and the issue of how the ticket was financed. The fifth chapter discusses the development after the end of the ticket. Conclusion summarizes the main points.

2 EFFECTS OF THE TICKET ON PASSENGERS' NUMBERS

The ticket enabled the railway companies to win back many passengers lost due to the pandemic. This allowed the results of the regional railway (SPNV) companies with net contracts or transport contracts with an incentive system to improve significantly due to positive passenger development. With a gross contract, the public transportation authority is still responsible for the revenue risk. The transportation business subtracts the fare earnings and pays its own operating costs with the order fee. However, a gross incentive contract is created if the public transportation authority and the transportation provider agree on an incentive, such as one for gaining more passengers. In a net contract, the transportation firm bears the revenue risk and is responsible for financing it with a lower order fee while keeping the fare revenue (DB Regio, 2017).

In addition, the ticket offer attracted passengers who had never traveled by rail before. In general, the development of the passenger numbers shows that between June and August 2022 shows that the number of passengers in SPNV due to the introduction of the 9-Euro-Ticket increased, but in September 2022, i.e., after the end of the ticket, these numbers again decreased. From June to August 2022 there were in comparison to the time before the pandemic on average over a quarter (+24%) more rail trips over lengths of 30 kilometers or more made from Monday through Friday. Even more rail trips were taken on the weekends (+105%), exceedingly twice as many. In a focused analysis of mobility data, the Federal Statistical Office discovered that train journeys over 30 km increased on average by 43% between June and August 2022 in comparison with the corresponding time in 2019; the increases were much higher on weekends. Most of the extra passengers used short and medium-distance trips (Destatis, 2022).

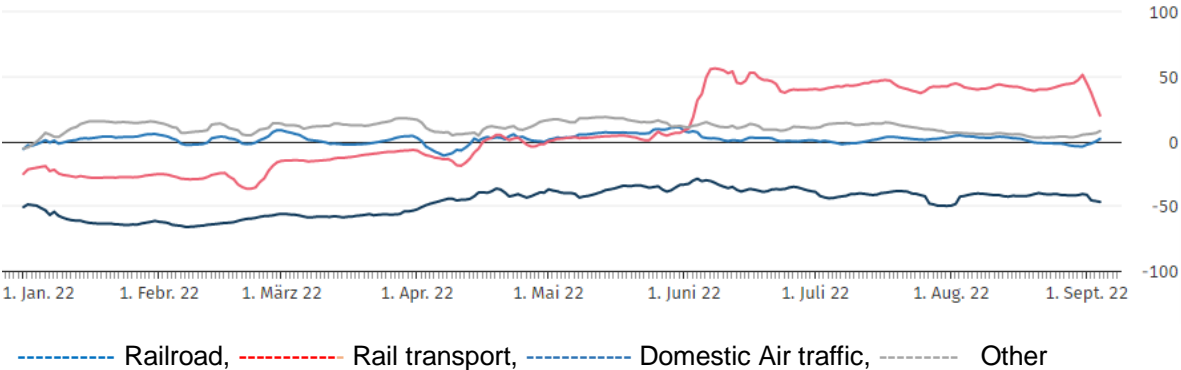


Fig. 1: Change in mobility in Germany in 2022 by mode compared to 2019
Source: Destatis (2022)

When examining travel distances, the number of train trips under 300 kilometers grew significantly during the 9-Euro-Ticket period. For instance, the average number of rail trips between 30 and 100 kilometers was 43% higher during the period from 1st June to 31st August than in 2019. A 57% increase was seen for medium distances (100 to 300 kilometers). The number of trips made in the course of a week across distances of less than 30 kilometers, on the

other hand, was exactly at the level of the previous year and only slightly (+7%) over during the weekends. So, it can be inferred from the data that, compared to the comparison period in 2019, significantly more train trips under 30 kilometers were canceled during the time of the 9-Euro ticket. The number of daily movements in rail transportation will once more reach the level of 2019 after the 9-Euro-Ticket expires in September 2022. Based on these numbers, it can be said that rail passengers rarely utilized the 9-Euro-Ticket, which is good for local and regional transportation, for lengthy, time-consuming trips because using other ways of payment was more expensive. If all distance classes are taken into consideration, a fall in mobility to the pre-crisis level can be seen once the 9-Euro-Ticket expired. On August 31, 2022, rail travel between 30 and 100 kilometers was still two-thirds (+67%) above the level of 2019, but by September 1, 2022, it was already less than one-fifth (-19%) below that level. Surveys among people buying the ticket carried out during the period of its validity also indicated that the number of passengers will decrease after the expiry of the ticket. Horpenaikova (2022) found that only 9% of respondents with a 9-euro ticket expected to use public transport more often after the offer comes to an end. Another 38% expected their public transport use to remain the same, 40% wanted to travel less and 14% didn't expect to keep using it at all.

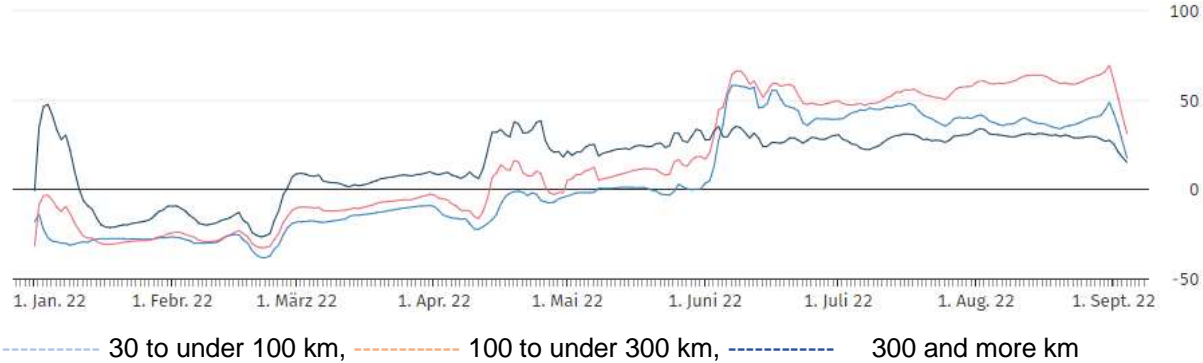


Fig. 2: Change in rail mobility in Germany in 2022 by distance compared to 2019
 Source: Destatis (2022)

The use of 9-Euro-Ticket should have an effect on other forms of transport, for instance, road transport. The statistical federal office conducted a special examination of the mobile phone data regarding changes in the number of drivers. Data from Telefónica's mobile network that has been anonymized and aggregated by the Teralytics company was compiled and made accessible to the Statistic Federal Office. Telefónica, as one of three mobile communications providers on the German market, has a market share that is roughly one-third nationwide but may be higher or lower in particular areas. Hence, variations may happen as a result of the respective regional market shares. Nevertheless, the data provider claims that an extrapolation method is used to try to reflect the entire German population. Movements are determined utilizing anonymized and aggregated mobile-funk data from position changes when stays at the start and objective locations last for at least 30 minutes. The mobile phone data makes it possible to make day-to-day inferences about the use of various modes of transportation while traveling more than 30 kilometers. The mode of transportation is determined using data on the layout of road and rail lines as well as trends in the synchronous connections of numerous mobile radio devices (Destatis, 2022). As the figure shows the increase in railway transport was not accompanied by a significant decrease in other forms of transport. From these numbers can be concluded that the ticket lured especially people who would have not traveled by train if the ticket had not been introduced. The Research of Horperniakova (2022) who had asked travelers for the reason of their journey also confirms that ticket was used mainly for leisure travel, with 60% of respondents using it for excursions and leisure activities at the weekend, 34% for leisure

travel during the week, and 21% for holiday travel. Tickets played a lesser role in commuting: 18% used them to travel to work or for training.

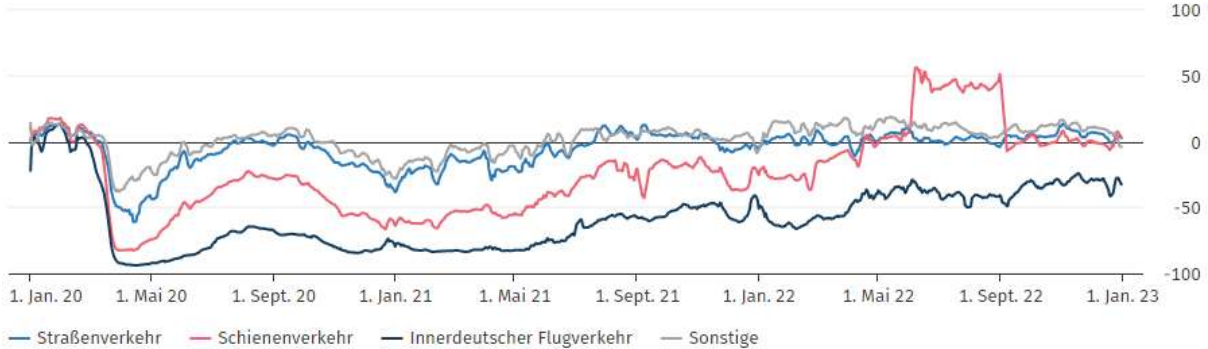


Fig. 3: Change in mobility in Germany in 2022 by mode of transport. Source: Destatis (2022)

The above-mentioned findings are supported by data from specific routes. The article takes based on the analysis of Teralytics (2023) two routes: 1. Berlin – Rostock; 2. Düsseldorf – Köln. The first route is used mainly by people traveling from Berlin to Rostock for a holiday trip. Here it is compared the 9- Euro-Ticket period with time directly before and after (full May and Sept up until February). The period of the ticket is connected with a small increase in road trips, but the increase in train trips is remarkable – over 250% for certain weekdays.

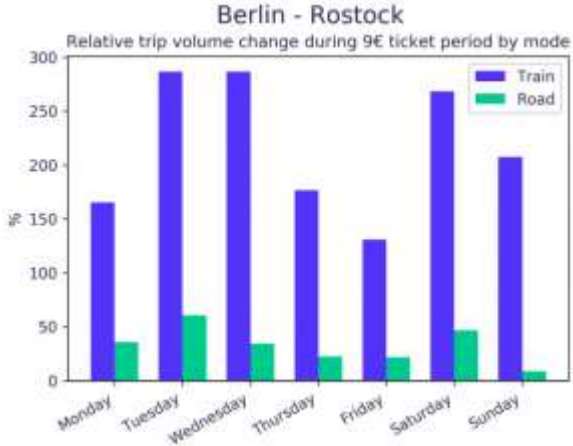


Fig. 4: Berlin – Rostock: Relative trip volume change during the 9-Euro-Ticket period by mode Source: Teralytics (2023)

The second route Düsseldorf – Köln, is one of Germany’s most frequented commuter connections. This 45km long city-to-city center journey is well connected both by train and road. It is interesting to look whether the initiative decreased road transport. The data said yes – a clear decrease of approximately 10% in road traffic can be observed on weekdays. As this is a May to September 2022 comparison, the effects of more people working from home post pandemic can be excluded as the reason for the decline in road transport.

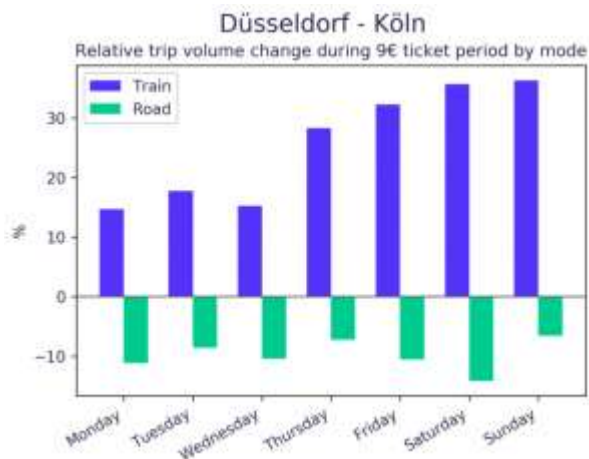


Fig. 5: Düsseldorf – Köln: Relative trip volume change during 9-Euro-Ticket period by mode. Source: Teralytics (2023)

3 PROBLEMS CONNECTED WITH THE TICKET

9-Euro-Ticket was also, unfortunately, connected with some problems. The strong demand could not always be satisfied, although all railway companies made their capacities available. This occasionally led to overcrowded trains and situations where not all passengers could find a seat. As passengers were sometimes standing in the boarding areas, the light barrier could not always function and thus the doors were not closed automatically. There were delayed departures due to overcrowded trains. The consequence could therefore be that contractual penalties for unpunctuality or passengers could assert their passenger rights and thus negatively influence the results of the railway companies. For instance, based on a six-minute cut-off, DB Regio's punctuality rate dropped to 88.5 percent in June 2022 from 98.3 percent the month before (ZDF, 2022). The main cause is thought to be delayed departures related to the 9-Euro-Ticket.

The EVG trade union claims that in addition to benefits like high demand and ticket simplicity, which is a welcome change from the intricate "small-small" of the German tariff system, there were problems with commuters. The railway system could not be ready for the passenger run, which was a drawback. Capacity bottlenecks were caused by a lack of railway operating staff, a lack of trains, and the railway infrastructure's numerous building sites. As a result, there were overcrowded trains, safety hazards on the platforms, and an increase in passenger aggression in general (EVG, 2022).

The situation in Thuringia can be mentioned as a typical example. The Erfurter Bahn, a regional railway transport company, was happy about the end of the 9-euro-Ticket. Resources could barely keep up with demand. Demand for local public transport had doubled. Transport companies in Thuringia are looking for relief at the end of the 9-Euro Ticket at the end of August 2022. The managing director of the Erfurt and Southern Thuringia Railway, told MDR AKTUELL that passenger numbers had increased significantly since June 2022. However, technical and personnel resources were barely keeping up with demand. About 100 railcars and 600 employees are in operation, many of them close to exhaustion - especially on routes such as Saalfeld-Erfurt, Erfurt-Ilmenau or Eisenach-Meiningen, he said. At some stations, passengers have to be left standing. But there are no cars that can still be attached. The managing director reports of employees who are happy when September begins and the 9-Euro-Ticket is history (MDR, 2022).

Some problems concern passenger checking. The customer service staff in the regional trains of the railway companies have reached their capacity limits due to the 9-Euro-Ticket. In overloaded trains, it was often difficult to conduct ticket checks and there were chaotic situations. Rates of illness took a very bad turn. In the months of June through August, the influx of passengers on local transportation caused serious wear and tear. Heavy use had harmed the trains, the elevators were broken, or the onboard restrooms were broken. As many train conductors and drivers approached their breaking points, the rate of illness rose exceptionally high (WDR, 2022). The overwhelming demand also caused some railway companies to stop transporting bicycles. As the carriage of bicycles was not covered by the 9-Euro-Ticket, a separate bicycle ticket was required. In contrast, bicycles can usually be carried free of charge all day or at certain times in a number of federal states or transport associations. In the summer 2022, when the 9-Euro-Ticket was valid, there was a noticeable rise in verbal abuse directed at railway employees throughout Germany. Between June and August 2022, there were more than 3,000 verbal attacks, claims DB (Bahnblogstelle, 2022).

However, on the other side, traveling without a valid ticket greatly declined in the local and regional transport of DB Regio as well as in the other railway companies. The affordable price was one of the causes of this. It also seems that the above-mentioned problems did not lead to passenger dissatisfaction. The survey of Heineke et al. (2022) revealed satisfaction levels among consumers who use public transport frequently before the 9-Euro-Ticket remained unchanged in comparison with previous surveys made before the introduction of the ticket. Among consumers who are only occasional riders, 41 percent report that they are satisfied with their experience on public transport after purchasing the ticket. By contrast, only 23 percent of occasional riders reported having been satisfied with public transport before the ticket's introduction. The survey also revealed that more than 70 percent of the respondents who have bought such a ticket said they would increase their public-transit usage in the future.

4 FINANCING OF THE TICKET

To finance the 9-Euro-Ticket, the federal government has increased the regionalization funds of the federal states to the amount of 2.5 billion euros. This allows the federal states to compensate the transport companies, as the ticket price was extraordinarily subsidized and the railway companies thus lost revenue. Regionalization funds are distributed according to the so-called Kiel Key.

The German Conference of Transport Ministers settled on the Kiel Key in October 2014 as a distribution key for the regionalization subsidies for local public transportation that the federal government distributed to the federal states. The federal states came to an agreement on this key and it includes half of the population and half of the SPNV services requested in railway kilometers. Federal states who suffer disadvantages as a result of the Kiel Key application in comparison to the prior funding distribution are given more monies. Each year, the federal government provides regionalization funds to the federal states to help pay for local rail passenger transportation. With the railway reform of 1994–1996 in Germany, control over local rail passenger transport was passed from the federal government to the federal states. Since then, the federal states have decided which routes and to what extent local public transport is offered within the framework of the "orderer-provider system". Local rail passenger transport is financed by both public funds and fare revenues. Part of the federal tax money flows to the federal states. According to the Regionalization Act, these funds are called regionalization funds (RegG). The regionalization funds are earmarked, i.e. the federal states may only use them for local public transport. The majority of the funds are used to order train services or to pay railway undertakings for train services. However, some of the regionalization funds are

also used for the purchase of new vehicles or for the expansion of the rail network. The financial losses of the SPNV companies due to the low fare were ultimately largely compensated by the increase in regionalization funds by the federal government in the amount of € 2.5 billion. A more detailed presentation is possibly to be expected from the railway undertakings with the annual financial statement for the 2022 financial year to be published.

5 AFTER THE END OF 9-EURO-TICKET AND INTRODUCTION OF 49-EURO-TICKET

Transport experts, associations, passengers and others have argued for an extension of the 9-Euro-Ticket due to the high demand. The 29-Euro-Ticket was adopted by the state of Berlin after the expiry of the 9-Euro-Ticket and will be continued until April 2023. From 1 May, the Deutschlandticket will also be valid in the federal state of Berlin.

On 4 September 2022 the federal government declared at the presentation of the third relief package that it would provide the states with an additional 1.5 billion euros annually for a nationally valid local transport ticket in return for at least an equal financial contribution. The talk was about a monthly ticket that could cost between 49 and 69 euros (NDR, 2023). Generally, it was agreed, in order to prevent misallocations, a price is needed that to a certain extent has a regulating effect on a quasi-unbridled demand but the ticket must be still affordable to the general public. A survey by made the Technical University of Munich and the Bavarian School of Public Policy (Innovation in Brings 2022) found that the survey participants in the Munich metropolitan region would be willing to pay an average of 52.39 euros for a comparable ticket. The amount is slightly higher than the 47.74 euro average determined by a national survey. From that data, it seems that the 49-Euro-Ticket satisfies the ideas of German citizens about the affordable price and can be again connected with success and with the increased numbers of passengers. However, the supply of transport has to be expanded too and the railway companies have to employ additional operating staff, which they do not have and cannot build up so quickly.

On 2 November 2022, the Federal Government and the Minister Presidents of the Federal States agreed on a 49-Euro-Ticket, the so-called “Deutschlandticket”. The third assistance package included a decision by the federal government to launch the 49-Euro Deutschlandticket. The 9-Euro-Ticket, which was offered from June to August 2022 and aimed to make public transportation more enticing, will be replaced by it. Thanks to the inexpensive, ticket within the context of regional transport, travelers can conveniently travel across national and tariff borders without having to deal with various local transport tariffs. Currently, all parties involved are assuming that the introduction date will be 1 May 2023.

However, some experts did not consider an earlier date realistic, as many details still need to be clarified (Zeit online, 2022). There are several reasons for the later introduction of the Deutschlandticket, since after the clarified financing, the conversion of ticket machines, committee decisions and railway companies still have to be equipped with sufficient operating staff. Another obstacle is the capacity of the train’s equipment, which cannot be increased quickly and the problem of the many construction sites in the rail infrastructure network. Furthermore, the many construction sites of DB Netz should be mentioned, which do not lead to the overall stability of railway operations. Due to the introduction of Deutschlandticket in May 2023, the DB Regio general works council is demanding more security measures, such as the increased deployment of railway police and an increase in the number of customer advisors, for railway staff. Furthermore, the works council leader demanded that trains be taken out of service if the video recording did not work (Bahnblogstelle, 2023). Overall, there are several obstacles to satisfying such a demand as during the period of the 9-Euro-Ticket. But the German

government declared that the 49-Euro-Ticket will be made available on May 1, 2023 in any case, and it started to be sold on April 3. The public transport authorities, therefore, try to prepare higher demand that can be expected as the consequence Deutschlandticket. They, for instance, prescribe a train attendant quota of 200% in many news transport tenders, especially in the evening hours (ntv, 2023).

Both the federal government and the federal states want to make up for half of the money lost by the transportation companies as a result of the lower pricing. From 2023 to 2025, the federal government will pay 1.5 billion euros per year toward the cost of the ticket; the federal states will cover the remaining amount.

6 CONCLUSION

The 9-Euro-Ticket was a one-month valid ticket in Germany for the months June, July and August 2022. Passengers can simply travel throughout Germany on buses and trains with just one ticket using a nationwide local public transportation subscription, crossing all network boundaries and tariff districts. This is a huge benefit for Germany's public transportation system because it lowers costs for frequent and long-distance commuters as well as residents of urban areas and outlying villages. As a result, both the environment and German individuals are safeguarded from the effects of rising inflation.

Overall, the effects of the 9-Euro-Ticket on the transport companies are the following: The 9-Euro-Ticket was a complete success in terms of passenger demand. It led to high interest among passengers but was connected also with some problems. Transport companies were not able to prepare sufficiently for the operational processes, as the introduction was decided by the federal government at short notice. They had to refuse some transport demands especially travelers with bicycles. As the main shortage can be seen high property damage (toilets, seats, etc.). Cleaning the vehicles inside and outside was very difficult. The ticket also caused a high rate of sickness among the operating staff, especially among the customer service staff. Generally, the opponents or critics of the ticket pointed out the following issues (The Germany Way, 2023): 1. the overcrowded buses, trams, commuter rail, and regional trains – a strain on an already stressed system. 2. reduction in car use was only temporary and limited to larger cities. 3. What was really needed, they said, were true improvements to public transport service, such as faster and better connections. Some opponents including German Tourist Association mentioned these points before the establishment of the ticket and the following development proved that they had had the truth.

The ticket was a natural transport experiment allowing to make the research on how the behavior of people changed if the price for some kinds of transport changed. It proved that an affordable price is able to lure new passengers but it itself does not cause a decrease in car transport. Similar findings were made in other regions. For instance, Estonian capital Tallinn had introduced free public transport in 2013, but this step has not led to a reduction of car trips. The number of public transport users increased, but more than half of all trips to work are still made by car (Punamäe, 2022). As Mobility Institute Berlin (2022) indicates the use of cars can decline if the time of travel by public transport will be same or lower in comparison with cars. If it takes a person more than twice as long to cover a distance by bus than by car, if (s)he have to change the line often, or if there is no connection at a certain time of day, it's clear that (s)he choose the car.

With the third relief package, the Federal Government has also decided to introduce the Deutschlandticket for 49 euros. It is to be the successor to the 9-Euro-Ticket. The railway companies have already had a long time to prepare for the introduction. However, it will not be

possible to increase the capacity of the operating staff or the vehicle fleets. Thanks to the "flat rate for regional transport", travelers and commuters will be able to travel easily across national and tariff borders without having to fight their way through the jungle of different local transport tariffs. The introduction is scheduled for 1 May 2023. It can be expected that demand will be lower due to the introduction of the 49-Euro-Ticket. The fare is still cheap for season ticket holders, but for many occasional travelers or groups who have made "adventure trips" through Germany (for example, a trip from Munich to Sylt by regional transport only) the price may be too high. Half of the funding for the ticket will come from the federal government to the tune of € 1.5 billion. The other half will be provided by the federal states. Possible additional costs are also to be borne by the parties involved in this proportion. The further research should analyze the consequences of 49-Euro-Ticket for passenger numbers development, if higher demand for travelling again causes some problems to railways operators, if there will be decline in other means of transports and other consequences of the ticket. The new data can help to solve the issue whether it makes sense to support railway transport for instance with the aim to reduce other means of transports or to achieve a climate goals.

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Since 2004 self-employed as a management consultant with a focus on interim management in the stationery industry, tobacco industry and mechanical engineering companies. From 2010, active in the railway industry as a board member, managing director and in other managerial positions, among other things with a focus on transport tenders, setting up new railway companies and managing the operational business. In 2019, training in insolvency law took place with the final examination to become a certified ESUG advisor (DIAI).

The Online Price Index: A New Approach to Measuring Inflation

Robert Laskowski

Abstract

The purpose of this paper is to explore the current state of research of calculation the consumer price index (CPI). It shows how the CPI and the Harmonised consumer index of consumer price (HICP) are calculated. It specifically reviews how the price data are collected and the calculation on which the CPI is based. It describes the challenges faced by statistical offices in determining the CPI in an ever-changing world and the innovations that must be mandatorily introduced to ensure an inflation rate close to "True Inflation". The paper highlights the necessity to take online prices into account and to create a unique online price index (OPI) with collecting online prices by web-scraping with infinity number. The OPI can be also a good predictor for the CPI. It identifies services, goods, mortgages and assets that are not or insufficiently taken into account in the calculation of inflation but should be, according to current research. It further examines the challenges in price collection, calculation and weighing scheme faced by central banks, Governing Council, governments and statistical offices and how they are resolved. With the growing digitisation in the country, the share of goods and services purchased by consumers from online retailers is also increasing. Online prices are already taken into account to a small extent in the CPI, but should be given greater attention.

Keywords

inflation, online price index, consumer price index, statistical office

JEL Classification

E31, E39, O12

1 INTRODUCTION

The most important economic objectives of a state government are to ensure high employment in the state, steady adequate economic growth, external balance and a stable price level. The monthly consumer price index (CPI) is used to monitor the price level. The annual difference between the price indices gives inflation. The calculation of inflation regularly poses new challenges to countries and central banks alike (Diewert, 2002).

In this paper, the current theoretical and empirical literature will be used to answer the question of which current determination methods are up-to-date and how prices can be collected in the future. The aim of this paper is to explore whether prices of online trade need to be considered in the calculation of the CPI to a larger extent in order to calculate accurate inflation. The differences in the characteristics of online prices and offline prices are compared. In particular, the price differences and the frequency of price changes will be compared. Furthermore, the advantages and disadvantages of price collection of online prices will be described.

This study is structured as follows. First, the importance of the CPI and the HICP is highlighted. Then, data collection and product price collection are discussed in order to show the current challenges in calculating the consumer price index. Solutions and concepts that have been described or developed in the literature to improve the calculation of the CPI and to meet future challenges are highlighted. We will specifically address the possibilities of web scraping online

prices, which are becoming more important with the growing online trade. In the last section we will evaluate the possibilities and derive our own recommendations.

The consumer price index (CPI) measures the average price development of goods and services, such as clothing, food, energy, package holidays and rents in a country. The CPI is used for some important economic purposes, such as indexing trade contracts, financing elements and wages, as well as social transfer payments (Hoffmann, 1998). To determine inflation, prices of goods and services are collected that are defined in a fixed basket of goods. The value of the basket of goods is compared with the value of the same basket of goods from month to month and year to year. The change in the CPI is called inflation and is an important measure of monetary depreciation. It is a tried and tested means of comparing living standards and economic growth internationally. As money devalues, people's savings decline and are increasingly invested in real assets, which in turn limits the ability of banks to lend. Inflation exists when the quantity of goods is matched by too much money and thus the demand for goods is greater than the supply.

To ensure the goal of a stable currency, steady economic growth and external balance, the goal of central banks is to ensure a creeping but controlled inflation of just below 2% (European Central Bank, 2011) annually. The European System of Central Banks is an institution guided by consumer price inflation (Issing, 2004). Over 340 million people from 19 countries use the euro as their common currency. The Governing Council of the ECB is responsible for a single monetary policy and is supposed to ensure price stability in the euro area. Price stability is widely recognised as a major contributor to general welfare, including a strong economy and high employment (www.wirtschaftsdienst.eu, 2022).

While the CPI measures the consumer price in one country, the Harmonised Index of Consumer Prices is a cross-country index in Europe that is intended to make comparisons between the countries of the EU or the Economic and Monetary Union easier (www.ec.europa.eu, 2022). Eurostat (the Statistical Office of the European Union) collects prices of various product categories at the country level but publishes them via Eurostat. As a rule, the CPI covers all relevant consumer expenditure, which, however, varies from country to country. The Harmonised Consumer Price Index (HCPI) attempts to take into account the relative importance of households in different countries for goods and services. The common rules for calculating the HCPI are provided by Eurostat, to which the member states have been subject since 1997, based on the Stability and Growth Pact (Diewert, 2002).

In order to determine inflation as accurately as possible, prices must be recorded where the consumer buys the items. Thus, internet trade is gaining importance in a digitalised world, rising to 86,7 billion euros in Germany in 2021. For 2022, even 97,4 billion Euro will be expected (Online-Monitor, 2022). One of the big profiteers is the retail giant Amazon, which alone turns over 54 billion euros of this. In the last two years alone, during the Covid-19 pandemic, online retail sales increased by 40% in Germany. Thus, almost every fifth euro is already spent online by consumers if food spending is neglected in the analysis. Including food, the online share for goods and services is already 14.7% in 2021. Although online trade is dominated by only a few large players such as Amazon, Zalando, Otto and Ebay, it is nevertheless multi-layered and diverse. Online prices are also highly volatile due to the high price competition of online shops with the help of computer-controlled price adjustment tools and are constantly changing due to external and internal market influences. This phenomenon is described by Cavallo (2018) in his research as the "Amazon effect" and Hansen (2020) for Germany.

Online trade is thus increasingly influencing price formation in a modern market economy. For this reason, various researches have already been dealing with a web-based type of price collection for the determination of inflation for years. With the help of modern and computer-

controlled crawler or price-scraping systems, it is possible to obtain daily updated price data of products in an almost unlimited number and in the best quality automatically and with relatively little effort. In addition, many measurement errors can be eliminated in advance through this type of price collection.

For the calculation of the CPI, price data are still mainly collected manually by commissioned price investigators in stationary trade (www.destatis.de, 2022). This type of price collection is time-consuming and costly and raises the question of whether it is still up to date in the way it is done and whether it makes an accurate calculation of the CPI possible in Germany and other developed economies (Blaudow and Ostermann, 2020). If the share of goods purchased in online trade is becoming larger and larger, this brings with it a growing fuzziness in the calculation of inflation. For the calculation of the German consumer price index (CPI) and the resulting inflation rate, prices are already being recorded and evaluated via web scraping (Blaudow and Ostermann, 2020).

1.1 RESEARCH QUESTION AND HYPOTHESIS

This research aims to answer the following key question. Does the calculation of the consumer price index (CPI) and the resulting inflation already sufficiently take into account the prices of online trade? The hypothesis is that web-based prices have so far been insufficiently taken into account for the calculation of the CPI and inflation. Without the integration of online prices, an exact calculation of the CPI and inflation is already no longer possible today.

2 THEORETICAL BACKGROUNDS

The present literature is composed as follows. All articles are essentially concerned with the calculation of the consumer price index and the collection of inflation rates. Thirty-one relevant articles on the CPI were extracted from the existing literature. The dates of the publications range from the early 1920s to the present day. Five articles predate the year 2000, nine were published between 2000 and 2010 and 17 from 2011 to the present.

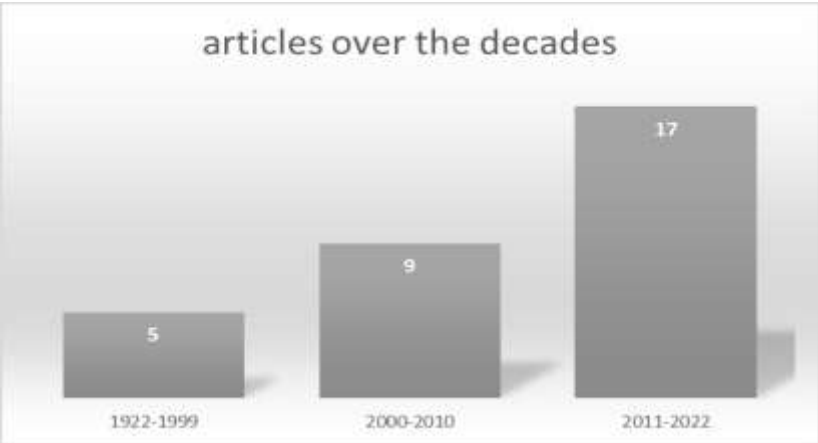


Fig 1: Number of articles over the decades
Source: own research (scholar.google.com, 2022)

The available studies were divided into three main areas - CPI target setting, doubts in the current collection of the CPI and the inflation rate, and alternative calculation methods.

29% of the studies deal with the objective of the CPI in the main purpose. Why does the CPI have to be collected, what makes the CPI or the calculation of inflation important and what

economic and political insights can be derived from it. How must the CPI and inflation be collected and calculated in order to take into account as far as possible all consumer prices in the correct proportion and to make it equally understandable and comprehensible for all.

The largest part (39%) of the available literature deals with alternative methods of collecting the CPI. Alternative data collection methods are discussed, such as how the integration of online prices and scanner data must be taken into account in the inflation calculation. Furthermore, there are studies that deal with the inflation of asset prices or mortgages and interest costs and want these to be taken into account in the inflation survey.

Approximately one third (32%) of the available literature lists reasons for doubt in the core of the studies as to why the CPI is not surveyed correctly. For example, the inflation rate would not sufficiently take into account welfare as well as quality and substitution effects. Some researchers conclude that the data basis for calculating the CPI is too insufficient and that the weighing scheme does not accurately reflect consumers' purchasing behaviour.

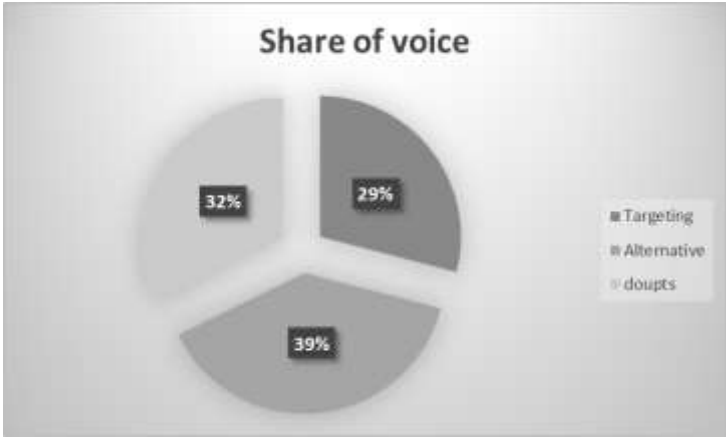


Fig. 2: Share of topic in the related literature
Source: own research (scholar.google.com, 2022)

Alberto Cavallo and Erwin W. Diewert dominate the literature in terms of published articles on the CPI and the inflation rate. Irving Fisher's basic book "The making of index numbers: a study of their varieties, tests, and reliability" is the most cited work in the literature. Diewert dominates the literature when it comes to setting targets and calculating the current inflation rate and the CPI. Alberto Cavallo is a proponent of the urgent inclusion of scraped online prices in the CPI.

Tab. 1: Authors, Articles and Citations

Authors	Articles	Citations	Autoren	Articles	Citations
Fisher, Irving	1	1965	Mark Wynne	1	22
Cavallo, Alberto	5	933	Vito Gaspar	1	22
Chevalier, J.	1	636	Andersson, Fredrik	1	21
Goolsbee, A.	1	636	Feenstra, R. C.	1	18
Diewert, W. Erwin	5	557	Inklaar, R.	1	18
Roberto Rigobon	1	304	Timmer, M. P.	1	18
Lebow, David E.	1	249	Ferrari, G.	1	14
Rudd, Jeremy B.	1	249	Laureti, T.	1	14
Issing, O.	2	149	Mostacci, F.	1	14
Boskin, M.	1	143	Israel, K.-Friedrich	1	10
Dulberger, E. R.	1	143	Schnabl, Gunther	1	10
Gordon, R. J.	1	143	Theil, H.	1	8
Griliches, Z.	1	143	Kretzschmar, M.	1	4
Jorgenson, D. W.	1	143	Mai, C.-M.	1	4
Silver, M.	1	95	Hansen, Malte	2	3
Ioannidis, C.	1	95	Blaudow, C.	1	2
Hoffmann, J.	1	88	D. Seeger	1	2
Kohn, D. L.	2	85	Herzberg, J.	1	2
Bernanke, Ben S.	1	85	Knetsch, T.	1	2
Evans, A.,	1	35	Schwind, P	1	2
harbonneau, K. B.	1	35	Tödter, K. H.,	1	2
Sarker, S	1	35	Weinand, S.	1	2
Suchanek, L	1	35	Ziebarth, G.	1	2
Diego Aparicio	1	34	Erdemsiz, B.	1	1
Bertolotto, Manuel I.	1	34	Koch, J.	1	1

Source: scholar.google.com, 2022

2.1 THE CHALLENGES AND COLLECTING CPI/HICP

For the collection of the consumer price index in Germany, approx. 300,000 item prices of approximately 700 types of goods of a predefined basket of goods are collected every month. The consumer price index (CPI) is determined in a multi-stage index procedure with different weighting schemes. On the one hand, there is a weighing scheme for the business types where

the price was collected, such as specialised trade, supermarket, petrol station or kiosk. There is another weighting scheme for the federal states in Germany, which influence the CPI with different weightings. And last but not least, there is the weighting scheme for goods and services. These three weighting schemes are kept constant and revised only every five years (destatis.de, 2023). The weighting scheme for the 700 types of goods represents the upper level of the basket of goods and is constant for five years. The weighting scheme represents the weighting information that reflects the importance of the goods areas. The weighting scheme is adjusted using consumption and income samples and official economic accounts. Expenditure must account for at least one thousandth of consumers to be included in the weighting scheme. The calculation of the CPI/HICP is determined according to the Laspeyres index, based on a fixed basket of goods. The Paasche index is often described in the literature as the more accurate index, but it is time-consuming and resource-intensive due to its necessary adjustments to the basket of goods and therefore it is not used in the Eurozone, The Paasche index takes into account not only the price of goods and services but also the quantities purchased. Another index not used in Eurozone - the Fisher Price Index builds on Laspeyres and Paasche by describing the root of the product of both indices.

The lower level of the shopping basket is represented by the prices of the individual items, which are constantly updated and adjusted depending on consumer behaviour. The selection of products results from representative samples. The prices are collected by commissioned price collectors, mostly decentrally in stationary trade, but also partly centrally and on the internet. In addition, the Federal Statistical Office informs on its website (www.destatis.de, 2022) that prices are also already collected centrally via web scraping, which is to replace manual collection at some point. Especially package tours, prices for insurances, medicines and rental car conditions are already mainly recorded online. The use of new and modern price capture options expands the range of consumer prices and timeliness.

According to Diewert (2002), the following requirements should be attached to the HICP. The index should have a broad coverage, be comparable across countries, be reliable, objective, reproducible and available in a timely manner. Different statisticians would have to be able to produce the same value for the index figure using the same specifications for the index and the same basic data. According Diewert (2002) the HICP should be as simple as possible for the people dealing with it and should be easily understood by the population at large. And in the last instance, the index should be inexpensive to produce and theoretically consistent.

During his presentation to an ECB workshop on 16 & 17 November 2001 (Camba-Mendez et al., 2002), Diewert again highlights which properties are in the compilation of the HCPI:

- Only market transactions should be included in the calculation of the HICP.
- Interest rates should not be included.
- Owner-occupied housing is currently excluded.
- The Laspeyres formula should be used in the calculation of the HICP.
- Expenditure for business purposes shall be excluded.
- Consumption expenditure by non-residents is recorded in the HCPI, but consumption expenditure by residents abroad is not.
- The HICP uses retail prices which already include commodity and value added taxes.
- The subsidised prices should include the discount.

In Diewert's (2002) opinion, it is important that the indices of Walsh, Fisher and Törnqvist-Theil are chosen as the index number concept. His research has shown that the different

methods only differ in the second decimal places. It does not matter whether the approach to index number theory is fixed basket, stochastic, axiomatic or economic.

The main challenges in collecting the CPI and HICP are quality changes and substitution or representativeness biases of products and prices. Another weakness in the collection of item prices is the timeliness of the data. Normally, prices are collected only once a month and in only one shop (www.destatis.de, 2022). Another problem arises in the differences in the frequency of rebasing across EU countries. At the lower levels of aggregation, the weightings of volume and expenditure are missing, which may well lead to a significant overestimation of inflation. Finally, the treatment of owner-occupied housing and seasonal goods poses a challenge (Diewert, 2002). The aim is always to measure the "true" inflation, which includes all influences. As things stand, however, this seems to be more of a superlative. In the literature, researchers are concerned with the weighting of prices within Europe. When weighting was introduced among the countries of the EU, the weighting scheme for goods and services was still updated every 10 years. Later, it was updated every two years. In the meantime, the weighting scheme in Germany is adjusted annually according to the regulation of EU 2016/792 and (EU) 2020/1148. (German Statistic Office, 2023). Hoffmann (1998) dealt with the calculation of the HCPI in Germany. The ECB (2014) concluded that "it is not possible to estimate the measurement errors of the euro area HCPI".

Recent research by the German Bundesbank (Herzberg, et al., 2021) regarding inaccuracies in the measurement of HCPI is predominantly concerned with the substitution effect and the given weighing scheme. After intensive investigations of several researches by Boskin (et al., 1997), Lebow and Rudd (2003), Silver and Ioannidis (2001) they came to the conclusion that the currently given weighing scheme shows inaccuracies but the calculations of the HCPI do not suffer. In doing so, they only refer to publicly available price indices and consumer expenditure weights from 1997 to 2019 of the upper level of aggregation of price coverage, which means the product prices that are included in the weighing scheme. It was also found that the substitution effect has been further weakened since the introduction of the annual update of the quantity component of the weights in 2012.

Substitution effects are caused, among other things, by changing consumption habits of people, the introduction of new products or the introduction of new distribution channels, which cannot be taken into account promptly in the predefined basket of goods for the calculation of the HCPI. Another factor influencing substitution bias is the customer's substitute purchase when something else has become too expensive. For example, tropical fruits that become expensive lead to eating more locally grown apples that have not become more expensive. Until now, changes in purchasing behaviour have only been included in the weighing scheme with a time lag and taken into account in the HCPI survey. Monetary policy shocks cannot be detected with the survey of consumer prices (Andersson, 2011).

In their working paper "Alternative measures of price inflation and perceptions of real income in Germany" (Israel et al., 2020), Israel and Schnabl (2020) explained that the CPI has long since ceased to take all inflation drivers into account. They examined inflation in combination with asset prices, such as shares and real estate, as well as costs for public goods in order to identify hidden inflation. They concluded that hidden inflation is 1.1% higher than officially calculated inflation. From 2010 onwards, hidden inflation is even 2.5% higher, according to their research. They also conclude that there has been no real income growth since 1999 when assets are taken into account in determining the HCPI or in calculating inflation. Tödter and Ziebarth (2020) also already pointed out that shares and real estate rose disproportionately to inflation and therefore had to be taken into account. In Great Britain, therefore, the Retail Price Index (RPI) is already collected on a monthly basis compared to the previous year in addition to the CPI. This RPI at least also includes mortgage payments and interest costs, which

significantly influence this index (Diewert, 2012). On the other hand, Boskin (et al., 1997), Lebow and Rudd (2003) have already estimated the bias of the calculated HCPI of the US to be more than 1% (i.e, the measured inflation is 1 % p.a. higher than “true” inflation). They concluded that especially the welfare or qualitative improvement of products as well as the introduction of new products were not sufficiently taken into account. Lebow and Rudd (2003) concluded that welfare from quality improvement and new product introduction is not sufficiently taken into account.

2.2 INNOVATIONS

The German Federal Statistical Office (GSO) is currently experimenting with scanner data (Koch and Erdemsiz, 2020). Scanner data is cash register data from stationary trade that provides daily gross prices as well as sales and sales region. The collection of prices via web scraping is also to be expanded since 2012, as more and more consumers purchase their goods online. The GSO has already been investigating the collection of price data via web scraping since 2012. The share of prices collected online for the CPI in Germany has already risen from 5% to 10% from 2005 to 2015 (Blaudow and Ostermann, 2020). This is true at least for goods classes where one can distinguish the types of business (online and offline), which already accounts for 10,000 out of 300,000 prices. These online prices are recorded centrally by the German Federal Statistical Office manually on a computer. For example, car rental conditions, insurance rates and package tours are already recorded online (www.destatis.de, 2022). The GFO does not yet make use of computerised automation. A significant advantage for price collection via web scraping is that the price data can be collected as often as desired without significant additional effort. In addition, the sample of prices can be enlarged many times over compared to the current shopping basket. According to Brunner (2014), there are no legal concerns with web scraping, as only facts are read and no intellectual property is copied and used. It has already been found that inflation can be forecast very well via online price scraping (Aparicio and Bertolotto, 2020) and can be predicted for more than one month.

Especially at the time of the pandemic and the associated lockdowns or legally imposed shop closures, many shops were closed and prices could not be recorded manually as usual (Mai and Kretzschmar, 2020). The more importance is given to web-scraping and the faster work is done to integrate web-based data.

Alberto Cavallo (2018) has been researching the use of scraped online prices for the calculation of the consumer price index for some time. He has already found that web-scraping opens up a unique source to collect prices in large numbers and with simple effort. Prices would be retrievable without delay and are free from measurement errors, such as time averages and imputation methods, which can affect traditional micro price data. However, he also points out that it is a very labour-intensive task to define baskets of goods that are comparable across countries.

The Federal Statistical Office and Eurostat also want to optimise and expand the frequency of price collection via web scraping, as it has been found that prices change much faster and are more volatile online than in bricks-and-mortar retail (Blaudow and Burg, 2018). The way prices are collected brings new challenges of a methodological and technical nature but should replace manual price collection in the long term.

Research on the collection and evaluation of online prices (Charbonneau et al., 2017) came to the conclusion that with growing digitalisation, the purchase of goods online is increasing. Consumers are more technically equipped and also more savvy to compare and buy their goods online. With growing digitalisation, the number of online purchases is increasing, which in turn

leads to more competition between online shops on the internet. As competition increases, dynamic pricing increases, as price is usually the only reason a consumer decides to buy an item from a particular online shop. This creates a more price-driven competition in online retailing, which is reinforced by automatic price adjustment systems. In his paper, Hatzius et al. (2017b) calls the divergence between offline and online prices the "outlet bias", even if both prices converge again after a while (Cavallo, 2017). According to the researchers, this can explain the low inflation rates in developed economies after the global financial crisis. Moreover, it is pointed out that online purchases are hardly taken into account in the CPI, which can lead to a blurring of the consumer price index and inflation.

Based on publicly available sales figures and online prices of books from the online shops Amazon and BarnesandNoble, correlations between demand and online prices could already be demonstrated in one of the first researches on web-based prices (Chevalier and Goolsbee, 2003). An online price index for books was determined and compared with predicted sales volumes. The aim is to show and determine the influence of demand on prices.

According to Hansen (2020), the pricing of online shops by computer algorithms and the use of artificial intelligence varies according to peak and time of day, similar to the dynamics of fuel prices at petrol stations. If the price were to be read at different times of the day, it could lead to detected price increases that are not actually price increases at all. In his research, Hansen (2020) examines which online shops dynamically adjust their prices in order to identify the frequency of web scraping and the optimal time of day for a recommendation to the German Federal Statistical Office. In doing so, he mainly looks at the webshops for the CPI prices that have been recorded online so far. For this study, about 300 online shops were monitored and prices were recorded hourly. In total, 90% of the 10,000 prices already recorded online were included in the investigation, resulting in over 40 million recorded price points.

In a subsequent paper, the 42 million item prices were used to determine that price volatility does not yet have a significant impact on the CPI. This is because the prices of the currently captured online shops do not change that often (Hansen, 2020). This examination of price deviations is differentiated down to the 3rd digit level of the goods classes.

One of the largest research projects is MIT's Billion Price Project (Cavallo, et al., 2016). In this project, millions of online prices from hundreds of online retailers from more than 50 countries have been collected and analysed since 2008 using a programmed price crawler. Some future academic work and research builds on the data from the Billion Price project (Leal, et al., 2021) and (Diego and Bertolotto, 2020).

Cavallo (2016) is well advanced with his research with online prizes. He already gives recommendations on how to deal with the obtained data and use it for further research and measurements. Using state-of-the-art price scraping software, one can generate a lot of accurate price data with little effort. Cavallo is an advocate for incorporating price data via web scraping to determine the CPI for calculating inflation. This would help mitigate challenges in empirical research such as endogeneity, sample selection and errors in variables that are common in traditional datasets (Cavallo and Rigobon, 2016).

In a published paper by Cavallo (2016), the first results of the Billion Dollar Project were published, in which a programmed price crawler was used to capture and analyse millions of prices on hundreds of websites in over 50 countries. The recorded online prices were used to calculate an online price index and compared with the official consumer price indices of the respective countries.

Furthermore, it could be proven that online as well as offline prices change almost twice as often in comparison from 2008-2010 to 2015-2017. This means that with increasing

digitalisation and growing online trade, the volatility of online prices is increasing. His research concludes that competition between online and offline prices, unifies overall pricing. While in the US an item may have different prices per state, retailer and postal code, competition is gradually leading to price synchronisation. This "Amazon effect" is often picked up by other scholars in the current literature.

Moreover, it has been shown that one can determine quarterly purchasing power parities among different developed and developing countries based on online prices by using a fixed basket of goods with identical calculation methods (Diewert, et al., 2018). Furthermore, the data can be used to estimate countries' real consumption without the need to extrapolate consumption indices. To date, the determination of purchasing power parities has relied on data from the World Bank's International Comparisons Program (ICP). This records prices of goods and services via the statistical offices of the various countries, which is time-consuming and not up-to-date. Currently, purchasing power parities are calculated every 6 years and are only published with a time lag of about 3 years. In addition, the cooperation of all countries is decisive for the quality of the results. If countries such as Argentina share manipulated data or no data at all, the results of purchasing power parity suffer.

The research by Goolsbee and Klenow (2018) uses online price data from two million products from Adobe Analytics in the US. The data, unlike the BPP data, also included quantity sold. Online prices from 2014 to 2017 were examined, which revealed a bias towards overall inflation. The researchers concluded that inflation calculated with online prices rose 1.3% less than the official inflation rate of the statistical offices. The survey was conducted for most classes of goods and compared with the official figures. The researchers also found that new goods or product introductions had a significant impact on the CPI calculation. When inflation was adjusted for the new goods, a deviation of over 3% from official inflation was even found.

Gorodnichenko (et al., 2018) analysed online prices from price comparison portals for their research. In addition to the product and the price, the click rate of an item can also be used. The click rate is supposed to serve for the attractiveness or demand of the product at the offered price. Similar to Cavallo's (2018) description of the "Amazon effect", the researchers explain that there is a link between offline and online prices. That is, there is little difference in prices between the online market and the traditional market after a certain period of time.

In the study by Santiago and Lein (2020), online data from debit card transactions are used to evaluate product prices in online retailing and compare them with the inflation rate in Switzerland.

Stelmasiak, et al. (2022), examined online prices of food and soft drinks from the websites of large Polish online shops. Research by Jaworski (2021) also looked at web-based food prices in Poland. Scraped online prices during the pandemic were used to investigate the accuracy with which inflation for food could be read in real time. The research found that estimates for monthly and annual food inflation could be provided about 30 days before the statistical offices published them. Daily price trends increase the understanding of price trends and make it easier for decision-makers to identify inflation trends in a timely manner, the researchers said.

A major contribution to the incorporation of online prices into the CPI is the research of Aparicio and Bertolotto (2020). The study shows that online prices can be a good predictor of the CPI. The researchers were able to predict the inflation forecast one month ahead of the statistical offices. They also found that online prices gave a better and more accurate estimate than surveys of professional forecasters. The researchers interpret the success of their forecasts developed in the model similarly to Cavallo (2016). Online retailers are flexible in their pricing and can adapt prices to new market conditions without much effort. For brick-and-mortar retailers, adjusting a price is more costly, as new price tags have to be printed and manually

attached to the shelf. Nevertheless, there is a synchronisation between online and offline prices that takes place with a time lag, which predicts the model more accurately than existing estimation models. The online price precedes the offline price.

Another predictor of inflation is collected in a reduced-form Philips curve model, using regressions from lagged values of inflation in the US (Groen et al., 2013). Due to an ever-changing world, traditional inflation forecasts using business cycle variables have shifted and become more difficult. By incorporating structural changes in time series models, forecasts can be improved.

Machine learning (ML) can be used to identify a larger number of variables that influence inflation forecasts (Medeiros et al., 2021). They also identify the most important predictors that have the greatest influence on the inflation forecast. The more variables considered in the forecast calculation, the better the results.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

This research aims to answer the following key question. For the calculation of the consumer price index (CPI) and the resulting inflation, are online trade prices already sufficiently taken into account?

The hypothesis is that web-based prices are insufficiently considered for the calculation of the CPI and inflation so far. Without the integration of online prices, an exact calculation of the CPI and inflation is already impossible today.

For the verification of online prices, item prices from webshops are automatically collected with the help of computer-controlled crawlers (Cavallo, et al. 2016). In addition, price data can also be collected via adobe analytics (Goolsbee and Klenow, 2018), debit card transaction (Santiago and Lein, 2020) and price comparison portals (Gorodnichenko et al., 2018). This price data is collected at least daily to hourly. This price data forms the basis for the study and enables the determination of an online price index (OPI).

Online prices can be collected manually or fully automated on the web. Even though manual online price collection is still more time-consuming than fully automated, it is already more cost-effective than the collection of prices in stationary retail by commissioned price collectors (Polidoro et al., 2015). It also increases the sample and thus the quality of the prices. With the support of fully automated price collection techniques, the workload for data collection can be additionally reduced by up to 30%.

The biggest challenges in web scraping of prices at the moment are the changing websites (Hansen, 2020). For example, the price may suddenly appear in a different place where the VAT rate may have been displayed before. This poses the risk of errors in price collection, as web shops can also display net prices without VAT or numbers that are not prices but are incorrectly recognised as prices by the scraping tool. Therefore, data must be validated particularly well, which entails new stochastic effort and assessment of online prices.

In Germany, about 10,000 product prices are already collected online for the CPI. 8,624 of these products were scanned hourly for 56 weeks by 241 online shops, resulting in a dataset of 42 million online prices (Hansen, 2020). If prices differed by more than 400% upwards or 80% downwards from the previous price, they were sorted out. Based on the data, it was possible to determine how many items were subject to dynamic pricing, how much the price deviation was and which product groups were particularly affected by price changes. An arithmetic mean of 2.83 price increases to one price decrease could be determined (Hansen, 2020). It was found that there are significantly more price changes on weekdays than on weekends and that the most

price adjustments occur with the change of day at midnight. In addition, it could be seen that prices were lowered to a greater extent and then gradually increased again.

It was also found that online prices changed much more often when products had a high click-through rate and accordingly high demand, and when many online shops were selling the item (Gorodnichenko et al., 2018).

With price data from over 18,000 books from 1996 to 2000 from Amazon and Barnesandnobles, the largest online shops for books during that time, a relationship between demand and sales price could already be established (Chevalier and Goolsbee, 2003). The demand or sales could be imitated by an online sales rank, which was estimated according to the Pareto principle. To better assess the sales rank, the same book was bought six times in 10 minutes and the sales rank was noted. This made it possible to determine how the rank changes when a book is bought. In the evaluation, sales were then estimated with the help of the sales rank. The smaller the rank, the greater the demand. It could be proven that the rank fell when the prices became more expensive. Furthermore, the results show that the customer buys where it is cheapest. Thus Barnesandnoble had better sales figures than Amazon when they had a better price. The same result could be found in reverse.

Evidence could be provided that the official consumer price index and the official inflation of various countries with web-based prices differ greatly (Alberto Cavallo, 2017). A prime example of this effect was provided by a first comparison of the consumer price index against the online price index (OPI) in Argentina. It was proven that the Argentine statistics office manipulated the inflation rate (Cavallo, 2013). Furthermore, the CPI and OPI were compared for some countries with the result that the deviation is mostly more significant in developing countries than in developed economies (Cavallo and Rigobon, 2016).

Using price data from MIT's Billion Price Project (BPP), it was found that prices change much more frequently online than in bricks-and-mortar retail. Due to automated pricing technologies, external market influences are reflected in the online price much more quickly than prices in bricks-and-mortar retail react. For example, online prices react more often and faster to commodity price increases (Cavallo and Rigobon, 2018).

The fact that brick-and-mortar retail prices are influenced by online prices describes the "Amazon effect" (Cavallo, 2018). Due to automated price adjustments in online retail and direct and price-driven competition, online prices change regularly. Brick-and-mortar retailers react to price changes in online retail with delays of up to 6 weeks. This effect could also explain the relatively low inflation in the US in recent years after the financial crisis, but is difficult to prove empirically (Cavallo and Rigobon, 2018).

To determine the OPI for product categories and classes of goods, daily price data from Adope Analytics are analysed and aggregated to average monthly prices by sales and quantity, as with the CPI (Goolsbee and Klenow, 2018). Inflation was then determined by product groups and goods classes, such as clothing, household goods and food, and compared with the CPI data. Lastly, the average monthly prices at the category level were combined into an online price index (OPI). The calculated OPI per category could then be compared with the CPI categories. A deviation of up to 3% was found depending on the product and goods group.

To determine the deviations between OPI and CPI in Switzerland, data series of online prices were compared with the Swiss CPI (Santiago and Lein, 2020). Demand and supply shocks can be read much more quickly and accurately online than via the CPI. Official statistics could only reflect price changes with a lag, which could be proven using the data material around the imposed lockdown in Switzerland in connection with the Covid-19 pandemic. A deviation of 0.5% could be detected after the lockdown, which was only reflected in the CPI six weeks later.

The more price data are available, the more accurately a forecast for the CPI can be predicted (Stelmasiak, et al.,2022). In an experiment, an inflation rate is determined on the basis of daily prices. The daily CPI, called the "nowcast", is calculated on a daily basis using a model.

In Poland, the OPI of food and beverages is compared with the official CPI of the statistical offices (Jaworski, 2021). Inflation for Poland could be predicted with better accuracy and 30 days earlier than the forecast of the statistical offices.

Using the online indices of PriceStats, a private company founded out of MIT's Billion Prices Project (BPP), the online price data of 10 countries were analysed - United States, United Kingdom, Australia, Canada, France, Germany, Greece, Ireland, Italy and the Netherlands (Aparicio and Bertolotto, 2020). A forecasting model was developed that was able to predict the inflation rate one month ahead based on daily price data. Thus, from the middle of the month, the online index could be forecast at the end of the month.

Inflation forecasts are important for national economic decisions. Up to now, Philips curve models with the use of business cycle variables have been used to forecast inflation. An improvement in the forecast comes from modelling quarterly samples of US inflation with real-time data from 1960 to 2008 (Groen et al., 2013). A range of real, nominal and financial forecast variables are used. The different specifications are used to predict inflation for one quarter and one year. The reduced-form Philips curve model takes into account the uncertainties in the use of relevant predictor variables and the estimation uncertainties of the model parameters. The results show that the methodology better identifies the different US inflation rates with potential predictor variables. Even drastic events on inflation, such as the oil crisis or the change in monetary policy, can be simulated in the model.

The more variables one takes into account in the calculation, the better the results of the inflation forecasts (Medeiros et al., 2021). Using 122 variables from the FRED-MD database, a large macroeconomic dataset, different machine learning systems were compared. The sample contains data from 1960 to 2015. The results of the ML forecasts are more accurate than the standard forecasts. The results underline the advantages of modern ML methods and "Big Data".

To compare purchasing power parities between different countries, online prices can equally support (Diewert, et al. 2018). The procedure of the International Comparisons Program (ICP) of 2011 and 2014 is imitated to determine the purchasing power parities of 11 different countries. 267 items are defined, covering all categories from food to fuels of the Classification of Individual Consumption by Purpose (COICOP). The ICP had used only 238 items for its comparisons in 2011. In contrast to traditional data collection, it was possible to use daily updated prices from the BPP instead of monthly prices from the statistical offices. The results deviate on average by 15% from the ICP data. For Australia, the model was able to provide identical results, for Japan the results differed by 28%. The online data is helpful, but also has limitations. Less food is sold online, which limits the sample. In addition, it is not possible to determine how often an item is purchased or what relevance it has in the respective country, and online shops convert better in large cities and do not optimally represent rural areas.

4 RESULTS AND DISCUSSION

If every fifth euro (excluding food) in Germany is already spent by consumers in online retail (Online-Monitor, 2021), this must also be taken into account proportionately when calculating the CPI and inflation. In addition, it has been proven that online retail offers lower prices than brick-and-mortar retail (Cavallo et al., 2016). If, in categories such as textiles and consumer electronics, around 40% of products are already purchased online, the online price is obligatory

for a precise consideration of the price picture. For the calculation of the CPI, as many product prices should be recorded online and included in the calculation as the share of the shop type of the respective product category. The online prices must also be recorded more frequently and more broadly. That is, due to the volatility of online prices, the digital price tag also needs to be looked at more often. A daily observation and recording of online prices is recommended, otherwise an accurate calculation of inflation cannot be given. One could say that online prices are alive.

Moreover, emerging market inflation can be monitored by developed economies (Cavallo, 2017) to detect manipulation at an early stage. After all, inflation is one of the most important macroeconomic indicators to manage the economy. Furthermore, the purchasing power parity between countries can be determined faster and more effectively to avoid surprises due to too large determination intervals (Diewert et al., 2018). The forecasting of inflation rates through online prices should also find its way into the statistical offices of the countries as quickly as possible in order to obtain up-to-date information as a tool for political control, especially in times of crisis and shocks. Price data are available in sufficient form from various sources. Technical solutions are available for scraping prices. There are no legal concerns, as it is only a matter of data transfer and no intellectual property is being tapped (Brunner, 2014). Logically, there are also new challenges for the statistical offices, as the data must also be verified. Online shops change, so false information could also be transferred. This will require new verification methods. The research came to consistent results in relation to online prices:

- Online prices have a measurable impact on the CPI (Cavallo et al., 2016).
- There is sufficient price data available that can be collected online via computerised systems at low cost and in infinite numbers.
- Online prices are available on a daily basis and allow for daily calculations of inflation (nowcasts) and forecasts (Stelmasiak, et al., 2022).
- Online prices are volatile and change faster and more frequently than brick-and-mortar prices and are therefore of particular interest (Cavallo et al., 2016).
- Webscraping online prices significantly increases the CPI basket sample and is free from statistical measurement error (Cavallo, 2017).
- It requires adapted calculation and validation methods, for the inclusion of online prices in the CPI.

5 CONCLUSIONS

This literature review summarizes the current state of research on the collection of the Consumer Price Index and the Harmonized Index of Consumer Prices and the resulting inflation. It highlights the importance of taking online prices into account using an online price index. It provides a summary of what is required of the CPI and highlights doubts, biases, and challenges that are not considered in the current calculation of the CPI. For example, interest rates, home living, assets, and seasonal product are not considered in the CPI, and substitution effects are inadequately accounted for. But innovations are also on the way to improve the calculation of the CPI and also price collection, such as price scraping of online prices. As online trade grows with a country's increasing digitization, online prices must also be taken into account accordingly in the CPI. A separate Online Price Index (OPI) can be applied for this purpose to reduce the hidden inflation caused by online prices. The OPI can also be used for forecasting and prediction. Online prices are available in infinite numbers and are easy to collect

through web scraping. Authorities, banks, and statistical offices that base their decisions on the CPI could achieve better results with better data.

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Real Estate Market Development in Germany's Top-7 Cities from 2017 to 2022

Keanu Niclas Moseler

Abstract

This paper examines the determinants and impacts of the German real estate market from 2017 to 2022, focusing on the Top-7 cities. It analyzes indicators like income, rents, housing prices, construction costs, and interest rates to evaluate the affordability and profitability of real estate investments in these cities. The findings indicate a significant rise in housing prices and construction costs, accompanied by a surge in interest rates. These factors have led to a decline in new constructions and increased purchase prices, posing challenges for real estate investors and homeowners. However, rental increases in the Top-7 cities remain relatively moderate, aligning with net income salary growth. The study also compares housing affordability for the average German citizen with that of a typical resident in the Top-7 cities, highlighting additional monthly rental burdens for city dwellers. Homebuyers face substantial increases in incidental purchase costs and monthly annuity payments. In conclusion, the current real estate market faces multiple challenges, making investments in the Top-7 cities less attractive. Rental yields have decreased to a point where fixed-term deposit accounts offer similarly attractive investment options without incurring high ancillary purchase costs.

Keywords

Real Estate, Germany, Metropolitan Regions, Financial Investment, Real Estate Investment

JEL Classification

A13, G01, R11, R30, R31

1 INTRODUCTION

It can be reasonably argued that real estate markets across Europe are experiencing substantial pressure. Property values are witnessing a significant surge, predominantly in metropolitan areas and capital cities of the continent. Moreover, regions with robust economic foundations are progressively impacted as well. This phenomenon extends to Germany, where both expanding and contracting regions have been subject to escalating real estate prices (Empirica, 2022a). Furthermore, the seven most populous cities in Germany, the “Top-7”, have been distinctly affected by steep augmentations in residential property values (McMakler, 2022).

Beyond the mere escalation of prices in the residential real estate market, there has been a confluence of factors that have diminished the appeal of such investments.

Over the past half-decade, construction costs have exhibited a substantial increase alongside property prices (Destatis, 2021), signifying the pronounced demand for housing in urban areas of Germany. This surge in construction expenses has propelled the costs associated with new development projects to levels that render the prospect of lucrative real estate investments increasingly elusive for a significant number of investors.

Commencing in early 2022, these dual aspects have been further augmented by a pronounced escalation in construction interest rates. Consequently, not only has the valuation of real estate and the development of new properties experienced a surge, but the financing mechanisms

underlying these projects have also undergone a transformation. Once considered a dependable element in the planning process for the past decade, financing has now emerged as a potential risk factor for the venture.

The objective of this paper is to systematically examine the economic progression of various elements within the real estate sector over the preceding half-decade and to assess the subsequent implications for distinct stakeholders, including tenants, property owners, and investors. The underlying hypothesis is that recent developments of raised interest rates and steadily rising real estate prices have significantly worsened the general conditions for real estate investors.

2 THEORETICAL BACKGROUND

2.1 STATUS QUO OF GERMANY’S TOP-7’S ECONOMY AND REAL ESTATE MARKET

Subsequently, an examination will be conducted to elucidate the significant impact of Germany's Top-seven cities on the nation's populace, as well as the profound influence they wield on the German real estate market and the overall economy. The term "Top-7" in the context of the German real estate market predominantly refers to the following in table 1 shown German metropolitan cities:

Table 1: Population Data and GDP about Germany's Top-7

City	Population (2021)	Population metropolitan area (2021)	GDP per capita per city (2020)
Berlin	3,677,000	5,352,000	ca. 42,000 EUR
Cologne	1,073,000	2,000,000	ca. 58,000 EUR
Düsseldorf	619,000	1,557,000	ca. 82,000 EUR
Frankfurt (Main)	759,000	2,736,000	ca. 92,000 EUR
Hamburg	1,854,000	3,353,000	ca. 64,000 EUR
Munich	1,488,000	2,933,000	ca. 81,000 EUR
Stuttgart	626,000	2,788,000	ca. 85,000 EUR

Source: DeStatis, 2022; Statistische Ämter des Bundes und der Länder, 2022a.

The population distribution within Germany's Top-7 metropolitan cities indicates that 10,096,000 out of the total 83,237,000 people residing in the country (Destatis, 2022) are inhabitants of these major urban centers, which constitutes approximately 12% of the overall German population. Consequently, any market-related factors impacting these cities would directly influence 12% of the population, although this figure does not encompass the surrounding metropolitan areas. When considering the inclusion of these metropolitan areas, the total number of individuals directly affected by the market fluctuations in the Top-7 cities rises to 20,719,000, nearly 25% of Germany's entire population.

It is evident that there exists a significant disparity in the Gross Domestic Product (GDP) per capita among various cities, highlighting the economic inequality that prevails across different regions. Metropolitan areas such as Frankfurt (Main), Stuttgart, Düsseldorf, and Munich boast a GDP per capita nearly twice as high as that of Berlin, the capital city of Germany.

Consequently, one would expect significant disparities in housing and rental prices; however, empirical observations reveal that these variations do not correspond proportionally to the fluctuations in GDP per capita or income per capita. In order to conduct a valid comparative

analysis, it is imperative to consider the disposable income per capita rather than solely focusing on gross income.

Table 2: Economical Data and real estate prices of the Top-7

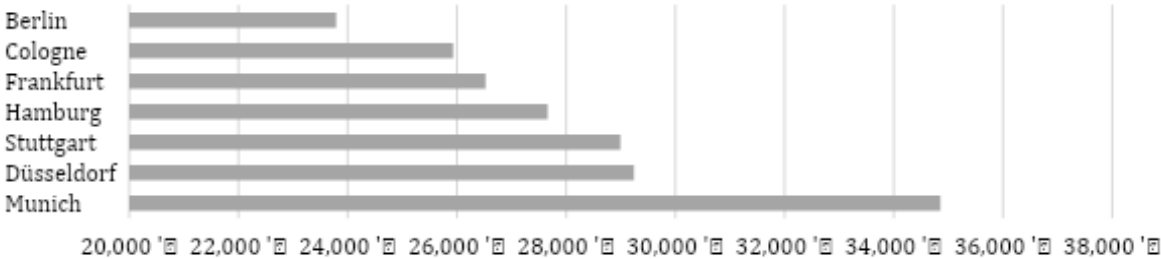
City	Disposable income (2020)	Average rent per sqm (2022)	Average price per sqm (2022)	Rental yields (2022) ⁴⁰
Berlin	21,745 EUR	16.70 EUR	5,347,00 EUR	3.75%
Cologne	23,703 EUR	14.30 EUR	4,662,00 EUR	3.68%
Düsseldorf	26,729 EUR	13.80 EUR	4,849,00 EUR	3.42%
Frankfurt (Main)	24,246 EUR	17.30 EUR	5,716,00 EUR	3.63%
Hamburg	25,285 EUR	15.70 EUR	5,799,00 EUR	3.25%
Munich	31,859 EUR	20.80 EUR	8,976,00 EUR	2.78%
Stuttgart	26,503 EUR	16.90 EUR	5.277,00 EUR	3.84%

Source: Statistische Ämter des Bundes und der Länder, 2022b; DZ HYP, 2023; empirica 2022c – 2022i.

In Table 2, the mean rental and housing prices per square meter are derived from apartment units ranging between 60 and 80 square meters in size (DZ Hyp, 2023; empirica, 2023). A first particularly salient observation emerges from the rental yields displayed, as a considerable disparity is evident between rental and housing prices in the Top-seven German cities. But the main factor to be analyzed will be how the rental and housing prices and their increase influenced the inhabitant’s life in the last five years.

However, average salaries in 2020 differ significantly across the Top-7 cities:

Figure 1: Average net income in 2020 in the Top-7 German cities

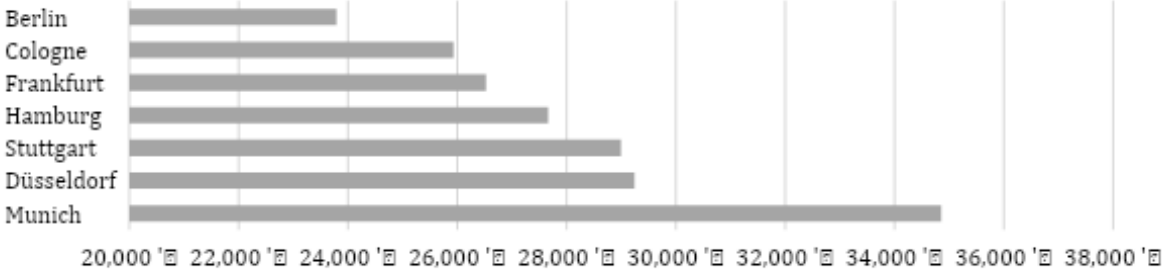


Source: Statistische Ämter des Bundes und der Länder, 2022.

Regrettably, there is presently an absence of up to date data pertaining to mean remuneration levels in the year 2022. However, considering the escalation in the mean compensation level from 23,745 euros in 2020 to 25,982 euros in 2022, it may be surmised that an average growth of 9.4% in mean salaries has occurred in the leading seven metropolitan areas. This change leads to the following hypothetical average incomes in 2022:

⁴⁰ It has been calculated with the average yearly rent divided by the average price per sqm.

Figure 2: Average net income in 2022 in the Top-7 German cities calculated on an average income increase of 9.4% based on the average income increase



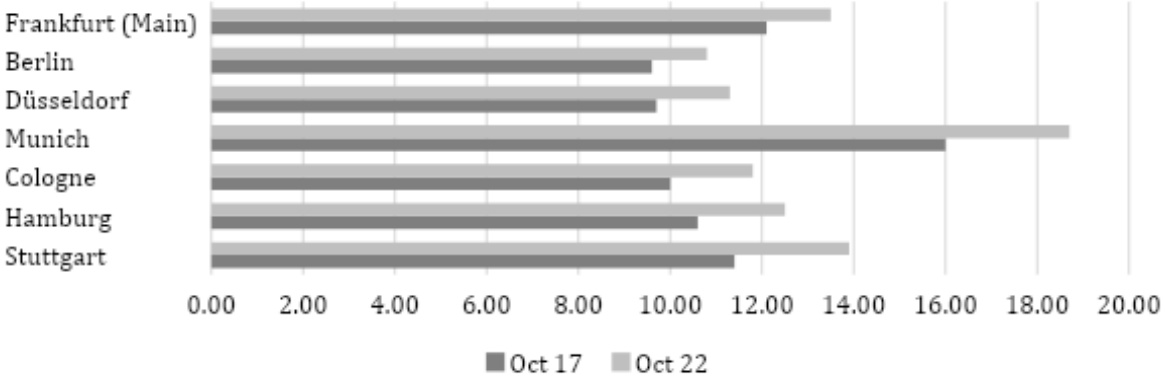
Sources: Statistische Ämter des Bundes und der Länder, 2022; BMF, 2023.

With an average net income in a Top-7 city of 28,142 euros in 2022 (BMF, 2023), residents of the Top-7 cities are about 8.31% higher than the income of an average German citizen (25,982 euros in 2022).

2.2 DEVELOPMENT OF RENTAL AND PROPERTY PRICES IN GERMANY’S TOP-7

In the past five years, a significant escalation in rental prices has been observed across the seven most populous German cities, as clearly demonstrated by Figure 3:

Figure 3: Rental price development of Germany's Top-7 from 2017 to 2022



Source: Immowelt, 2022.

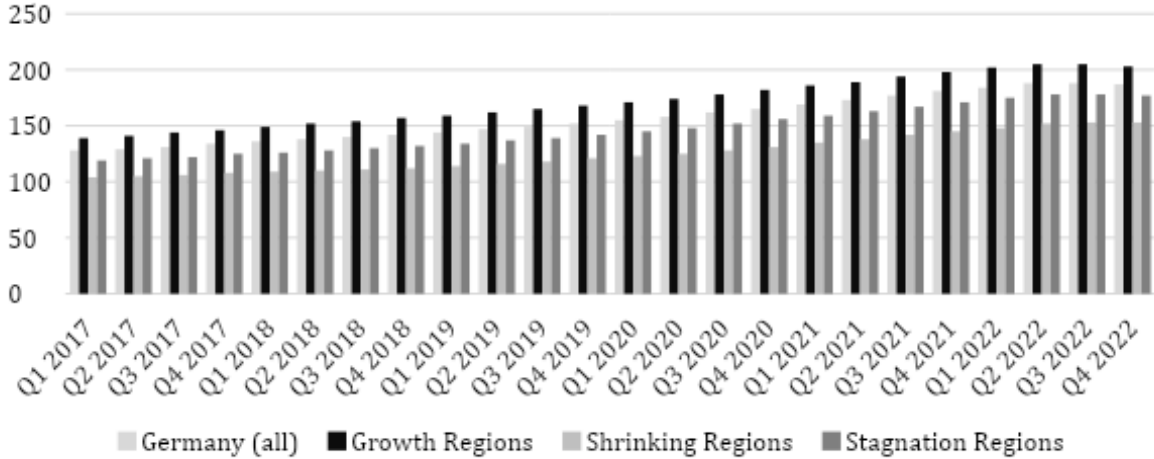
With an increase of 22%, the rental price increases of Stuttgart are the highest, followed by Munich, Hamburg, Cologne, and Munich with 17 to 18%, Düsseldorf with 17% and Frankfurt (Main) and Berlin with 12 and 13%. Moreover, as illustrated in Table 3, the mean housing prices experienced a considerable augmentation from 2017 to 2022. It is essential to note that the data exhibits some degree of volatility throughout these years; however, this study will not investigate a specific period, but rather draw comparisons between disparate timeframes.

Table 3: Price development of Germany's Top-7 from 2017–2022 (empirica 2022c–2022i).

City	Average price per sqm (2017)	Average price per sqm (2022)	Increase rate 2017 - 2022
Berlin	3,025.00 EUR	5,347.00 EUR	+ 56.57%
Cologne	2,840.00 EUR	4,662.00 EUR	+ 60.92%
Düsseldorf	2,805.00 EUR	4,849.00 EUR	+ 57.85%
Frankfurt (Main)	3,815.00 EUR	5,716.00 EUR	+ 66.74%
Hamburg	3,561.00 EUR	5,799.00 EUR	+ 61.41%
Munich	6,254.00 EUR	8,976.00 EUR	+ 69.67%
Stuttgart	3,682.00 EUR	5,277.00 EUR	+ 69.77%

Overall, the average increase was about 63.28% in the German Top-7 cities, which is in comparison to the whole German average still underperforming because on average real estate prices in Germany increased to around 68.45% between 2017 and 2022 (empirica, 2023a):

Figure 4: Real Estate Price Index in Germany 2017–2022



Source: empirica, 2023.

As illustrated in Figure 4, a substantial increase in real estate prices is observed across all German regions, encompassing areas experiencing population decline (shrinking), growth, or stagnation, within the time frame of 2017 to 2022.

The observed fluctuations in pricing trajectories exhibit substantial ramifications on macroeconomic conditions, given that property valuations exert a considerable influence on various stakeholders, including investors, homeowners, and tenants, ultimately impacting the entire populace of Germany. Nevertheless, it is imperative to delineate the consequences experienced by tenants from those encountered by property owners and investors. The juxtaposition of these groups frequently results in a divergence of interests, necessitating a purposeful differentiation in the ensuing analysis of their respective repercussions.

2.3 DETERMINANTS OF THE GERMAN REAL ESTATE MARKET

For investors, the escalation of real estate prices yields various implications. One notable consequence is the heightened demand for equity, as ancillary purchase costs in Germany, for instance, typically necessitate funding through equity. As such, the primary obstacles for novel real estate investments can be attributed to the increased equity requirement.

Nevertheless, a notable paradigm shift has occurred in the aftermath of the Russian-Ukraine War, diverging from the trends observed over the past five years. Previously, debt capital could often be procured at an annual interest rate of less than 0.5%. In the current climate, however, interest rates on debt capital have surged to approximately 4.0% per annum in certain instances (Interhyp, 2023). It is increasingly evident that the central banks in Europe, including the European Central Bank (ECB), Czech National Bank (CNB), and Swiss National Bank (SNB), are pursuing a policy of gradual elevation of the key interest rates. For instance, the European Central Bank (ECB) has demonstrated a gradual increase in its key interest rate, commencing from a base of 0.0% in 2017, increasing to 2.5% in 2022, and ultimately attaining a level of 3.5% in the current year (ECB, 2023). Similarly, the Czech National Bank (CNB) has elevated its key interest rate to 7.0%, while the Swiss National Bank (SNB) has also exhibited a notable shift from a negative benchmark rate to an established rate of 1.5% (Global Rates, 2023a & 2023b).

Amidst the confluence of elevated real estate prices and substantial borrowing rates, investors are increasingly facing challenges in identifying lucrative investment opportunities. This predicament persists despite the longstanding decline in rental yields observed over the years. For instance, empirical data from Empirica (2022) demonstrates a reduction in average rental yields in Stuttgart from 4.85% in 2017 to a mere 3.84% in 2022, as shown in Table 2. This trend signifies a potential diminution in the allure of real estate as an investment vehicle for market participants.

In light of the markedly deteriorated financial circumstances for property investment, precipitated by substantial price escalation and elevated borrowing expenses, the political landscape has concurrently undergone numerous alterations that have diminished the allure of real estate investment. A comprehensive analysis of the past half-decade reveals substantial shifts, particularly for investors with a focus on residential property assets. Before the end of the year 2020, the standard practice when rental property entailed the tenant bearing the responsibility for remunerating the real estate agent's commission, typically equivalent to three net monthly rental payments.

Since the implementation of the buyer principle on December 23, 2020, it has been mandated that the client for the brokerage service must also bear the responsibility of paying the brokerage commission to the landlord or investor (Gustorff 2021, Voigtländer 2018). Consequently, each new lease now incurs a cost equivalent to either the investor's time or three net monthly rents as a brokerage commission. This development provides insight into the political trajectory of legislative measures within the real estate sector. Although the Federal Constitutional Court annulled the Berlin rent cap, which was initially introduced in February 2020, at the outset of 2021, a certain degree of uncertainty among investors was instigated by the Berlin rent cap (Gustorff 2021). The apprehension stemmed from the potential legal capping of rents at a fixed amount, which would likely render the majority of investments unprofitable.

In summary, investors are confronted with an escalating number of risk factors, consequently diminishing the appeal of real estate investments. This can be attributed to the substantial financial risks inherent in the substantial capital outlays required for such investments, compounded by the growing inadequacy of support from German policymakers.

2.4 IMPACT OF THE DETERMINANTS ON GERMAN REAL ESTATE MARKET

The aforementioned determinants exert varying influences on the German real estate market. Nevertheless, this study will exclude inflation from further analysis, as its implications on the real estate market are not unequivocally discernible. Consequently, other key indicators will be compared. It is imperative to delineate between the factors that impact the German populace and those that affect the real estate market per se.

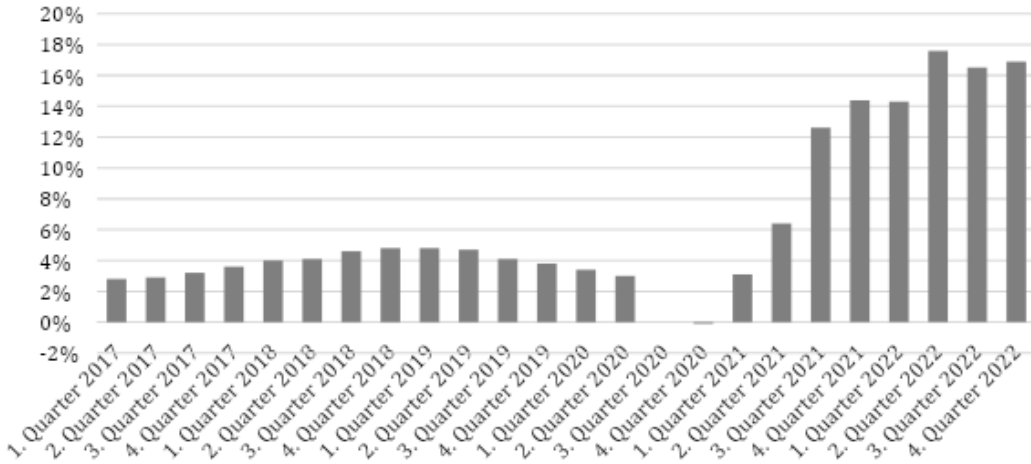
An examination of German citizens' financial data is warranted to directly illustrate the impact on the populace. For instance, the mean net annual income of single individuals in Germany witnessed a 17.5% growth, from 22,119 euros in 2017 to 25,982 euros in 2022 (BMF, 2023). Concurrently, rental prices within the Top-seven urban centers escalated between 12% and 22% during the same time frame, as detailed in Chapter 3.

The present analysis reveals that while net salaries have augmented by 17.5%, rents in major urban areas have escalated from 12% to 22%. This implies that tenants have not encountered a substantial surge in their cost of living. However, an accompanying surge in purchase prices by an average of 63.27% during the same period, as delineated in Chapter 3, portends a formidable challenge for prospective homeowners to acquire residential properties from 2022 in comparison to 2017.

The German populace has not been the sole entity impacted by the numerous factors affecting the real estate market in recent times; the market itself has also been subject to fluctuations. This trend is particularly evident in the case of new-build apartments. The new-build price index, which stood at 104 in Q1 2017 (with a base value of 100 in 2015), has risen sharply from 115.1 in Q3 2021 to 154.7 in Q4 2022, according to DeStatis (2023a). This surge in index value indicates a rapid and substantial escalation in the prices of newly constructed apartments within a relatively short time frame.

More specifically, the asking prices for newly constructed condominiums have witnessed a sharp increase from 3,040 euros per square meter in 2017 to 4,779 euros per square meter in 2022, as reported by empirica (2023b). This marked rise in prices may be attributed to various factors, including the sudden and steep upswing in construction costs, as illustrated by the following graphics.

Figure 5: Yearly increase of construction prices in residential property compared to the previous year's month,



Source: DeStatis, 2023b.

Figure 5 depicts a conspicuous increase in construction costs ranging from 14% to nearly 18% in each quarter of 2022 relative to the previous year. The augmented costs correspondingly led to a decline in the number of building permits issued, with only 354,400 homes authorized in 2022, a reduction of 26,300 homes compared to the preceding year and marking the lowest level since 2018. The number of building permits dwindled significantly towards the end of 2022, with the initial six months seeing only a marginal decrease of about 2%, while each month of the latter half witnessed double-digit percentages fewer homes authorized compared to the corresponding period in the preceding year. December 2022 recorded the lowest number of building permits with a decrease of 20.1% compared to December 2021. Of note, the reduction in approval rates was notably more pronounced for single- and two-family homes, which typically consist of owner-occupied properties. Specifically, Q1 2022 saw a 26.2% decrease in the number of single- and two-family homes approved compared to Q1 2021 (DeStatis, 2023c).

However, it is pertinent to acknowledge that the count of building permits merely serves as a preliminary measure of forthcoming construction undertakings. In actuality, the accumulation of construction projects, commonly referred to as the construction backlog, that have received approval but remain unfinished or are completed beyond the designated timeline, has been on the rise for an extended period (DeStatis, 2023c). Consequently, it is plausible that the decrease in the count of completed units may be more pronounced than the already declining number of building permits implies.

The contemporary real estate market is encountering an array of challenges. Escalating construction expenses and elevated financing costs consequent to the surge in key interest rates, have contributed to a significant downturn in new constructions. These market forces are driving up purchase prices, posing considerable challenges for real estate investors and homeowners. Nevertheless, rental increases in the Top-7 cities appear relatively restrained, tracking in tandem with net income salary hikes. This suggests that, at least for renters, living standards have not been radically undermined. Nonetheless, for investors, the present trajectory of the real estate market appears to be a source of considerable apprehension.

3 CASE STUDY ABOUT AN AVERAGE TOP-7 CITY

In order to demonstrate the potential impact upon an average Top-7 municipality in a realistic scenario, a hypothetical case study of a Top-7 city will be constructed utilizing the average data extracted from Table 1 and Table 2. The hypothetical case study Top-7 city is characterized by a population of 1,442,000 inhabitants, a metropolitan area encompassing 2,960,000 individuals, a GDP per capita of 72,000 Euro, and a surge in housing prices of 63.27%. The average price per square meter is around 3,711.00 Euro in 2017 and around 5,804.00 Euro in 2022. The rents are around 11,34 Euro per square meter in 2017 and around 13,21 Euro in 2022.

The present case study aims to assess the divergence in housing costs incurred by a typical resident of the Top-7 cities in Germany compared to an average German citizen. According to DeStatis (2023d), the average rental expenditure per square meter for a rental apartment is 8.70 euros for an average German citizen, whereas a resident of a Top-7 city already spends 13.21 euros per square meter for the same. Additionally, the average German citizen is found to occupy 55.5 square meters of living space, and dedicate 27.8% of their income towards rent (DeStatis, 2023d). Based on this information, it can be inferred that an average Top-7 city resident, assuming a similar living space, would expend approximately 733 euros in cold rent for their apartment. Given the average income of 28,142 euros for a Top-7 city resident as presented in Chapter 2, this would translate to an annual cold rent of 8,796 euros, equivalent to

31.26% of their income. As such, it is evident that the rent burden of a Top-7 city resident is roughly 11.2% higher than that of an average German citizen.

Notwithstanding the discernible additional monthly rental burden borne by the residents in question, it may be postulated that it is not a source of concern, given the average income of a Top-7 resident which is approximately 8.3% higher than that of the average federal citizen.

More critical, however, is a consideration of the affordability of housing as a home or investment in the average Top-7 city:

Table 4: Average framework of hypothetical Top-7 city and interest rate increase 2017 to 2022 (Interhyp, 2023).

Average price per sqm (2017)	Average price per sqm (2022)	Interest Rate 2017	Interest Rate 2022	Repayment rate (general)
3,711.00 EUR	5,347.00 EUR	0.5%	4.0%	2.5%

Notwithstanding the degree of affordability in relation to income, the subsequent discussion pertains to alterations in property procurement expenses. In the event that the average citizen purchases a commensurate apartment, the ensuing financial estimates can be observed:

Table 5: Comparison of buying an average apartment in 2017 and 2022.

Factors	Buying 2017	Buying 2022
Average price 55.5 sqm	205,960 Euro	297,868 Euro
Interest rate	0.5%	4.0%
Repayment rate	2.5%	2.5%
Incidental purchase costs (12%)	24,715 Euro	35,744 Euro
Monthly annuity	515 Euro	1,613 Euro
Yearly annuity	6,179 Euro	19,361 Euro

Table 5 indicates a substantial increase in incidental purchase costs that investors would have to bear in 2022 compared to 2017. Specifically, the increase in purchase prices alone would require investors to pay EUR 11,029 more for the same apartment. However, this increase in ancillary purchase costs is not the only factor contributing to the financial burden of home ownership. The monthly annuity payments are also a crucial consideration, and they increased significantly due to a sharp rise in interest rates in 2022. Consequently, the total amount paid after purchase in 2022 would be over three times that paid in 2017.

To illustrate this point, it is to consider an average annual income of EUR 28,142, which translates to a monthly income of EUR 2,345. In such a scenario, an annuity of EUR 1,613 would be a substantial financial burden for homebuyers. Moreover, this annuity payment is comparable to the basic rent paid by tenants, but homeowners also have additional maintenance costs that tenants do not bear. The burden of housing costs for homeowners in the hypothetical Top-7 city is substantially higher than that for renters, with homeowners having to invest approximately 68.8% of their income in housing costs, also as additional expenses such as heating, water, taxes, and so on.

However, a similar scenario arises for investors. The data foundation remains the same as in Table 5, which also applies to investors. In addition, an average rental income of €11.34 in 2017 and €13.21 in 2022 should be considered.

Upon dividing the annual gross rental income by the acquisition cost exclusive of ancillary acquisition expenses, a rental yield of 3.67% and 2.95% is obtained for 2017 and 2022, respectively.

In 2017, an investor generating an annuity of 6,179 euros was able to gain around 7,552 euros in rental income, resulting in a positive cash flow of 1,373 euros per annum. Conversely, in 2022, an investor with an annual annuity of 19,361 euros would only be able to generate 8,798 euros in annual rental income, thereby incurring a negative cash flow of 10,563 euros. Private investors must possess the capacity to bear and offset this high negative cash flow. Despite tax structuring options, the cash flow remains the decisive factor for investors.

Real estate investors often engage in long-term planning to at least cover the interest with rental income, in order to ultimately secure a stable value investment upon loan repayment. However, it is evident that this strategy no longer works. Whereas a rental yield of 3.67% in 2017 was offset by a mere 0.5% interest (yielding 3.17% after interest), the 2.95% rental yield in 2022 is offset by 4.0% interest, justifying a loss of 1.05% after interest.

Since 2023, fixed deposit interest rates have often exceeded 2%, thereby rendering real estate as an investment asset increasingly unattractive. In fact, most real estate investments do not even cover running costs, and in some instances, borrowing costs. Additionally, with the exponential rise in acquisition costs and with the need to make monthly payments over several decades, it is questionable how much appeal can still be attributed to the Top-7 cities as an investment location. The average rental yields of 2.95% have also dwindled to a point where fixed-term deposit accounts present a similarly attractive investment option, without incurring ancillary purchase costs in the five-digit range.

4 CONCLUSION AND OUTLOOK

The present paper examined the determinants of the German real estate market, analyzing the impact on the populace and the market per se. The results reveal that the average net income of single individuals in Germany increased by 17.5% from 2017 to 2022. While rents in major urban areas rose between 12% and 22%, they still tracked the hike in net salaries, indicating that tenants did not face a significant surge in their cost of living. However, home purchase prices surged by an average of 63.27% during the same period, posing significant challenges for prospective homeowners to acquire residential properties.

Furthermore, the paper found that the new-build price index in Germany rose sharply from 115.1 in Q3 2021 to 154.7 in Q4 2022, indicating a significant escalation in the prices of newly constructed apartments within a short period. This increase in prices is attributed to a sudden and steep upswing in construction costs. Additionally, financing costs have increased due to a surge in key interest rates, all in all leading to a significant downturn in new constructions.

The paper also constructed a hypothetical case study of a typical top 7 city in Germany, showing that residents in these cities bear a discernible additional monthly rental burden compared to the average German citizen. The case study found that homeowners in these cities bear a substantially higher burden of housing costs than renters, with homeowners investing approximately 68.8% of their income in housing costs, including additional expenses such as heating, water, taxes, etc.

In conclusion, the study highlights the challenges faced by both homeowners and investors in the German real estate market due to the surge in housing prices, construction costs, and financing costs. These challenges call for a sustainable and robust approach to real estate investment, emphasizing long-term planning and an understanding of the dynamic market forces at play. The hypothesis that recent developments of raised interest rates and steadily rising real estate prices have significantly worsened the general conditions for real estate investors can thus be confirmed.

Looking forward, policymakers may consider implementing measures to encourage new constructions and control purchase prices. The development of affordable housing could also alleviate the housing burden of low-income households. Additionally, with the rising trend of remote work, suburbs and rural areas may become more attractive, presenting opportunities for real estate investments outside the Top-7 cities. Overall, it is imperative that policymakers and investors remain vigilant of the evolving dynamics of the German real estate market to make informed decisions.

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How Mergers and Acquisitions increase the performance of Banks in the EU: Evidence from the ECB

Azra Muratovic

Abstract

Since the global financial crisis, bank mergers and acquisitions (M&As) have been suppressed in the EU. Most M&A activity has had a domestic focus and has involved smaller targets, with larger and sounder acquirers acting as consolidators. Consolidation has had a moderately positive impact on the profitability of the banks involved. Improved post-transaction profitability can be linked to targets' lower cost efficiency, liquidity, and capitalization. Consequently, cost-cutting after the M&A transaction process decreased the overall quantity of banks and banking sector employees in the EU. Additionally, M&As noticeably increased competition in the banking sector. The objective is to describe the downward trend in the number of banks while checking the return on equity (ROE), which indicates bank profitability. The paper will use the official data provided by the European Central Bank (ECB) on the number of banks and the ROE within the EU over a given period of time conducting a time-analysis. The major findings are a positive impact of M&As on banking profitability, consequently decreasing the number of banks in the market.

Key Words

M&A, banking profitability, number of banks, banking competition

JEL Classification

O43, E58, G21, J01

Introduction

The main challenges the banking sector is experiencing are the present geopolitical instabilities in Eastern Europe, the Covid Crisis, but also some structural ones such as increase in competition in the market, regulatory changes, advancement in technology and mergers and acquisitions, resulting in more efficient and consolidated banking sector. In the recent years, the number of banks in the EU banking sector has decreased and the trend is continuing.

The motivation of this paper is to describe how M&As have influenced the number of banks in the EU consequently increasing the performance of the banks which stayed in business. Bank mergers and acquisitions (M&As) are often regarded as an option for reducing overcapacity and weak profitability in banking sector. The aim of the paper is to show how bank mergers intend to consolidate its capital, technology and customers in order to stay competitive in the market. Additionally, the paper will show the costs of M&As such as the decrease of employees in the banking sector.

The objective is to describe the downward trend in quantity of banks while checking the return on equity (ROE), which serves as an indicator of bank profitability. The paper will use the official data provided by the European Central Bank (ECB) on the number of banks and the ROE within EU over a given period of time.

The analysis within this paper has found that the number of banks within the EU banking sector has decreased due to M&As and that these had a positive impact on the banking performance

overall. The time analysis also found that with the increase in M&As, the number of employees within the banking sector has steadily decreased.

The content of the paper is as follows: First, a theoretical background on the main topic will be provided, describing the current stand of the research, giving the reader a brief insight into the theme. Secondly, the methodology and data section will cover the data gathering process and a brief elaboration on which methods of empirical analysis will be used in order to present the output. Thirdly, the results and discussion part will cover the statistical output, where the main findings will be presented in form of graphs and tables. Additionally to the output, a brief discussion of the results will be presented in order to show what other research has found on that topic. Finally, the concluding part will summarize the objective and results of the paper and provide some contribution for further research.

Theoretical Background

Bank mergers and acquisitions are often regarded as a way to reduce overcapacity and weak profitability in the European banking sector. The EU banking market has become increasingly concentrated, and a third of its banking groups – mainly the smallest banks – have disappeared since the global financial crisis. Despite all that, the banking sector struggles with weak profitability and excess capacity, with too many undersized banks and a costly physical banking infrastructure, such as human capital and technology. (ECB, 2021)

Some measures of bank efficiency need to catch up to those of other advanced economies too. The efficiency and stability of the banking system would benefit from further consolidation, which – as several policymakers have noted – should be driven by market forces, with each proposed transaction assessed individually. Against this background, this unique feature reviews recent trends in the consolidation of the EU banking sector examines the characteristics and drivers of bank M&A transactions and analyses the impact of bank mergers and acquisitions on the performance of EU banks. (ECB, 2019)

M&A activity markedly slowed in the EU banking sector after the global financial crisis. In line with developments globally, the value of M&A transactions, proxied by the total assets of M&A targets, fell by about two-thirds between the pre-crisis decade and the period since 2008. (Fernandez-Bollo et al. 2021)

Haleblian et al.'s (2009) review identified a variety of strategic goals such as market power and efficiency (Andrade 2000). Responding to dynamic global competition and technological changes in recent years, studies after 2009 have found that the primary motivations for strategic acquisitions have changed to the purchase of advanced technologies and the exploration of new businesses outside of firms' primary businesses (Lee and Lieberman 2010; Stettner and Lavie 2014).

Large transactions have become exceptionally uncommon, while the drop in the total number of transactions has been less steep. Finalizing M&A transactions in the aftermath of the global financial crisis has also become more challenging. On average, one in three attempted transactions has ended without a deal in the post-crisis period, up from one in six in the pre-crisis decade. This problem highlights the difficulties EU banks face in finding an attractive match in an increasingly challenging operating environment characterized by low-interest rates, low returns on capital, and the ongoing digital transformation of the financial industry. (ECB, 2021) Only recently has bank M&A activity started to recover, although it remains below pre-crisis levels.

Larger institutions and banks with more robust fundamentals have played a dominant role as consolidators of the banking market. From the acquirer perspective, medium-sized and large institutions have accounted for around 60% of all bank M&As in the EU, predominantly targeting smaller institutions. This may indicate that targets have been selected to complement the existing business model of the acquirer rather than to combine two institutions with similar balance sheet footprints.

The preference for smaller banks might also reflect disincentives for increasing the size of large domestic institutions in the capital buffer framework. Moreover, most bank M&A deals since the global financial crisis have contained at least one bank perceived by investors to be stronger than the median bank. Around 15% of all deals (mostly domestic deals) seem to have involved weaker institutions to the extent that lower bank valuations and weaker bank profitability are indicative of less solid bank fundamentals.

Bank M&A activity in the euro area has mainly focused on transactions within national markets. Around 80% of all completed deals in the euro area have been domestic. Italy and Germany, which have two of the least concentrated banking sectors within the euro area, have witnessed the largest number of transactions, but very few of these have reached beyond national borders. Cross-border activity has been less frequent since the global financial crisis, comprising rather small deals involving mainly Belgian, French and Dutch banks.

Studies have found that bank mergers and acquisitions follow diverse rationales and have no single dominant motivation. These studies, mostly focused on the 1990s and early 2000s, indicate that mergers often aim at improving profitability and efficiency. More profitable banks were more likely to bid for other, weaker banks, as M&A targets. (Berger et al 2002) This also held for cross-border mergers, which were moreover found to occur more frequently when countries were closely linked by a common language or trade, for instance. (Focarelli and Pozzolo 2014)

Banks also engaged in M&As to gain market share and market power, or to diversify revenues. (Amel and Rhoades 2010) European studies support most of these rationales, finding in particular that smaller and less efficient banks were more likely to be acquired. (Buch and DeLong 2016)

Empirical analysis shows that cross-border bank M&A transactions in the euro area tend to follow existing financial links. (Beccalli and Frantz 2013) A gravity model was used to evaluate the determinants of M&A transactions in Europe based on data covering 385 transactions over the period from 2014 to 2020. (Lebastard 2022) Stronger links through bilateral interbank loans and securities holdings are associated with a higher number of cross-border M&As. Banks also often tend to acquire targets in countries where they already have a physical presence through subsidiaries, while entry into new countries seems relatively less frequent. (Lanine and Vander 2007)

Cross-border transactions are more likely to occur within clusters of euro area countries. An M&A compatibility index was constructed using a gravity equation which captures the impact of financial, trade, and cultural linkages on the frequency of bank M&As over the period from 2014 to 2020. It shows that mergers between banks operating in some core euro area countries, including Belgium, Germany, the Netherlands and Austria, are the most probable constellation. Consolidation is deemed likely within two further clusters: French banks are thought likely to engage with banks in neighbouring countries, and Spanish banks are seen as a good fit with their Portuguese peers. (ECB 2021)

By contrast, banks operating in physically distant countries are not so suitable as merger partners. However, the actual frequency of cross-border mergers involving some country pairs

seems to lie significantly below model-implied potential. This suggests that factors not captured by the compatibility index, such as the prominence of cooperative and savings banks in a given country, may impede M&A activity (ECB 2021), in spite of the strong financial links already existing between the countries involved.

While the aggregate effects of mergers on bank performance seem mixed in the literature, they are conditional on sound execution and strategic fit. US studies provide only partial support for M&A-driven improvements in bank profitability or efficiency. (DeLong and DeYoung 2007)

A similar picture is painted by many European studies. For example, an analysis of the period prior to the global financial crisis finds that M&A transactions had a moderate but positive impact on the profitability of the banks involved. It also underscores the role of strategic similarities which generate economies of scale as a success factor in bank M&As, while integration of dissimilar banks often proves costly. (Altunbas and Marqués-Ibañez 2007)

The positive impact of M&As also appears to be more pronounced when transactions are executed in a financial crisis, as distressed valuations may prove opportune to a well-positioned bidder. (Shen et al. 2020) At the same time, other studies find that M&As have a slightly negative impact on profitability but a positive impact on cost efficiency. This is interpreted as a sign that cost savings are passed on to customers in a competitive banking market. (Beccalli and Frantz 2009)

Bank profitability following cross-border mergers seems to differ from that following domestic mergers, depending on the timing of the transactions. (Castro and Galán 2019) Mergers completed in the late 1980s and early 1990s tended to generate no clear improvement in ROE, while later cross-border mergers seem to have delivered a superior performance than domestic mergers. (Peek et al. 1999)

Although poor bank performance following cross-border mergers is often a result of problems preceding the transactions, it may also reflect an excessively optimistic price (ECB 2021), poor execution and an inability to change the strategic course of the target.

M&A transactions involving banks with weaker capital and liquidity positions and higher cost inefficiencies yield higher post-merger profitability. Before the global financial crisis, ROE improved following about 51% of transactions, rising slightly to 57% after the global financial crisis, as investors became more selective about approving mergers. Mergers involving more cost-efficient banks are less likely to generate improved profitability over two years. This indicates that M&As catalyze cost synergies (ECB 2021) which may be absent from transactions between highly efficient banks.

While the link between the capitalization of M&A participants and merger success is less clear, in the case of profitability-enhancing deals, the median capital ratio of the acquirer is higher than that of the target. Finally, M&A transactions involving banks with lower levels of liquidity translate into positive profitability effects, suggesting that higher levels of bank liquidity deter banks from exploiting business opportunities.

Econometric analysis suggests that on average M&As lead to an improvement in the profitability of the merged entity. Following the methodology applied by Beccalli and Frantz (2009), the findings indicate that M&A transactions were followed by a statistically significant increase in the ROE of the merged bank after two years, relative to the weighted average of the acquirer and target, and the effect is larger for cross-border mergers. However, large variance within this effect indicates that the risk to an M&A's success may be sizeable. (ECB, 2021) The effect of cross-border mergers seems to have waned over time too.

Credit risk and funding structures seem relevant to explaining the improvement in bank profitability after a merger. A study of pre- and post-merger performance in the EU before 2001 finds that domestic mergers performed better when participating banks were similar, as measured using a similarity index defined as the distance between normalized financial variables of the two banks. (ECB 2021) However, cross-border mergers enhanced profitability when banks followed diverse lending and credit risk strategies

When mergers over the last two decades are examined, stronger profitability improvements are found for transactions in which one of the sides is burdened by high levels of non-performing loans. This may point towards acquirers having better capacity to manage credit risk. When two participating banks differ in terms of funding structure, and the acquirer is more reliant on deposit funding, then historically the performance of the combined bank was marginally weaker.

Research Objective, Methodology and Data

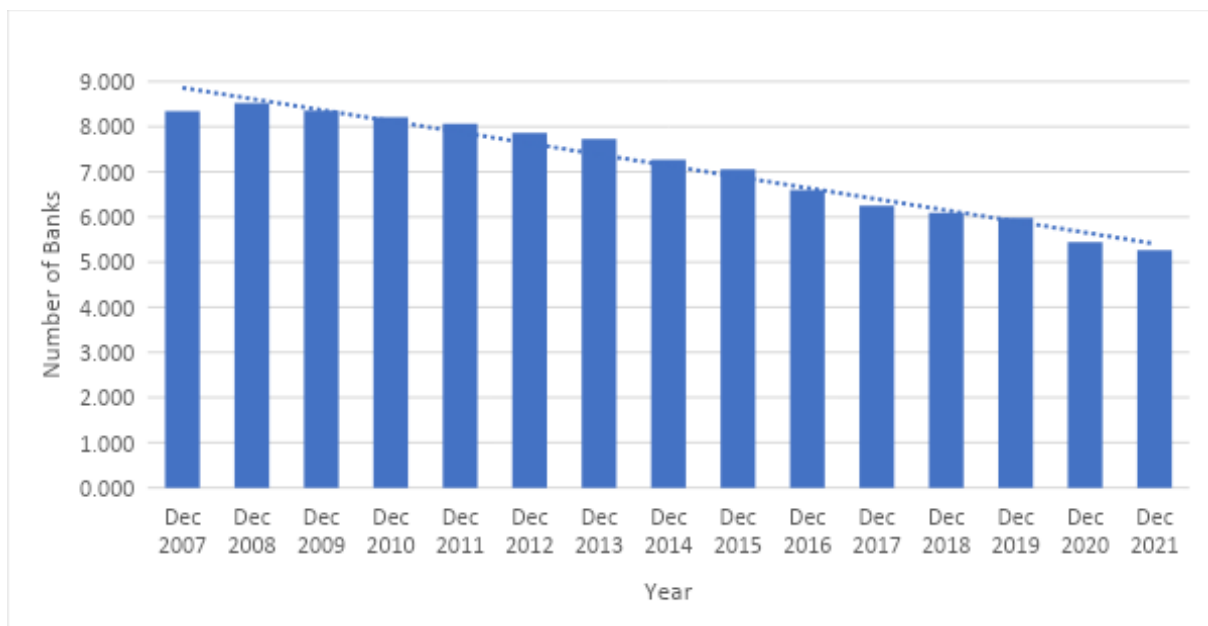
The data used in this paper has been gathered mainly from the official data tool provided by the ECB. In order to prove for the objective of the paper, a time analysis has been used firstly on the number of banks in the EU, secondly for ROE. Additionally, a time analysis has been used too in order to describe the costs of M&As such as the number of employees in the EU banking sector. The rationale behind choosing a time analysis is that this method can compare the numbers over the years and with these present the decrease in the number of banks but an increase in ROE at the same time. Any other method would have not led to such a precise output. However, there were some difficulties which were encountered while data gathering. Namely, ECB was the only institution which provided these kind of data, however, not for a constant amount of time. On the other hand, the data provided was more than enough to compute the time analysis.

The main objective of the paper is to present the impact of M&As in the banking sector on the number of banks firstly, and the ROE secondly. The assumption is that the increase in banking M&As will decrease the number of banks which consequently will lead to higher banking performance but also a decrease in the quantity of banking employees.

Results and Discussion

In this part of the paper, the gathered data has been used in order to present a change in the number of banks in the EU. From figure 1 we can see that the number has been decreasing steadily over years. According to the literature, there are few reasons for that. First, more and more customers are moving to online-banking and using online tools in order to complete their business. Second, the competition in the market has increased: larger banks entering the market are eating up small and medium-sized banks, taking u their market share and customers. The third commonly found reason in the literature is the regulatory changes: small and medium-sized banks cannot bear the increase in capital demanded in order to fulfill the regulatory predispositions.

Fig. 1: Number of Banks



Source: own research

All of the reasons have led to an increase in M&As within the banking sector. Banks with higher technology levels are merging with banks which have a larger market share, so both benefit from each other. Larger banks undertake acquisition of medium-sized banks in order to get into a foreign market, profiting from their market shares and customers.

Fig. 2: Return on Equity of European Banks



Source: own research

All of that has resulted in a higher banking performance. Small and medium-sized banks which have undergone M&As, have now consolidated capital and are therefore more competitive in the market.

The exception is the recent Covid Crisis, which decreased highly the banking profitability in the EU in 2020. However, at the fourth quarter of 2021, the numbers were surprisingly high and, according to literature, back at the pre-crisis level. The other exception are the years around the Financial Crisis and its aftermath negative results can be seen in the years 2008 and 2009.

Fig. 3: Number of Employees in the European Banking Sector



Source: own research

Although M&As have had a positive impact on banking profitability, figure 3 shows the downward trend in the employment in the EU banking sector. The first explanation is that not all employees can preserve their position within a bank during and after a M&A. Otherwise, there would be positions after an M&A double-booked.

Human Capital is a large cost-factor. In the recent years, technology has compensated for some amount of employment within the banking sector, which additionally decreased the number of employees.

These results, as expected, were also proven by the literature. Mainly the ECB, which gathered a large spectrum of data, has proven the positive effect of M&As on banking profitability. They also found a correlation between an increase in M&A and the number of banks within the sector.

Conclusion

The objective of the paper was to present the impact of M&As in the banking sector on the number of banks firstly, and on the ROE secondly. The assumption was that the increase in banking M&As will decrease the number of banks which consequently will lead to higher banking performance but also a decrease in the quantity of banking employees.

This paper has found that in the recent years, mostly after the Financial Crisis, M&As in the EU banking sector lead to a higher banking profitability. This has had as a consequence that the number of banks in the market decreased which also cut many working places within the sector. The major reasons for that are technological innovations, increase in competition and regulatory changes in the banking sector.

A time analysis has been used in order to prove for the hypothesis. Although the data was sufficient for the aim of the paper, the data-gathering process has found that only the ECB did provide facts and figures regarding these issues. Additionally, the data was missing for some years which presented an obstacle, however, it did not have a negative influence on the output, as the research could be done.

Further studies on this topic could implement the aspect of the banking union, which would address one of the key sources of financial fragmentation, could unlock the potential of cross-border M&A transactions. Although appealing from a profitability perspective, such transactions may be impeded by the limited financial integration of the euro area. While the supervisory approach to bank mergers has been clarified by the ECB, further harmonization of the regulatory and supervisory framework could help to overcome the fundamental drivers of fragmentation.

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Influencers on YouTube and Investment Advice: Thin Regulatory Ice and Potential Threat for First-Time Investors in Czech Republic

Vladimír Petřík

Abstract

Members of demographic cohort known as Generation Z (born 1997–2012) are now becoming potential first-time investors. It is also the first generation that is strongly related to the Internet use, as they can basically handle everything online. It is also valid for handling their investments. The goal of the paper is to indicate the potential activities of YouTube creators active in investment content in Czech Republic that might be non-compliant with current regulatory requirements and investigate the influence of YouTube content by first-time Generation Z investors. Paper has a character of exploratory research and utilizes qualitative research approach: document analysis of current regulatory requirements and written statements with 30 respondents. Results show that some activities of YouTube creators related to investment content might be considered as regulated activity requiring license. Moreover, YouTube and also TikTok were identified as the most influential sources for making investment decisions by respondents. As a recommendation, papers calls for deeper future research and cautions monitoring of online world by regulators to ensure that there is no misleading of investors.

Keywords

consumer, digitalization, finfluencer, influencer, investment, investor protection

JEL Classification

D1, D18, G11, G28

1 INTRODUCTION

As such influencers can have a significant impact on their followers, focus of the paper is to investigate potential compliance areas needed to be taken into the account while exercising the social power over his or her followers while providing investment-related content. For this purpose, the methods of qualitative research are utilized. Moreover, it seems that this topic is quite significant, therefore it might be useful at least partially uncover practices of Generation Z (born circa 1997–2012, also “Gen Z”) members in relation to investment decision making and the influence of social media.

The goal of the paper is to indicate the potential activities of YouTube creators active in investment content in Czech Republic that might be non-compliant with current regulatory requirements and investigate the influence of YouTube content by first-time Gen Z investors.

The paper is structured to 5 sections. Firstly, the Introduction provides a brief idea on researched topic, followed by second section describing current body of knowledge pertinent to the goal of the paper. Third section describes methodology and data used for the research. Following fourth section of the paper is very important as it states the results and discussion of gathered evidence and knowledge. Last section, the Conclusion, summarizes the researched topic and asserts future possible ways of research, expanding the knowledge and filling the research gap.

2 THEORETICAL BACKGROUND

Act No. 119/2020 Coll. amending certain acts in the field of financial market regulation effective from May 1, 2020 has implemented significant changes to understanding what is and what is not the regulated activity requiring previous authorization in capital market.

Legal rules applicable to the capital market comprise both laws, which are prepared by the Ministry of Finance of Czech Republic and, in some cases, the Ministry of Justice of Czech Republic, and implementing decrees and provisions, which are usually issued by the Czech National Bank (hereinafter as “CNB”). In order to support market participants, the CNB also issues many explanatory documents and guidelines in the form of official information and answers to enquiries. EU authorities are also increasingly issuing directly binding regulations and guidelines. The basic regulation of investment-related influencer marketing might be found in local regulation (especially Act No. 256/2004 Coll., on Capital Markets Undertaking Act, as amended; hereinafter as “Capital Markets Undertaking Act”) and European Union legislation level (especially Commission Delegated Regulation (EU) 2017/565 of 25 April 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council as regards organisational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive; hereinafter as “Regulation 2017/565”). CNB (2011, 2017a, 2017b, 2018, 2019) in its CNB opinions on financial market regulation provides additional information on understanding differences between various activities on capital market. Some indications regarding marketing is given by ESMA (2018). These legal sources will be analyzed further to indicate potential threats of non-compliance while providing investment-related influencer content.

In this legal framework there are also customers and providers of services on capital market. One group of these customers are members of demographic cohort known as Generation Z (born 1997–2012) (Krol & Zdonek, 2023). This generation has achieved adulthood and became also potential first-time investors. It is also the first generation that is strongly related to the Internet use, as they can basically handle everything online. It is also valid for handling their investments. Pintér, et al. (2021, p. 191) stated: *“Generation Z, who can handle almost everything online, from the picture taken by their mobile phone to purchasing or transferring money. Therefore, using several tech solutions, they are not looking for traditional banking solutions, like the ones where physical presence is needed. Their wish is to obtain secure, fast, easy financial solutions, and services. Additionally, to ensure payments can be easily made and investments are available on hand. All of this being virtually available any time when it is needed, even from their mobile phones and also providing a high-level of personalization possibilities.”* Usually, for this generation, the social networks are of great importance for their day-to-day decision making and purchase behavior (Kim & Baek, 2022). Social influencers are widely known as the promoters of (purchase) behaviors to influence individuals in their social networks for marketing and advertising purposes (Vrontis et al., 2021).

In following text of this section, the semi-systematic (narrative) literature review will be proposed on the relationship between investment related content of influencers and its effect on investment decisions of recipients of this content. This literature review was based only on articles in Web of Science database of period from 2020 to 2023.

One of current marketing trends is influencer marketing. Influencer has significant effects on social media engagement and purchase intention of viewers (Kim & Baek, 2022). Yan et al. (2023) conducted an early study investigating the relationship between influencer advertising and impulse buying, showing that there are well functioning strategies of influencer marketing leading to urge of viewer to buy impulsively via attitude toward influencer ads. Chung-Wha, Sangssoo & Youn-Kyung (2022) elaborated current knowledge of social media influencers and

proved that social media influencers are not only “brand endorsers” or “online opinion leaders”, but they play a greater role as a source of inspiration for consumers. Living in a time when people are looking for ideas and inspiration, they found that social media influencers satisfy consumers’ need for inspiration by providing them with new ideas, some of which they may not have been aware of or may find surprising. These findings imply that brand marketers may benefit from influencer marketing if they collaborate with social media influencers who are able to showcase new ideas and inspirational online content to their audience well. Smit et al. (2022) adds that for social influencers to be successful in changing behaviors, it is essential that they convey their message in an authentic, original, credible, and persistent manner. Wang & Huang (2022) stated that several forms of social power from digital influencers (including expert power, informational power, referent power and legitimate reciprocity power) could affect consumer engagement behaviors (including content participation and content creation). Moreover, the two types of consumer engagement behaviors could further affect consumer’s purchase expenditure in the social commerce community. Rudeloff & Damms (2022), drawing on the example of car manufacturer Tesla and its early investor Elon Musk, explored the connection between the personal communication activities of influential entrepreneurs on social media, the emergence of parasocial interactions, and the related communication outcomes for the company. Their results showed that following entrepreneurs’ personal social media activities amplifies parasocial interactions, which in turn positively impact the company’s communication outcomes. Organization-public relationships and purchase intentions are improved by parasocial interactions. Tricás-Vidal et al. (2022a) concluded that United States residents who felt encouraged to perform physical activity by fitness influencers on Instagram achieved more the World Health Organization recommendations for substantial health benefit for moderate physical activity. They were predominantly females and millennials with normal weight and spent more time on Instagram checking for nutrition or exercise. Taylor & Carlson (2021) outlined forces that have led to changes in the advertising industry in recent years, including cluttered environments, digital advertising and technological advancements, growing concerns about privacy, greater emphasis on corporate social responsibility, and more focus on return on investment. The degree to which these forces have changed the very definition of advertising is discussed. Implications for academic researchers are drawn and key areas for future research are outlined, including social media and electronic word of mouth, influencer marketing, artificial intelligence, native advertising, privacy, socially responsible advertising, green advertising, and children’s advertising, among others. Tricás-Vidal et al. (2022b) builds on proven fact that the Internet today is the largest platform for food distribution, and there are concerns about the impact that digital marketing has in the field of nutrition by promoting non-evidence-based recommendations. In their results women and millennials followed more nutrition-related content. Scientific evidence was scarce and commercial interest in the network was evident. The vast majority of the posts were not based on scientific evidence and instead promoted a product/supplement.

Gupta & Goyal (2022) stated that millennials (generation born from 1981 to 1996) listen to experts but do not herd based on this. Both gender groups tend to herd more based on friends, relatives, siblings and parents.

Based on conducted literature review regarding relationship between investment related content of influencers and its effect on investment decisions of recipients of this content, we conclude that there is a research gap, as almost no literature focused on this topic and relationship. Considering this, we assert that topic and goal of the paper is attractive for future research.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

As it was already mentioned, the research objective (goal) is to indicate the potential activities of YouTube creators active in investment-related content in Czech Republic that might be non-compliant with current regulatory requirements and investigate the influence of YouTube investment-related content by first-time Gen Z investors.

Breakdown of this goal led to decision that this paper will aim to provide exploratory research regarding relationships “influencers – regulation – impact on customers” and there were 2 research questions stipulated:

- Research question 1: What is the decomposition of compliance risks related to influencer marketing of investments on basic level?
- Research question 2: What are the opinions, attitudes and experience of Gen Z members regarding influencer marketing of investments in Czech Republic?

For research question 1, secondary data was used. This data was represented by legal sources mentioned in previous section of this paper accessed by ASPI and Beck-online legal databases.

For research question 2, primary data was used. The technique, tool, for collection of this primary data were written statements by 30 Gen Z members. Available sampling was used. Respondents were all watching or following investment content on social networks. In total 46 students were questioned whether they want to take part in the research, 16 of them did not show the interest or did not watch/follow investment content on social networks, resulting to 30 relevant respondents. Respondents were given 30 minutes to handwrite on provided paper their answers on following questions:

- Do you watch/follow investment content on social networks?
- Which social networks you watch the most for investment-related content?
- Do you watch/follow any influencers with investment content on social networks?
- What are your thought on relevancy of information you receive from social networks’ investment-related content? What about influencers?
- Do you invest or do you plan to invest your money? What is the role of influencers and their content you watched/followed in your decision-making regarding investments?
- Does social networks play other roles in your investment behavior besides being the medium for visiting investment-related content?

Respondents were undergraduate students of Prague University of Economics and Business (10 respondents) and Czech University of Life Sciences Prague (20 respondents), all in studies related to Economics, but not directly related to investments. Although the choice of respondents might seem biased, we expected from students of this study area broader and deeper answers (Denzin & Lincoln, 2018).

For both research questions and associated data the method of qualitative content analysis (QCA) method was used. QCA can be a powerful method for analyzing legal documents and developing a deeper understanding of legal concepts and practices (Schreier, 2012). It allows researchers to identify patterns and themes within the data in a rigorous and systematic way, and to draw meaningful conclusions based on the analysis, mainly if it is accompanied by narrative, thematic and content analysis (Creswell & Poth, 2017).

Limitations of research are obvious, mainly method of sampling and size of the sample.

4 RESULTS AND DISCUSSION

In line with the research question 1, first part of this section will provide brief analysis and decomposition of compliance risks related to influencer marketing of investments.

The first critical decision point (Fig. 1) is whether influencer has already a license or permission for providing investment services (e.g. most probably as regulated investment intermediary).

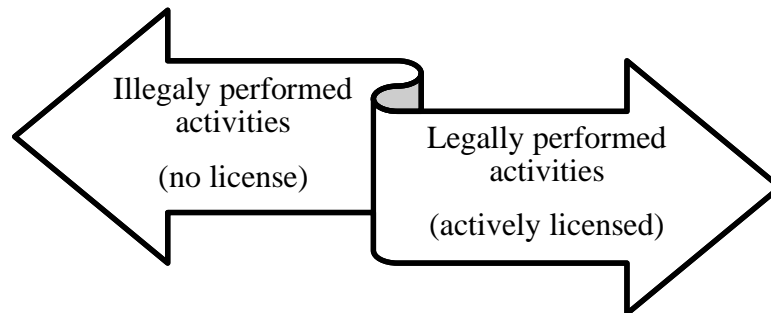


Fig. 1: Critical decision point: authorization of influencer for investment services.

Source: own research

This might seem as an unnecessary step, as we mostly imagine influencers as natural persons having thousands of followers, but in reality, the influencer can be also a legal person which basically fulfill this premise of significant reach over many followers. It is not uncommon, especially in niche markets, that also a specialized company (legal person) (not only natural person) can become an influencer in that particular topic. In investments, these legal persons in the role of influencers can be banks and branches of foreign banks, investment firms, including branches of foreign investment firms, investment intermediaries, etc.

If the influencer does not have any license or permission for providing investment services, influencer must be aware of the compliance risks associated with potential crossing the line of regulated activities.

Hobza (2020) warns that in some cases there is a very thin line between making judgement about providing investment services and our analysis of legal sources confirms this statement.

Pertinent to investment related content of influencers it seems that the thinnest line of probable providing investment services without license or permission is occupied by two legal terms:

- providing main investment service of investment advice in relation to one or more financial instruments according to Sec. 4(2)(e) of Capital Markets Undertaking Act, and
- providing main investment service of reception and transmission of orders in relation to one or more financial instruments according to Sec. 4(2)(a) of Capital Markets Undertaking Act on base of conducting “intermediation of transactions in financial instruments” in meaning of Sec. 2(1)(y) of Capital Markets Undertaking Act and its reflection in investment services by Sec. 4(4) of Capital Markets Undertaking Act.

Influencer marketing covering investments might be also considered as providing ancillary investment service called investment research and financial analysis or other forms of general recommendation relating to the trading of financial instruments according to Sec. 4(3)(d) of Capital Markets Undertaking Act. For providing this ancillary investment service it is not required to have authorization issued by regulator (see Sec. (4a) of Capital Markets Undertaking Act). On the other hand, no one shall provide the main investment services and ancillary investment service referred to in Section 4(3)(a) of Capital Markets Undertaking Act without an authorization issued by the regulator.

No entity can operate in the capital market on a long-term and entrepreneurial basis without any permission or license (except of “tippers” – persons just finding out the general interest of third party regarding investments and then passing the contact information of this third party to licensed provider of investment services for future communication, usually receiving a provision for providing the suggestion on potential customer; see for instance Czech National Bank, 2011; hereinafter as “tipping”).

Activities carried out by influencers involving the promotion and offering of specific investment instruments or even investment services may go beyond potentially permissible activities exempted from investment services regulation, such as advertising or tipping.

Regarding comparison of main investment service of investment advice (requiring authorization) and ancillary investment service called investment research and financial analysis or other forms of general recommendation, the key aspect is to identify whether a prospective or existing client could gain the impression that the investment instruments were intended for him and personalization of the content. Recital 14 of Regulation 2017/565 stated: *“Advice about financial instruments addressed to the general public should not be considered as a personal recommendation for the purposes of the definition of ‘investment advice’ in Directive 2014/65/EU. In view of the growing number of intermediaries providing personal recommendations through the use of distribution channels, it should be clarified that a recommendation issued, even exclusively, through distribution channels, such as internet, could qualify as a personal recommendation. Therefore, situations in which, for instance, email correspondence is used to provide personal recommendations to a specific person, rather than to address information to the public in general, may amount to investment advice.”* Generic advice about a type of financial instrument is not considered investment advice, but it might be seen as the propagation of investment services. CNB (2018) stated that the characteristic of individualization can also be fulfilled by the mere selection of intended recipients of given content with similar personal circumstances to be targeted by the publicly available recommendation, e.g. by addressing people with common characteristics such as portfolio composition, age group, etc. The mere selection of a group of beneficiaries by an internal system does not necessarily mean that the product is suitable for all beneficiaries. However, if the reason for the inclusion of an individual in the group, such as portfolio composition or some similar feature, is presented as a reason for communicating with the customer, it is likely to be a product that is targeted as suitable for its recipient and therefore could reasonably be investment advice under Article 9 in conjunction with Recital 14 of Regulation (EU) 2017/565.

The activity of an influencer shall not fulfil the defining characteristics of investment intermediation within the meaning of Section 2(1)(y) of Act No 256/2004 Coll., on Capital Market Undertakings Act.

Another important aspect to evaluate is whether the influencing activities were also aimed at attracting a potential customer (or a conviction in the form of a mental decision or serious interest to take up a more specifically defined investment instrument).

Offering is also a part of advertising (Flídr, Veteška & Slanina, 2017) and Section 2(1)(y) Capital Market Undertakings Act states “offering” as one of the characteristics of “intermediation of transactions in financial instruments”. Moreover CNB (2011, 2017a, 2017b, 2018, 2019) in its opinions on financial market regulations indicates that propagation, marketing and offering of investment services and investment instruments might be considered as the “intermediation of transactions in financial instruments” in meaning of Sec. 2(1)(y) of Capital Markets Undertaking Act. If influencer's promotional communications contain specific information about investment services or investment instruments, the one may conclude that this is already investment intermediation, which requires further authorization. There is a space

for some disputes, but if there is a purpose of such content to arouse the client's interest in purchasing investment services or investment instruments in sufficient detail, there is always a probable expectation that the line of permitted activities without further authorization is crossed.

While assessing the admissibility of propagation and offering of investment services or investment instruments through influencer marketing and related content, one shall focus in particular on: whether and how the presentation of investment services and instruments is capable of creating the interest of a visitor, viewer for further active search potentially leading to providing investment services or instrument and thereby influencing his or her investment decision. The detail of provided information, layout of the content of the displayed information, transparency statements regarding possible cooperation and declared intention of the content (incl. transparency of paid advertisement), magnitude of mentioning advantage of product and providing references and encouragement of viewers to use them for arranging such investment (by displaying the contact details of the investment service provider, contact forms, etc.) (Herinková, Kubát, Nejedlý & Petřík, 2023).

In hypothetical case, the long-term providing of investment services with significant impact on society and personal gains of influencer from this activities might be considered as a criminal offence pursuant Sec. 251 of Act No. 40/2009 Coll., the Penal Code, as amended.

Another important part of regulation to follow is the market abuse regulation. Crossings the line of market abuse regulation are not unprecedented, e.g. the U. S. Securities and Exchange Commission recently announced charges against eight individuals in a \$100 million securities fraud scheme in which they used the social media platforms Twitter and Discord to manipulate exchange-traded stocks (U.S. Securities and Exchange Commission, 2022). Capital Markets Undertaking Act in connection with Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC states clearly activities that shall comprise market manipulation.

There are also general legal obligations regarding consumer protection, in other words, it is not only sectoral legal regulation of investment services to follow:

- Obligations pursuant Act No. 634/1992 Coll., on consumer protection, as amended, (Drachovský, 2023; Stárková, 2017),
- Obligations pursuant Act No. 40/1995 Coll., on Advertising Regulation, as amended, especially with focus on hidden advertisement (Veselá, 2022),
- Unfair competition, intellectual property, tax regime and other topics, clearly summarized in publicly available PDF publication by Ondřejová et al. (2022).

If the influencer has relevant registration, license or permission for providing investment services, influencer shall create and conduct its content in compliance with relevant general and also sectoral legal rules pertinent to its form of business conduct (e.g. bank, investment firm, investment intermediary, tied agent). As the current legal rules as found in various legal sources, for simplification of this matter in case of influencer marketing, we state that among other influencer shall follow encompassing term “professional care” and basic understanding of “market abuse” rules. The mere selection of, in our opinion the most important, obligations for influencer in regulated role, is stated in Fig. 2.

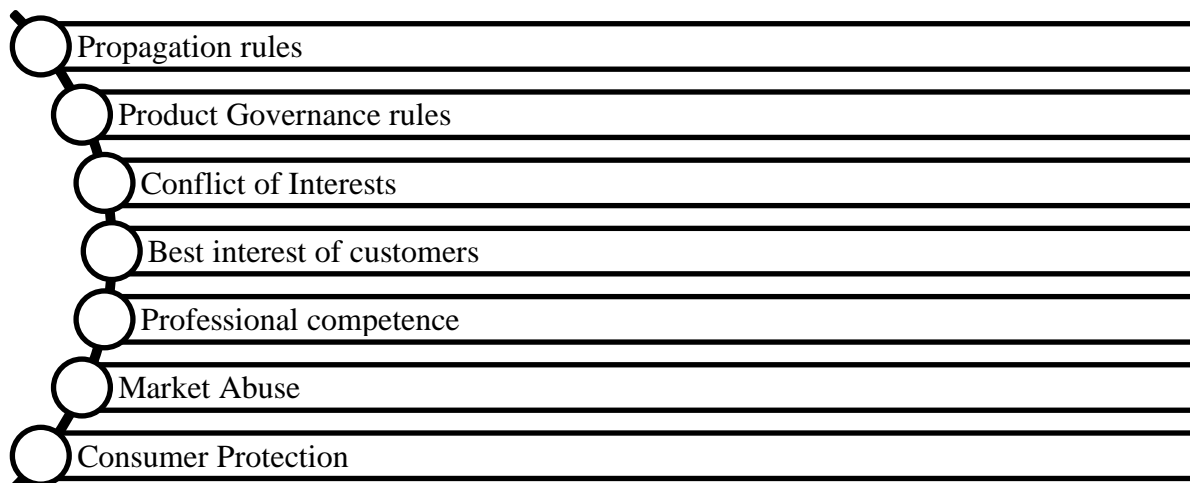


Fig. 2: Selection of various regulation requirements in case of licensed activity of influencer.
Source: own research

Naturally, even the influencer with relevant registration, license or permission in the area of investment must ensure that he or she is compliant with general legal requirement stated in previous part.

The logical subsequent step in the paper and research structure could be the analysis of current YouTube content related to investment, but considering the range limitations for this paper and its goal, paper does not provide any further evaluation of real-life status quo of influencer marketing related to investment area, what makes this suggestion a future research opportunity.

Second critical decision point is the intention and contractual background of influencer marketing (Fig. 3).

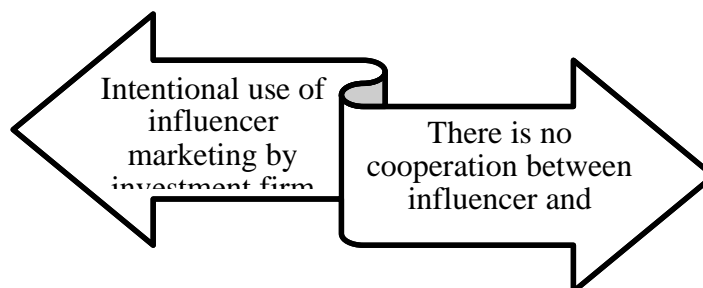


Fig. 3: Critical decision point: role of investment firm (owner of marketed investment product).
Source: own research

We would like to mention the threat of non-compliance with ban of hidden advertisement. YouTube and other social content sharing networks currently allow for the indication of paid collaboration directly next to a specific post and the use of this tool can only be recommended. However, given that, that such a label may be easily overlooked in some cases, further we also recommend the use of other options for indicating advertising cooperation (Ondřejová, 2022).

Moreover, in case that cooperation between influencer and investment firm is established, or there is also an intermediary in form of marketing agency, investment firms shall establish a control and approval process over the final version of influencer marketing output (usually the video contribution). As Article 44(1) of Regulation 2017/565 stated, “*investment firms shall ensure that all information they address to, or disseminate in such a way that it is likely to be received by, retail or professional clients or potential retail or professional clients, including marketing communications satisfies*” other obligations stipulated by Article 44 of Regulation

2017/565. Simply put, using of influencer marketing does not exonerate the sponsor (contracting party) of any obligations related to the content of influencer marketing.

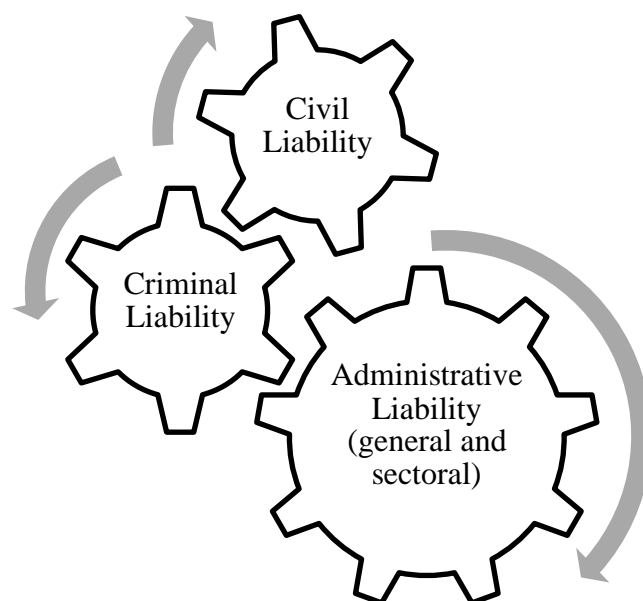


Fig. 4: Indicative decomposition of liability in influence marketing.

Source: own research

In addition, an influencer who violates the legal rules resulting to damage to customers could also be held liable for the damage he or she causes to consumers (e.g. on the basis of Sec. 2950 of the Act No. 89/2012 Coll. Civil Code). In hypothetical cases, some activities may lead also to criminal offence pursuant Penal Code. The most probable (most frequent) situation in our opinion would be administrative offence.

Moreover, while assessment of severity of administrative offence, one might consider assessment of the severity of conducting investment services without license or permission. In our opinion, there might be some aggravating and mitigating factors taken into account, but stating these is a matter of legal research. In our opinion, the aggravating factor should be also the level of compliance with sectoral legal rules pertinent to investment services. From the point of consumer protection, the situation when influencer without any relevant license or permission provides content stipulating propagation and active marketing of specific investment services and investment instruments while giving, for instance with all relevant disclaimers and balanced communication is less severe than the situation when influencer without any relevant license or permission provides content stipulating propagation and active marketing of specific investment services and investment instruments while providing absolutely unbalanced and misleading information. It of course does not mean exoneration of influencer from probable administrative offence. It might be considered a good practice for influencers to be aware of some basic ideas of consumer protection in investment services stated in Fig. 2.

Regarding second research question, the paper in following text interprets information gathered by anonymous written statements of 30 Gen Z members on their opinions and experience regarding influencer marketing of investments.

Respondents tend to get more detailed information about investing from YouTube. The second widespread platform is TikTok. The information they watch and get is not random, but most of the respondents follow several channels dedicated to investments or more specifically finance

in general for a long time. Respondents are aware that there are many channels and creators on YouTube offering investment tips and advice, but not all of them are qualified and serious experts on the topic. Therefore, they are cautious, especially when watching new channels, but do not regularly check the authenticity and qualifications of video creators before believing them and accepting their advice. Rather, they are interested in the overall appearance of the creator and channel, the quality and professionalism of the visuals and sound as confirmation of relevance, and they significantly value any links to named services, companies or resources. A problem with investing mentioned by respondents is the perception of investing as a closed industry that has only opened up to the public thanks to the internet, hence the need to get involved in investing here and now. Related to this is the perception of the FOMO effect from social networks and peer groups (in line with Gupta & Goyal, 2022). Another issue is the language and complexity of investment topics. Investing can be a complex topic, full of technical terms and complex concepts, which can be confusing and misleading for some people. Therefore, the average person from this generation might look for videos that are presented in a clear way, without an overabundance of technical terms, and that are accessible to non-investment laypeople. Respondents also consider the influence of influencers to be significant. The influence of domestic influencers such as Kovy and Ondřej Koběský is also important. We consider significant the finding that many respondents identify with certain videos, leading to the impression that this particular content is suitable for them, even as an investment decision. Investing in execution-only mode associated with a mobile app is very popular among respondents. Some respondents admitted that they base their decisions purely on YouTube content and investing is still more of a guessing game for them and following the social media trends without any deeper investment philosophy or strategy. Although, some of respondents named their investment approach as dividend strategy or dollar cost averaging strategy, the inclusion of stocks to portfolio was purely based on social media content (usually YouTube).

The synopsis of coded data from statements of respondents indicated that there might be forming something what we, for the purpose of this paper, define as “Gen Z Investment Trap” (Fig. 5).

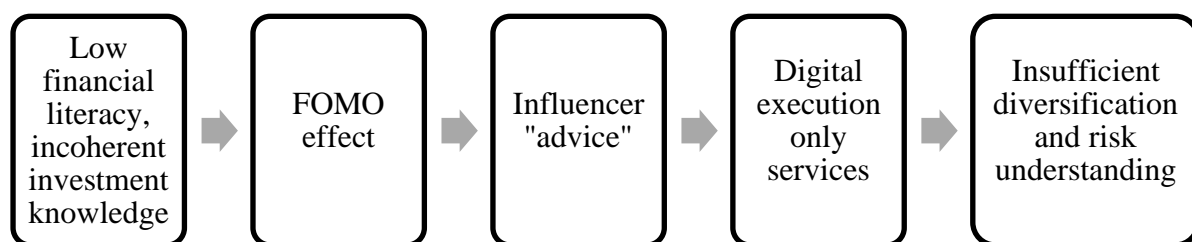


Fig. 5: The “Gen Z Investment Trap”.

Source: own research

It is generally known fact that financial literacy is, especially in countries of central Europe, quite low in comparison to more developed European countries or in comparison to its ideal levels (Novák, 2022). Despite the fact that respondents were students of economics-related study programs, most of their investment knowledge came from YouTube content and other social networks. This situation might be considered as alarming. In that situation of financial education Gen Z members do not have sufficient skills and knowledge to understand and comprehend even the basic relations and terms in investment (Goyal & Kumar, 2021). They definitely know some terms and relations pertinent to investments, but these are often isolated without providing comprehensive view as in case of semester long subject taught at university or a textbook. On one hand knowledge sharing of social network is great, but it may not always be able to lay foundations

needed for informed investment decisions (Hernandez-de-Menendez, Diaz & Morale-Menendez, 2020). General premise in investment services is (e.g. in assessment appropriateness or assessment of suitability) is that investment services might not be intended for everyone (see for instance the result of assessment appropriateness by Sec. 15i(2) of Capital Market Undertakings Act). The culture trait of Gen Z members of sharing everything on the social networks some of these natural persons may get under influence of so-called FOMO effect (“Fear Of Missing Out”) which has been with similar results in detail empirically researched by Elhai et al. (2021). Economic turbulences and uncertainty, together with general recommendations of one’s taking care of his own future due to instability of long-term public finance, only fuel the drive of Gen Z members to invest. Traditional ways of providing investment services to customers might seem to Gen Z member outdated and with no real investment education they naturally seek answers in the on-line and virtual world of the Internet (Krol & Zdonek, 2023), but overreliance on social media content leads usually only to following the short-lived trend without more robust strategy worth following mirrored by appropriate diversification or general risk understanding.

5 CONCLUSION

The paper provided, in line with its goal stated in the introductory section, the indication of potential activities of YouTube creators active in investment-related content in Czech Republic that might be non-compliant with current regulatory requirements on capital market.

There are legal, administrative and in hypothetical case also criminal, responsibility (liability) resulting from influencer marketing. There are many aspects which need to be taken into the account while evaluating the admissibility of influencer marketing content, e.g. remuneration of influencer, formal cooperation between provider of investment product (investment service, investment platform, investment instrument) and influencer, intentional dissemination of content and especially the ability of content to be perceived by not only intended viewer to be influenced by it and make investment decision.

Regulation of investment services on capital market is special sectoral regulation due to significant reasons, as sometimes it is the game about customers’ savings and, with all due respect, the consequences can be much more severe than in case of most consumer goods. Therefore, the influencer marketing of regulated investment services requires much more scrutiny and awareness of potential pitfalls.

The role of investment firm using the services of influencer marketing for promotion of its investment services or investment instruments is not passive. The investment firm using the influencer marketing is responsible for final and publicly disseminated propagation of its investment services and investment instruments.

Moreover, the paper indicated that YouTube and possibly also TikTok content is valid source of information regarding investments and frequently used by Generation Z. This shall increase the urgency of the matter in the regulatory and supervisory point of view.

Considering the fact that paper utilized exploratory research approach accompanied with anchoring by methods and techniques of qualitative research, these facts might be perceived as limitations of this paper, but on the other hand, it creates the research opportunity for future.

In conclusion, the paper proposes the need for better understanding of influence of this type of content on decision making of investors and also calls for higher scrutiny of regulators accompanied with complex guide how to prevent and identify potential malpractice and unethical behavior in influencer marketing of investments. These future topics should be based on more rigorous research, using the combination of qualitative and quantitative research.

Overall, it is important for all investors to be cautious and critical when listening to influencers' advice on investing and should always verify information and recommendations from other sources. They should also be cautious when choosing investment products and be aware of the risks associated with different types of investments, but changing some investment decisions which customers has already made, potentially unconsciously, by influence of influencer marketing, might be difficult.

We consider the first time investors from Generation Z as vulnerable part of customer base for investment services. Often they follow trends and base their decisions on social media content. The primary recommendation is to include the financial and investment literacy to general education. The highest perceived risk in this situation is the misleading of investors.

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Are sustainability-linked derivatives "fashion" trends or new types of financial products? Overview of a current European market.

Eleonora Salzmann

Abstract

Over the past five years, the volume of sustainable investments (ESG-linked investments) has increased more than ten times. This type of investment covers a wide range of assets but focuses on the selected assets' environmental, social and governance aspects. ESG derivatives are seen as an instrument that can facilitate the transition to a new type of economy and help to tailor ESG-related exposure. Hence, this article attempts to determine the place of environmental derivatives in the structure of the financial market and the prospects of green instruments development in transforming exchanges into socially responsible institutions.

The author uses a systemic analytical approach to study environmental derivatives, existing initiatives in the green finance field, and the experience of international cooperation in sustainable development. The additional focus is on green instruments' possible advantages and disadvantages and their application in the EU. So far, this topic still needs to be widely addressed in the literature, especially the new type of Sustainability-Linked Derivatives issued first by ING in 2019.

Keywords

Derivatives, ESG, sustainability linked derivatives

JEL Classification

G00, G15, G18

1 INTRODUCTION

The ethical side of the business has long worried people, and the millennial generation influenced the emergence of "conscious" capitalism discussed by Frémeaux & Michelson (2017) and the growth in popularity of ESG investments. Moreover, the development of sustainable financing is politically encouraged and supported by the EU Green Deal, European Commission (2020). The Program for the Environment and Climate Action (LIFE) clearly states that the transition is expected to strengthen traditional European sectors in changing global markets. According to a recent analysis by Riegler (2023), the interest in the role of the financial sector increases steadily also in scientific literature. However, sustainable banking has no uniform definition due to the lack of generally accepted sustainability indexes.

ESG-investing is a form of socially responsible investment (hereinafter SRI), for example, addressed by Nájera-Sánchez (2020) and Oehmke & Opp (2020), where the decision to invest in a business is based on the company's contribution to society in environmental, social and governance aspects. The border between ESG and SRI is that the latter investment principles are limited only by ethical/moral codes, as Chen & Scott (2021) described. The company's positive impact can be assessed through three main factors: ecological (environment), social, and governance. These criteria characterise a company regarding environmental stewardship, social responsibility, and corporate governance performance. In simple terms, investors choose companies in terms of financial performance and how socially and environmentally responsible their business is. And they also refuse to sponsor companies that pollute the planet or maltreat

employees. It turns out that through ESG strategies, investors can positively impact the development of society and nature conservation.

According to the "Global Sustainable Investment Review 2020", published by the Global Sustainable Investment Alliance (2021), ESG investments continue to grow in most regions of the world, with the most significant increase in absolute terms in recent years in Canada (up 48%), followed by the United States (42%) and Japan (34%). For example, the research of Hale (2021), who published the volume of ESG investment in the USA, has shown ten times growth within the five years between 2015 and 2020: less than \$5 billion in 2015 against \$51.1 billion in 2020 according to Morningstar Investors. At the end of the second quarter of 2022, the volume of investments into sustainable investments was around \$300 billion.

Since March 2021, the EU sustainable finance disclosure regulation has become obligatory for financial market participants, including financial advisers. Based on this information, the European Fund and Asset Management Association sums up that in Q1 2021, the net assets of funds promoting ESG in Europe were around \$3.7 trillion. Hence, the European region consistently dominates the sustainable finance landscape with a share above 80% of the global market or slightly above \$2 trillion of direct investment in ESG-linked assets according to Global Sustainable Fund Flows: Q2 2022 in Review by Morningstar Investors, 2022. In addition, the PwC Assets and Wealth Management team also published global research in 2022, which covers a period from 2015 to 2021 and states that the market share of ESG-linked assets will increase from 14,4% in 2021 to 21,5% in 2026.

This rapid growth also involves the development of a palette of so-called sustainability-linked derivatives or SLDs, which play an essential role in the ESG transition through long-term capital allocation into sustainable projects. For example, the first product was designed and launched in 2019 by ING. The payoff profile of this interest rate swap is directly linked to ESG KPIs assessed by an independent third-party / scoring agency.

Currently, we can observe the development and extension of a whole family of new transactions and structures embracing sustainable features (e.g. ESG-related CDS indices, derivatives on listed ESG-related equity indices, emissions trading derivatives, renewable energy and fuels derivatives, weather and catastrophe derivatives). In response to the market changes, in 2022, the International Swaps and Derivatives Association (hereinafter ISDA) launched a survey called "The Way Forward for Sustainability-linked Derivatives" to assess the current state of development. At least half of SLDs are conducted by Banks / Brokers, with dominating shares of the UK at 15,22%, the US at 14,2%, and France at 8,12%.

This rapid change can raise the question: what is behind all of this – hype or a rational approach? The answer to this question may lie not only in the moral aspect of this kind of investing but also based on its profitability and risk impact. Hence, this article aims to introduce the reader to this "new" type of product, a subset of the well-known ESG derivatives cluster, and analyses the place of SLDs in the structure of the financial markets with a focus on the current European market.

In the chapter "THEORETICAL BACKGROUND", the author provides an overview of the current state of development of climate finance, its regulation and new expected measures within the EU. The research is based not only on scientific articles but also considers a fair share of official EU regulatory documents and a report of international organizations. This background analysis is necessary to explain the role of financial markets, their ESG-linked financial instruments and their new subtype – SLDs in the current climate agenda. The next chapter, "RESEARCH OBJECTIVE, METHODOLOGY AND DATA", briefly describes data and data sources used to perform a systemic analytical approach, including the data from corporate reporting or stock exchanges. The chapter "RESULTS AND DISCUSSION" consists

of three subchapters: the first one contains analysis of current corporate reporting within the European banking sector to illustrate general trends and development of regulation within the banking sector; the second analyses the development of financial products on the stock exchanges, performing as a growth facilitator for the ESG-derivatives, and also provides some brief examples of ESG or sustainability rules and regulations introduced by stock/commodity exchanges; the last sub-chapter is focused on a transformation of well-known ESG-Derivatives in favour of economic transition, with examples of latest deals and challenges of their implementation. The section "CONCLUSIONS" summarizes all findings and formulates the potential development of this product.

2 THEORETICAL BACKGROUND

Climate policy is becoming one of the main components of implementing the EU Green Deal strategy (2019) and an instrument of competition. The EU is currently moving at a steady pace towards achieving "climate neutrality" by 2050. At the end of 2020, European leaders agreed on a new, more ambitious goal to reduce greenhouse gas emissions. By 2030, greenhouse gas emissions should be reduced by at least 55% from the values of 1990, while the original target was 40%. By 2050, the EU intends to phase out fossil fuels and replace oil and natural gas with "decarbonised" gases, primarily hydrogen. To do this, the EU redirects capital flows to climate projects, leading to concrete results.

In the scientific literature, climate finance is one of the hottest topics and is being considered in several areas. Considerable attention is paid to the impact of climate-related risks on the cost of capital and companies access to financing. Pizzutilo et al. (2020) studied the relationship between carbon risk and the cost of borrowed capital by analysing companies included in the Euro Stoxx 600 index. On average, a 100-basis point reduction in carbon intensity results in a 16-basis point decrease in the total cost of debt of large European companies. This allowed the authors to conclude that the cost of debt financing is related to the carbon intensity of companies within the European financial markets. Scatigna et al. (2021) confirm the financial market's role in fulfilling "climate neutrality" goals through the impact on funding costs and prove the existence of a carbon premium for firms with a higher carbon footprint. Moreover, investors are ready to pay a premium for social bonds rather than conventional ones.

Several studies reveal the impact of climate risks on the economy's financial sector. Kling et al. (2021) concluded that, on average, the cost of debt capital for companies with high climate risks is higher than for countries with low climate risks due to their vulnerability to climate change, which might have a significant implication for their economic development. Grippa et al. (2019) have identified two main channels of climate change impact on the financial system: material risks (damage to property, infrastructure, and land) and transition risks caused by changes in climate policy, technology, and behavioural patterns of market participants during adaptation to a low-carbon economy. The study by Semieniuk et al. (2021) highlights the growing awareness of transitional risks among the world's finance ministers, as evidenced by their joining an international coalition to advance climate action by integrating climate change issues into financial policy. Gunningham (2020) notes the importance of government regulation in addressing climate change, given market failures.

In this way, the growing role of institutional investors becomes apparent. At the EU level, authorities are keen to promote and regulate this emerging area to ensure that socially responsible economic activity is adequately financed while protecting investors from "greenwashing". According to Abdala et al. (2010), this term originated 90-es and refers to the whitewash expression – concealing one's errors and deceptions, causing one's reputation to

remain clean. Therefore, greenwashing denotes a greenwashing of the products or the organisation to look ecologically correct, even though it might be far from reality. Initiatives such as Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector seek to prevent "greenwashing" in the financial sector, while Regulation (EU) 2020/852 addresses the Taxonomy of environmentally sustainable economic activities aims to establish a common language to facilitate ESG-related discourse and disclosure.

Moreover, in 2023, the first set of KPIs for EBA Pillar 3 should include climate risks, mitigation actions and institutions' strategy, governance, and risk management framework. Disclosure of environmentally sustainable activities (Green Asset Ratio) based on the Taxonomy Regulation (Art. 8) starting from 2024. The last crucial legislative initiative within the Commission Legislative Proposals on Sustainable Finance (2018) is creating a new category of benchmark aggregates to help investors compare the carbon footprint of their investments. The legislation introduces additional disclosure requirements for asset managers and institutional investors to increase transparency for end/ retail investors on sustainability factors, including the impact of investment decisions on the climate. The new requirements cover the disclosure of information at the pre-contractual stage, in periodic reporting and on official websites. The document requires the European supervisory agencies to develop detailed regulatory technical standards to clarify the content and procedure for reporting information.

The European Commission pays special attention to integrating climate and environmental factors into the risk management system of banks and insurance companies, in which more progress is currently needed. For example, Riegler's (2023) context analysis of 234 publications confirms no agreement on a common definition of sustainable banking due to the absence of generally accepted / standardised sustainability indexes. Furthermore, the analysed definitions have a descriptive character that makes comparability impossible.

Nevertheless, the European Commission plans to amend the prudential requirements for banks to ensure they include ESG factors in their risk management framework. For example, in 2022, the ECB performed the first climate risk stress test for the banks under its supervision. It involved a sophisticated framework, long term strategic response and challenged the banks to collect meaningful climate metrics relevant to credit, market and operational risks.

Thus, an investment environment is currently being formed in the EU that facilitates the mobilisation of institutional investment in projects related to climate change. In this case, derivatives also play critical roles in improving access to the necessary transition amount of capital. The spotlight is on existing ESG-linked derivatives and their developing subcategories. That statement confirms in-depth research on the role of derivatives by the European Capital Markets Institute, Lannoo & Thomadakis (2020). Moreover, their analysis demonstrated a greater resilience of ESG-linked products during the market decline caused by the pandemic. It will be pivotal in accelerating the transition to a sustainable economy.

Furthermore, the research of Morningstar Investors by Hale (2020), performed during the pandemic, confirms that ESG-linked funds tend to perform better on a down market than conventional funds. These results can be confirmed by the empirical studies of the Morgan Stanley Institute for Sustainable Investing (2019) that covered a period from 2004 to 2018. The efficiency of ESG-linked products compared to peers can be explained by low reputational, political, and regulatory risks, which leads to more stable cash flow and increased profitability.

The idea of ESG-linked derivatives itself is not new. For example, weather extremum like unexpectedly heavy rains and heat waves directly affect business processes, according to Benth & Benth (2013). In 2004, Cao et al. (2004) described weather derivatives in detail. An interesting fact is that temperature-related deals were and are staying the most prevalent among

all the weather derivative transactions accounting for more than 80% of all trades. Since its inception in the late 1990s, the market for weather derivatives has grown steadily.

Chikhani & Renne (2021) analyse the growing role of so-called climate linkers. The authors assessed the impact of climate risk premiums on returns. They found strong sensitivity between the climate risk premium and potential damages due to the temperature increase or carbon emissions. Finally, Bloch et al. (2021) analyse the application of digital coupon swaps, where both parties of the contract can bet on the sea level rise, versus climate default swaps allowing two parties to bet on the sea level rise at different fixing times, thereby, the default is the first passage time until an upper barrier for the rise of the sea level is breached. An interesting finding is that analysing climate and weather time series exhibits different characteristics that need to be addressed by structuring weather derivatives.

Starting in 2018, the next step in a maturing product became available in the form of exchange-traded ESG derivatives (e.g. index futures) linked to various ESG indexes. Index futures fulfil an essential risk management function for investors, as they precisely reflect the performance of underlying ESG Equity indices and can be replicated. As a result, active asset managers may overweight or underweight certain constituents of the ESG equity index to pursue better returns. Moreover, the price interaction between the ESG Index futures and the underlying ESG index will contribute to the price discovery of the underlying assets.

However, there are also some challenges needed to be addressed. EUREX (2022), in its report "Derivatives markets 2022. Focus: Sustainability & investing", lists the following pain points for ESG derivatives development. First, there is a lack of homogeneity due to different internal ESG guidance, benchmarks, and targets between the investors. Also, through the increase of the index complexity, there may be some difficulties for investors. Secondly, a quickly changing ESG regulation can be challenging, especially forthcoming MIFID ESG adjustments.

Moreover, the regulation on a local level for the internal market may vary as well. Therefore, further harmonisation is needed to ensure joint product development and increased liquidity. EUREX intends to create a stable environment for listed ESG-linked derivatives to achieve more transparency and standardisation.

In 2019 a new subset of ESG derivatives – Sustainability linked derivatives emerged. Currently, a relatively limited number of deals can be traced. In January 2021, ISDA published the first overview of ESG-related products with a chapter dedicated to SLDs. These OTC products encompass ESG-related KPIs affecting the cash flow and are meant to create an incentive for sustainable behaviours of the counterparty. Blackburn (2021) systemised the results of consequent ISDA publications. Most frequently, the ESG goals are linked to ESG ratings, where the assessment is performed yearly by an independent rating agency. However, KPIs can also be linked to positive ESG contributions, renewable energy targets, business opportunities, responsible choices, and industry certifications.

The consequences if KPIs are not met may also vary, starting from the adjustment of the floating interest rate, the decline in supporting some innovative social projects or even an obligation of charitable donations. Hence, these contracts need to be standardised and highly customisable. Most of the reported deals are structured as Interest - or FX-rates swaps or forwards with an initial aim to hedge Interest and FX risks. However, there are also some cases of credit derivatives linked to the CDS index. Baker (2022) focuses on the unique advantages of ESG Derivatives, such as hedging ESG-related risks, data integrity and standardisation, and potential shortcomings for CDS. For example, in the current SLD market, either the seller or a third party decides whether the ESG metrics of the contract are met. As with the CDS definitions, these are decentralised solutions with implicit conflicts of interest and the potential for conflicting market decisions. If the seller has a financial interest in the determination, the seller has the

incentive to make a decision that aligns with its economic interest. For example, there are SLDs for which the Dealer Bank will face a discount or penalty due to ESG compliance. However, the author also notes that the SLD market is currently too small to be a source of systemic risk.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

This research aims to answer whether SLDs are only a "fashion trend" and an element of "greenwashing" or a new subcluster of ESG-linked derivatives. To answer this question, we need to address scientific literature research and provide an overview of market development. Considering that the market for ESG-linked products is actively developing, and SLDs can be described through a limited number of deals, the following sources of information can be used:

1. **Stock Exchanges** contain information on products and their specifics: EUREX, Nasdaq, CBOE, CME, Euronext, ICE, Chicago Mercantile Exchange and London Metal Exchange.
2. **Market indices:** STOXX ESG EUROPE 600, Domini 400 Social Index, OMXS 30 ESG Futures, The MSCI World, ESG Screened Index Futures, The EURO STOXX50 Low Carbon Index Futures, The S&P 500 ESG Index Options, Euronext Eurozone ESG Large 80 Index Futures.
3. **Corporate reporting for FY 2020–2022:** direct communication from top EU-market banking sector players (investor relations reports, ESG Policies, data packs and year-end reporting). For detailed sources of information, please see the list of literature, section Corporate Reporting (investor relations materials) and market analytics (42–62)
4. **Insights from international organisations**, such as International Swaps and Derivatives Association

4 RESULTS AND DISCUSSION

4.1 A brief overview of corporate reporting on ESG finance

A brief review of corporate reporting was performed for ten top-tier banks active in Europe to illustrate the development of the sustainable finance market. However, the table 1 below includes information only on those banks with precise numbers and where it was possible to trace their development. As expected, due to the obligatory sustainable finance disclosure regulation, banks tend to provide a detailed description or more information on "sustainable finance" products starting in 2021. Usually, this information is to be found in ESG Overview, Sustainability Report or Green (Funding) Framework. These reports generally contain information not only on social responsibility and governance but also provide an overview of business sectors where the bank is involved.

Interestingly, banks use different approaches to report their sustainable finance activities. Some provide aggregated numbers for years (e.g. UBS). Others report sustainable investment and responsible, climate and social impact finance in different tables/sections, such as ING. HSBC even provides a data pack in Excel with a split of volumes per product group for the last three years. Hence, the table below should be interpreted carefully, as its basis may vary slightly from bank to bank and their "definition" of sustainable products palette. To enhance comparability, the table below has a ratio of "sustainable finance" investments to the bank's total assets, even though those sustainable finance might have different setups.

The most extended detailed history can be found for UBS, which provides a ratio of sustainable investment to invested assets for the consequent five years from 2018 to 2022: 0,8%, 1,50%,

3.4%, 5.5% and 6.8%, respectively. Moreover, UBS has adjusted their ESG-investments reporting, as in 2020, their sustainable investment definition included "ESG integration", which created much higher volumes and was excluded starting from the 2021 reporting. For example, after this adjustment, sustainable investments for the financial year 2020, previously reported as high as USD 793 billion, turned into USD 141 billion.

Tab. 1 – Extract from Corporate reporting – investment in sustainable products in billions.
*Planned numbers.

Source: own research, banks corporate reporting.

#	Bank	2020	2021	2022
1	UBS	141	251	268
		12,52%	22,47%	24,27%
2	Société Générale	80,8	157	*300
		4,84%	9,06%	20,18%
3	Commerzbank	103	194	246
		17,79%	34,66%	52,68%
4	HSBC	44,1	82,4	84,2
		1,49%	2,78%	2,81%
5	ING	X	87,7	125
			7,81%	12,15%
6	UniCredit	X	36,6	57,7
			3,99%	6,28%
7	Deutsche Bank	X	X	*200
				14,96%

Hence, consequent changes in sustainability regulation within Europe lead to standardisation and comparability of results. The focus of the reporting, which differed noticeably from that of the other banks examined, could be traced back to the legal environment on the one hand. On the other hand, UBS is mainly active in the investment business. In contrast, the other banks examined generate large parts of their sales in private and corporate customer business, which explains the focus on sustainable asset investments.

Société Générale's business is divided into three divisions, each contributing approximately equal amounts to the bank's net income (French Private Banking, International Private Banking and Financial Services, and Global Banking and Investors Solutions). An interesting observation is that till 2021 Société Générale used mostly the term E&S and thus was mainly focused in its reporting on only two of the three ESG components, the environmental and the social component. Consequently, provided numbers in the table above are primarily based on the investment into ESG-linked and sustainability-linked bonds. Therefore, the bank does not offer a comparative volume of investments into sustainable assets or finance.

Commerzbank reported in 2022 a good development of sustainable products, which included advisory products (ESG- and sustainable bonds transactions, sustainable investment solutions, asset management and brokerage) and loans (green mortgages, renewable energy loans etc.). The segment of loan products has shown a considerable increase, especially renewable energy loan portfolio, sustainability-linked loans and KfW sustainability-linked programs. The total increase compared to 2021 is 55% or EUR 41 billion. The presence of KfW sustainability-

linked programs (or so-called German government subsidised loans) explains a considerable increase in the ratio between "sustainable finance" and total assets within the last two years. The "Private & Small-Business Customers" segment has also shown a 38% growth (EUR 17 billion increase). That segment includes Asset management, securities advisory and brokerage, Commerz Real products, and Retirement solutions. This difference can be explained through the extended scope of included advisory products.

HSBC provides an ESG data pack with environmental, social and government metrics. Based on its sustainable finance portfolio, we can see an increase in sustainability-linked loans by 10.7 times within the last two years (from 2.3 in 2020 to 24.6 in 2022), green bonds by 62%, green loans by three times from USD 2.1 billion and sustainable trade instruments in 32 times from USD 0.1 billion. Additional growth comes from the "sustainable investment" section from USD 0.7 billion to USD 7.5 billion.

In 2020, UniCredit reported an increase in the ratio of social bonds to total bond issuance rising from 5% in 2019 to 15% in 2020, which is 119.7 billion. In addition, its investments in renewable projects were 6.1 bn and around 2.2 bn in energy-efficient loans. However, the report "Task Force on Climate-related Financial Disclosures" (2021), for some reason, includes the numbers till the first half of 2022, which makes the comparability with the Integrated Report for 2022 a bit complicated. Environmental lending, ESG investment products and sustainable bonds in the Task Force report contribute to EUR 36.6 billion. The results for these three categories in 2022 are 52.9. Another category disclosed is "social lending" (lending for High Impact and Disadvantaged Areas), around EUR 4.8 billion.

Deutsche Bank's sustainability strategy set cumulative sustainable financing and investment volumes since January 2020 of over € 200 billion by the end of 2022 and € 500 billion by the end of 2025 (excluding DWS). There is no other information in this section on sustainable finance in the Annual Report 2022. However, the ESG products attracted net inflows of € 1 billion in 2022 despite the adverse environment. ESG-dedicated funds accounted for 40% of total annual net inflows, totalling EUR 48 billion.

4.2 Stock exchanges as growth facilitators for the ESG-derivatives

To start our analysis, looking at the state of development of ESG-linked derivatives by stock exchanges would be beneficial. One such example is index futures, which institutional investors widely use to hedge securities portfolios. ESG index derivatives perform the same functions but are calculated based on the prices of instruments issued by companies that meet a set of ESG criteria.

At the same time, the indices themselves are built on different principles: "negative screening" - exclusion of companies share whose income is based on activities that do not meet the goals of sustainable development, for example, revenue from the production of tobacco, alcohol, weapons, processing of fossil resources, gambling etc.; evaluating companies that adhere to ESG principles to select the best companies in their class and include them in the benchmark index according to their obligations; construction of a specialised index focused on the participation of issuers in solving specific problems in the field of sustainable development (thematic index).

By having a specific integrator in the form of a stock exchange or specialised index provider (e.g. MSCI Inc, EUREX, Nasdaq etc.) responsible for building the index and its ongoing valuation, a specific integrator is responsible for constructing the indexes, providing a complex benchmark standard and obtaining transparent price information necessary for the specification of a fixed-term contract. The first ESG index, the Domini 400 Social Index, was introduced in

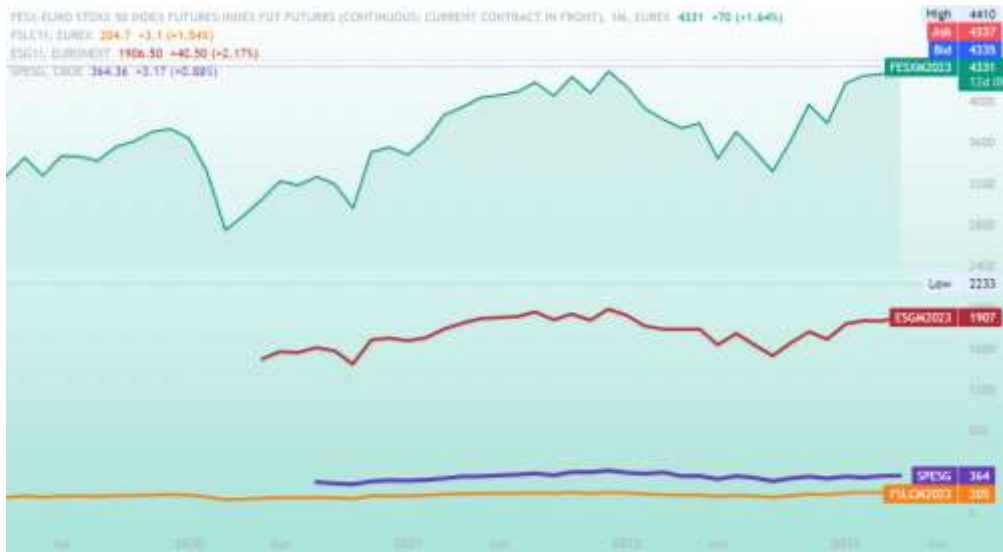
1990. Since then, the number of calculated ESG indices has exceeded one thousand. In addition, since 2018, several futures exchanges, including CBOE, CME, Euronext, ICE, and Nasdaq, have started trading futures and options on several ESG indices (see Table 2 below).

Tab. 2 – Examples of exchange-traded index ESG derivatives. For more details, please see Fig. 1.

Source: own research.

#	ESG derivatives	Underlying asset	Launch Date Market
1	OMXS 30 ESG Futures	ESG version of the OMX Stockholm 30 Index, which excluded companies with income from activities, contrary to the goals of sustainable development	15. 10. 2018, Sweden
2	The MSCI World ESG Screened Index Futures	Shares traded on the Intercontinental Exchange (ICE) are included in the MSCI World Index, which excludes companies related to producing weapons, tobacco, thermal coal mining and oil sands, etc. and does not comply with the requirements of the Global UN treaties. (Fig.1, FESXM2023)	5. 11. 2019 World
3	The EURO STOXX50 Low Carbon Index Futures	EURO STOXX 50 Index Adjusted for Level Assessment carbon emissions, using weighting factors based on market capitalization multiplied by the corresponding carbon intensity ratio. (Fig.1, FSLC11, EUREX)	9. 11. 2020, Europe
4	The S&P 500 ESG Index Options	The S&P 500 index, which excludes companies whose shares apply on CBOE, with the worst ESG indicators. (Fig.1, SPESG, CBOE)	21. 9. 2020, USA
5	Euronext Eurozone ESG Large 80 Index Futures	Euronext Eurozone ESG Large 80 Index - Benchmark European Union in terms of sustainable development with a particular focus on the problems of "energy transition". Futures are developed jointly by Euronext with Vigeo Eiris, an affiliate of Moody's, in collaboration with market participants. (Fig.1, ESG1! EURONEXT)	1. 6. 2020, EUROPE

Fig. 1: Market data to illustrate a couple of examples of exchange-traded index ESG derivatives.



Source: own research & EUREX / TradingView

Despite the prominent positive properties (transparency of indices, incentives for companies to create investment products focused on sustainable development, etc.) of ESG index derivatives, the activity of exchanges in this segment is low. For example, in a year and a half since the start of circulation of STOXX ESG EUROPE futures, trading volume continues to be below the average daily trading volume as of the end of October 2020. The volume of ESG index futures was no more than 4% of the volume for contracts on the traditional index. Nevertheless, the notional volume has grown almost three times since December 2020, up to EUR 8 million, and amount of lots has reached 273,630, with 92,437 throughout the first quarter of 2023.

Fig. 2: Volume of STOXX ESG EUROPE 600 and STOXX EUROPE 600.



Source: own research & EUREX / TradingView

Several derivatives exchanges have taken measures to specialise in the sustainable development of the commodity derivatives segment (e.g. Chicago Mercantile Exchange and, therefore, the London Metal Exchange). This affected the introduction of requirements for the sustainability of traders through the tightening of conditions for its suppliers, the introduction of transparency

elements (the Malaysian Exchange), the listing of the latest products, which are focused on the transition to a low-carbon economy or sustainable fuels, also as for climate risk management (European Energetic Exchange AG).

Currently, EU Emissions Trading Schemes (EU ETS) are available because of the US Regional greenhouse emission Initiative (ETS) and, therefore, the California Cap and Trade program. Futures and options on the so-called renewable identification numbers (Renewable Identification Numbers, RINs) are traded on the ICE Intercontinental Exchange - documentary evidence identifying specific batches of biofuels blended with fossil fuels. The Energy Policy Act of 2005 establishes annual quotas determining what percentage of such fuel must be within the total amount of motor fuel consumed. At the equivalent time, RINs themselves are the topic of trade, which made it possible to form them at the bottom of the asset of the respective derivatives. In addition, ICE and European Energy Exchange offer futures and options on instruments, almost like the RINs utilised in the electricity market, called "green" certificates (Renewable Energy Certificates, RECs).

Several "green" initiatives associated with introducing restrictions on the content of harmful substances in certain commodity assets provoked a rise in volatility within the relevant markets. To effectively manage price risks related to the increase in demand for commodity assets with a more environmentally friendly content, some exchanges have introduced derivatives following existing underlying assets, i.e. CME and ICE have begun trading in low-sulfur heating oil settlement derivatives that suit International Maritime organisations (International Maritime Organization, IMO 2020). In addition, in December 2018, the Singapore Exchange introduced swaps and futures for 65% high-grade ore. More than 20 years ago, another sort of derivative appeared related to the climate direction of sustainable development - weather derivatives, which permit protection against adverse weather changes. Consistent with some reports, 25–42% of the US GDP is sensitive to weather changes, and about 70% of companies are hooked on weather disasters. The primary organised trading in air temperature futures happened on the Chicago Mercantile Exchange in the late 1990s, when many companies faced the danger of severe financial losses thanks to a strangely mild winter. Later, derivatives for other indicators appeared: air pressure, humidity, precipitation, and wind speed.

4.3 ESG-Derivatives: transformation in favor of economic transition

ING claims to be the first bank, which develops a concept of sustainability-linked loans in 2017 (collaboration with Philips on a EUR 1 billion syndicated loan). In 2019 the same bank issued the first sustainability improvement derivative in cooperation with SBM Offshore to hedge a five-year \$1 billion floating rate of a revolving credit facility. The fixed rate within this contract is impacted by SBM's ESG performance, which is accessed on a yearly basis by Sustainalytics. That also confirms ISDA (2021, "a") calling this type of financial product a "Sustainability-Linked Derivative" (SLD). And since then, an increase in trading of these derivatives has been observed primarily in European markets and the US and Asia-Pacific regions. Currently, existing SLDs are comparable to classical "plain vanilla" derivatives, often used to hedge interest rates or currency risks. However, these instruments include additional terms / KPIs, which impact payoffs and other parties' obligations depending on one or both ESG obligations' performance. The generated cash flow is tied to the underlying transaction payments. KPIs can influence the spread of each payment date. Alternatively, the premium payment is made on each or final payment date. However, some deals are structured with the link to the re-evaluation for KPIs (e.g. monthly, quarterly or annually) or as one-off payments.

The following types of SLDs are currently available:

1. **Interest Rate SLDs** are usually structured as an interest rate swap with a provision that increases or decreases the effective rate based on that company's future ESG performance against metrics fixed in the contract. Moreover, the agreement fulfils the initial purpose of the interest rate swap – it protects the company against potential higher interest rate fixings. If it meets its sustainability targets, it will effectively enjoy reduced interest expenses on bank debt. One of the recent examples, in March 2023, ING closed US\$400 million SLD for China's technology provider Ant Group. The underlying KPIs are material to the company's operations. For example, this tech giant is determined to apply green computing algorithms to reduce Scope 3 emissions by improving servers' efficiency to achieve sustainability goals. In case of achieving these goals, the company is entitled to a discount from the bank. Conversely, if none of these targets is met, the company must pay back a pre-agreed amount to the bank.
2. **Foreign Exchange SLDs** (hereinafter FX SLDs) The currently existing market agreements oblige counterparties to invest in different ESG projects (e.g. reforestation) or donate to charities. For example, Enel S.p.A., in September 2019, hedged its exposure through the sustainable-linked Cross-Currency Swap (hereinafter CCY Swap). Enel got a discounted rate for the swap based on its commitment to sustainability by Société Générale. In addition, the bond is linked to the increase of renewable electricity generation by 10% by December 2021. Otherwise, the interest rates on the bond will rise. Based on ISDA's (2021; "a") extended overview of performed transactions, the most typical FX SLD are CCY Swaps or FX options.
3. **Credit SLDs.** Credit derivatives can also encompass ESG components through the ESG-specific CDS index. One of the first indexes was launched in May 2020. IHS Markit created the iTraxx MSCI ESG Screened Europe Index based on ESG criteria. This index is a broad European corporate CDS index. Meanwhile, there is also LCH CDS-Clear, launched in September 2020. The index includes CDS contracts on companies meeting various ESG criteria. Overall, the index can be seen as a macro instrument to hedge investment for firms under long exposure to a portfolio of ESG companies. Hence, the changes in CDS spreads might also be partially explained by the ESG risk.

According to ISDA (2022, "b"), survey interest rate swaps (hereinafter IRS) were identified as the underlying product for the majority of SLD transactions, followed by foreign exchange (FX) swaps and cross-currency swaps. However, CDS, equity derivatives or commodity derivatives are still staying rare.

Based on the performed review of corporate reporting (see section 4.1), including investor relations materials and ISDA research (2021, "a"; 2022, "a", "b"), it is possible to conclude that SLDs remain a not very common financial vehicle in comparison to more traditional ESG-linked derivatives, briefly addressed in the chapter before. Meanwhile, there are obvious benefits for both sell- and buy-sides: easy step to integrate ESG in a daily business provides better conditions in comparison to conventional products in case KPIs are met, helps to hold accountability for ESG goals, and positive signal to shareholders due to increase of ESG-linked market profile, and in general, it helps to stand out from the mass of other competitors (e.g. ING policy within last six years).

One of the critical challenges may be seen in traditional reporting requirements, as SLDs remain OTC contracts with ESG overlay. For example, the following requirements might be applied: obligatory trade reporting, risk mitigation (e.g. portfolio reconciliation) and margin requirements, as well as certain transparency requirements on conducted trades with some counterparties. Further regulatory considerations were analysed by ISDA (2021, "c") for

European, UK and US markets. Following the EMIR classification of clearing categories, group 1 can be directly classified as derivative, disregarding its ESG overlay. Surprisingly, group 2 is likely not affected by the strict EU regulations, as its cash flow does not directly relate to financial instruments unless this is not carbon derivatives or credit risk transfer.

In its attempt to standardise SLDs, ISDA (2022, "b") issued recommendations on embedded KPIs which should include the following qualities: specific (e.g. numerical as possible) and well documented; measurable (quantifiable and objective); verifiable through the industry benchmarking and transparent; the chosen KPI should focus on sustainability (e.g. consistent with ESG strategy, and ensure a significant contribution to ESG goals). In addition, these principles should ensure that KPIs are contractually enforceable. Moreover, it is also important to remember that variable SLDs' components might have tax and accounting consequences.

The market participants also confirm that a standardised approach is needed to document IRS, CCY and FX derivatives ISDA (2022, "b".) Current market practice is to document the embedded KPIs of SLD within the trade confirmations. However, some clients prefer to fix it in a separate agreement referenced in trade. Interestingly, project financing and other loan-linked hedging transactions may contain KPIs in the ISDA agreement. As expected, KPIs may vary due to the business specific. However, about half of the known SLDs encompass KPIs focused on greenhouse gas emission reductions, followed by ESG ratings and renewable energy ratios. Relatively rare are KPIs linked to ESG-rated investments and diversity targets.

There is only a unified approach to the consequences for the counterparty if it satisfies its obligations regarding the ESG component of the agreement (e.g. non-payment of premium), even though the standard part of the derivative transaction is timely implemented. In some cases, it would lead to default due to missing payment. In other cases, it would just increase a fixed rate through the penalty premium, as it is seen as an inability to meet ESG KPIs.

5 CONCLUSIONS

Within the last three years, the European market has shown a considerable improvement in sustainability. Currently, Europe is the leader in the volume of investments in ESG-related funds. These changes are encouraged by the regulatory authorities and local governments. The financial sector (e.g. banks) has to play a significant role in the green deal transition by providing the necessary financing. Based on the corporate reporting, it is possible to conclude that the amount of sustainability-linked financial products at least doubled within the portfolios of the significant European financial institutions. Moreover, after the introduction of obligatory disclosure for ESG, banks intend to include more information on their ESG activities, even though the reporting approach varies greatly.

The market for SLDs started to grow slowly in 2019 at a much slower pace than standardised stock exchanged ESG-linked derivatives or ESG-linked products in the bank portfolios. For now, it stays a niche market. This slow pace can be explained through the high degree of individuality SLDs depending not only on their OTC nature but also on a possible structure of integrated ESG overlay. Within the last four years, some standardisation attempts were performed by ISDA through the development of guidance on possible KPIs structure. However, if one considers the guiding rationale of these products, it becomes apparent that standardisation might also be counterproductive.

Nevertheless, standardisation would harmonise the market and lower the entry barriers even though the hedging strategies/approaches must be tailored to specific clients' needs. Additionally, due to the high degree of individuality, implementing SLDs is time-consuming.

Therefore, some experts, such as EUREX, still see more potential in the standardisation and development of ESG-linked exchange-traded instruments and set it as a priority.

Despite all existing complications, SLDs can facilitate the market transition to sustainable business models. These products can allow companies without direct access to capital markets to demonstrate their development and attitude to sustainability. Typically, medium- and small-size companies rely on bank financing and do not publish their reporting. Hence, ESG-linked products (incl. SLDs) become a statement to communicate their participation in the green transition. However, greenwashing remains a potential problem for the industry and investors.

Most respondents in the ISDA (2022, b) survey mentioned that structuring SLDs takes considerable time. Hence, the earlier treasury learns how to deal with this type of new product (also through communication with the banks and other market participants), the quicker the process will be. Another concern related to SLDs is the influence of a product on daily performance measurement (e.g. KPIs should not affect it), as ESG-component analysis and improvement of its performance require a decent amount of time.

Hence, the performed review of existing regulation, patterns in ESG investments and market data allow assuming that there will be further development of sustainability-linked derivatives as it is encouraged from both sides: by the regulatory authorities and the market participants who currently use them more like a statement of their green policy intentions.

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Methods for Calculating Real Estate Value at Risk

Frederik Schröder

Abstract

The calculation of value-at-risk (VaR) has long been a problematic topic for real estate portfolios. The difficulties arise mainly from the lack of suitable data, the lack of transactions, the non-normality of returns and the special character of real estate. In addition, specific risks remain hidden in the real estate portfolios, so risk measurements based on standard methodologies do not exactly reflect the risks of a real estate portfolio.

In this paper, different VaR models are examined for their suitability for estimating the risks of real estate portfolios. In the second step, the specific properties of real estate and the associated influencing factors on the risk are examined and approaches to measurement are discussed. The paper contributes to the literature on real estate risk management by discussing methods for estimating the risk of real estate portfolios and considering the characteristics of real estate investments. It provides approaches for more precise measurement of real estate risk.

Keywords

Risk Management, Value at Risk, Real Estate Finance

JEL Classification

G32, G11

1 INTRODUCTION

Black Monday on October 19, 1987, was the first major stock market crash after World War II and began on the Hong Kong Stock Exchange. A few hours later, the Dow Jones fell by more than 20% in one day, triggering the development of new risk metrics. This was the first major financial crisis in which practitioners and supervisors became concerned with the possibility of global bankruptcy. Given existing statistical models, the collapse was so unlikely that the crisis could easily be repeated. Therefore, there was an urgent need for action to revise the risk models. In particular, the occurrence of extreme events had to be investigated much more intensively and included in the models. Limitations of traditional risk measures were acknowledged, with improved measurement of risks of a major decline in asset value has become an urgent task. In the following decade, a new measure of risk was developed. The Value at Risk, regularly abbreviated by the acronym VaR, quickly became standard in the finance industry. The VaR model works in such a way that the greatest percentage loss is determined with a given probability, the so-called confidence level, during a given period. In other words, for a given portfolio and time horizon, and having selected a confidence level, VaR is defined to be that threshold value, such that the probability of the mark-to-market loss in the portfolio exceeding this value is exactly the preset probability of loss. In principle, the convention is that the greatest loss is expressed as a positive value.

At the end of the 1990s and the beginning of the new millennium, the Basel II financial regulation led to the widespread adoption of VaR as a measure of risk worldwide. With the implementation of Basel III, another risk indicator, the expected shortfall, will also be introduced in parallel. However, the financial supervisory authority regularly requires the VaR of portfolios of different asset classes to be determined and sufficient capital to be held to cover

the losses forecast by the VaR. The financial supervisory authority proposes a standardized approach but leaves open the possibility of developing internal models. When considering the risks of real estate, specific real estate characteristics must be taken into account. Therefore, the basic suitability of VaR as a risk estimator or its adequacy for risk budgeting purposes has long been discussed in the literature (Pflug, 2000; Rodríguez-Mancilla, 2009; Krokmal et al., 2011). This point is not examined further in this analysis, since for regulatory reasons the VaR has been determined for the calculation of the required economic capital to be held. Thus, the use of the VaR of all regulated companies is mandatory and it is only necessary to identify and select the optimal VaR model or the VaR model with the fewest restrictions. Since the late 1990s, there have been systematizations of VaR models as a whole (Duffie and Pan, 1997), but systematic overviews of the special requirements of real estate portfolios are largely ignored.

When assessing and afterwards managing risks in a portfolio, the idiosyncratic risks of real estate that differ from other asset classes must be taken into account. In the context of portfolio theory or the capital asset pricing model, idiosyncratic risk is understood to mean the part of the risk that can be reduced by risk diversification of the portfolio. Managing unsystematic risk can thus reduce the risk position in a portfolio. Thus, the determinants of idiosyncratic risk also move into the focus of this paper. According to the research of this paper, a complete listing of the determinants acting on the unsystematic risk is not yet available.

This paper elaborates a systematic survey of current VaR models from the literature in section 2. The different models for determining VaR and determinants of idiosyncratic risk are elaborated from the existing literature without claiming to be exhaustive. The findings are presented in Section 3. Section 4 includes a summary of the findings, limitations, and recommendations for the choice of models. Section 5 then concludes the paper.

2 METHODS

This study aims to answer the following two research questions. Which VaR method is best suited to calculate the real estate risk of a portfolio? And which determinants are most suitable for measuring the idiosyncratic risk of real estate portfolios? To answer the proposed research questions, an extensive literature search and a qualitative literature analysis were carried out.

For this purpose, the following databases/library catalogs were used for literature searches:

- Google Scholar
- Google Search
- SpringerLink
- Elsevier (Scopus)

The following search terms were used as part of a targeted literature search:

- Value at Risk
- Value at Risk Property
- Value at Risk Real Estate
- Risk measurement Property
- Risk measurement Real Estate
- Idiosyncratic Risk Property
- Idiosyncratic Risk Real Estate

The literature research identified 52 potential sources, 31 of which were identified as relevant sources. All sources that corresponded to the generally valid scientific requirement for the level of detail and quality of the elaboration were classified as relevant. These are all scientific publications and articles in scientific journals. These are mainly more recent works with a publication date above 2005. A few works explaining generally accepted scientific foundations are even older than the previously mentioned ones. The oldest work used is the 1997 publication an overview of value at risk (Duffie and Pan, 1997), and the 1996 publication calculating value-at-risk (Fallon 1996). The most recent work used is Volatility and the Cross-Section of Real Estate Equity Returns during Covid-19 (Milcheva, 2022).

The methods for calculating VaR have already been the subject of extensive research after the VaR was introduced in regulatory and banking practice. Basic articles on the assessment of VaR and the methods used to determine it have already been published. From these publications, the common methods that have been examined in the literature of this review for determining the value at risk in real estate portfolios are first worked out, without claiming to be complete or using a per se consistent system. In the next step, the basic functions of the VaR methods are presented. This is followed by a presentation of the main differences between the different methods for determining the VaR for real estate portfolios using quality criteria such as the robustness of the method or the effort to be made. This is followed by an examination of the methods for calculating the VaR about the extent to which the specifics of real estate portfolios are considered. The literature on VaR related to real estate investments is generally sparse, yet some studies focus on risk management and real estate risk assessment. Thus, it is common ground that, for practical reasons, real estate investors are forced to treat immovable property differently from other asset classes. The specifics of real estate portfolios and the associated risk positions can be measured by determinants and are identified by this paper (Booth et al., 2002; Amédée-Manesme et al., 2015). From the measurement of these risks, a classic management control cycle can be initiated and thus the risks can be more efficiently controlled. The control of risk is not the subject of this work either at the level of facility management of the property or in the selection of the individual property for the portfolio. Nevertheless, the management of these determinants in a portfolio opens the possibility of actively influencing the idiosyncratic risk and thus reducing the overall risk position of the portfolio. The current economic, political, and geopolitical situation has repositioned the view of real estate as an asset class. In particular, the considerable rise in interest rates in the euro area and Europe means that it is becoming topical to be able to determine the risks from real estate portfolios as precisely as possible. By specifically including property-specific determinants in the determination of VaR in real estate portfolios, this paper provides a contribution to the current discussion.

3 RESULTS

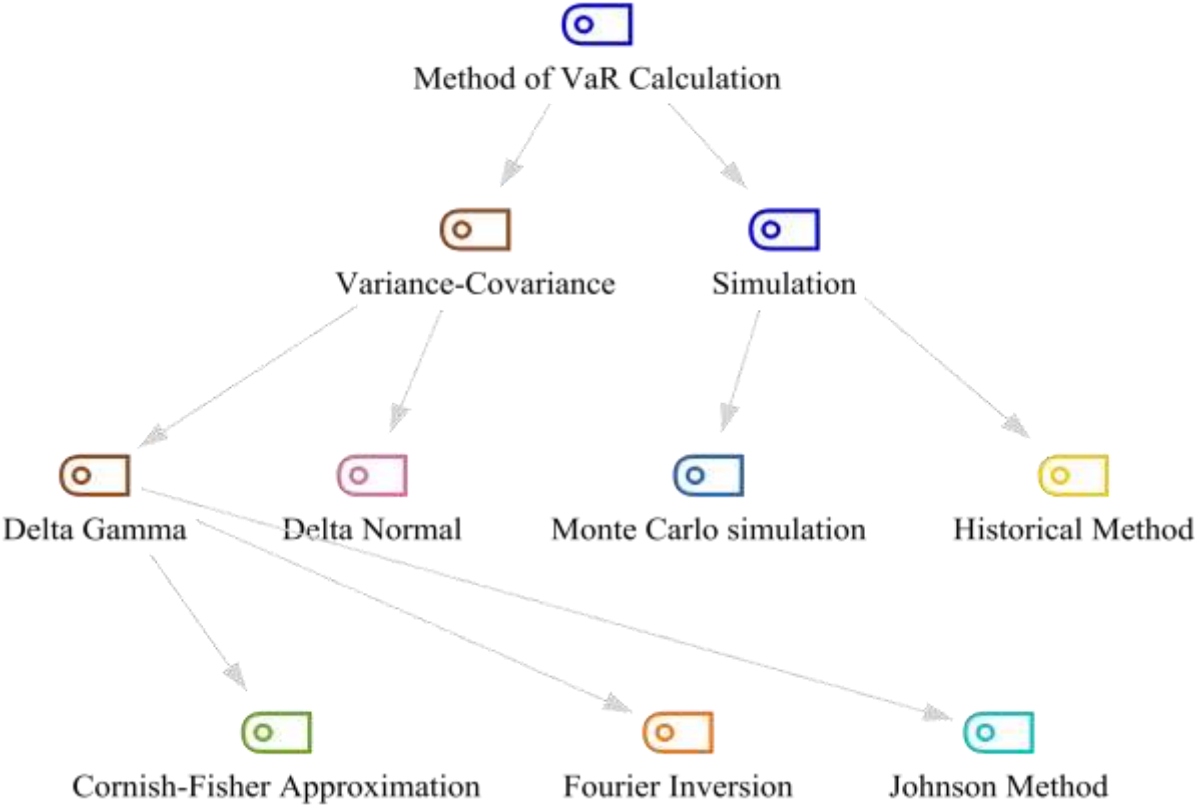
First, the different methods for calculating the VaR are systematized to be able to assign the different calculation methods mentioned in the literature to the basic species. Basically, the calculation methods can be divided into two different approaches. Based on this, the various idiosyncratic risks are examined in the assessment of risks from real estate portfolios.

3.1 Systematization of Value at Risk Calculation

In the current state of research, many publications generally deal with different methods for determining VaR and discuss the different characteristics of the methods. A widely used approach to systematizing VaR methods is the division into analytical methods and simulations.

This division into analytical methods on the one hand and simulations on the other is applied below. Since there is currently no scientific work that also differentiates the different methods for determining the VaR considering the specifics of real estate, those methods of VaR Calculation are used, which were found in more than two papers in the context of the literature search. The different methods of VaR Calculation are shown in the following graphic.

Fig. 1: Hierarchical Model of VaR Calculation Methods.



Sources: Own research.

The variance-covariance method is also known as the parametric method. VaR is determined directly as a function of the standard deviation of the portfolio return, calculated from the variances and covariances of market factors. As a rule, the return is subject to a normal distribution. This does not always have to be the case, as well as, for example, a t-distribution could be assumed, which allows a better representation of outliers. To perform the calculation, variances, and covariances of returns must first be estimated from historical data. The advantages of variance-covariance are the low computational effort and the possibility to perform an if-then analysis. Problems arise when the returns of the portfolio under consideration depend in a non-linear manner on the underlying risk factors, which is the case, for example, with options. The distribution of portfolio returns then shows a skewness and is no longer normally distributed. Another advantage of the concept is the future orientation of the method. The variance-covariance method exists basically in two variants, the delta-normal approach, and the delta-gamma approach. The delta-normal approach assumes that the market values of the positions in the portfolio react linearly to changes in risk factors and is therefore suitable for calculating the risk of portfolios with symmetric profit and loss profiles. The second method of the variance-covariance model is the delta-gamma approach. This considers the change in the delta by another key figure. The gamma indicates the rate of change of the delta with respect to the (Miller, 2019; Fricke, 2006) change of the determinant. The delta normal method leads

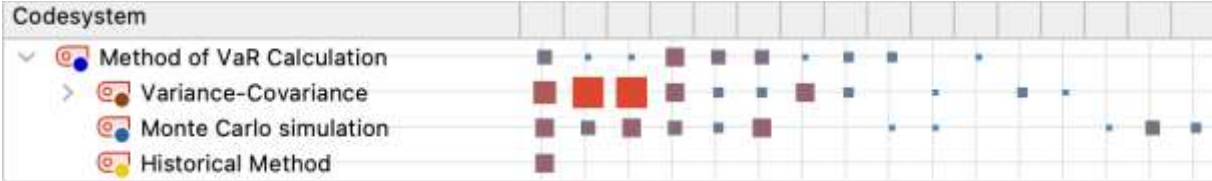
to incorrect risk forecasts if options are included in the portfolio under consideration. The extent of the error grows with the portfolio share of asymmetric products. As an alternative, the delta-gamma method is proposed to solve the problem. The application of the delta-gamma method provides more accurate value-at-risk estimates than the delta-normal method for portfolios with optional products. Nevertheless, even with the delta-gamma method, erroneous risk assessments occur if the remaining term of the option is close to zero. With the Cornish-Fisher method, the quantile of a distribution function can be estimated based on the first four moments (expected value, standard deviation, skewness, and kurtosis). The method allows a better estimation of VaR when the normal distribution hypothesis is violated (Cornish and Fisher, 1938). The Fourier inversion method is also used to calculate the nonlinear VaR model for an option portfolio (Mina and Ulmer, 1999). If data is not normally distributed, one of the possible countermeasures is to transform the data with the Johnson transformation (Johnson, 1949).

The Monte Carlo simulation is a comprehensive simulation on the computer. Market price changes are simulated in many different scenarios (e.g. 10,000 scenarios). In this method, the entire distribution of the change in the value of the portfolio is generated and the VaR is derived as a corresponding quantile from this relative frequency distribution. This also leads to the term Full Valuation Method. The flexibility concerning distribution assumptions can be regarded as the greatest advantage of Monte Carlo simulation. This increases the estimation effort accordingly. A disadvantage is the high computational effort in the case of complex portfolios (Miller, 2019).

The historical simulation is similar to the Monte-Carlo simulation. The difference is that the value changes are not generated utilizing a random number simulator but are derived directly from historical data. It is assumed that the price development and the fluctuation intensity will behave similarly in the future and can thus be concluded about the future. Consequently, no explicit distribution assumption is necessary. The historical simulation is easy to use if there are enough observation values that are considered representative (Wolke, 2016).

To analyze the relevance of the VaR calculation methods, the frequency with which the models are generally mentioned in the literature examined is examined. The methods for calculating VaR are shown at different levels in Figure 1. For better comparability, the systematization of the methods at aggregated levels is used in Figure 1. In this way, the methods can be divided into variance-covariance method, Monte Carlo simulation and historical simulation. The frequency with which the models are mentioned in the literature is shown in Figure 2 below.

Fig. 2: Frequency of the VaR calculation methods.



Sources: Own research.

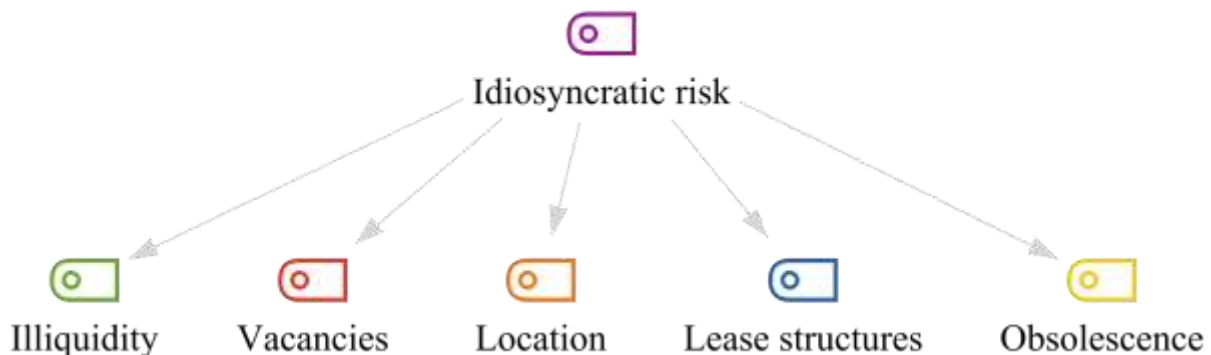
In the figure, the three methods are shown in the rows and columns mentioned in the respective references. The size of the squares represents the frequency of mention within a literature source. It becomes clear that the most mentioned method is the variance-covariance approach. In further differentiation, delta-normal methods were taken up in 11 works, whereas the different delta-gamma variants were used in 20 literature sources. Subsequently, the Monte Carlo simulation is the second most frequently mentioned in the literature and is thus the method among the simulation methods that are much more frequently investigated in the

literature. The historical simulations are only occasionally used in the literature to determine the risk of real estate portfolios.

3.2 Idiosyncratic Risks

Unsystematic or idiosyncratic risks refer to the risk of a single investment or the risk of a single property in a real estate portfolio. This risk can be significantly reduced in a portfolio through diversification, i.e. the diversification of the investment across many investments. With a widespread, the proportion of a single property is very small. It is important in a portfolio that the unsystematic risks are not strongly positively correlated. To manage these risks, these specific risks must first be identified. In the literature research, a total of seven different risks were identified, five of which have been mentioned more than three times and are therefore shown in the chart below.

Fig. 3: Hierarchical Model of idiosyncratic risks of real estate portfolios.



Sources: Own research.

This list of the specific risks of real estate shows that these risks can also occasionally occur in other asset classes. In particular, illiquidity has already occurred more frequently in many other asset classes, especially in stressful situations. Thus, it is common ground that, for practical reasons, real estate investors are forced to treat immovable property differently from other asset classes. However, the basic existence of these five idiosyncratic risks is only the case with real estate. Consequently, when assessing the risk of real estate portfolios, these specific risks should be taken into account. In a subsequent step, it can then also be considered how these risks are to be managed. However, the management of these risks is not the subject of this work. By specifically including property-specific risks in the determination of VaR in real estate portfolios, this paper contributes to the current discussion (Booth et al., 2002; Amédée-Manesme et al., 2015)

Illiquidity

Ametefe et al. (2016) first of all, a distinction is made between two types of liquidity in real estate investments. On the one hand, trading (or market) liquidity refers to the nature of different assets and the markets on which they are traded. Financing liquidity, on the other hand, is related to investors and their ability to obtain funding to execute transactions with these assets. This form of liquidity is particularly relevant for real estate investors, but not a priority for the valuation of a real estate portfolio on closer inspection, which is why the focus of this work is on trading liquidity. This approach is confirmed by Chen & Khumpaisal (2009) through their study, which examines a total of 29 criteria for measuring real estate risk and also rates illiquidity risk among the 14 most important ones. As part of the further development of existing pricing models, Crosby et al. (2016) comment that the local economic structure and catchment

area are considered relevant, especially concerning their contribution to liquidity in local markets. Following Guo (2018) it is not completely conclusive to assert that the risk of real estate assets is not measurable due to the non-normality of its return, the instability of its distribution parameters and its nature. The returns on real estate assets are the net inflows accrued during the holding period and the capital appreciation realized through the successful sale of the asset. Net cash flow is impacted by the property's operating costs, which are one-time costs that most other financial assets do not bear. Normally, success in selling a financial asset would require no attention other than controllable transaction costs. However, this is not the case with real estate assets: the illiquidity price discount, which leads to the illiquidity yield premium, could reduce capital appreciation. In doing so, Guo (2018) emphasizes the special importance without providing an approach for inclusion in a model.

Vacancies

By using a Monte Carlo simulation, Amédée-Manesme et al. (2015) show that a longer vacancy period, and an increasing negative pension yield, all other things being equal, tend to reduce the optimal holding period of a real estate asset and thus increase the risk. Crosby et al. (2016) develop a pricing model for real estate and plead in this context to also include the vacancies in the calculation. As part of the creation of an early warning system, Zhou et al. (2021) examine the vacancy of high-quality retail property in the Beijing real estate market and find a correlation to price and risk, but the early warning indicator vacancy rate has a comparatively small influence on the risk compared to other indicators. Ho et al. (2015) examine risk premia for real estate and find that the vacancy rate has a relatively high statistically significant risk premium of 2.5%. On the other hand, Szumilo et al. (2016) note that based on their property valuation model, factors can be identified that affect value but cannot be considered safe. This also includes unsystematic fluctuations such as fluctuations in the vacancy rate.

Location

As with the criterion of illiquidity, Chen and Khumpaisal (2009) named also location as one of the 14 important criteria for measuring the risk of real estate. However, they do not integrate the location risk into a VaR model, but merely provide an approach to measuring the risk. These risks related to property type are measured by using the degree of location concentration concerning the density of similar type properties for each specific development. Crosby et al. (2016) tested the importance of sub-markets for cap rate determination at the level of the real estate market on the risk scale. The results are in line with expectations from the literature that specific asset risks explain fluctuations in capitalization rates much more than location differences between submarkets. Around 15% of the declared fluctuations in cap rates are explained by the sub-markets, compared to 85% by asset-specific characteristics. The location quality of the submarket has a considerable influence on the variation of the capitalization rates of the submarket. The measurement of the location was carried out based on submarket quality. Specifically, the real average rent was measured in the submarket, lagged one quarter, in logs, and grand mean centered. The rather surprisingly small influence of the submarket situation on capitalization rates could be explained by investor perception of the safe-haven characteristics of the central London market(s) during the investigation period with this factor.

Lease structures

To accurately estimate the real estate VaR risk measure, taking into account specific property characteristics and expected future returns, we took into account the lease structure and its impact on price and income. Based on the modeled price and income components, Amédée-Manesme et al. (2015) built real estate indices. Then they ran Monte Carlo simulations to subtract the VaR from the replications. An essential feature of our analysis was therefore the examination of the difficulties for standard risk modeling, which arise from the peculiarities of

commercial real estate markets. In another paper, Amédée-Manesme et al. (2015) used Monte Carlo simulation framework to simulate the cash flows of a real estate asset by explicitly taking lease structures into account. They assume that a tenant makes use of his right of termination if the rent paid is higher than the market rental value of similar properties. The authors also stochastically model the vacancy period. Finally, the net present values and the market rental value assumed to be correlated are simulated by specific stochastic processes. The authors thereby derive the optimal holding period for the asset as the value that maximizes its discounted value. The authors show that in line with real estate business practice, termination options in leases can dramatically change the optimal holding periods for real estate assets and thus portfolios. The paper shows that shorter lease periods, higher market rental value volatility, increasing negative annuity yields, higher vacancy periods and more interruption options all other things being the same tend to reduce the optimal holding period of a real estate asset. The reverse also applies.

Obsolescence

The lease structures approach of Amédée-Manesme and Barthélémy (2018) could be adapted to almost all asset classes that are not regularly traded, such as art, wine, private equity venture funds, hedge funds, etc. Risk managers who need to develop appropriate risk models should find a useful approach here. Obsolescence is taken into account to accurately estimate the VaR risk measure for real estate. Real estate indices are formed using the modelled price and income components. Other property features such as obsolescence can easily be added to the current proposal. In the literature, obsolescence is regularly considered in conjunction with the lease structure, so no articles exclusively on this topic were found in the literature examined.

4 DISCUSSION

As part of the study, it was found that a widely used approach to the systematization of VaR methods is the division into analytical methods and simulations. As a common analytical method, the variance-covariance method has prevailed, which is characterized by a low computational effort. The method can be further differentiated into the Delta Normal and Delta Gamma methods. With the delta normal approach, however, problems arise when the returns of the portfolio under consideration depend on the underlying risk factors in a non-linear manner. This is the case, especially with options. When considering real estate, for example, the relevant leases have termination or extension options that cannot be included in a delta-normal approach. In the delta-gamma approach, the change in delta is taken into account by another measure, which is why this approach was most frequently used in the literature examined. The gamma indicates the rate of change of the delta with respect to the change of the determinant. The application of the delta-gamma method provides more accurate value-at-risk estimates for real estate portfolios than the delta-normal method (Jaschke, 2000).

In the banking industry, the variance-covariance method has largely prevailed in recent years due to the advantages described. In the literature for the risk measurement of portfolios, a simulation method is also used with approximately comparable frequency. In principle, the historical and Monte Carlo simulations have prevailed, but in the literature, the Monte Carlo simulation is regularly used for the simulation methods to measure risks in real estate portfolios. The greatest advantage can be regarded as the flexibility concerning the distribution assumptions of the Monte Carlo simulation, whereas the estimation effort increases accordingly. Thus, the disadvantage lies in the high computational effort of the Monte Carlo simulation. Consequently, there is no method for determining the risk from real estate portfolios

that prevails over the other approaches, but depending on the procedure, the methods have specific advantages and disadvantages.

In this paper, a total of five determinants of idiosyncratic risks in real estate are identified, which will be examined below. The aspect of illiquidity is initially not a peculiarity in the assessment of the risk of real estate portfolios but can occur especially in times of stress for all asset classes. However, there are no public trading venues for real estate where real estate is traded neither regularly nor at high speed. In addition, real estate is location-bound, so an analysis of local conditions is relevant. The integration of the local economic structure and the catchment area used leads to reliable results to be able to better assess the property-specific liquidity risk (Crosby et al., 2016). The limited liquidity has an impact on real estate pricing, which is regularly subject to uncertainty. A market value can therefore only be determined exactly at the time of a real estate transaction, which has an influence on risk measurement with a VaR method. The calculation of the return is also influenced by this, since the return of a real estate investment is measured on the one hand from the continuously generated cash flows and, on the other hand from the increase in value between purchase and sale. Guo (2018) identifies the special significance and details the relevant parameters but does not provide a method approach to integrate this initial situation into risk measurement. In the case of real estate assets, for example, only a possible illiquidity price discount is demonstrated, which leads to an illiquidity yield premium and could reduce capital appreciation.

In this context, property type-related risks are also measured by using the degree of location concentration with the density of similar property types for each specific development. It is noted that location differences between regional markets are significantly less relevant than specific asset risks. The location quality of the submarket has a considerable influence on capitalization rates, but not on real estate risk. The rather surprisingly small influence of the submarket situation on capitalization rates could be explained by investor perception, for example, of the safe-haven characteristics of the central London markets during the investigation period with this factor. The approach to measuring the obsolescence risk of Amédée-Manesme & Barthélémy (2018) could be adapted to many asset classes that are not traded regularly. Using the modelled price and income components, real estate indices are formed and thus taken into account to accurately estimate the VaR risk measure for real estate (Crosby et al., 2016).

To be able to take into account the real estate VaR risk measure for the lease structures and their effects on price and income, price and income components for real estate indices are also modelled. Monte Carlo simulations are carried out on this synthetic index. The simulation model regularly takes into account that a tenant makes use of his right of termination if the rent paid is higher than the market rental value of similar properties. This also works out how termination options in leases can dramatically change the optimal holding periods for real estate assets and thus also for portfolios. For example, the optimal holding period of a real estate asset has shorter rental periods, higher market rental value volatility, an increasing negative pension yield, a longer vacancy period and more interruption options all other things being equal. Consequently, the vacancy period can also be determined stochastically. Crosby et al. (2016) show that vacancies should be included in the calculation, but Zhou et al. (2021) summarize that vacancies are not suitable as early warning indicators. There are also arguments in favour of integration into the risk models (Ho et al., 2015). On the other hand, Szumilo et al. (2016) note that based on their property valuation model, the influence of vacancy could not be considered certain. Consequently, there is no agreement on the vacancies in the literature.

Regardless of the method or the determinants examined, however, difficulties can arise from an insufficient amount of data (Hoesli et al., 2006; Baroni et al., 2007; Amédée-Manesme et al., 2014; Battisti et al., 2020; Blundell et al., 2005; Lausberg et al., 2020). For example,

synthetic indices are regularly used to describe property-specific risk determinants, which could lead from generalization and approximation to uncertainty even before the method is applied due to assumptions made. Or data is used that only indirectly reflects a risk.

All five determinants examined for the idiosyncratic risks of real estate portfolios can be found to be correlated, at least in most of the literature. However, the risks examined do not include any types of risk that should necessarily be included to improve risk measurement. On the one hand, this could be due to the limited amount of data. There is no data collection that assembles transaction parameters, for example, with the required scope and level of detail. On the other hand, less rational, as yet unconsidered, or difficult to measure investment parameters such as the safe haven approach could influence or outshine other determinants. Similarly, the example of private property owners who make special repayments on real estate financing could be transferred. From an isolated economic perspective, this is regularly irrational, but the desire for debt relief is not taken into account in the model but is highly relevant for many property owners.

5 CONCLUSIONS

The challenge in modeling real estate risk is to adequately incorporate the specifics of this asset class. Since under- or overestimating the risk can lead to either high losses or significant missed opportunities, it is important to estimate it reliably. This paper examines which method of calculation is suitable for calculating risk in a real estate portfolio. While the variance-covariance method has prevailed in large parts of the financial sector, Monte Carlo simulation is also used to calculate risks in real estate portfolios. The disadvantage of Monte Carlo simulation is in particular the high effort, but options and asymmetric determinates can be integrated much better. Because of these advantages, the Variance-Covariance approach regularly uses the delta-gamma method instead of the delta-normal method.

The aim of this paper was also to provide approaches for existing VaR methods for the special requirements of real estate portfolios by including further determinants to increase selectivity. Illiquidity risk is relevant in many asset classes but has a special character when estimating real estate risks. However, since real estate is localized, liquidity is not to be measured in a market, but indirectly in local quality. However, the quality and quantity of data is limited here. When the location was included in the risk measurement, it was found that the location differences between the regional markets are significantly less relevant than the specific asset risks. Lease structures also have an influence on the optimal holding period of a property from a return point of view, but only a minor influence on the risk position. Again, the availability of data is a limiting factor. An essential feature of this analysis was therefore the examination of the difficulties that arise from standard risk modeling due to the peculiarities of real estate. A recommendation for the VaR method to be chosen or the determinants to be included for the optimized management of the idiosyncratic risks of real estate portfolio cannot be made due to the different advantages and disadvantages.

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Behavioral Biases and its influence on investment decisions of German investors

Bastian Schulz

Abstract

Behavioral finance is a modern approach to capital markets that is important in financial decisions. Many behavioral biases are related to gains and losses and significantly influence the way how individual investors behave in the emerging field of behavioral finance. This study assesses how behavioral biases affect German investors' investment decisions. Three hundred forty-two investors are surveyed, and the results are compiled in a questionnaire. It was found that there are several reasons why people get into trouble on the stock market. These reasons are related to behavioral biases, effects, and errors in human thinking. In this article, one behavioral bias, the loss and regret aversion bias, was investigated. It was also established that demographic variables like gender, age, experience, education, and marital status affect this preference among German investors. The findings indicate that female German investors are more susceptible to the loss and regret aversion bias than male German investors.

Keywords

Behavioral economics, behavioral finance, behavioral biases, loss aversion, regret aversion

JEL Classifications

G4, D91

1 INTRODUCTION

In order to comprehend the process and elements that influence investment decisions, research into the study of investor decision-making is intensifying (Kengatharan & Kengatharan, 2014). The development of theories in conventional finance has been rationality-based (Merton, 1985). Traditional financial pioneers promoted logic in the decision-making process, justifying the judgments based on the information at hand (Fama, 1970; Solnik, 1973). These ideas support, advance, and provide evidence for the traditional idea of rationality in investment decision-making, which assumes that investors are rational decision-makers.

However, several questions remain unanswered, including why investors' decisions are not always supported by logic and reasons, why emotional processes lead investors to make choices that are not rationally sound, what causes an investor to make mistakes in judgment when making decisions, and how decision-making differs from person to person (Baker & Ricciardi, 2014). As a result, behavioral finance explained that the effect of behavioral biases might be used to explain the irrationality of investing decision-making (Jain et al., 2021).

Several empirical investigations undertaken during the 1990s have refuted existing research and prepared the way for those supporting behavioral finance. In their critical examination, Joghee et al. (2020) questioned the existence of efficient markets and sane investors by using examples of stock booms and market collapses. Decisions are not always reasonable and methodical; cognitive mistakes might occur, according to Chen et al. (2017). Much research revealed recurring patterns of irrationality in people's decision-making within uncertain circumstances (Nofsinger, 2001; Chen et al., 2007; Ngoc, 2013). Uncertainty in the financial

climate might push investors to make poor investing decisions, which leads them to rely on heuristics.

Most of the time, investors in capital asset exchanges make investment selections to increase their wealth. However, some investors consider using market timing strategies to achieve this aim. In contrast, some investors are more risk-averse and follow low-risk stocks simultaneously. On the other hand, other investors accept high-risk stocks while using diversification strategies to reduce unsystematic risks. Studying the effect of investor behavioral finance on stock investing decisions became crucial; as a result, investors seldom base their judgments on the presumptions of financial theories.

According to conventional financial theory, investors are rational when they want to maximize their wealth, abide by basic financial laws, and base their investment strategies and decisions on weighing risks and returns (Baker et al., 1977). Nevertheless, their psychological biases (overconfidence, herding, regret aversion, loss aversion, and many more) may impair their investment judgment (Jagongo & Mutswenje, 2014). Therefore, the main objective of this study is to explore the behavioral finance factors influencing the stock investment decisions of German investors.

The article aims to determine if the loss and regret aversion bias in connection with demographic variables like gender, age, experience, education, and marital status affect preferences among German investors.

The article is organized as follows. The second chapter describes behavioral biases and heuristics, the third the regret and loss aversion bias, and the fourth methodology. Results are presented in the fifth chapter, and the conclusion summarizes the main points in chapter six.

2 BEHAVIORAL BIASES AND HEURISTICS

Today's trade and financial markets are highly active, fast-paced, and opaque. Reaction time has evolved into a critical element of effective trading since far more data is accessible than one can analyze. In today's fast-paced environment, heuristics, the brain's shortcuts to facilitate decision-making, are becoming more prevalent. These quick cuts might be innate mechanisms the investor could disregard or a purposeful selection of rules of thumb to aid decision-making (Hirshleifer, 2015; Jordan et al., 2015). A key component of human decision-making is heuristics. According to Kahneman, they have been proposed as simple, helpful guidelines to show how people make decisions, draw conclusions, and solve problems, typically when faced with complicated issues or a lack of information (Parikh, 2011). Heuristics are quick ways to conclude past actions or experiences (Bracker, 2013). They help people understand the intricate, dynamic world around them. They eventually changed to support someone's survival and success (Ritter, 2003; Valsová, 2016).

In their 1974 paper "Judgment under Uncertainty," Kahneman & Tversky identified three basic heuristics: representativeness, availability, and anchoring. When Thaler & Shefrin (1981) observed that most individuals utilize their dividends and income instead of the investment theory, they discovered one of the earliest heuristics. The investor would utilize this rule of thumb to liquidate and eliminate the investment without considering any other options with an analytical approach to save stress and mental energy. This was used by Shefrin & Statman (1984) as justification for why many investors choose assets that provide cash dividends. Their heuristics can be identified as the root cause of this.

In "Heuristics and Biases: The Psychology of Intuitive Judgment," Gilovich et al. (2002) identified six "general purpose" heuristics (affect, supply, causality, fluency, likeness, and

surprise) and six "limited purpose heuristics" (attribution, substitution, outrage, prototype, recognition, choosing by liking and choosing by default). Malmendier et al. (2011) and Greenwood & Nagel (2009) show that past life experiences can significantly impact investment decisions. These historical circumstances are occasionally a heuristic that accidentally permeates an investor's strategy. Before just storing and relying on specific behaviors, investors may need to take them into account (Hirshleifer, 2015). The continuous use of heuristics has numerous strategic benefits, but it may negatively affect the financial and investing environment.

Investors may over-extrapolate their past investing performance when making investment decisions, as demonstrated by Choi et al. (2009). This gives the investor the naive confidence that his past investing success would only help him make better investment judgments in the present (Choi et al., 2009). Hirshleifer (2015) has also shown that practitioners might be susceptible to heuristics. Everyone might be prone to different heuristics they unintentionally put up, but they can make better informed and successful investment decisions by being aware of them.

Some researchers do not distinguish between behavioral biases and heuristics and use the terms synonymously, while others distinguish and label biases' values, judgments, or desires. Still, others seek to meaningfully classify behavioral biases into a context, for example, along cognitive or emotional lines (Subash, 2012). While such a taxonomy can be helpful, according to Pompian (2006), there must be a single, basic explanation for why one's actions are occasionally prone to prejudice. Behavioral finance studies may also concentrate on a wide range of empirical facts showing the failure of human judgment in many economic decision-making settings as opposed to a single general premise of investor decision-making and behavior.

The behavioral biases that characterize and define the decision-making of economic agents are various due to the contributions of several academics, particularly Kahneman & Tversky (Idárraga Calderón, 2018). Gains and losses are connected to these behavioral biases. They are strongly related to prospect theory, which contends that a person is loss-averse when presented with a potential reward (Idárraga Calderón, 2018). Generally, people prefer to avoid losing money than take a chance to receive a similar return (Boyce, 2022). Numerous specific behavioral biases are identified by psychological and behavioral research. More than fifty of these have been expanded through recent efforts and studies in behavioral finance to encompass human investor behavior in various situations and locations (Valsová, 2016). Consumers are predisposed toward such activities, which results in cognitive errors, and behavioral finance leverages well-known social biases to identify anomalies in the capital markets. By incorporating these obvious, systemic, and human departures from reason into traditional stock market structures, behavioral finance loosens the standard rules of financial economics (Subash, 2012).

Eventually, behavioral finance continues because only a subset can acquire and use the same information. Everyone reads and hears things differently, and everyone sees things differently. This different perception is at the heart of many studies on behavioral bias in finance. Rieger (2012) addresses this issue directly. In his paper, Rieger (2012) investigates the dynamic structure of organized financial instruments and how investors perceive them. He suggests that certain behavioral biases enable investors to overestimate the likelihood of particular results connected to structured financial product payout.

Nonetheless, there may be methods to interpret product features to avoid confounding investors (Hammond, 2015). According to Baker & Ricciardi (2014), investor behavior regularly deviates from reason and logic, and investors display a range of behavioral biases that influence

how they choose which investments to make. Furthermore, it was discovered that psychological aspects are affected by an individual's gender (Hoffmann et al., 2013).

Samuelson & Zeckhauser (1988) discovered the status quo bias, which occurs when an investor chooses the default option from a set of alternatives. In their work "An Exploratory Investigation into the Psychological Biases in Financial Investing Behavior," Sahi et al. (2013) attempted to outline the faults that investors appear to make. The paper is essential because it provides a complete list of behavioral biases encountered when interviewing various individuals with extensive financial expertise (Hammond, 2015). Krishnan (2020) claims that between 1979 and 2016, the year the most recent research was released, the field of behavioral finance found 17 different types of behavioral biases.

The 17 behavioral bias categories are as follows: Overconfidence, the Herding Effect, Representativeness, Anchoring, Regret Aversion, Loss Aversion, Mental Accounting, Framing, Conservatism Bias, Confirmation Bias, Self-Attribution Bias, Home Bias, Endowment Effect, Disposition Effect, House Money Effect, Recency as well as ushering in a new era of understanding behavior, human emotions, and viewpoints, which was previously dominated by the study of financial markets. The literature contains a variety of behavioral biases and heuristics, as was already established. To better understand how and why investors make (financial) decisions and how they are influenced while doing so (sometimes unknowingly), one of them, namely the loss and regret aversion bias, will be studied in the following section.

3 THE REGRET AND LOSS AVERSION BIAS

The loss aversion and regret aversion biases are considered jointly due to their similarities.

3.1 Loss aversion bias

Loss aversion, which causes investors to be reluctant to sell any investment that may experience losses, is the idea that investment losses affect an investor's emotions more than equal investment profits (Doviak, 2016; Jordan et al., 2015). However, this does not apply to first investments since, at that stage, investors who are loss averse are more inclined to sell a losing investment immediately (Wamae, 2013). Psychologically, losing is detestable, and in actuality, individuals prefer to avoid losses to achieve profits since they loathe losing far more than they love winning (Kahneman & Tversky, 1979; Benartzi & Payne, 2015; Fieger, 2017; Sullivan, 2020; Jayaraj, 2013; Subramaniam & Velnampy, 2017).

According to Doviak (2016), when an investment acts as predicted, a person's satisfaction may be gauged by a consistent, smooth rising trajectory. However, when an investment underperforms, a person's dissatisfaction may be measured by a dramatically declining cliff (Doviak, 2016). The endowment effect and the status quo bias both have an impact on people's aversion to loss. The endowment effect illustrates people's tendency to value assets more highly than otherwise (2022; Aceres-Santamaria). Status quo bias is the idea that one prefers that their circumstances and surroundings stay the same. An individual picks the more comfortable choice over the unfamiliar but more advantageous alternatives when making selections (Vinney, 2019). Furthermore, the endowment effect and the status quo bias emerge due to loss aversion (Idárraga Calderón, 2018).

Kahneman & Tversky, the first to record loss aversion, calculated the average loss aversion coefficient to be between 2-2.5, indicating that a subjective value of losses is seemingly two to two and a half times greater than gains (value of loss and gains are the same, for example, a person can lose or gain 100 USD) (Montier & Strategy, 2002; Valsová, 2016). The actual

interpretation of this conclusion is that if the payout is just half as large as the downside, the loss aversion bias will cause more people to reject the bet. Investors with a loss aversion bias are likelier to choose the safe route by investing in firms they are acquainted with (Chandra & Kumar, 2012).

Generating profits makes investors risk-seekers because they invest more in riskier assets, but loss makes them risk-averse. Most of their assets are allocated to low-risk investments (Hallale & Gadekar, 2019). Being a loss-averse person is natural, and nothing is inherently wrong with it. Therefore, evaluating how an asymmetric perspective of losses may influence decision-making (Benartzi & Payne, 2015) is critical. It is also claimed that aversion to losses influences financial choices. In an experiment with 401 participants, Benartzi & Payne (2015) demonstrated that people make decisions based on a willingness to avoid the psychological pain of losing money rather than being motivated by objective theoretical risk factors like predicted returns or volatility. Instead, people choose to make decisions based on a willingness to avoid the psychological pain of losing money.

To conclude, loss aversion is the belief that investment losses hurt an investor's emotions more than equivalent investment earnings, causing investors to be hesitant to sell any investment that may face losses.

3.2 Regret aversion bias

Most investors have at least once made a poor investment decision (Kisaka, 2015). Investors lament losses realized due to bad choices (Zeelenberg & Pieters, 2007). In order to provide a better explanation of the decision-makers behavior, regret theory incorporates the ex-post sensation of failure that follows from a choice that does not perform well compared to an alternative decision that would have been stronger (Dhankar, 2019). Investors frequently worry that they may choose poorly and later regret it (Wamae, 2013; Valsová, 2016). Several academics created the regret theory in 1982 and discussed its empirical and normative status (Fishburn, 1982; Loomes & Sugden, 1982; Bell, 1982).

According to Shimanoff (1984), regret aversion is investors' most common adverse emotion. In addition, regret aversion bias causes people to hold onto unsuccessful investments for an extended period and to avoid investing in lower-value assets when their values decrease (Shiller, 2003). One study found that people commonly overestimate their capacity for regret, which suggests that people are less likely to experience regret than they may believe (Gilbert et al., 2004).

Two key assumptions serve as the foundation for the theory of regret. First, many individuals feel remorse and delight, and second, it aims to forecast and consider these feelings while making judgments in ambiguous circumstances (Wangzhou et al., 2021). Due to the psychological phenomenon known as regret aversion, investors frequently regret investment choices, and this occurrence does not provide the desired result (De Mori et al., 2016). The feeling of unhappiness brought on by blaming external sources for unfavorable outcomes is distinct from the regret that results from actions that a person subsequently regrets (Moreira Costa et al., 2021).

The consequences of omission and commission errors may be feared by those who fear making mistakes (Seiler et al., 2008; Valsová, 2016; Sharma, 2019). Investors do not want to make mistakes or pass up a chance. Zeelenberg & Pieters (2004) assert that the decision or choice made at the moment directly affects regret. According to Yang & Wang (2018), regret theory may serve as a stand-in behavior theory to explain regret aversion. People commonly have

regret aversion preferences while making decisions, and they feel regret if they take the wrong course of action, according to a study by Chen et al. (2018).

Zahera & Bansal (2018) contend that regretting a decision has a significant psychological influence. Isidore & Christie (2019) claim that regret aversion is a bias that prevents people from making decisions they will regret later. According to Sattar et al. (2020), remorse aversion is the investor's desire never to regret making bad investment decisions. As a result, they cannot choose an effective investment since they must own up to their poor decisions (Fogel & Berry, 2006). According to Talha et al. (2015), this bias mainly results in investors earning low returns since they appear to quickly sell their successes while holding onto their losers for an extended period.

While regret is not always ex-post, it can sometimes influence a decision-behavior maker's ex-ante (Dhankar, 2019). Additionally, studies from Subash (2012) and Pashtoon (2016) show that investors are as likely to exhibit regret aversion bias in their investment choices, independent of their ages or level of investing knowledge. Even so, younger investors are less likely than more seasoned investors to make investment decisions under the influence of regret aversion bias, according to Gupta & Ahmed (2016). Shah & Malik (2021) examined how the biases against loss and regret influenced how frequently individual investors traded on the Pakistan stock exchange. The researchers prove that regret and loss aversion have statistically significant adverse effects on individual investors' trading frequency.

To summarize, the preference for avoiding losses over receiving equivalent gains is regret aversion. Investors are caught between wanting to avoid committing to failure and giving up an opportunity.

4 METHODOLOGY

The information for this study is gathered through a questionnaire. A vital quantitative research tool in empirical research is the questionnaire, a series of questions to be given to interview subjects or survey respondents to acquire data appropriate for analysis (Acharya, 2010). Because of its low cost and widespread application, the method of information gathering is utilized most frequently (Maier et al., 2000). Questionnaires are an excellent method to swiftly get data from many individuals since they are a great way to capture their ideas and thoughts. Standardization of the questionnaire is crucial.

The same questions are posed in a standardized questionnaire, and the responses are consistently categorized. Using this technique, the responses to the questions can be understood as reflecting changes in the respondents' behavior (Siniscalco & Auriat, 2005). The questionnaire is accessible online, on computers, and on regular paper. As a result, data from various sources may be quickly compared (Kirchhoff et al., 2010). So, it is more focused on obtaining something that has yet to be produced. People are motivated to respond by information.

An online survey was used for the research. To avoid a high dropout rate and provide the respondents' transparency, the average processing time and the number of pages were previously mentioned in the welcome paragraph at the beginning of the questionnaire. Nonetheless, since there are so many investors in the population, only a tiny sample of persons needed to be surveyed. As a result, the sub-survey units were carefully chosen based on the population's known characteristics (Homburg, 2017).

1. Investors, whether active or passive.
2. Investors have to do their business on the German stock exchange.

3. The participants comprehended English.

The responses' adherence to the requirements for the general public was closely observed. Two strategies were used to reach the study's target audience:

- Professional Network: The link to the questionnaire was targeted and given to the professional network based on the stated demographic.
- Private Network: The survey link was given to the personal network through email and WhatsApp. Friends, relatives, and other doctoral students comprised the network.

Participants were asked to select the best and worst phrases summarizing their investment decisions from a list of biases. Consequently, based on their replies to the questions, the study examined the widespread behavioral biases in German investors' judgments. The choices will be compared to determine whether there are any gender disparities. The author will compare the findings using the mean value expressed among the biases in percentages.

5 RESULTS

The 342 participants in the research were 181 male and 161 female German investors. Participants were also separated into age categories. The age group of 25-34 years had the most responses (121), while those beyond 70 years received the fewest (five persons). The demographic parameters for this study, including age groups and gender, are shown in the table below.

Tab. 1: Investor's demographic profile

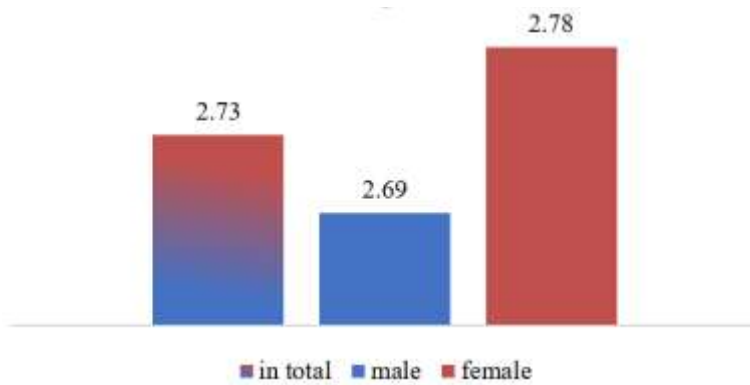
Demographic variables	Participants (in total)	Participants (in %)
Age	342	
18-24 years	37	11%
25-34 years	121	35%
35-44 years	101	30%
45-59 years	60	18%
60-69 years	18	5%
>70 years	5	1%
Gender	342	
Male	181	53%
Female	161	47%

Source: Own research

The loss and regret aversion bias, discussed in chapter 2, and how the bias and demographic variables affect German investors will be discussed after the presentation of the demographic characteristics.

First, the loss and regret aversion is reviewed, divided by gender.

Fig. 1: Gender - Loss and regret aversion bias

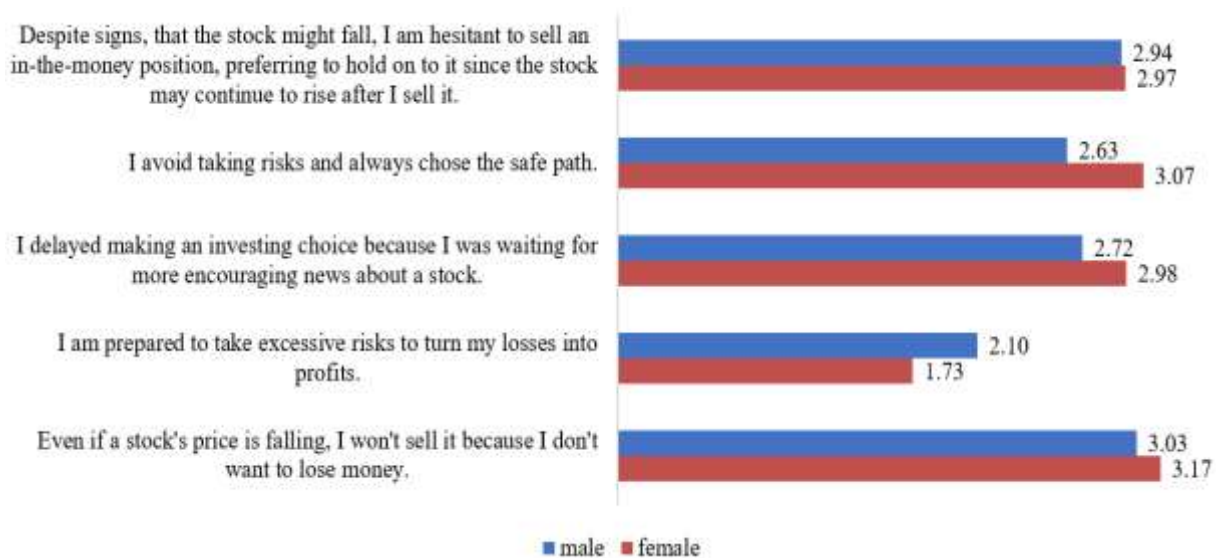


Source: Own research

The results show that the mean value for loss and regret aversion is 2.73. Females (2.78) are more susceptible to loss and regret aversion bias than men (2.69).

These results need to be reviewed in more detail as all five questions about the loss and regret aversion bias are reviewed separately by gender.

Fig. 2: Loss and regret aversion bias - Each of the five questions – By gender

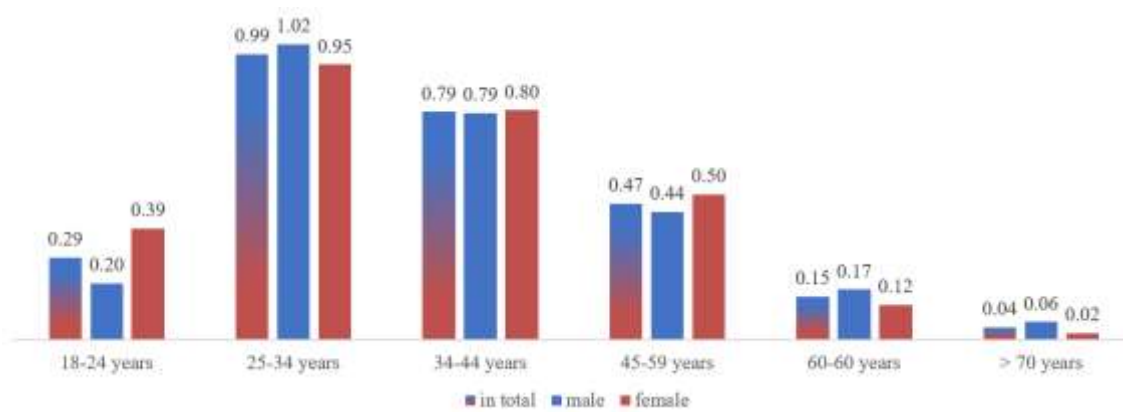


Source: Own research

The results show that among all the five questions asked in the questionnaire about the loss and regret aversion bias, the mean value for almost every question is higher for women than men. The only question that was ranked higher among men was whether they were prepared to take excessive risks to turn their losses into profits, with 2.10 for men and 1.73 for women. The findings do, however, confirm the first finding that females are mostly more prone to loss and regret aversion bias than males.

How different age groups have different tendencies regarding the loss and regret aversion bias, in total and separated by gender, is expressed in Figure 3.

Fig. 3: The loss and regret aversion bias – By Gender – By age groups

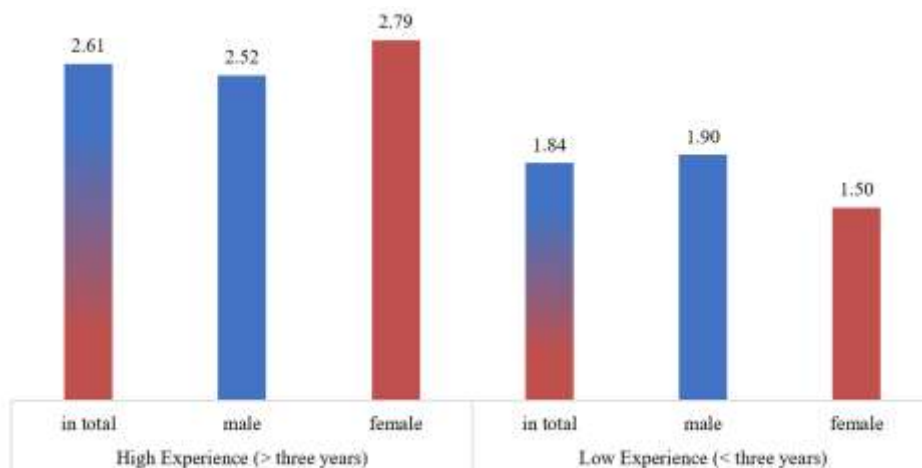


Source: Own research

The findings show that the loss and regret aversion is higher for females among three age groups (18-24 years, 34-44 years, 45-49 years) while it is higher among three age groups (25-34 years, 60-69 years, >70 years) for males. The last two age groups, 60-69 years and >70 years, are the smallest regarding the number of people. The figure explains further the findings from before.

In addition to gender and age, it will also be interesting to see if German investors' experience influences the loss and regret aversion among German investors. The respondents were separated by high experience if they had more than three years of experience and low experience if they had less than three years of experience. Among the 342 German investors, 188 were low-experience investors (72 males and 116 females), and 154 were high-experience investors (109 males and 45 females). The following figure shows the results.

Fig. 4: Loss and regret aversion bias - Low-experience investors vs. High-experience investors



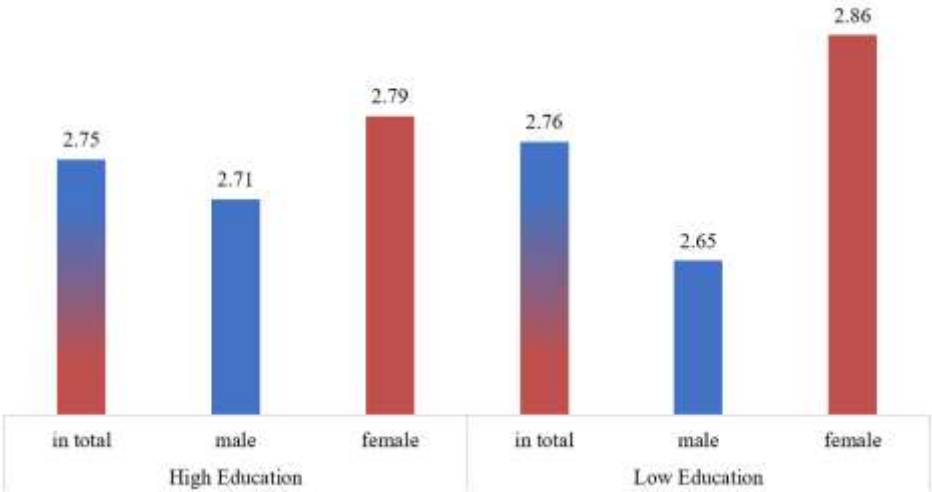
Source: Own research

The results show that high-experience investors have a higher tendency for loss and regret aversion bias than low-experience investors, in total and among genders. In addition, the results

show that while the tendency among female German investors (2.79) is higher compared to German male investors (2.52) among high-experience investors, the tendency for males (1.90) is higher than for females (1.50) among low-experience investors. The results show that there is a difference among genders when it comes to the investment experience of German investors.

Furthermore, it should be analyzed if the education level influences loss and regret aversion bias. Therefore, the 342 respondents were separated into high and low-education groups. Participants with bachelor, master or Ph.D. were categorized in the high education group. In contrast, participants with an apprenticeship or high school degree were categorized into the low-education group. Among the high-education group were 209 German investors (120 males and 89 females), respectively 133 German investors (61 males and 72 females) were among the low-education group.

Fig. 5: Loss and regret aversion bias - Low-education investors vs. High-education investor

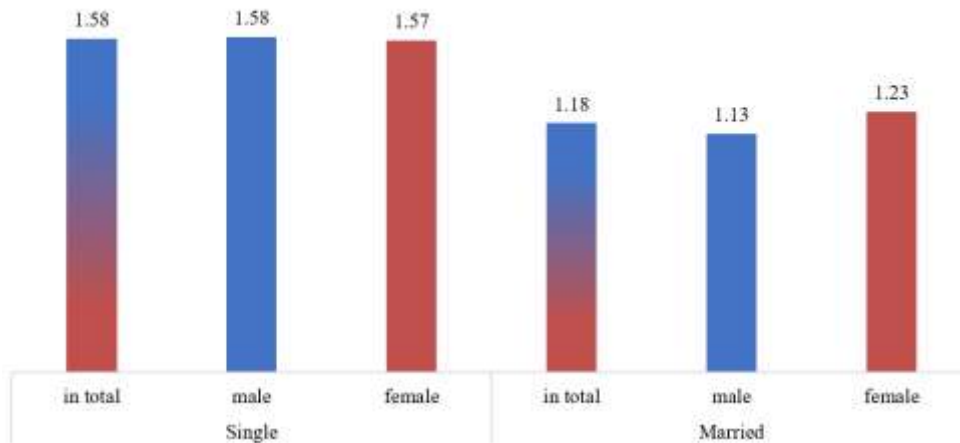


Source: Own research

The results show barely any difference when looking at the total between the high-education investors (2.75) and low-education investors (2.76). However, when looking at the genders, there is again a higher tendency among female investors for high-education investors (2.71 to 2.79) and low-education investors (2.65 to 2.86). Furthermore, the findings show that the tendency for the loss and regret aversion bias is higher for high-education males (2.71) than for low-education males (2.65). In contrast, the mean value for females is higher for low-education investors (2.86) than for high-education investors (2.79).

Lastly, the research looks at marital status and if there are any differences in total and between genders. The 342 participants were separated into two groups; single (106 males and 89 females) and married (75 males and 72 females). The results are shown below.

Fig. 6: Loss and regret aversion bias - Single vs. Married investors



Source: Own research

The results show that single German investors (1.58) are more prone to loss and regret aversion bias than married German investors (1.18). The tendency among single investors is almost the same among genders, yet it has to be mentioned that fewer female respondents than male respondents participated in the survey; hence the almost identical mean value indicates that it is higher for women. The mean value among married investors is higher for females (1.23) than males (1.13).

The data revealed that German investors were susceptible to loss and regret aversion bias. Women had a higher tendency than men. Among the five questions in the questionnaire, women ranked the loss and regret aversion bias higher among 4 out of 5 questions. There were also differences among the age groups. Furthermore, more demographic variables were reviewed. High-experienced investors (more than three years of experience) had a higher tendency for the loss and regret aversion bias than low-experienced investors (less than three years of experience). Among education, there was no difference in total. However, the different genders showed different results. In addition to these results, single investors showed a higher loss and regret aversion tendency than married investors. Overall, women are more prone to loss and regret aversion bias among German investors than men. German investors and their tendency for loss and regret aversion bias were highly influenced by demographic variables, among them age, gender, experience, education, and marital status.

6 CONCLUSION

This study investigated how behavioral bias affected German investors' choice of investments. The behavioral biases that this study focused on were the loss and regret aversion bias. A survey was sent to 342 German investors to examine and evaluate the behavioral bias. The question was whether or not German investors' behavioral biases and consequent investment decisions are influenced by gender, age, experience, education, and marital status. The study's conclusions suggest that behavioral bias affects German investors. Also, this study showed that the behavioral bias tendencies of German investors who were male and female varied. The research showed that women are more susceptible to loss and regret aversion bias than men.

The most recent study emphasized how irrational financial market players' decision-making processes are. Biases are deeply ingrained in an investor's subconscious thinking and nearly dictate every choice he makes. Behavioral finance seeks to address these biases to help individual investors deal with them. Moreover, biases among investors have been shown to

impact how people spend, save, and invest significantly. The emotional makeup of society and the brain's information-processing shortcuts are to blame for these prejudices. Because of this, most investors experience the prevailing prejudices that induce them to behave poorly and go against their best interests. Moreover, market swings induced by the pandemic and inflation crises show that investor behavior fluctuates over time, making this research incredibly difficult to conduct to acquire a deeper understanding of investor behavior. Moreover, investor behavior can be impacted by various factors that influence an investment or trading decision.

Consequently, factors, including the traded stock industry and the business cycle, tend to impact investment behavior. Certain biases are assumed to feed off of one another, and the external environment and other biases in the process are two factors that influence bias intensity. However, while certain biases may be avoided in specific contexts, they cannot be eliminated.

According to the study, behavioral biases affect how people judge things. Further research may look into other biases and demographic factors.

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A literature review on inflation and German households Assets returns

Jannik Schumann

Abstract

As Inflation is on the forefront since 2021, This paper provides an in-depth analysis of the influence of inflation on German household asset returns since 2015, focusing on overall asset classes, to illuminate strategies households can adopt to manage return rates and hedge against inflation in the face of evolving global economic conditions. The following paper's aim is to examine the existing literature on inflation and household portfolio returns, especially in Germany. The period of study is from 2015 to 2023, and while the Eurozone started 2020 with low interest rates and low inflation, German households are navigating high inflation and ECB rate hikes starting in 2022. The finding of this paper, drawing on established frameworks, is that households tend to earn relatively low returns on their assets in this environment. Especially as German households have a high share of cash and cash equivalents and are relatively mature households. The conclusion is that real returns on total household assets have declined almost everywhere in Germany as well as the Eurozone over the past two years but were systematically positive up to and including the first half of 2022.

Keywords

inflation, household assets, financial assets, non-financial assets, Germany

JEL Classification

E31, G51, G11

1 INTRODUCTION

In recent years, global economic conditions have changed significantly, and inflation has become an increasingly important factor affecting household asset returns. In this context, this paper examines the impact of inflation on German household asset returns since 2015. Analyzing the relationship between inflation and household asset returns is critical to understanding how households can best manage their assets return rate in an uncertain economic environment. Since inflation affects the general price level, it has a direct and indirect impact on asset returns such as real estate, stocks, and bonds. It is therefore important to analyze the impact of inflation on different asset classes and the strategies that households can adopt to hedge against inflation risks. Therefore, a comprehensive overview will be provided to all asset classes German households invest into.

The research questions this study seeks to answer is: how has inflation affected the return on German household assets since 2015, and what factors may influence this relationship? The goal of this study is to gain a comprehensive understanding of the literature discussing the impact of inflation on different types of assets and uncover the mechanisms that determine this relationship. What is the empirical and theoretical evidence on the impact of inflation on the return and value of household financial and nonfinancial assets, and how can this evidence help optimize household asset allocation and risk management in times of inflationary pressures?

The paper will provide a comprehensive overview of existing literature covering inflation, reasons for inflation followed by German household's asset portfolio. The section results will discuss the link between inflation and household's asset return rate ending up in the conclusion.

2 THEORETICAL BACKGROUND

The methodology of this paper is centered on the review and analysis of existing literature and empirical research studies (Snyder, 2019) on the relationship between macroeconomic environment and German households asset investments. The author has leveraged on existing empirical study, even though not delving into those studies numbers but focusing on their findings.

The theoretical landscape is a rich tapestry of interconnected economic models and concepts. Their relevance to this topic, focusing on the case of Germany from 2015-2023, is enhanced by the shifting economic conditions during this period, particularly the low interest rates from 2015-2021 and the marked increase in both interest rates and inflation from 2021 onwards.

The role of expectations and behavioral economics in the context of inflation is an important aspect of understanding households' decisions regarding wealth accumulation and savings. The theory of rational expectations, developed by Muth (1961), states that agents in an economy make decisions based on the best available information and forecast future events based on historical experience and available data (Muth, 1961). This theory has important implications for understanding the impact of inflation expectations on household financial behavior. Behavioral economics complements and extends this view by incorporating human psychology and cognitive biases into the analysis of economic decisions. For example, Kahneman and Tversky (1979) developed Prospect Theory, which shows that people weigh losses more heavily than gains and make decisions based on reference points that influence their perceptions of value. In the context of inflation, such biases can lead households to make financial decisions based on distorted expectations and perceptions, which in turn affects their wealth accumulation and savings.

In the following, the concept of inflation and the household's asset management is discussed, and available literature analyzed.

2.1 THEORETICAL BACKGROUND ON INFLATION

In general, Inflation is the raising of the level of prices, and it reduces the purchasing power of money. The inflation rate is used for analysis of long-term trends (time series) in price development and cost of living. Irving Fisher (1911) spelled out his famous equation of exchange viz. $MV = PY$ M = money supply; V = velocity; P = price level; Y = quantity of output). In General, there can be (Fisher, 1911) 3 causes of inflation:

1. The change in money supply
2. Demand-pull inflation. The aggregate demand comprises consumption, investment, and government expenditure. For example, during Corona in Germany, an overheated economy with excessive spending but same amount of goods.
3. Cost-push inflation, caused by wage increases enforced by unions and profit increases by employers. Cause of Cost-Push inflation is the rise in money wages more rapidly than the productivity of labor.

The study of causes of inflation has probably given rise to one of the most significant macroeconomic debates in the field of economics. The debates differ in their hypotheses, mainly due to a range of conventional views about the appropriate measure to control inflation and due to macroeconomics interdependencies of inflation factors. In practice, however, it is deep economical understanding needed to decompose the observed inflation into its monetary, demand-pull, cost- push and structural components. The process is dynamic, and the shocks to

prices are mixed. Furthermore, inflation itself may also cause future inflation. Anyhow the countermeasure of inflation is mainly trust in the politic and most powerful the central bank's lending rate.

Measuring inflation, the consumer price index (CPI) is a central indicator for assessing the development of the value of money. The ministries, central banks, economic research institutes, the economic departments of large companies (e.g., commercial banks), science and research, collective bargaining parties and the media are all particularly interested in such a measure of inflation (Destatis, 2021).

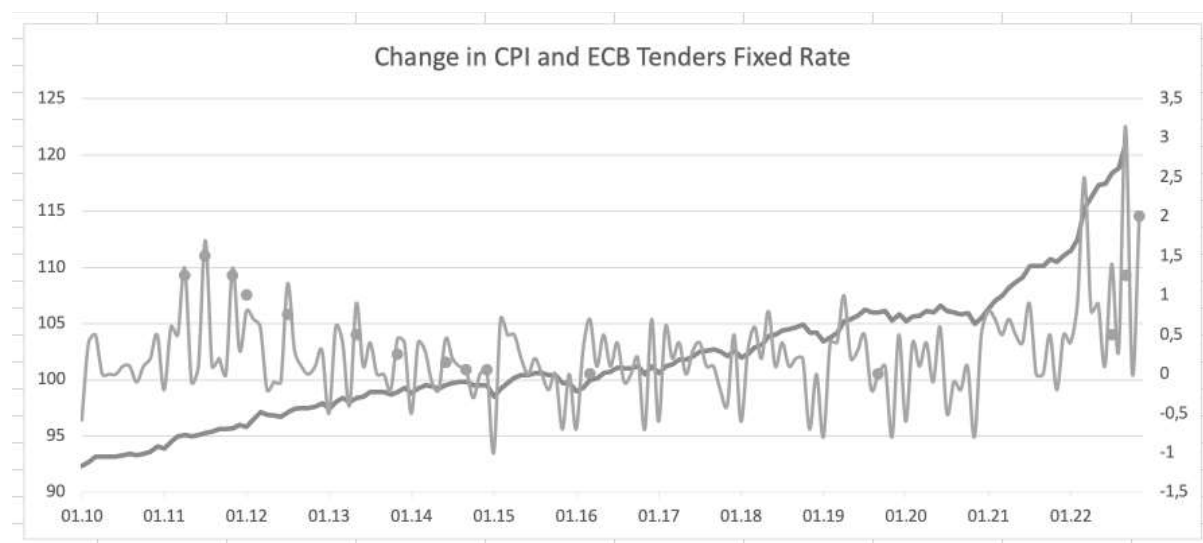
In Germany, the Federal Statistical Office is responsible for computing the CPI inflation rate by assessing the average monthly price development of approximately 650 distinct goods and services, utilizing the year 2015 as the basis for comparison. Figure 1 illustrates the rise in inflation spanning from 2010 through July 2022. The inflation growth rate, from 2010 until December 2020, averaged at a moderate 1.29%. However, beginning in January 2022 and continuing until October 2022, inflation experienced a notable surge, climbing to 6.16% (representing the change from the same month of the previous year). This significant upward shift in inflation can be clearly demarcated into two distinct economic periods: one during and preceding the COVID-19 crisis, and the other following the pandemic's decline, as Russia initiated its invasion of Ukraine.

At the onset of the COVID-19 pandemic, Germany, along with the majority of European Union nations, implemented lockdown measures for several weeks, which curtailed the purchasing power for various services and goods. Consequently, this resulted in a substantially lower forecast for the Gross Domestic Product (GDP) index. In response, the German government sought to bolster purchasing power by implementing tax reductions for specific goods and offering one-time financial assistance to both businesses and employees.

Figure 1 depicts the evolution of both the CPI and the European Central Bank (ECB) fixed rate tenders within Germany, beginning in 2010 and extending through the end of 2022. The smooth graph represents Germany's CPI development, exhibiting a consistent increase throughout the period from 2010 to 2019, accompanied by an annual cycle of inflationary contraction and expansion. Meanwhile, the fluctuational graph illustrates the percentage of monthly fluctuations in CPI. These fluctuations were particularly volatile in 2011, but exhibited reduced volatility from 2012 through 2021.

The dots represent specific data points at which the ECB has implemented changes in the tenders fixed rate. These adjustments can be observed throughout the years, offering an insightful perspective on the ECB's monetary policy. In the year 2011, the decision-making process of the ECB seemed to be in complete harmony with the progression of the CPI in Germany. As the CPI experienced an upward trajectory, the tenders fixed rate followed suit, and a similar pattern was observed when the CPI declined during the years 2012 and 2013. This remarkable synchronization between the CPI and the tenders fixed rate continued to be evident until the end of 2019. The beginning of 2020 marked a shift in the economic landscape, with Germany approaching a near-deflationary state. Interestingly, the ECB did not respond to this development by increasing the money supply. This decision stands in contrast to the previous alignment between the ECB's actions and the German CPI.

Fig. 1: Inflation 2010-01/2022-12 in Germany based on 2015



Source: own research

As the year 2021 progressed, the CPI began to exhibit anomalous behavior, which persisted into 2022. One contributing factor to this anomaly was the emergence of supply chain disruptions that had been taking place since mid-2020. These disruptions led to a further scarcity of goods, exacerbating the situation. Meanwhile, the money supply reached an all-time high, which, in turn, exerted additional pressure on the already rising CPI. This combination of factors resulted in a divergence from the previously observed harmony between the ECB's monetary policy and the German CPI.

This shortage of goods increased heavily on basic commodities like oil and crops as Russia started invasion into Ukraine. Even so, the risk of Russia's invasion into Ukraine was previously known, the ECB failed to forecast the effects on CPI. Showing ECB, the risk of Russia's invasion into Ukraine, which was politically announced. And still reacting quite slow starting July to counter fight CPI skyrocketing. Inflation constitutes a vital macroeconomic factor with the potential to considerably impact the return rates of households' investment portfolios, as highlighted by Mishkin (2012). The significance of portfolio return rates in the context of households' wealth management cannot be overstated, as these rates essentially dictate the actual growth of wealth over an extended period (Bodie, 2014). As such, grasping the intricacies of the relationship between inflation and asset returns emerges as a critical aspect of informed decision-making processes for both policymakers and households.

To delve deeper into this relationship, the present paper embarks on a literature review that aims to elucidate the connection between inflation and the household asset return rate for Germany. This exploration will be conducted with a particular emphasis on the yield generated by both financial and non-financial assets in these households' portfolios.

2.2 THEORETICAL BACKGROUND ON HOUSEHOLD ASSET

One of the most influential and widely recognized theoretical frameworks that establishes a connection between inflation and asset returns is the Fisher Effect, as proposed by economist Irving Fisher in 1930. This theory essentially posits that nominal interest rates are determined by the combination of real interest rates and anticipated inflation. In simpler terms, investors are likely to demand higher nominal returns to compensate for the gradual erosion of their purchasing power as a result of inflationary pressures. According to this theoretical perspective,

in the event of an increase in inflation, nominal interest rates should correspondingly rise to preserve the equilibrium of the real interest rate. Therefore, the returns on fixed-income investment instruments, such as bonds, are expected to exhibit a positive correlation with inflation levels. Nevertheless, the Fisher Effect primarily focuses on the relationship between inflation and nominal interest rates and does not delve into the potential consequences of inflation on a broader range of asset classes. For example, the impact of inflation on equities and real estate investments may not be fully explained by this theory alone.

Adding to this, the Mundell-Tobin effect, introduced by Robert Mundell (1963) and James Tobin (1965), posits that an increase in inflation leads to a decline in the real rate of return on money and bonds, resulting in a shift of investment from these assets to equities and other real assets. This effect indicates that the relationship between inflation and portfolio returns is contingent on the portfolio's asset allocation.

The impact of inflation on bond returns is well documented in the literature. For example, Fama and Schwert (1977) found a positive relationship between inflation and nominal bond yields in the United States. Similar findings have been reported for German bonds by Bohl and Siklos (2004), who demonstrated that nominal bond yields in Germany move in tandem with inflation.

The relationship between inflation and equity returns is more ambiguous. Eichholtz and Straetmans (2015) examined the relationship between inflation and stock returns in Germany, finding that stock returns were negatively correlated with inflation. This result is consistent with the findings of Fama and Schwert (1977), who suggested that nominal interest rates and expected inflation rates are positively correlated, leading to a negative relationship between real stock returns and inflation.

Fama (1981) reported a negative relationship between inflation and stock returns in the United States, while Bohl and Siklos (2004) found a weakly negative relationship for Germany. This negative relationship can be attributed to the fact that higher inflation increases the discount rate, which reduces the present value of future cash flows, leading to lower equity valuations. However, other studies have challenged this view, suggesting that the relationship between inflation and equity returns can be more complex and context-dependent (Modigliani & Cohn, 1979) (Boudoukh & Richardson, 1993). Several studies have investigated the relationship between inflation and financial asset returns in Germany. For instance, Kugler and Lenz (2000) found that German stocks and bonds exhibited a negative correlation with inflation, indicating that these assets might not serve as effective inflation hedges.

While the existing literature provides valuable insights into the relationship between inflation and portfolio returns, not all German households are affected in the same way by inflation. Differences in portfolio composition, financial sophistication, and risk preferences can lead to varying impacts of inflation on household portfolio returns. Household portfolio compositions in Germany can vary significantly due to differences in asset allocation, investment horizons, and risk tolerance (Ehrmann & Ziegelmeyer, 2017). The impact of inflation on a household's portfolio return rate is contingent on the specific assets held within the portfolio. As discussed earlier, inflation has differing effects on bonds (Bohl and Siklos 2004) equities (Fama E. F., 1981), and real estate (Hoesli, Matysiak, & Nanthakumaran, 2008). Households with a higher proportion of inflation-sensitive assets, such as real estate or inflation-indexed bonds, may be less adversely affected by inflation than those with a large share of nominal bonds or equities.

2.2.1 FINANCIAL ASSETS

Financial assets play a crucial role in the economic well-being of households, serving as a store of value, a source of income, and a means for managing risk (Campbell, 2006). Common

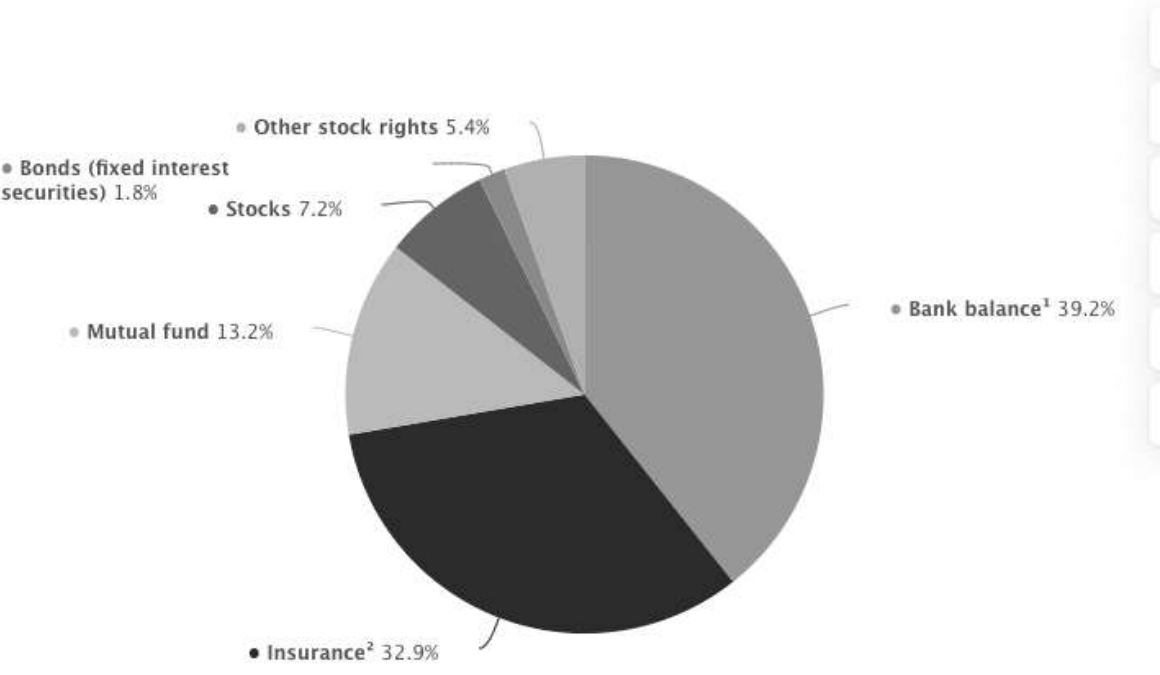
financial assets include stocks, bonds, cash, and bank deposits (Campbell, 2006). Adding Equity, Pension entitlements, Insurance Contracts and financial derivatives, Poterba (2000) discussed the difficulties to measure the individual return rate per household. Savings and investment behavior among households has been extensively studied (Karen E. Dynan, 2004) (Hurd, 1990). Research has shown that factors such as age, income, education, and risk tolerance significantly impact households' decisions to save and invest (John Ameriks; Andrew Caplin; John Leahy, 2003) (Luigi Guiso, 1996). Additionally, social and cultural factors have been found to influence households' financial asset accumulation (Chiteji & Stafford, 1999).

CASH AND BANK DEPOSITS

Cash and bank deposits are generally considered to be the safest financial assets, but they are not immune to inflation risks. As inflation increases, the purchasing power of cash holdings and the real returns on bank deposits decrease (Feldstein, 1983).

The following graphic shows the breakdown of household’s cash and bank deposit. The assets into banks, insurance and securities shows a rather conservative investment behavior. 72% of assets are attributable to insurance policies and bank deposits, 28% to securities. The statutory pension entitlements and civil servants' pension entitlements of private households are not included in this analysis. households.

Fig. 2: Distribution of financial assets in private households in Germany in 2021, by type



Source: Statista, 2021

Adding to this conservative behavior, Eymann et al (2002) examined saving behavior and financial asset holdings in Germany using data from the Socio-Economic Panel (SOEP). They found that German households tend to have a higher preference for risk-free assets, such as savings accounts and government bonds, compared to other developed countries. Similarly, Fuchs-Schündeln and Schündeln (2005) analyzed the distribution of financial assets across German households, revealing a high degree of wealth inequality and a low participation rate in risky assets.

A study by Tiefensee and Grabka (2015) analyzed the wealth distribution among German households between 2002 and 2012. They found that the median net financial wealth increased during this period, driven mainly by the accumulation of savings deposits, bonds, and shares. The study also identified significant wealth disparities between different socio-economic groups, with the top 10% of households holding 61% of the total financial wealth.

STOCKS

When examining the composition of German household portfolios, Fichtner and Weber (2021) found that stocks represent a relatively small share of the average German household's financial assets, with the majority of households preferring to invest in safer assets like savings accounts, bonds, and real estate. Glaser and Weber (2007) found that German households tend to be risk-averse, which might explain their low stock market participation rates. However, their study also indicated that households that do invest in stocks tend to hold well-diversified portfolios, which could mitigate the risk associated with stock investments.

One of the main factors influencing stock market participation among German households is the level of financial literacy. According to Bucher-Koenen and Ziegelmeyer (2014), financial literacy is positively correlated with the likelihood of participating in the stock market. Moreover, they found that households with higher income and education levels are more likely to invest in stocks. Another important factor is the role of trust in financial institutions. Ehrmann and Tzamourani (2012) found that trust in banks positively influences stock market participation among German households, suggesting that trust in the financial system is a crucial prerequisite for households to engage in stock market investments.

Eisele et al. (2018) found that households owning stocks tend to have higher net wealth compared to non-stockholding households. They also suggested that stock market participation might contribute to wealth inequality in Germany, as wealthier households are more likely to invest in stocks and benefit from stock market gains.

EQUITY

The German household sector has long been characterized by a low equity ownership rate, as documented by Börsch-Supan and Eymann (2000). They showed that only a small fraction of German households held stocks or equity mutual funds. Later, Haliassos and Michaelides (2003) confirmed the low share of equity in the German households' financial portfolio and explored the reasons behind this phenomenon. They attributed it to risk aversion, lack of financial literacy, and high transaction costs. These findings were further supported by Dorn and Huberman (2005), who revealed that both risk aversion and limited financial knowledge contributed to the low equity participation rate in Germany.

In an attempt to explain the underlying reasons for this risk aversion, Guiso, Sapienza, and Zingales (2008) conducted a cross-country analysis that compared German households' investment behavior with that of other countries. They found that trust played a significant role in the equity investment decision. German households, according to their research, were less likely to invest in stocks due to a lower level of trust in the stock market compared to their counterparts in other countries.

A more recent study by Bucher-Koenen and Ziegelmeyer (2014) analyzed the role of financial literacy and education in determining equity investments. They found that financial literacy positively impacted the likelihood of holding equity assets. Moreover, they revealed that the gap in equity ownership between Germany and the United States could be partially explained

by differences in financial literacy. The role of cultural factors in influencing equity investments was also explored by Georgarakos and Pasini (2011). They found that intergenerational transmission of financial habits and preferences played a role in the low equity ownership among German households. This finding emphasized the importance of considering cultural factors when studying household financial behavior.

Finally, more recent research by Eisele et al. (2018) has suggested that digitalization and the emergence of new investment platforms could potentially change the landscape of German households' financial asset allocation. They argue that digital platforms such as Trade Republic can lower transaction costs and improve financial literacy, which may lead to increased equity investments among German households.

PENSION ENTITLEMENTS

As mentioned in the beginning, one of the earliest comprehensive studies on German household financial assets was conducted by Börsch-Supan et al. (2008), who analyzed the German SAVE panel data, offering valuable insights into the savings behavior and portfolio composition of German households. They found that pension entitlements, particularly from public and occupational pension schemes, constituted a significant portion of German households' total wealth.

Subsequently, Schröder (2016) examined the distribution of pension entitlements and income inequality among German households. The study found that the statutory pension insurance (*Gesetzliche Rentenversicherung*) played a crucial role in reducing income inequality. This was further corroborated by a study conducted by Bönke et al. (2017), which revealed that occupational pension plans also contributed to wealth disparities due to their unequal distribution across socio-economic groups. In addition to public and occupational pension schemes, Riester pensions have become an important pillar of the German pension system since their introduction in 2001. A study by Pfarr and Schneider (2013) investigated the determinants of Riester pension adoption, finding that factors such as age, income, and education significantly influenced the likelihood of households choosing Riester pensions. Moreover, Corneo (2017) highlighted that Riester pensions might exacerbate wealth inequality due to their regressive nature, as they tend to benefit higher-income households more than lower-income households.

More recent studies have focused on the impact of demographic changes and macroeconomic factors on German pension entitlements. For instance, the effects of population aging on the German pension system, is argued that it would lead to a decline in the system's financial sustainability. Meanwhile, Fichtner and Weber (2021) analyzed the implications of low-interest rates on German pension entitlements, emphasizing the need for policy adjustments to preserve the long-term stability of the pension system.

The financial assets of German households have garnered significant attention in recent years, especially due to new technology and an uprise in wealth in Germany. Nevertheless, the non-financial assets also play a crucial role in most household portfolios. Finishing the literature review on financial assets, the following part will provide an overarching literature overview of non-financial assets in German household's portfolio.

2.2.2 NON-FINANCIAL ASSETS

Non-financial assets are characterized by their intrinsic value and potential to generate income and/or capital gains. Especially real estate, intellectual property, and collectibles. Ibbotson and

Siegel (1984) were among the first to demonstrate that real estate investments in Germany exhibited a positive correlation with inflation. This finding has been supported by subsequent research, including that of Eichholtz et al. (2015), who found that German residential real estate offered a significant inflation hedge over the long term. Similarly, Döhrn and Dunz (2018) investigated the impact of inflation on German households' real estate investments. They found that real estate investments acted as a partial hedge against inflation, as property prices tended to rise in tandem with inflation. This finding is in line with the research conducted by Hoesli et al. (2008), who found that real estate investments in several European countries, including Germany, provided a hedge against inflation. In the following, there will be a deep dive on real estate and collectibles as those represent the main contribution to non-financial assets of German households.

REAL ESTATE

Real estate is a popular non-financial asset in households' portfolios. Himmelberg, Mayer, and Sinai (2005) showed that housing returns are positively correlated with inflation, as property values and rental income tend to increase with higher inflation rates. However, the strength of this correlation may vary depending on the specific housing market and economic conditions (Case & Shiller, 1989). (Barasinska, 2011) provide an extensive analysis of the distribution and composition of non-financial assets in German households, emphasizing the importance of real estate. Their findings show that real estate assets account for a significant portion of households' wealth, with the homeownership rate in Germany being approximately 51%. Several studies have examined the factors influencing the decision to own real estate in Germany. Chiuri and Jappelli (2003) found that age, income, and family structure are critical determinants of homeownership. In a later study, Fritzsche and Vandrei (2016) highlighted the role of cultural factors, including the preference for renting over owning property in Germany.

The role of real estate in shaping household wealth and inequality has been the subject of various research. Westerheide (2012) found that real estate assets are a significant contributor to wealth inequality in Germany, as they are concentrated among higher-income households. Conversely, Frick and Grabka (2013) argue that real estate can serve as a stabilizing factor, as it is less volatile than financial assets.

Regional differences in real estate ownership rates and values have also been explored by researchers. Bönke et al. (2017) found substantial regional disparities in homeownership rates across Germany, with higher rates in rural areas and lower rates in urban regions. Additionally, Kholodilin, Mense and Michelsen (2018) highlighted the impact of local housing market conditions on homeownership rates.

The literature has also discussed policy implications for the German housing market. Voigtländer (2011) argued that targeted policies could increase homeownership rates and reduce wealth inequality, while Kholodilin and Kohl (2018) examined the effectiveness of various housing policies in Germany. Especially the low occupancies rate of homeowners in Germany – relatively to the southern European states is often the ground for political discussion.

COLLECTIBLES

In Germany, the importance of collectibles as an asset class has been documented in various studies. German households held around 2% of their total assets in collectibles. The authors further found that collectibles were held mainly by wealthier households and were used as a means of portfolio diversification. The growing interest in collectibles as an investment has led

to the development of indices that track their performance. One example is the German Collectibles Index (GCI), which tracks the value of a diversified portfolio of collectibles, including art, wine, and classic cars. The authors found that collectibles provided a relatively stable performance over time, with low correlation to traditional financial assets.

Tangible assets, such as art and collectibles, are often considered to be hedges against inflation due to their unique characteristics and scarcity (Goetzmann, 1993). While some studies have found a positive correlation between inflation and the returns on art and other collectibles (Baumol, 1986) others have suggested that this relationship is weaker and less reliable than often assumed (Mandel, 2009). Adding to that, Bostic et al. (Bostic, 2010) found that collectibles could play a significant role in the diversification of household portfolios. They argued that collectibles offer an inflation hedge, while also serving as a store of value. In a study of German households, Eichholtz et al. (2012) found that collectibles, particularly art, had historically provided higher returns than bonds, while having a low correlation with traditional financial assets.

2.3 LITERATURE REVIEW CONCLUSION

This paper concluded that since the onset of high inflation and the ECB rate hikes in 2022, German households, which typically have a high proportion of cash and cash equivalents, have experienced a significant decrease in asset returns. The real returns on total household assets in Germany, and the wider Eurozone, have seen a consistent drop over the past two years, though they were systematically positive up to and including the first half of 2022. As such, in the evolving global economic conditions characterized by inflation, it's imperative for households to adopt effective strategies to manage return rates and hedge against inflation.

The aim of this research was to deeply analyze the effects of inflation on German household asset returns from 2015 to 2023, especially in the context of the high inflation and ECB rate hikes starting in 2022. The study employed an examination of the existing literature on inflation and household portfolio returns, placing on the German context. These households, which are generally mature, have seen almost universal declines in real returns on total household assets throughout Germany and the wider Eurozone in the past two years, despite being systematically positive up until the first half of 2022.

This study's findings are highly relevant in our current economic climate. They highlight the importance of households in Germany, and potentially similar economies, adopting effective financial strategies to manage return rates and hedge against the implications of inflation. The insights derived from this study could help in the development of financial policies and strategies aimed at cushioning households from the adverse effects of inflation, thereby providing a significant contribution to the body of knowledge and policy-making in this area.

The financial sophistication of German households can also play a role in the way inflation affects their portfolio returns. More financially sophisticated households are likely to possess a better understanding of inflation dynamics and may adopt investment strategies that account for inflation risks (Guiso & Jappelli, 2008). These households may actively manage their portfolios to minimize the negative effects of inflation, whereas less financially sophisticated households may not possess the knowledge or resources to do so.

The relationship between inflation and equity returns is complex and context-dependent, with differing effects on different types of assets. Real estate and collectibles are popular non-financial assets in German households' portfolios, with the former acting as a partial hedge against inflation and contributing to wealth inequality, while the latter is used for diversification purposes by wealthier households. Overall, the literature highlights the importance of

understanding the unique characteristics and drivers of household asset allocation in Germany to inform policy and investment decisions.

Moreover, risk preferences can influence the impact of inflation on household portfolio returns. More risk-averse households may hold conservative portfolios with a higher proportion of fixed-income assets, making them more susceptible to the adverse effects of inflation (Ehrmann & Ziegelmeier, 2017). Conversely, more risk-tolerant households may allocate a larger share of their portfolios to assets with better inflation-hedging characteristics, such as equities or real estate, which could mitigate the negative impact of inflation on their portfolio returns.

In conclusion, not every household in Germany is affected by inflation in the same way. In addition to household's financial sophistication, risk preferences, diversification and portfolio composition, people are differently affected, especially, young and old ones. As young people rely on certain purchases to pursue - they cannot time forward it, awaiting lower prices. And old people have limited chance to increase income while on pension pay.

The yield advantage of financial assets shown above was relatively large in Germany during the crisis, while the yield advantage of financial assets was almost zero. This is mainly due to the development of the economy in the first two quarters of 2022 in Germany, which was almost stagnant. However, the differences were different at the end of the high-interest phase when performance was worse. This was due to both a significantly lower average real return on nonfinancial assets and a decline in the average return on financial assets. Since 2015, however, real returns on German nonfinancial assets have also been declining. In the last reporting year, real returns on financial assets were systematically negative and could only be offset by positive returns on nonfinancial assets.

The preliminary conclusion is that real returns on total household assets have declined almost everywhere in the Eurozone over the past two years but were systematically positive up to and including the first half of 2022. However, this is only due to nonfinancial assets, as financial assets have consistently shown negative returns recently. In contrast, it remains to be seen whether households have responded to the different return trends by changing the composition of their portfolios and how this has affected returns.

With high inflation and rising interest rates in the EU and the U.S., more information on the impact of changes in household portfolios will become available in the coming months. On this basis, further research is proposed to identify the lagged inflation factor associated with asset returns.

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Shadow banking system and financial stability in Georgia

David Sikharulidze, Vakhtang Charaia, Mariam Lashkhi

Abstract

Shadow banking has grown to be a significant component of many financial systems..Given their importance in transferring risks to the financial system, institutions operating within the shadow banking system need to be given more consideration, as the recent global crisis has demonstrated. This paper aims to study the size and trend of shadow banks in Georgia in the context of financial stability. In this context, an analysis of the financial sector of Georgia was carried out in order to study the activities of shadow banks and the potential of risks related to their activities. In order to evaluate the size of shadow banking in Georgia and risk related to shadow banking we have utilized methodology used by FSB and ESRB. The results of the analysis indicate that non-bank financial institutions such as leasing and pawnshops are part of the shadow banking system that is not subject to banking regulations. Their shares and activities do not threaten financial stability.

Keywords

Shadow banking, Nonbank financial institution, Other financial intuitions, Financial stability

JEL Classification

G0, G1, G2

1 INTRODUCTION

In recent years Shadow Banking has grown its importance globally. According to the Financial Stability Board (FSB) the Non-Bank Financial Intermediation (NBFI) sector showed solid development in 2021, in huge portion since of higher valuations and inflows into an investment fund, which benefited from the economic recovery. The NBFI sector grew by 8.9% in 2021, exceeding the 6.6% increase it experienced over the previous five years reaching \$239.3 trillion. The total NBFI sector increased its relative share of total global financial assets from 48.6% to 49.2% in 2021. Investment funds, particularly equities funds, continued to be a major driver of NBFI sector growth in 2021.

Fig. 1: Dynamic of Total Global Financial Assets in Trillion USD



Source: FSB 2022.

Global trends in NBFIs sector covers 29 jurisdictions that account for around 80% of global GDP. In those Jurisdictions assets of non-bank financial entities are classified into the five economic functions (EF), used as a narrow measure of NBFIs activities which grew by 9.9% to \$67.8 trillion, representing 28.3% of total NBFIs assets and 14.1% of total global financial assets.

The largest growth was observed for collective investment vehicles with features making them susceptible to runs (EF1) remained by far the largest economic function (For detailed explanation of Economic Functions (EF) refer section 1.2 The Narrow Measure of Shadow Banking).

By enhancing credit availability or by promoting market liquidity, maturity transformation, and risk sharing, shadow banking can enhance traditional banking. For instance, financing companies and microcredit lenders frequently offer credit and investments to underbanked communities, subprime clients, and low-rated businesses in developing economies **Ghosh, et al. (2012)**. In industrialized nations, several types of funds have been stepping in to provide long-term loans to the private sector while banks have been fixing their balance sheets and cutting back on certain activities. These funds frequently function as middlemen for insurance companies and pension funds (Global Financial Stability Report 2014).

In order to have a meaningful discussion about potential upgrades to the macroprudential regulation of shadow banks, it is necessary to have a basic understanding of how they operate and to estimate the size and systemic significance of this area of the financial system using data that is currently available but still comparatively scarce. Therefore, the paper is aiming at to evaluate the size of shadow banking and potential systematic risk related to shadow banking in Georgia.

The paper is divided into three main parts. An introduction is followed by an explanation of the concept of shadow banking, its advantages and disadvantages. The third part discusses the assessment process of shadow banking in Georgia, the size and potential systemic risks associated with shadow banking, and the last part summarizes the main conclusions.

2 THEORETICAL BACKGROUNDS

Shadow Banking as less regulated segment of the financial system is growing and there are many studies and speeches on the subject, though there is no widely accepted definition or consistent method of measurement that conveys a unique characteristic of the sector in various nations (**Jackson & Matilainen 2012**). Shadow Banking is a credit intermediation that involves entities and activities outside the regular banking system and embraces other forms of direct lending without maturity and liquidity transformation **Financial Stability Board, (2012)**. Being outside the formal banking system generally means that they lack strong safety nets, such as guaranteed deposit insurance or lending facilities of last resort from central banks and operate under weak regulatory oversight. These characteristics increase the risks to financial stability, **Ghosh, Gonzalez at al. (2012)** which is the main reason why today's focus is on Shadow Banks from regulators perspective. Although the above definition gives an idea of Shadow Banking, it has some flaws. Notably, it may include organizations that are not typically considered as Shadow Banks, e.g.: leasing and finance companies, credit-oriented hedge funds, corporate tax vehicles, etc., but still, facilitate credit extension intermediary activities. In addition, according to the definition, Shadow Banking activities mostly take place outside the regular banking system. However, many Shadow Banking transactions, such as securitization (implemented by structured investment vehicles) collateral operations of dealer banks, repos, etc., take place in banks, especially Systemic Banks **Pozsar et al. (2011)**, **Cetorelli at all. (2021)**. The term "Shadow Banking" was first used by Paul McCully in his 2007 speech at the Annual Financial Symposium in Jackson Hole. His report **McCulley, (2007)**. at the financial symposium was about Non-Bank Financial Institutions (NBFI) that are engaged in maturity transformation, i.e. creating long-term loans from shorter-term sources and are not subject to the regulation applicable to credit institutions **Kodres, (2013)**.

In a narrow sense, Shadow Banking definitions usually refer to the core activities of conventional banking, it may be with regards to the financing perspective, i.e., taking liquid deposits or issuing deposit-like instruments, or the lending perspective, i.e., providing credit to the non-financial sector **Jackson & Matilainen (2012)**.

A review of the literature reveals several key characteristics of what is meant by the term "Shadow Banking". These characteristics are maturity, liquidity, and credit transformation. Institutions may have substantial maturity and liquidity mismatches, as well as problematic or weak lending rules and insufficient risk management. Regulators are concentrating on tools like leverage limits, capital requirements, prudential regulatory regimes similar to those that apply to banks, limits on concentration, restrictions on the structure of liabilities, restrictions on maturity/liquidity transformation, and liquidity buffers because of this **Financial Stability Board, 2013**).

There are several factors why Shadow Banking has developed, but evading taxes and laws stands out as being very significant. This implies that in order to reduce the regulatory load, individual institutions' operations must change **Adrian, (2014)**, **Shin (2010)**; **Mehrling at al (2013)**, **Vittas & Mundial, (1992)**. The risk of excessive regulation of the banking industry, one of the worries raised in the discussions about the complex regulatory reforms brought about by the Basel III framework, should be taken into account in this context.

It is unclear and conflicting to determine Shadow Banking's role and function within the system of financial intermediation. Numerous authors give the Shadow Banking system generally favorable reviews. For some demographic groups of people and medium and small businesses, the shadow system opens up new avenues for lending on the financial markets. For instance, in long-term financing operations of real sector enterprises, investment funds in developed countries act as intermediaries for insurance companies and pension funds, whereas in

developing countries, non-banking institutions (financial companies, microfinance institutions) have expanded credit opportunities for small businesses in locations where the network of banking institutions is not sufficiently developed and low for income earners **Ötke-Robe (2012), Rateiwa, R. & Aziakpono, M. J. (2017).**

In this regard, shadow banking can increase economic activity by lowering costs and expanding access to financial services, but this frequently comes at the expense of financial stability. One reason for the trade-off is that Shadow Banking's flexibility and price competitiveness frequently come at the expense of margins and security. For instance, banks must typically maintain far higher levels of capital and liquidity than Shadow Banks. They might also be able to serve clients that banks are unable or unwilling to serve or provide services that banks cannot. **Donald (2015), Pozsar et al. (2010).**

Contrary to traditional banks, shadow banks frequently provide riskier loans to dangerous borrowers and conduct their business with far less regulatory scrutiny intended to discourage risky activity. As a result, Shadow Bank operations are less secure than those of traditional banks and are not covered by the lenders of last resort and deposit guarantees that safeguard banks. As a result, these institutions' volatility can spread and accelerate more quickly than it can in traditional banks. **Noeth & Wolla. (2012).** However, it is stated in one of the documents of the European Commission (Green Paper on Shadow Banking) that Shadow Banking should not be viewed as a problem if risks are properly assessed and investments are made in assets whose value is supported by fundamental economic factors like economic growth, inflation, exchange rate, etc. **Islam, M. A. & Osman, J. B. (2011).**

As a result, we must consider the advantages of it in addition to the hazards. This is because shadow banks provide more funding options (for instance, for riskier businesses like startups), an alternative to bank deposits, a more effective way to use money because of their increased level of specialization, and the capacity to spread risks by reducing reliance on the banking industry **European Commission (2012).**

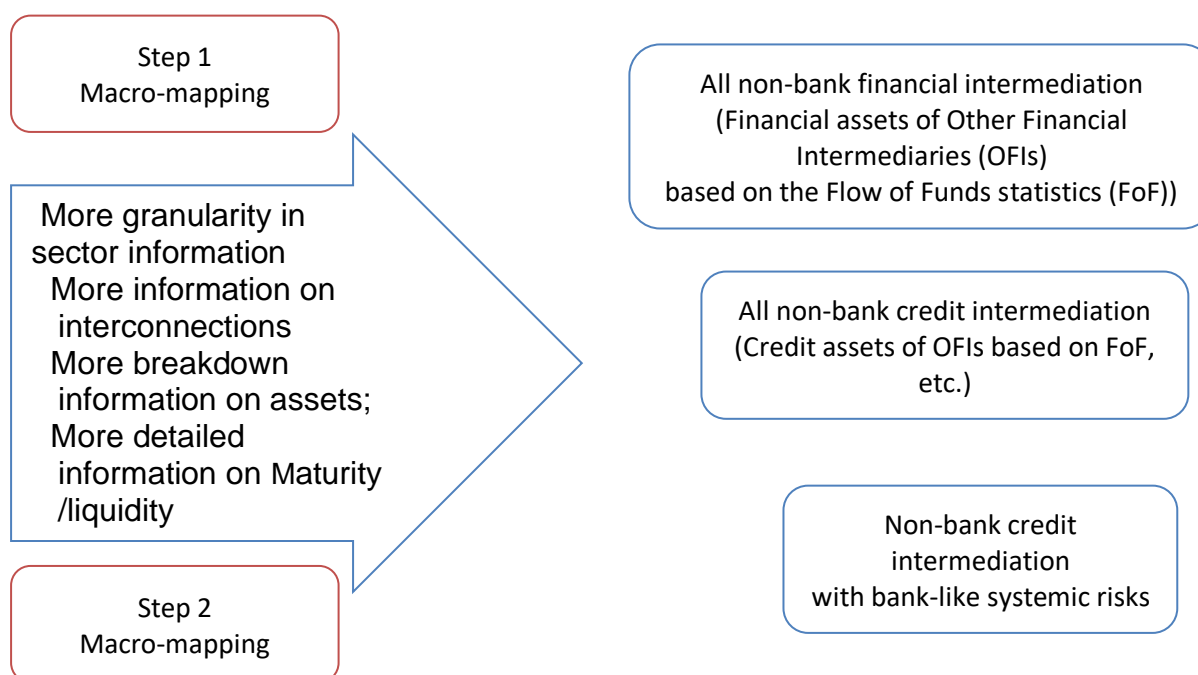
The Shadow Banking sector, as opposed to depository banks, heavily employs short-term loans to make investments in long-maturity wholesale money market assets. The Shadow Banking system is frequently referred to as a "market-based system" because of this practice **Pozsar at al. (2012).** The wholesale financing system and associated securitization activities, according to American economists G. Gorton and A. Metric, were significant elements in ensuring the rapid growth of the shadow banking industry in the late 19th century and the early 2000s **Gorton at al. (2013).** But, during an upcycle, when debt financing increases and a price bubble arises, shadow banking operations strengthen procyclicality and prevent the demise of such institutions, especially if they are systemically important, and pose additional risks to the financial system **Bakk-Simon at al. (2013).** The pro-cyclical nature of its activity is further strengthened by the Shadow Banking system's close operational ties to conventional banking institutions. Due to the high share of illiquid assets in the portfolios of shadow (parallel) structures, as well as the absence of financial support from official authorities, their activities have the potential to contribute to the emergence of an acute liquidity crisis in the money market. Shadow Banking also has a big impact on monetary policy because it can make central bank money instruments less effective **Deutsche Bundesbank (2014).** Thus, Shadow Banks can promote economic growth but usually do so at the expense of financial stability. This indicates the need to strengthen the regulation and control of this area of financial activity by official supervisory bodies

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

A better understanding and policy development of the Shadow Banking system requires a clear measurement of it. However, since it is a complex and interconnected system that includes many institutions, markets, and instruments, its extent depends on which measurement methodology is used to include or exclude any of its aspects.

The FSB created a working group with the aim of bringing more clarity to the definition of Shadow Banking, defining its role, developing approaches to monitoring the Shadow Banking system, and methods for measuring systemic risk. The monitoring framework developed by the FSB for the analysis of the Shadow Banking system includes two stages (see Figure 2):

Fig. 2: Measuring the shadow banking system



Source: FSB 2013

Mapping out the Shadow Banking system at the macro level. This is mainly done on the basis of regular statistics such as national accounts, monetary statistics. An example of this approach is the monitoring of subgroups in the category "Other Financial Intermediaries".

Identify relevant aspects of systemic risk and arbitrage opportunities. The information collected in the first step can be used to identify risks related to credit, maturity and liquidity transformation and leverage. It is important not to see Shadow Banking entities in isolation but to consider their position in relation to the rest of the credit chain. This exposes new Shadow Banking entities and makes it possible to reveal when activities interact with other parts of the financial system.

The next step is the detection of those non-banking financial entities that have the ability to create financial stability risks through Shadow Banking activities. In order to identify these entities, the FSB has developed a narrow approach to assessing "Shadow Banking".

According to the narrow assessment approach, financial entities are classified according to five economic functions (EFs), each of which includes non-bank credit intermediaries that may pose a risk to financial stability (see table 3). These functions are:

1. The management of collective investment schemes that are susceptible to runs (EF1)
2. Lending dependent on short-term funding (EF2);

3. Market intermediation dependent on short-term funding or secured funding of client assets (EF3);
4. Facilitating credit creation (EF4);
5. Securitization-based credit intermediation (EF5).

This approach allows the use of data from financial accounting and other related financial statistics, such as balance sheet data of non-banking financial institutions, which provides consistency both globally and regionally. The European Systemic Risk Board (ESRB) has developed a monitoring mechanism for the European Shadow Banking system, which is generally consistent with the definitions and approaches developed by the FSB. In particular, the ESRB distinguishes between risks arising from financial institutions (entity-based approach) and their activities (activity-based approach).

Systemic risk may be caused directly by activities regarding credit intermediation, maturities and liquidity transformation, leverage, or incorrect credit risk transfer, or it may be caused indirectly via connections between the Shadow Banking system and the main banking system. To assess Shadow Banking risks using a standard risk mapping approach, The ESRB has created a set of indicators, which are shown in Table 1.

The ESRB's proposed indicators are a collection of financial ratios that serve as risk indicators for companies and activities related to Shadow Banking. As a result, neither the framework nor its early-warning system is expected to be forward-looking. The interpretation of these indicators is challenging because none of the macroprudential policies of the ESRB have set definitions of key values related to risk measures (e.g., if they are too high or too low).

Tab. 1: Financial stability risk metrics

Examples of risk metrics
Credit intermediation (CI)
CI 1 Loans / Total assets
CI 2 Credit assets ² (loans and debt securities) / Total assets
Maturity transformation (MT)
MT1 (long term assets – (long term liabilities + equity) / total financial assets
MT2 short term liabilities / short term assets
Liquidity transformation (LT)
LT 1 = total financial assets – liquid assets + short term liabilities / total financial assets
LT 2 = (total financial assets – liquid assets (broad) +short term liabilities)) / total financial assets
Liquidity transformation (LT)
LT 1 = total financial assets – liquid assets + short term liabilities / total financial assets
LT 2 = (total financial assets – liquid assets (broad) +short term liabilities)) / total financial assets
Leverage
L1 = total financial assets / equity
L1= (total financial assets+ total off balance sheet exposures)/ equity

Source: FSB 2021

RESULTS AND DISCUSSION

3.1 Macro-mapping of all non-banking financial intermediation

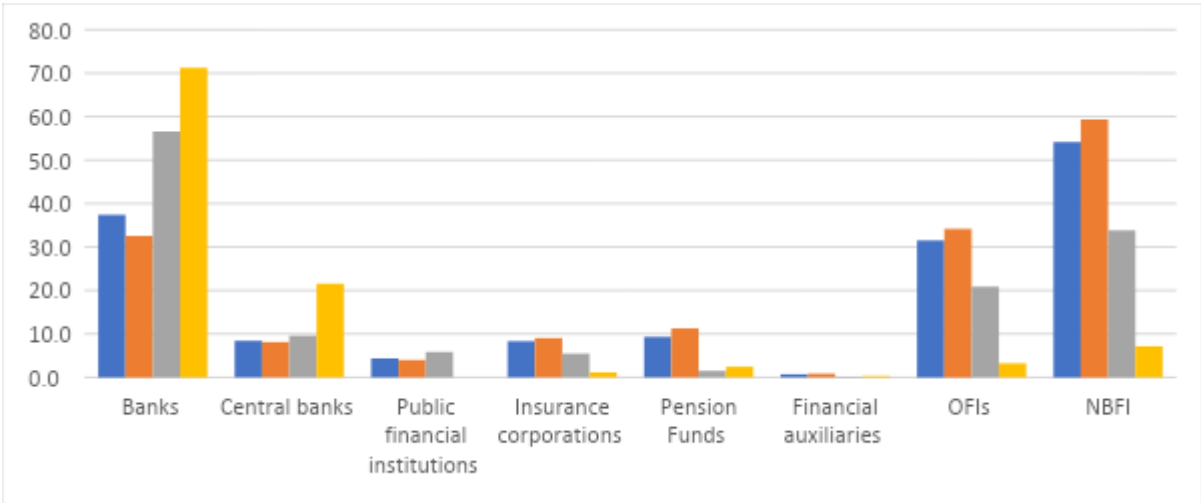
The financial sector of Georgia is one of the most developed segments of the domestic economy. However, when we consider the structure, liquidity, and type and complexity of operations of individual market segments, it still appears relatively underdeveloped.

The financial sector of Georgia mainly consists of deposit-taking banking institutions. According to Article 48 of the Law on the National Bank of Georgia, the supervisory authority of the National Bank extends to commercial banks, banking groups, non-bank depository institutions, microfinance organizations, independent registrars of securities, brokerage companies (except insurance brokers), stock exchange, central depository, specialized depository, asset manager on the activities of companies, accountable enterprises, currency exchange offices, investment funds, payment system operators, payment service providers, credit information bureaus and lending entities.

The financial sector of Georgia is bank-oriented and characterized by high concentration. By the end of 2021, there were 14 commercial banks (total assets - 91.69%), 38 microfinance organizations (2.47%), 18 insurance companies (1.49%), pension funds (3.14%), and other non-bank financial institutions. Three out of 14 commercial banks are domestic systemically important banks, whose share of total assets is 80%, and 20% of non-systemic banks. There are no state banks. After a period of mergers and consolidation, the banking system is now concentrated in the two largest banks, both listed on the London Stock Exchange, accounting for almost three-quarters of loans NBG (2022).

Based on the methodology of the Financial Stability Board **Jackson & Matilainen, (2012)**, we estimate the share of Shadow Banks in the financial system. First, we will compile a macro map of the financial system using the balance sheets of financial institutions, which allows the analysis of the developments in the financial system and the connections between financial institutions. The starting point of the analysis is the financial reports, which are the database of the National Bank of Georgia, the National Statistical Service of Georgia.

Fig. 3: Composition of the Global financial system (29 jurisdiction and Georgia) as % of total domestic financial assets for 2021



Source: FSB 2022, NBG 2022.

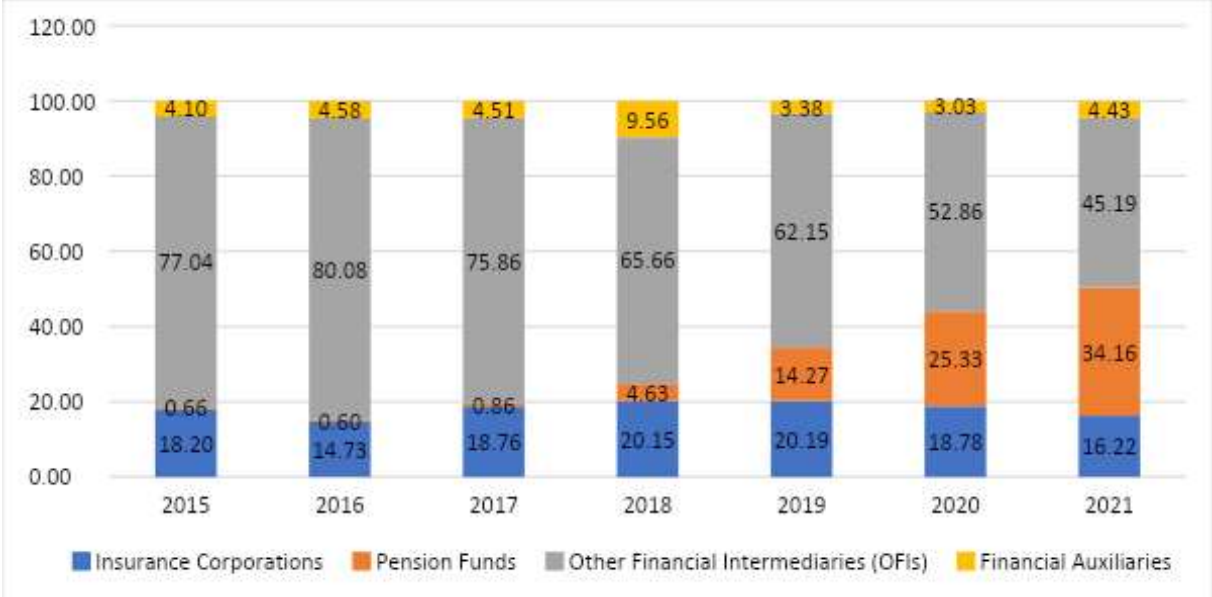
*29 jurisdiction - as % of total domestic financial assets; Georgia – as % of Total domestic assets

In 2021, the share of assets of other financial intermediaries (OFIs) decreased by 0.61%. For comparison, in 2021 the share of other financial intermediaries was 3.23%, while the share of OFI in the global financial sector was 31.5%, in advanced economies was 34.2%, and in emerging markets - 20.9% (see figure 3).

In 2021, OFI is the largest sub-sector of NBFI with 45.19% of total NBFI financial assets. It is followed by pension funds with 34.16% and insurance corporations with 16.22% (see figure 4).

Other financial intermediaries include microfinance institutions, pawnshops, finance leasing companies and credit unions.

Fig. 4: Composition of NBFI total assets using narrow measure Y-o-Y (% share)



Source NBG 2022

3.2 THE NARROW MEASURE OF NBFI

In this section, we describe the narrow measure to the evaluation process developed by the FSB in terms of five economic functions (EFs) or activities. Then we will review trends according to economic functions, taking into account the specifics of the financial sector of Georgia.

There are two steps in the FSB approach for reducing firms in the NBFI sector to an activity-based narrow-measure of NBFI. FSB (2022).

- The initial phase uses a wide-ranging approach to get an overall assessment of the financial assets of entities that engage in NBFI. Insurance companies, pension funds, OFIs, and financial auxiliaries are examples of such NBFI enterprises.
- The second phase narrows the focus on credit intermediation activities that may create vulnerabilities because they entail the use of leverage or the transformation of liquidity or maturities. The Experts Group divides a subset of the NBFI entities into the five economic functions (EFs) in order to achieve this narrowing.

Considering the financial sector of Georgia, other financial intermediaries include microfinance institutions, financial leasing companies, pawnshops and credit unions classified in Economic Function 2; Broker-dealers are classified in Economic Function 3 and loan insurance companies are classified in Economic Function 4 (see Table 2).

None of the entities of the sub-sector of other financial intermediaries of Georgia are classified in economic function 5 which includes: Asset-backed securities, structured finance, securitization vehicles.

As already mentioned, economic function 1 includes collective investment vehicles (CIVs). There are 5 investment funds operate in Georgia (joint investment fund "Real Estate Fund Elysium, JSC Foresight Capital, JSC Diversified Credit Portfolio" LLC Gazelle Finance Georgia, joint investment fund "Rushmore"). Investment funds in Georgia are regulated by the Law of Georgia on Investment Funds, which entered into force in 2020. According to the mentioned law, an investment fund is a collective investment scheme that attracts capital from investors in order to invest capital in accordance with a defined investment policy, for the benefit of investors. Legislative herald of Georgia (2020). According to the mentioned definition, we can include investment funds in the classification of economic function 1. However, their assets are very small and they cannot create systemic risk. In addition, the analysis of the balance sheet of investment funds shows that they are not involved in credit intermediation.

As for economic function 5, which includes securitization transactions, their implementation in the market is not possible because the functions and duties between the parties are not regulated, it is not identified what kind of base assets can be used in such a transaction, and it is also not visible how the special purpose of assets is implemented and transferred to the entities. In the absence of the aforementioned, the implementation of such a transaction is high risk, and accordingly, such an entity, which could obtain financing by selling the underlying assets, will not be able to benefit from securitization, and its sources of financing will be limited. Also, the validity of the transfer of basic assets in such a transaction is a problem, in particular, in order for the securitization to take place, in such a transaction where the assets are fully transferred to a special purpose entity, it should be clearly established that the assets are transferred from the initiator's balance sheet to the so-called true sale, so that the investor who buys such a financial instrument does not become bound by the demands of the originator's creditors. This is known in a securitization transaction as bankruptcy remoteness and is required in order for investors to be confident that the assets involved in the securitization transaction are completely and unconditionally separated from the originator. The draft law "On Securitization" which has been initiated in the Parliament of Georgia serves to solve this problem. In particular, with the adoption of the draft law, an appropriate regulating legal environment for securitization will be created in Georgia, as a result of which it will be possible to issue the mentioned financial instruments and purchase them by investors. A securitization classically works like a debt security, and through the underlying asset distributes a fixed income to investors over the maturity of the securitization. This financial instrument itself represents the so-called structured finance, which among them allows one financial instrument to have different risk/profit profiles.

The EF2 group includes credit intermediation entities that usually depend on short-term financing. Finance companies, specializing in areas such as consumer finance, auto finance, retail mortgage insurance, commercial property finance and equipment finance. Entities involved in these activities typically compete with banks or offer services in niche markets where banks are not active players, and often concentrate their lending activities in specific sectors. As a result of such specialization, financial companies can increase the cyclical exposure in the sector. Financial companies that rely on short-term or wholesale funding can exacerbate cycles in these sectors or become a means of transmitting shocks to the sectors they serve if they are unable to meet these short-term obligations. In addition, financial companies offering deposit-like products to the retail sector may increase further risks for households and lenders, particularly as such products may not be protected by deposit insurance schemes and

may be sensitive. Where the data allows, financial companies that are consolidated in banking groups are excluded from EF2.

EF 2 includes the following lending entities: microfinance organizations, pawnshops, financial leasing companies and credit unions (see Table 2).

As of December 31, 2021, the non-bank financial sector was represented by 38 microfinance organizations and 183 lending entities. On December 23, 2017, the organic law "On the National Bank of Georgia" was amended, according to which the National Bank of Georgia received the authority to fully supervise the activities of non-banking organizations. As a result of the mentioned changes, the registration requirements of microfinance organizations were tightened in terms of eligibility criteria and capitalization. The requirement for capital has been increased from 250 thousand GEL to 1 million GEL, the NBG has set a registration fee. The active microfinance organizations became obliged to provide the required capitalization in two stages: they must have more than/equal to 500,000 GEL by 1 September 2018 and have more than/equal to 1 million GEL by 1 July 2019.

According to the "Rule of Supervision and Regulation of Activities of Microfinance Organizations" economic norms and limits were established, including capital, liquidity, investment and other coefficients, as well as the amount of supervisory capital and the method of calculation.

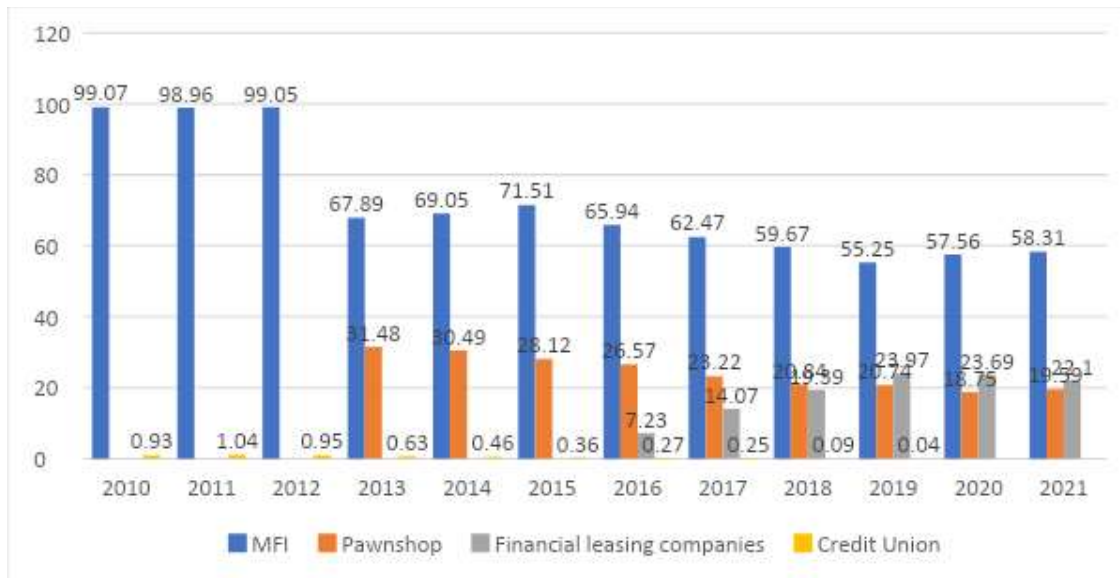
According to the mentioned regulations, microfinance entities are part of the banking group and are subject to prudential regulation, including for maturity/liquidity transformation, leverage, and imperfect credit risk transfer, and are therefore excluded from the narrow measure.

Tab. 2: Mapping Authority and Entity types classified by economic functions (EF)

EF1	Central bank	Investment fund
EF2	Central bank and prudential regulator	Microfinance organization,
	N/A	Financial leasing companies,
	N/A	Pawnshop
EF3	Central Bank	Broker-dealers (Investment firms)
EF4	LEPL Insurance state supervision service of Georgia	Insurance companies (credit insurances)
EF5	N/A	No entities classified

The share of financial leasing companies is growing slightly until 2019 (see figure 5). After 2019, it is characterized by a decreasing trend. In addition, it should be said that despite the adoption of macroprudential measures related to commercial banks, no changes were reflected in the assets of the rest of the financial system, which remained outside of regulation. While the assets of the entities of the financial system (leasing companies, securities activities, money market funds, repo market and hedge funds) remaining outside the regulations in the global financial markets have increased significantly. **Bakk-Simon et al. (2012).**

Fig. 5: Entity total assets share Y-o-Y classified by EF2



Source: NBG 2022

Among EF2 entities, microfinance institutions have the largest share of total assets (58.31%), however, as already mentioned, microfinance institutions are subject to prudential regulations and banking supervision and will be excluded from narrow assessments, and credit unions will not be taken into account during narrow assessments. Consequently, according to a narrow assessment, the volume of assets of Economic Function 2 (EF2) is 1.015 billion GEL (see Table 3).

As for economic function 3, this includes brokerage companies. As of 2021, there are 9 brokerage companies on the market with total assets of 195.2 million. Out of 9 brokerage companies, only two brokerage companies are engaged in credit intermediation. In particular, the volume of loans issued by Galt & Taggart amounts to 9 million GEL. And the volume of loans issued by Heritage Security is 2.9 million GEL. However, since brokerage companies are subject to regulation by the National Bank of Georgia, they are therefore excluded from the narrow measure.

Tab. 3: Size of aggregates and composition of the narrow measure: 2015-2021

<i>In GEL</i>	Total Assets	NBFI	OFls	Narrow Measure
Size In 2015	35 608 488 195	2 741 399 009	2 202 196 533	581 475 837
Size In 2016	43 427 720 128	3 512 824 774	2 948 307 578	897 518 759
Size In 2017	47 854 264 587	2 952 878 555	2 345 918 892	780 866 367
Size In 2018	54 529 075 705	3 336 068 956	2 422 042 181	907 076 110
Size In 2019	65 361 677 121	3 822 760 580	2 459 170 932	1 031 595 980
Size In 2020	79,127,969,593	4,728,688,786	2,577,813,542	1,015,821,835
Size In 2021	84,690,352,507	5,806,373,552	2,745,676,572	1,035,922,780
1-year Growth Rate	7%	23%	7%	2%
As % Of Total Financial Assets 2020		6%	3%	1%
As % Of Total Financial Assets 2021		7%	3%	1%
As A % Of NBFI Assets In 2020			55%	21%
As A % Of NBFI Assets In 2021			47%	18%

Source: Authors calculation.

The total assets of entities in the narrow measure grew by 2% in 2021 to reach 1,035 billion GEL compared to an 23% increase in total NBFI sector assets. Therefore, resulting narrow measure was 1 billion GEL at end-2020, representing 21 % of NBFI sector assets and more than 1% of total financial assets (see Table 3).

Compare to the ratio of the narrow measure across jurisdictions It can be seen from the same table that for AE the Narrow measure as % of NBFI assets is 25.56%, and for EME - 46.86%. It can also be seen from the table that the Narrow measure as % of total financial assets for AE is 13.88%, and for EME it is 12.73%. For comparison, in Georgia, Narrow measure as % of NBFI assets is about 18.00%, and Narrow measure as % of total financial assets is 1.18% (FSB 2022).

3.3 RISK METRICS FOR ECONOMIC FUNCTIONS ENTITIES

Risk assessment was carried out for all entities of EF2, EF3 and EF4. Though microfinance institutions were excluded from the narrow measurement (see Table 4).

Overall, EF2 entities perform significant credit intermediation and have limited or negative maturity transformation and moderate liquidity transformation. EF2 entities will use a somewhat moderate degree of leverage.

Tab 4: Risk metrics

	EF 2			EF 3	EF 4
	MFI	Pawnshop	Financial Leasing companies	Broker Companies	Insurance Corporations
Credit Intermediation (CI)					
Credit Intermediation 1 (CI1)	0,89	0,84	0,77	-	0,84
Credit Intermediation 2 (CI2)	0,89	0,80	0,70	0,00	0,02
Maturity Transformation (MT)					
Maturity Transformation 1 (MT1)	-0,87	-0,28	-0,20	-0,07	-0,43
Maturity Transformation 2 (MT2)	0,61	7,38	0,93	0,01	0,70
Liquidity Transformation (LT)					
Liquidity Transformation 1 (LT1)	1,04	1,09	0,90	-	-
Leverage					
Leverage 1 (L1)	2,72	4,43	5,60	18,36	1,65

Source: Authors calculation

Credit Intermediation: The values of CI1 (ratio of credit assets to total financial assets) and CI2 (ratio of loans on the asset side of the balance sheet to total financial assets) were 0.89, 0.84 and 0.77, respectively. Since the maximum value of this ratio is 1, it indicates that finance companies engage in significant credit intermediation. This is perhaps not surprising as EF2 entities and especially financial companies are involved in more traditional forms of lending.

The maturity transformation metric MT2 (the ratio of short-term liabilities to short-term assets) was 0.62, 7.38 and 0.93 for all three units of the EF2 function. In the case of microfinance institutions, the coefficient value of 0.62 indicates a negative coverage transformation. In the case of financial leasing, 0.93 indicates that short-term liabilities are fully covered by short-term assets.

Moreover, since the value of MT1 (ratio of short-term liabilities to long-term assets) was -0.87, -0.28 and -0.2, it shows that only an insignificant or negative part of long-term assets have been funded through short-term liabilities, which shows the absolute amount of that short-term liabilities is very small compared to long-term liabilities.

The liquidity transformation metric LT1 (the amount of less liquid assets funded by short-term liabilities) was slightly above 1 for the three entities that provided it, indicating that short-term liabilities are roughly equivalent to liquid assets for these entities.

L1 leverage ratio (ratio of total financial assets to equity) for companies was 2.7, 4.43 and 5.6 respectively indicating a moderate to low amount of leverage.

Economic function 3 includes brokerage companies. Table 2 shows that brokerage companies are not involved in credit intermediation. Maturity Transformation 1 is -0.07 . This coefficient is close to 0 indicating no maturity transformation. The coefficient of Maturity Transformation 2 is 0.01 which indicates negative maturity transformation. The brokerage's Leverage 1 ratio is 18.36 which is quite high. For comparison, in FSB's Global Monitoring Report, the median ratio of total financial assets to equity capital (L1) was about 13.6 in 2020, and in 2021, the his ratio decreased significantly.

Risk metrics for Economic function 4 appear stable. EF4 entities (Insurance companies) are not active in credit intermediation. Maturity Transformation (MT1 is -0.43 , and MT2 -0.7) which indicates negative maturity transformation. Risk metrics for EF4 for 29 jurisdictions are not published due to the difficulty in interpreting the relatively sparse risk data provided by jurisdictions due to the small size of EF4 assets as a proportion of financial assets in reporting jurisdictions, reporting of risk metrics data for EF4 is particularly sparse (FSB 2022).

Conclusion

The definition of the "shadow banking system" is a system made up of NBFIs that carry out or support the credit intermediation process. The size and quantity of these institutions must be considered, as well as the potential that their operations could lead to systemic risks that could jeopardize the stability of the system. Although non-bank financial firms are growing in importance, they continue to be a less regulated part of the financial system. They are also strongly related to the sectors that are governed.

Estimates indicate that Georgia's financial system now has a low enough percentage of shadow banks that they do not pose a systemic risk. Due to the percentage of non-bank financial institutions in Georgia's financial system and the maturity structure of their liabilities and claims, there is no longer a risk to the stability of its finances.

One of the key problems is the lack of comprehensive and high-quality information for risk assessment. Certain companies, however, continue to operate outside of any regulatory frameworks and are not compelled to produce any sort of statistical reporting, which raises questions about transparency. Additionally, the lack of data transparency and the scarcity of publicly available information about the balance sheet activities make it more difficult to understand the shadow banking entities, making it more difficult to assess risk and the connections between the shadow banking entities and the financial system..

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Analysis of the concentration of non-life insurance markets for selected European countries

Jiří Slanina

Abstract

The aim of this contribution was to find out whether the concentration of the insurance market can be explained using another insurance or economic indicator. Data published by the Insurance Europe Association was examined. The research method used was correlation analysis. In the countries of Central and Eastern Europe, it was found that the concentration of the insurance market increases with the growth of the share of gross written premium of non-life insurance in GDP and with the growth of average non-life insurance per capita. On the contrary, in the countries of Western and Northern Europe, it was found that the concentration of the insurance market does not correlate in any way with the share of gross written premium of non-life insurance in GDP or with the average non-life insurance premium per capita. A strong negative correlation was found between the concentration of the non-life insurance market and the total size of the non-life insurance market (expressed as total gross written premium of non-life insurance).

Keywords

concentration of insurance market, gross written premium, Insurance Europe, correlation analysis, concentration ratio, Harfidahl-Hirschman index

JEL Classification

G22, E44, C10

1 INTRODUCTION

The aim of this analysis is to find out whether the concentration of the insurance market can be explained using another insurance or economic indicator. The explained change is therefore still the concentration of the non-life insurance market, the following indicators take turns in the role of the explanatory variable:

- Share of non-life insurance in GDP (insurance penetration)
- Non-life insurance premiums per resident (insurance density)
- Total gross written non-life insurance premiums (size of the insurance market)

Insurance markets in individual European countries were deliberately limited to the market of car insurance, property insurance and liability insurance. Life and health insurance were omitted. The line between social and private insurance within the personal insurance mix can be different within individual states, and the methodology of individual states can also be different, all of which will be included in the reported premium statistics for life and health insurance. If non-life insurance is mentioned in the text, it means that which does not include personal insurance, i.e. it excludes health and accident insurance.

Three working hypotheses will be tested:

H1: There is a correlation between the share of non-life insurance in gross domestic product and the concentration indicator of the non-life insurance market.

H2: There is a correlation between the non-life insurance premium per capita and the concentration indicator of the non-life insurance market.

H3: There is a correlation between the total non-life insurance premium and the concentration indicator of the non-life insurance market.

2 THEORETICAL BACKGROUND

Kramaric (2012) deals with the relationship between concentration and maturity of insurance markets in new EU countries. It defines the maturity of the insurance market in the form of an indicator of the average insurance premium per capita, market concentration is measured using three indicators: Concentration Ratio, Harfidahl-Hirschman index and the entropy index. As other methods for calculating concentration Kramaric recommends the Gini coefficient or the Lerner index. Kramaric explains the different degree of concentration of insurance markets by the different speed of transformation of centrally planned economies, where insurance services were mostly provided by institutions owned by the state. According to him, the level of competition is primarily determined by the level of access to foreign capital.

Dimič et al. (2018) also deal with a similar topic in their study. He examines the relationships between the total earned premium, the degree of economic maturity and concentration indicators in the countries of South-Eastern Europe. He comes to the conclusion that the degree of concentration of the insurance market is only weakly correlated with the total GWP and the total GDP per capita of individual states.

The concentration of the Italian insurance market was studied by Di Bartolomeo (2015), who draws attention to the fact that the degree of concentration of the insurance market may not only have a negative effect on the price of insurance, but also the personnel connections in the management bodies of individual insurance concerns.

The concentration of the insurance market outside of Europe was studied by Sukpaiboonwat (2013), who investigated the concentration of the Thai insurance market. Like Kramarič, he also uses several indicators to measure concentration, specifically the concentration ratio (CR1 and CR4) and the Harfidahl-Hirschman index.

From studying other studies, it follows that more attention is paid to the concentration of the insurance market in countries where concentration reaches higher values and is therefore perceived as a potential problem. Only a minimum of studies are focused on monitoring the concentration of insurance in economically highly developed countries with a developed insurance market.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

3.1 Data

Data published by Insurance Europe was used for the calculations in this analysis. Insurance Europe (until March 2012 known as Comité Européen des Assurances) is a European insurance and reinsurance federation that brings together a total of 37 members, which are national associations of insurance companies. The member of Insurance Europe for the Czech Republic is the Czech Association of Insurance Companies.

The input data for the calculation were:

Total gross written premium of non-life insurance the monitored countries, the share of gross written premium of non-life insurance in the total gross domestic product, gross written premium of non-life insurance per capita.

The most recent data on the degree of concentration of insurance markets was available from Insurance Europe for 2019. However, in a sufficient range of monitored countries, it was only available for 2017.

The concentration ratio was used as an indicator of the concentration of the insurance market. This indicator expresses the market share of a specified number of the largest companies. As a rule, the share of one largest firm (CR1), five largest firms (CR5) or ten largest firms (CR10) is used. In this work, the CR5 indicator is calculated and used for further calculations, i.e. the market share of the five largest insurance groups in the individual monitored countries.

In the last chapter, data on the GWP of non-life insurance from the sources of the Czech Insurance Association for the years 2010-2019 were used for the calculations.

3.2 Methodology

Correlation analysis will be used to examine the data. Specifically, the Pearson correlation coefficient will be calculated. Pearson correlation coefficient is one of the coefficients used to measure the tightness of the relationship between two quantities.

The expression of the Pearson coefficient by the formula is

$$r_{X,Y} = \frac{\sum_{i=1}^n (X_i - \underline{X})(Y_i - \underline{Y})}{\sqrt{\sum_{i=1}^n (X_i - \underline{X})^2 \sum_{i=1}^n (Y_i - \underline{Y})^2}}$$

The concentration of the insurance market will be calculated using two indicators: according to the concentration ratio method (CR5) and using the Harfidahl-Hirschman index.

The CR5 concentration ratio is calculated according to the formula:

CR5 = C₁ + C₂ + C₃ + C₄ + C₅, where C_n means the market share of the n-th largest firm in the monitored market.

The calculation of the Harfidahl-Hirschman index will be done using this formula

$$HHI = \sum_{i=1}^n (MS_i)^2$$

MS is the market share of the ith company.

An HHI below 0.01 (or 100) indicates a highly competitive industry

An HHI below 0.15 (or 1,500) indicates a non-concentrated industry.

An HH between 0.15 and 0.25 (or 1,500 to 2,500) indicates a medium concentration.

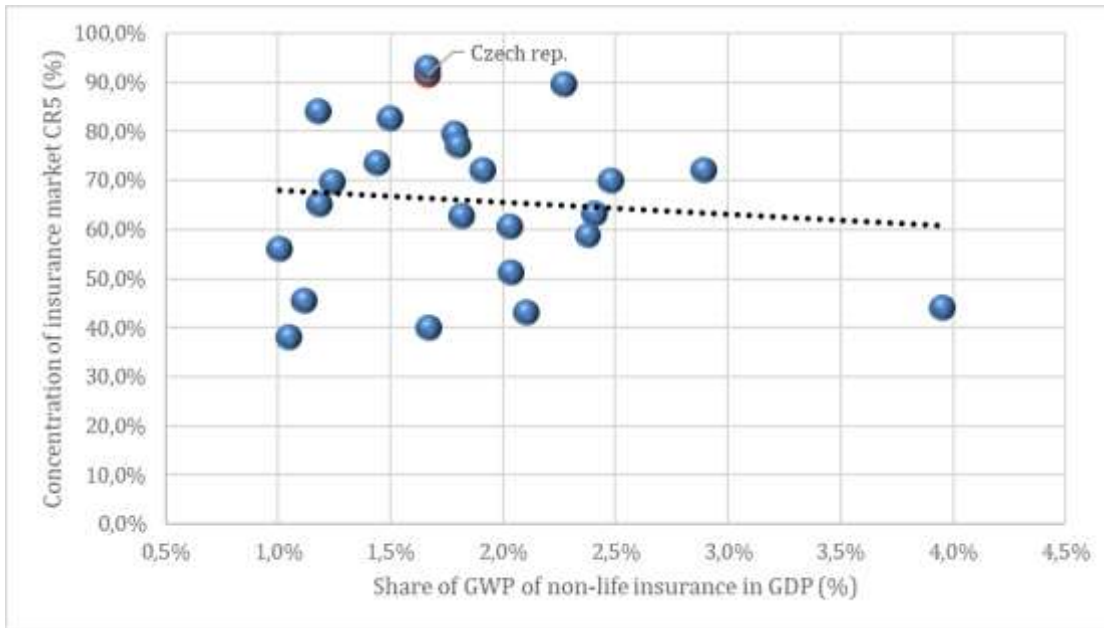
HHI above 0.25 (above 2500) means high concentration.

4 RESULTS AND DISCUSSION

4.1 Calculation of correlations between insurance market concentration and various economic and insurance indicators

There were XY graphs constructed from the calculated data, fitted with a regression linear function and Pearson correlation coefficients were calculated.

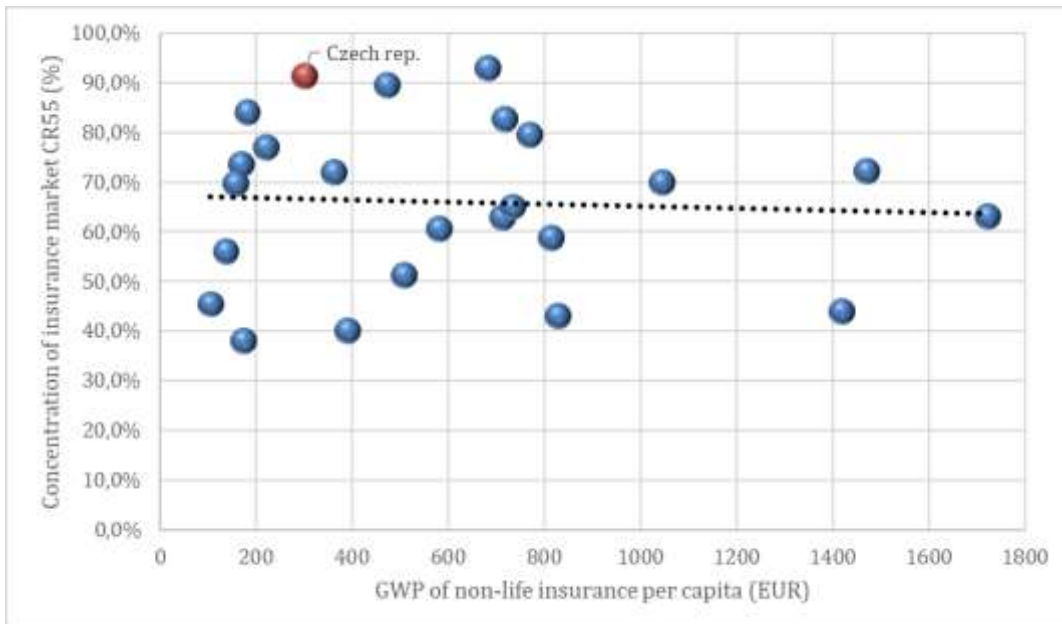
Fig. 1: The relationship between the concentration of the insurance market and the share of non-life insurance in GDP



Source: own research

Pearson correlation coefficient was calculated at -0.099. So this is an insignificant dependency.

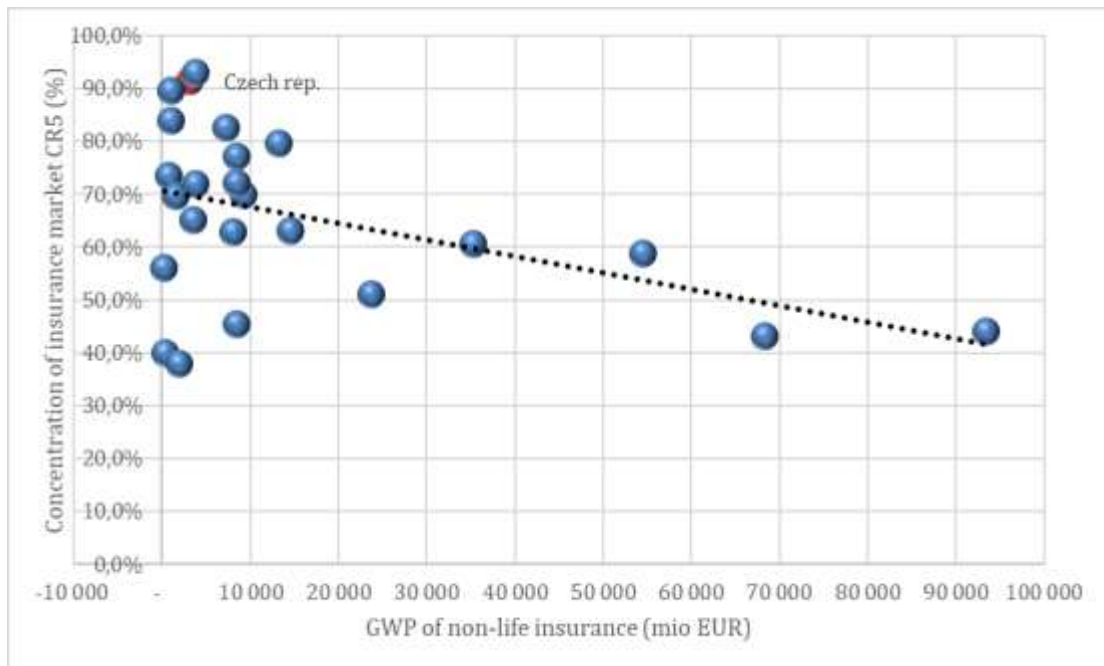
Fig. 2: The relationship between the concentration of the insurance market and GWP of non-life insurance per capita



Source: own research

Pearson correlation coefficient was calculated at -0.058. So this is an insignificant dependency.

Fig. 3: The relationship between the concentration of the insurance market and GWP of non-life insurance



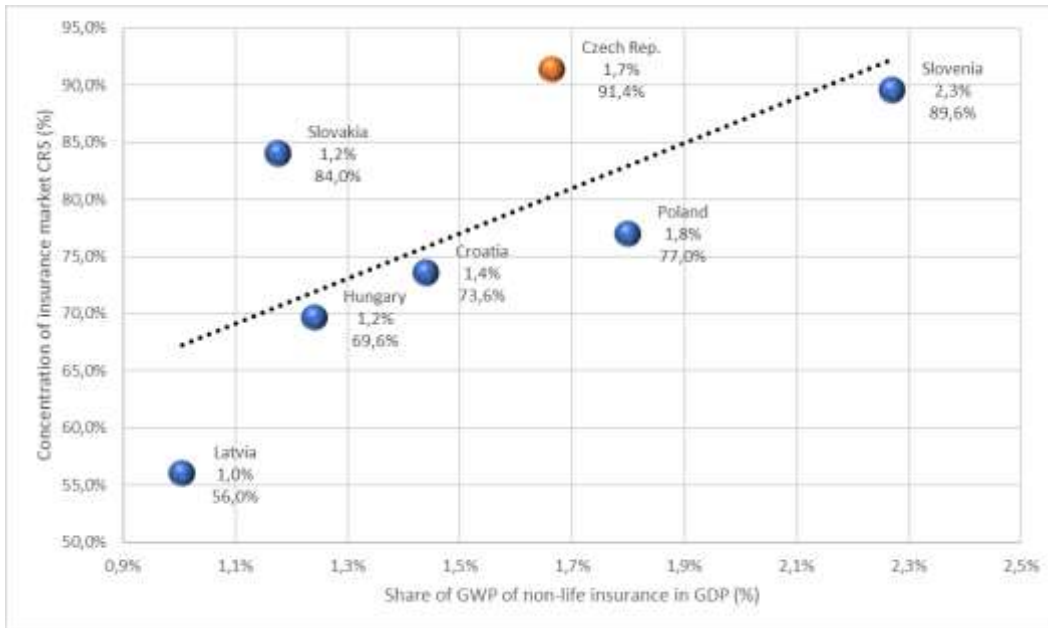
Source: own research

Pearson correlation coefficient was calculated at -0.45. It is therefore a moderately tight dependency.

The concentration of the insurance market cannot be sufficiently explained statistically using other insurance and economic indicators. With the partial exception of total gross prescribed non-life insurance premiums, there was negligible correlation between the observed variables. In terms of the concentration of insurance markets, a possible reason is the inhomogeneity of individual European insurance markets due to differences in the development of insurance markets. Insurance markets developed differently in countries with an uninterrupted development of a market economy, and they developed differently in post-communist countries, where the transition from a centrally planned to a market economy occurred.

Following the studies of Kramaric (2012) and Dimič (2018), who selectively monitored the markets of South-Eastern Europe, the insurance markets of Central and Eastern Europe and the insurance markets of Western and Northern Europe are monitored separately.

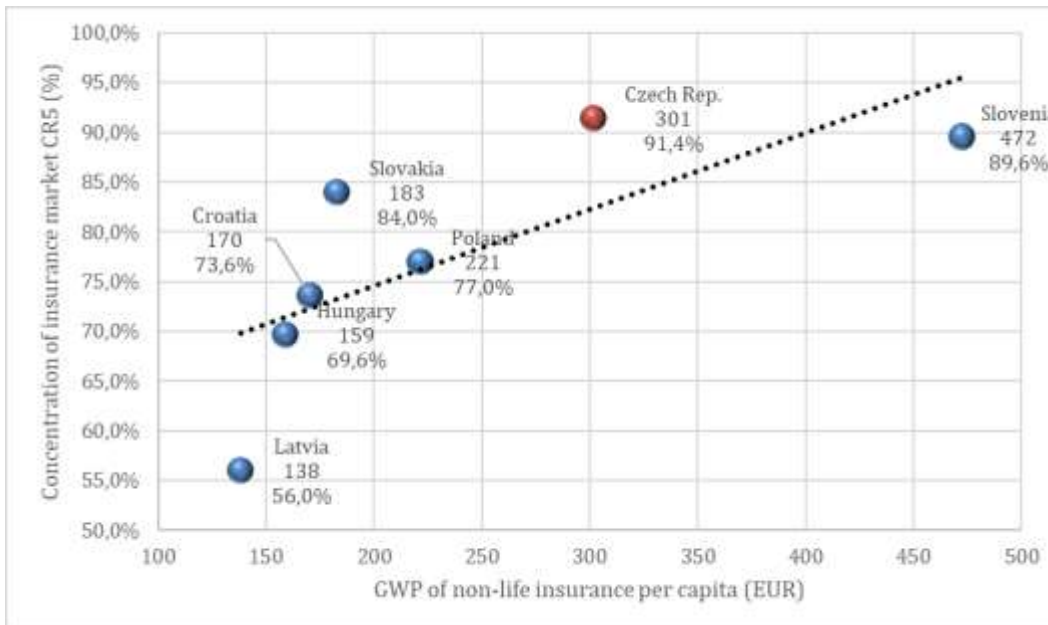
Fig. 4: The relationship between the concentration of the insurance market and the share of non-life insurance in GDP in Countries of Central and Eastern Europe



Source: own research

Pearson correlation coefficient was calculated at 0.6900. It is therefore a positive medium to very close dependence.

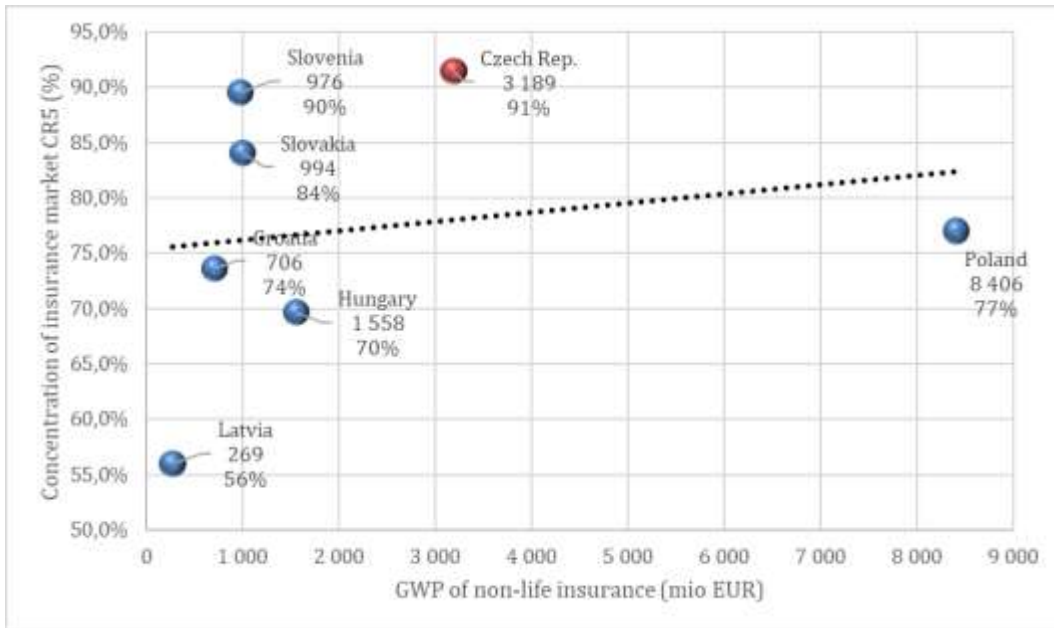
Fig. 5: The relationship between the concentration of the insurance market and GWP of non-life insurance per capita in Countries of Central and Eastern Europe



Source: own research

Pearson correlation coefficient was calculated at 0.7308. It is therefore a positive very close dependence.

Fig. 6: The relationship between the concentration of the insurance market and GWP of non-life insurance in Countries of Central and Eastern Europe

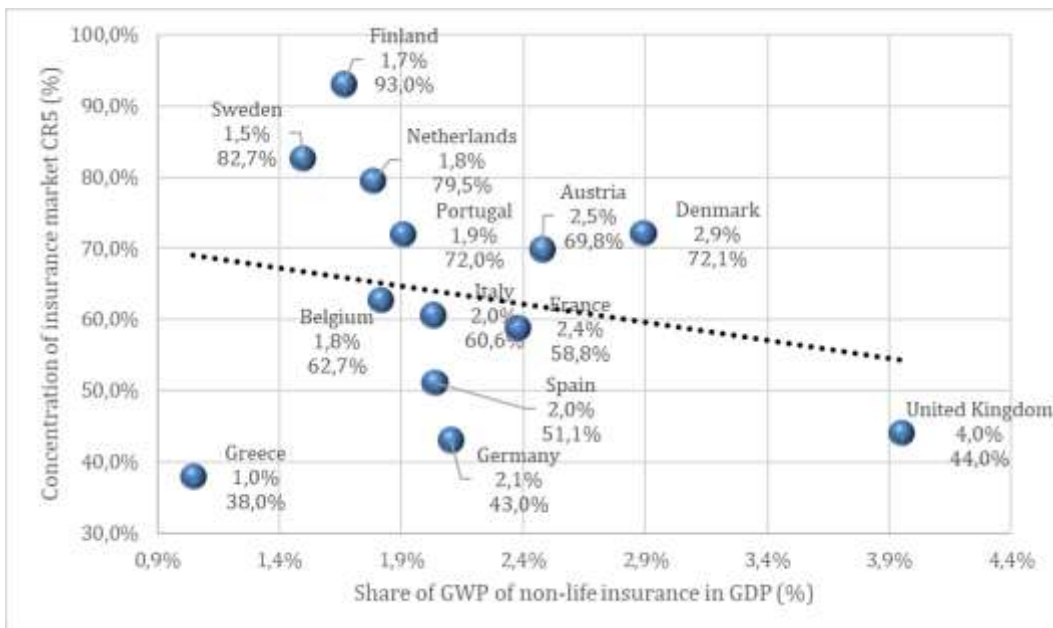


Source: own research

Pearson correlation coefficient was calculated at 0.1917. It is therefore a positive insignificant to not very close dependence.

For the countries of Central and Eastern Europe, it was found that the concentration of the non-life insurance market can best be statistically explained using the GWP of non-life insurance per capita and the share of GWP of non-life insurance in GDP. Conversely, the relationship between concentration and the total size of the non-life insurance market is almost insignificant in these countries.

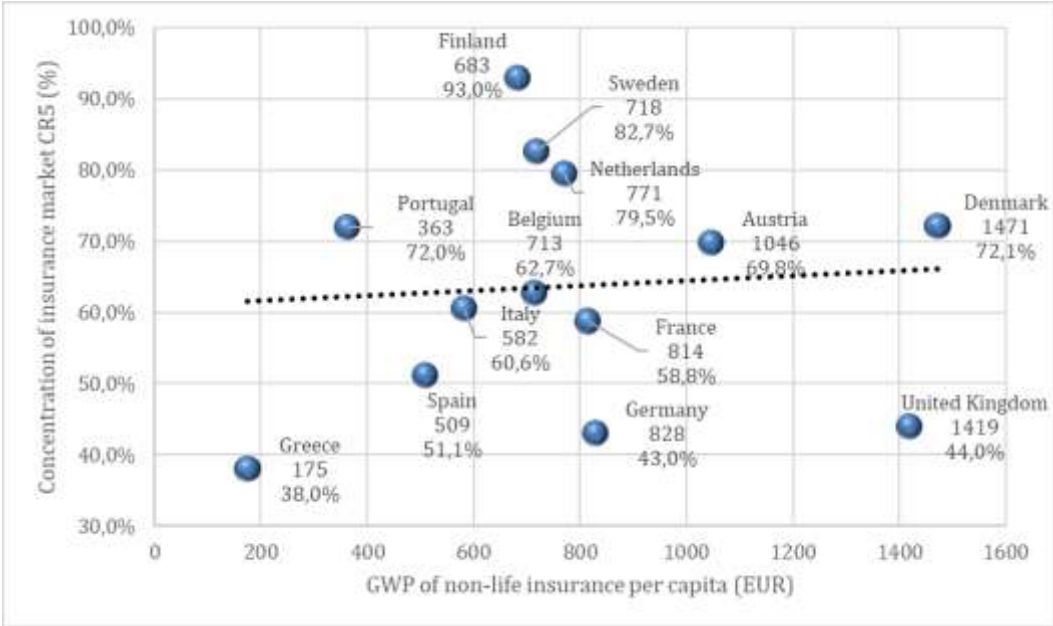
Fig. 7: The relationship between the concentration of the insurance market and the share of non-life insurance in GDP in Countries of Western and Northern Europe



Source: own research

Pearson correlation coefficient was calculated at -0.2198. It is therefore a negative insignificant to not very close dependence.

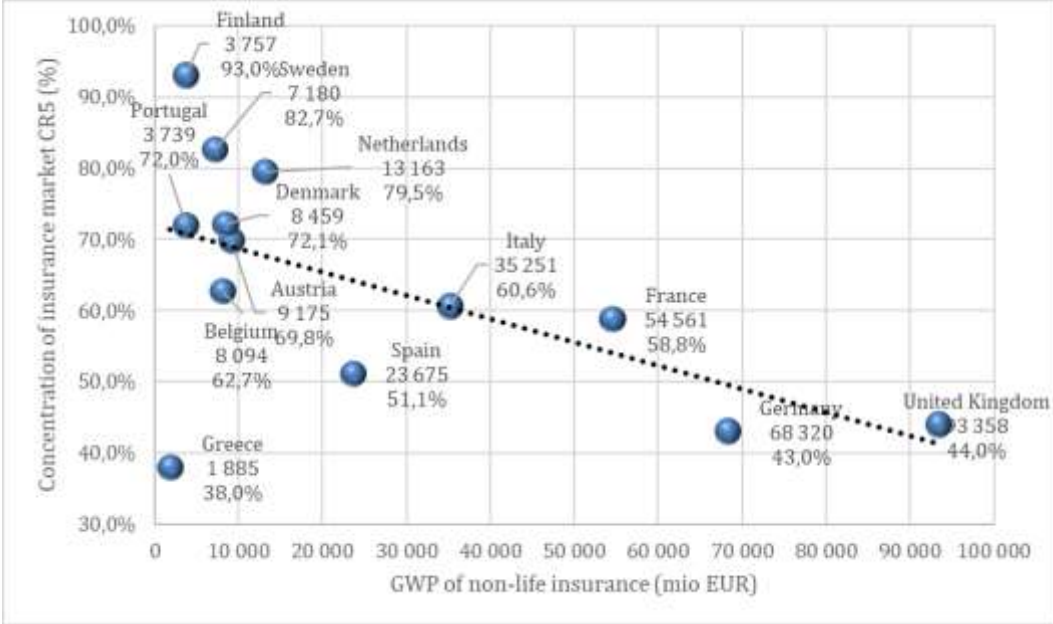
Fig. 8: The relationship between the concentration of the insurance market and GWP of non-life insurance per capita in Countries of Western and Northern Europe



Source: own research

Pearson correlation coefficient was calculated at 0,0779. It is therefore an insignificant dependence.

Fig. 9: The relationship between the concentration of the insurance market and GWP of non-life insurance in Countries of Western and Northern Europe



Source: own research

Pearson correlation coefficient was calculated at -0.5756 This is a negative medium close dependence. When the data of Greece, which is farthest from the regression line, is omitted

from the data for the calculation, the correlation coefficient is even at -0.8003 , which is at the level of a very strong correlation.

When examining the correlations between the concentration of insurance markets and other characteristics of the insurance markets, the monitored European countries had to be divided into two segments. In particular, the segment of the countries of Central and Eastern Europe and especially the segment of Western and Northern Europe was monitored.

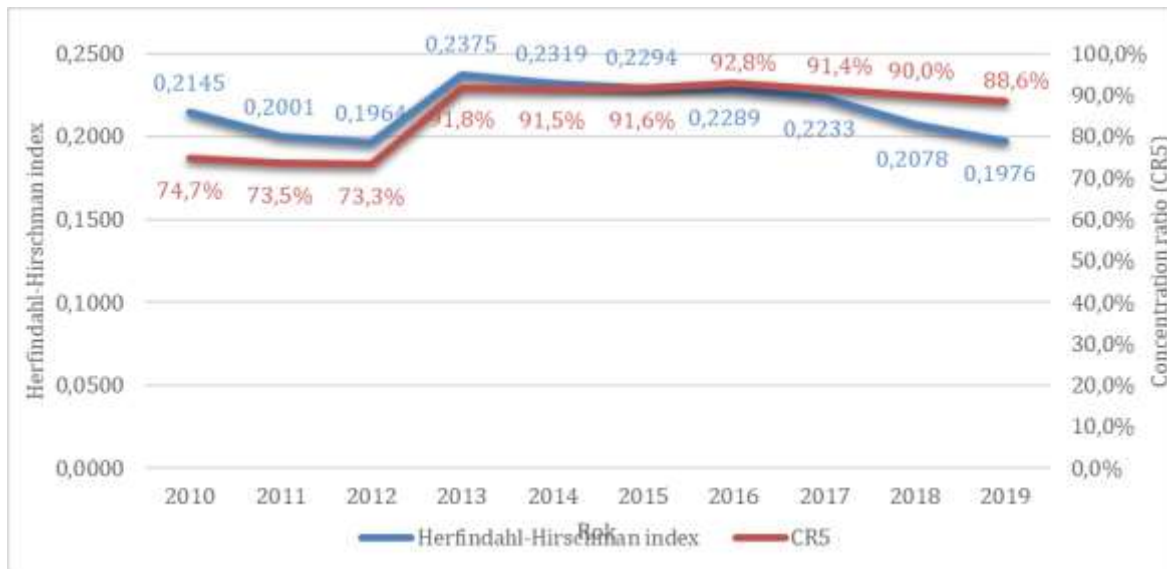
In the countries of Central and Eastern Europe, the concentration of the insurance market increases with the growth of the share of GWP of non-life insurance in GDP and with the growth of average GWP of non-life insurance per capita. For the countries of Central and Eastern Europe, we can state the following conclusion: The more developed the country is, the larger share of its gross domestic product it spends on non-life insurance premiums, and the higher is the concentration of the insurance market on the TOP5 insurers.

On the contrary, in the countries of Western and Northern Europe, it was found that the concentration of the insurance market does not correlate in any way with the share of GWP on non-life insurance in GDP or with the average GWP of non-life insurance premium per capita. On the contrary, a strong negative correlation was found between the concentration of the non-life insurance market and the total size of the non-life insurance market (expressed as GWP of non-life insurance premium). It can therefore be stated that the larger is the insurance market in countries with an uninterrupted market economy, the smaller is the concentration of the insurance market on the TOP5 insurers. This phenomenon can be explained, for example, by the fact that a larger number of insurers with a sufficient market share could easily develop and apply in a large insurance market. A larger number of significant market players is possible in large insurance markets also due to the specialization of insurance companies, either territorially or product-wise. The large insurance companies then complement each other rather than directly compete with each other. In small markets, specialization is not possible to such an extent, insurance companies try to have a full range of insurance products and thus compete with each other, they try to gain the largest possible market share even at the price of dumping, or even "buy up" the competition.

4.2 Comparison of concentration calculation using the concentration ratio (CR5) and using the Harfidahl-Hirschman index in the Czech Republic

In the previous chapter, the concentration of the insurance market was calculated using the concentration ratio of the five largest insurers. Whether this method is comparable with another concentration indicator - the Harfidahl-Hirschman index, will be determined on the data of the Czech Republic for the period 2010-2019. The data of the other monitored countries was not obtained in the required structure. The advantage of the Harfidahl-Hirschman index is that it takes into account the market shares of all insurance companies, not just the largest ones.

Fig. 10: Development of the CR5 concentration ratio and the Harfidahl-Hirschman index of the non-life insurance market in the Czech Republic in 2010-2019



Source: own research

Concentrations were calculated from data for insurance groups. The following adjustments were made to the data for individual insurance companies:

The values for Kooperativa pojišťovna and Česká podnikatelská pojišťovna were added to the Vienna Insurance Group for the entire monitored period. Since 2013, the values for Generali and Česká pojišťovna have been added, in 2019, the result for Pojišťovna Patricie is also added to the group. The performances of AXA pojišťovna and AXA životní pojišťovna were added up for the entire monitored period.

From the data shown in Chart 10, it follows that both monitored indices have a similar development. It was therefore correct that in previous calculations the Harfidahl-Hirschman index (for the calculation of which data was not available in the necessary range for other countries) was replaced by a simpler concentration ratio. From the values of the Harfidahl-Hirschman index, it can be concluded that the Czech non-life insurance market is moderately concentrated.

5 CONCLUSION

By examining the correlations between the concentration of non-life insurance markets and other characteristics of the insurance markets, no significant correlations were found due to the inhomogeneity of the monitored data. However, two significant sub-segments were identified within the European markets – the countries of Central and Eastern Europe and the countries of Western and Northern Europe. In the first sub-segment, the strongest positive correlation was found between the non-life insurance premium per inhabitant and the concentration of the non-life insurance market. In the second sub-segment, the strongest correlation was negative, namely between the total prescribed non-life insurance premium and the concentration of the non-life insurance market.

Evaluation of working hypotheses:

H1: There is a correlation between the share of non-life insurance in gross domestic product and the concentration indicator of the non-life insurance market.

This hypothesis was confirmed on the data of the countries of Central and Eastern Europe, where there was a positive medium to very close dependence. On the data of Western and Northern European countries, this hypothesis was disproved.

H2: There is a correlation between the non-life insurance premium per capita and the concentration indicator of the non-life insurance market.

This hypothesis was confirmed on the data of the countries of Central and Eastern Europe, where there was a positive very close dependence. On the data of Western and Northern European countries, this hypothesis was disproved.

H3: There is a correlation between the total non-life insurance premium and the concentration indicator of the non-life insurance market.

This hypothesis was confirmed on the data of the countries of Western and Northern Europe, where there was a negative very close dependence. This hypothesis was refuted on the data of the countries of Central and Eastern Europe. Calculations based on data from the Czech Republic from 2010-2019 also verified that, if data for calculating the Harfidahl-Hirschman index are not available, it can be substituted with a simpler concentration ratio.

Acknowledgment

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The impact of demographic development on public pension expenditure in Germany in comparison with OECD countries

Dennis C. Tale

Abstract

In an international comparison, the pension systems of the OECD countries are very different. However, the developments of the negative trends of falling birth rates on the one hand and rising life expectancies on the other are of common importance. For this reason, demographic trends will be significant to scientists and politicians who want to push through sustainable pension reform. This paper deals with why demographic development is crucial for the sustainability of pension systems. For this purpose, the attributes of international birth rates and life expectancies are explained based on the current OECD statistics from 2021. The associated demographic development is projected on state pension expenditure in Germany in an international comparison. It is noted that the intensity of the aging processes in individual countries is very different, and thus, there is unequal pressure for reform in an international comparison. For Germany, the old-age dependency ratio is expected to rise to 58.1 by 2050, which could make state pension expenditure 12.2 percent of GDP.

Keywords

Demographic development, old-age dependency ratio, pension system, Germany

JEL Classifications

H6, H55, J11

Introduction

In an international comparison, the pension systems of the OECD countries are very different. However, despite all the differences, all countries rely on the pay-as-you-go system as the fundamental financing principle of their statutory old-age provision. In this context, the demographic development from the parameters of the negative trends of falling birth rates on the one hand and rising life expectancies on the other is of considerable importance for all states (Queisser, 2023; Raffelhüschen, 2010).

Crucial for the financial situation of a pay-as-you-go pension system (PAYGO) is the old-age dependency ratio, which is sustainably influenced in different ways by falling birth rates and rising life expectancies and thus seriously questions the long-term sustainability of pay-as-you-go pension systems (Schön, 2023). The reason for this is, in particular, the rapid decline in the working-age population, which harms the financing of pay-as-you-go pension systems (OECD, 2021).

According to Fenge and Peglow's (2017) research, Germany will face significant population aging in the coming decades. The changes in the population structure lead to a growing mismatch between the development of pension expenditure and contribution income, so there is cause for concern about the sustainability of the pension system (Raffelhüschen, 2010). According to Schmidhuber et al. (2016), this circumstance makes it difficult to reform the pension systems. In the future, the financing of the German statutory pension insurance (GRV) will be secured by increasing state allowances because the old-age dependency ratio is rising

due to the decline in the working-age population. This will further burden the German national budget (Blank et al., 2021).

Since 2005, the Organisation for Economic Co-operation and Development (OECD) has analyzed and compared the pension systems in the OECD and G20 countries every two years in the report "Pensions at a Glance" using indicators. In this way, the OECD contributes considerably to academics and politicians who want to identify the essential potential for reform and political room for maneuver.

This paper examines the central question of why demographic development is crucial for the future viability of pay-as-you-go pension systems. In order to address this question, the old-age dependency ratio is discussed as a principle for the financing ratio of pensioners to the working population and which effects on the state budget are threatening in the future. In order to clarify the overall understanding of the influencing development factors, the characteristics of international birth rates and life expectancies are explained in Chapter 1 on the basis of the current OECD statistics from the year 2021, and in Chapter 2 the associated old-age dependency ratio is extrapolated to the state pension expenditure in Germany in an international comparison.

In order to answer this question, the statistics of the OECD report "Pensions at a Glance" 2021 and the online statistics of the Federal Statistical Office were used and evaluated in the course of the study. The relevant indicators on demographic development were explained in an international context and compared to the situation in Germany.

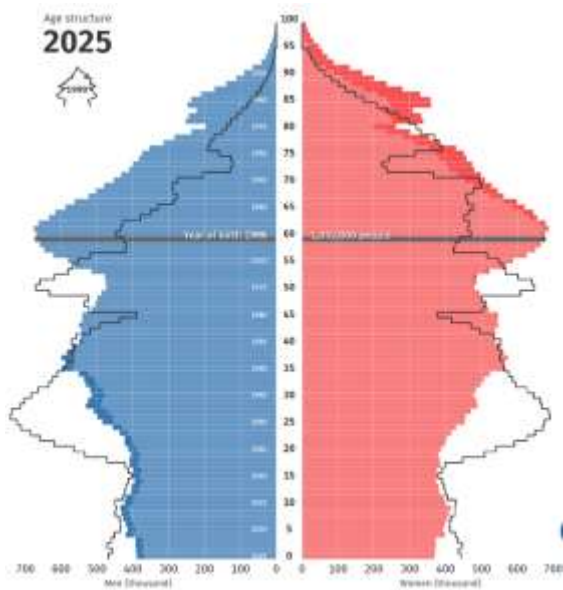
1 Demographic development in Germany

Population aging has been one of the main drivers of changes in pension policy. Aging is the result of demographic trends in fertility and life expectancy.

Demographic change has long since arrived in Germany. The declining number of people of younger age and the increasing number of older people are shifting the demographic framework in a way never seen before. Every second person in Germany today is older than 45, and every fifth person is older than 66. On the other hand, the population has "rejuvenated" in the last decade due to more immigration and births. Thus, since 2010, more people have come to Germany than left. The migration surplus was particularly marked among people of younger and middle age. The number of births also increased from 2012 onwards after a decline of many years. As a result, between 2012 and 2021, 656,000 more children were born than in the previous decade. This almost corresponds to the birth rate of the entire year 2011 of 663 000 children (Statistisches Bundesamt, 2023).

Figure 1 below compares the age structure in 2025 with the year of German unification in 1990 and illustrates the progress of demographic change. The heavily populated cohorts from 1955 to 1970, who belong to the so-called baby boom generation, formed the largest age group in 1990 as 20 to 35-year-olds. They still are today, but they have reached higher working age and will retire from the labor force in the next two decades. The number of people aged 70 and over has risen from 8 to 13 million between 1990 and 2021. Concerning the older age groups, it is clear that in the meantime, women and men are reaching a higher age.

Figure 1: Comparison of the German population calculation of 1990 and 2025



Source: Destatis, 2023

This population calculation was made based on data from the Federal Statistical Office, using reasonable assumptions on the development of birth rates, life expectancy, and net migration. In 1990, the population in Germany was 79.8 million people. In 2025, the population is expected to grow to 84.8 million, with an associated old-age dependency ratio of 33. Section 1.3 discusses the demographic ratio of employed and retired people, which makes up the old-age dependency ratio, in more detail.

1.1 Birth rates

Births are central to statistics, as birth data are the focus of social interest, and birth rates are the basis for planning pension security. Moreover, they are one of the essential factors of demographic change in Germany.

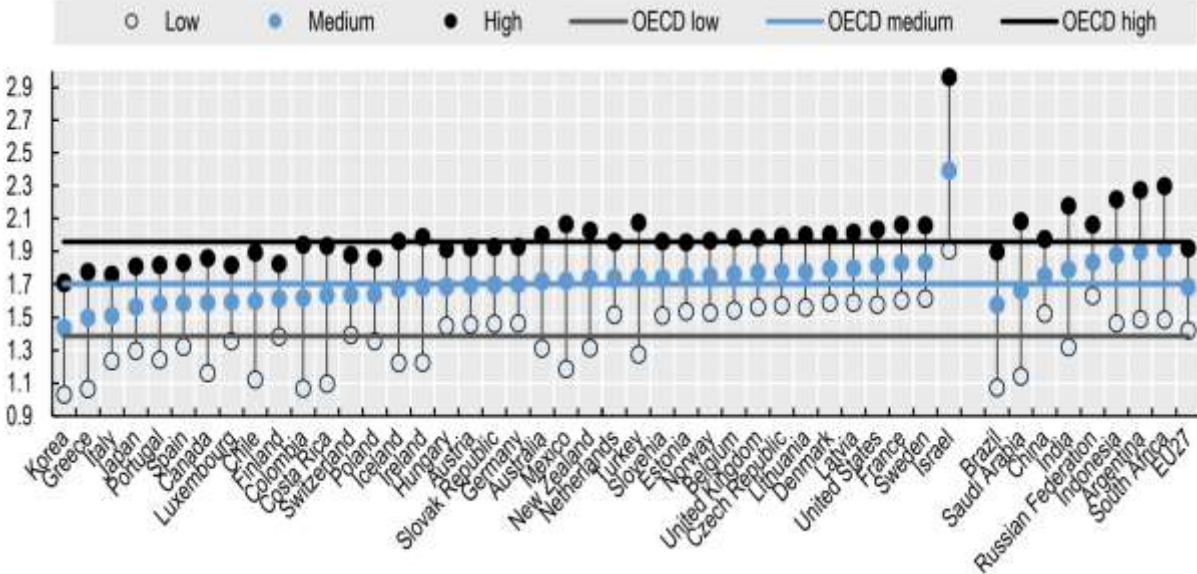
According to the OECD (2021), the total fertility rate in industrialized countries is below the estimated replacement level - the number of children per woman required to keep the total population constant - in 36 out of 38 OECD countries. The total fertility rate is below the estimated replacement level of about 2.1. Exceptions are Israel, with a total fertility rate of 3.04, and Mexico, with a total fertility rate of 2.14 in 2020. Fertility rates fell sharply in the second half of the 20th century and have stabilized on average across the OECD over the past two decades. In more than half of OECD countries, fertility rates have fallen since the early 2000s. Birth rates have profound implications for pension systems, as they, together with life expectancy, drive significant shifts in the demographic structure. Since 1960, fertility rates have steadily converged across countries, which is expected to continue in the coming decades.

The total fertility rate is the number of children each woman would have; each woman would be born if she lived to the end of her childbearing years and if the probability of giving birth at each age is the current prevailing age-specific fertility rate. It is generally calculated by summing the age-specific fertility rates defined over a five-year interval. A total fertility rate of 2.1 children per woman - the replacement level - broadly ensures a stable population size, assuming no migration flows and unchanged mortality rates (OECD, 2021).

Figure 2 below shows the projections of the low, medium, and high variants corresponding to the probabilistic projections' 20%, 50%, and 80% percentiles.

Germany and Austria have fertility rates in the range of the OECD mean. The Czech Republic, on the other hand, has a slightly above-average birth rate.

Figure 2: Summary of the birth rate



Source: OECD, 2021

1.2 Life expectancy

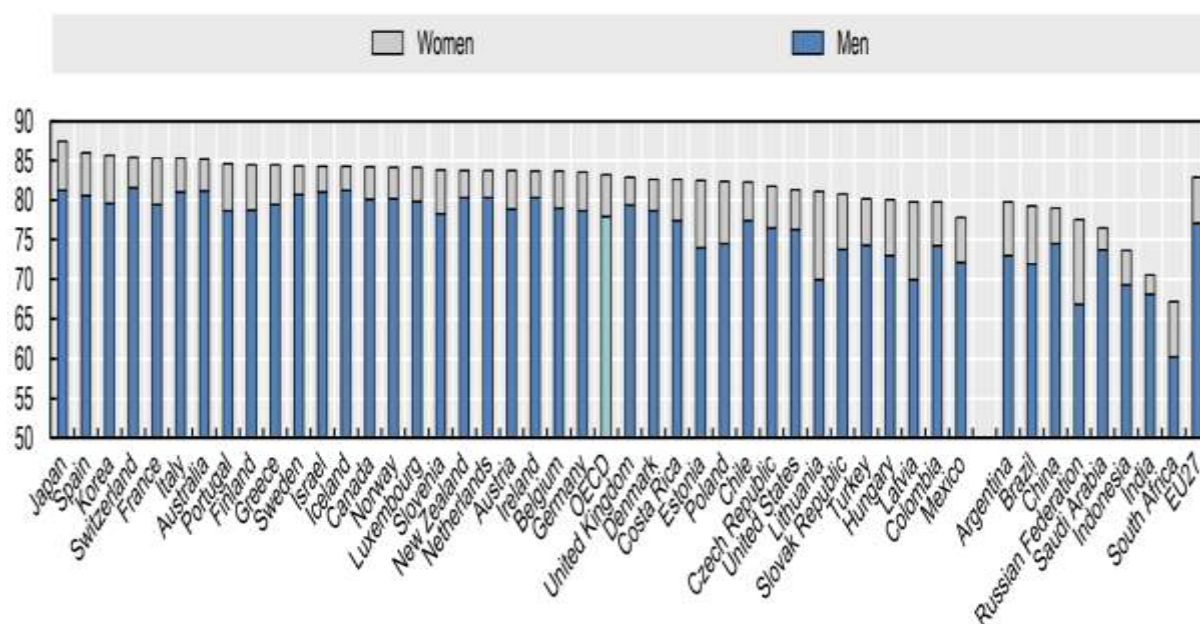
The remarkable increase in life expectancy is one of the most outstanding achievements of the last century. Life expectancy continues to increase, which is expected to continue, even if the pace of improvement in old age has slowed slightly. In 2015-20, life expectancy at birth averaged 77.9 years for men and 83.1 years for women. For women, the figure was highest in Japan (87.5 years) and lowest in Mexico (77.8 years). For men, life expectancy at birth was highest in Switzerland (81.6 years) and lowest in Latvia and Lithuania (69.9 and 70.0 years, respectively). On average, across OECD countries, life expectancy at age 65 is projected to increase by 3.9 years for women and 4.5 years for men by 2065 (OECD, 2021).

Life expectancy is the average number of years that people of a given age could expect to live given the age- and sex-specific mortality rates in a given country in a given year: in this case, 2015-20 and 2060-65. Because the determinants of longevity change slowly, life expectancy is best analyzed over a long time horizon. Cohort life expectancy considers projected changes in mortality estimates for a given cohort (OECD, 2021).

Figure 3 below shows the life expectancy calculated using mortality rates that apply to a specific period, here, 2015-20, rather than a specific birth cohort.

Men and women in Germany and Austria are subject to the same life expectancy, and men and women in the Czech Republic have a lower life expectancy.

Figure 3: Current life expectancy at birth for men and women in years



Source: OECD, 2021

1.3 Demographic ratio of employed and pensioners

On average, across OECD countries, there are 30 people aged 65 and over for every 100 people of working age (20 to 64 years), compared to only about 20 to 30 years ago. The aging of the population has accelerated, as the average age-demographic ratio - calculated while maintaining age limits - is expected to reach 53 in the next 30 years (OECD, 2021).

The demographic old-age dependency ratio is defined as the number of persons aged 65 and older per 100 persons of working age, i.e., aged 20 to 64. The resulting old-age dependency ratio thus indicates the ratio of how many working people finance one pensioner.

With an old-age dependency ratio of 36.5, 2.74 gainfully employed persons supported one pensioner in Germany in 2020. In 2050, the old-age dependency ratio is expected to rise by 21.6 points to 58.1. This results in a distribution of 1.72 employed persons to one pensioner.

The following figure shows the demographic relationship between age and working age: historical and projected values, 1950-2080.

Figure 4: Demographic relationship between age and working age (old-age ratios)

	1950	1960	1990	2020	2050	2080		1950	1960	1990	2020	2050	2080
Australia	14.0	16.0	18.8	27.7	41.6	49.4	Netherlands	13.9	16.8	20.6	34.3	53.3	62.2
Austria	17.3	21.0	24.3	31.3	56.0	60.2	New Zealand	16.3	17.0	19.5	28.3	43.8	57.5
Belgium	18.1	20.3	24.8	33.1	51.3	56.8	Norway	16.0	19.8	28.5	29.6	43.4	53.4
Canada	14.0	15.1	18.4	29.8	44.9	54.0	Poland	9.4	10.5	17.3	30.5	60.3	66.6
Chile	7.2	7.9	10.9	19.7	44.6	67.5	Portugal	13.0	14.8	23.9	38.6	71.4	72.3
Colombia	7.5	7.2	8.4	15.0	36.0	64.3	Slovak Republic	11.9	12.6	18.2	26.5	54.6	58.1
Costa Rica	6.8	7.1	9.0	16.6	41.6	69.4	Slovenia	12.5	13.7	17.3	34.7	65.0	60.7
Czech Republic	13.9	16.3	22.0	33.8	55.9	52.8	Spain	12.6	14.6	23.1	32.8	78.4	74.4
Denmark	15.6	19.0	25.9	34.9	44.6	52.4	Sweden	16.8	20.2	30.9	35.9	45.5	53.4
Estonia	19.3	17.7	19.7	34.9	54.9	63.2	Switzerland	15.8	17.6	23.6	31.3	54.4	56.7
Finland	11.9	13.5	22.0	40.1	51.4	65.0	Turkey	6.5	7.0	9.4	15.2	37.0	58.2
France	19.5	20.8	24.0	37.3	54.5	62.2	United Kingdom	17.9	20.2	26.9	32.0	47.1	55.1
Germany	16.2	19.1	23.5	36.5	58.1	59.5	United States	14.2	17.3	21.6	28.4	40.4	51.1
Greece	12.4	12.2	22.9	37.8	75.0	79.7	OECD	13.6	15.0	20.0	30.4	52.7	61.1
Hungary	13.2	15.5	22.9	33.4	52.6	55.4							
Iceland	14.1	16.4	19.0	26.6	46.2	64.5	Argentina	7.5	10.1	17.3	20.2	30.3	45.5
Ireland	20.9	22.8	21.6	25.0	50.6	60.0	Brazil	6.5	7.1	8.4	15.5	39.5	63.7
Israel	7.1	9.1	17.8	23.9	31.3	39.9	China	8.5	7.6	10.2	16.5	47.5	60.6
Italy	14.3	16.4	24.3	39.5	74.4	79.6	India	6.4	6.4	7.9	11.3	22.5	40.8
Japan	9.9	10.4	19.3	52.0	80.7	82.9	Indonesia	8.6	7.6	7.7	10.6	27.3	41.0
Korea	6.3	7.6	8.9	23.6	78.8	94.6	Russian Federation	8.7	10.5	17.2	25.3	41.7	41.9
Latvia	18.1	17.7	19.9	35.5	53.0	49.9	Saudi Arabia	7.5	8.4	6.1	5.3	28.2	44.8
Lithuania	17.5	14.0	18.4	34.7	55.7	55.7	South Africa	8.5	8.4	8.7	9.6	17.4	26.8
Luxembourg	15.8	17.6	21.1	22.3	43.8	50.1	EU27	14.6	16.0	21.6	33.6	56.7	62.0
Mexico	8.0	8.3	9.6	13.2	28.9	50.9							

Source: OECD, 2021

2 Government expenditure on statutory old-age pensions and survivors' benefits

Crucial for the financial situation of a pay-as-you-go pension system (PAYGO) is the old-age dependency ratio, which is sustainably influenced in different ways by falling birth rates and rising life expectancies and thus seriously questions the long-term sustainability of pay-as-you-go pension systems (Schön, 2023). The reason for this is, in particular, the rapid decline in the working-age population, which negatively impacts the financing of pay-as-you-go pension systems (OECD, 2021).

Public spending on old-age pensions and survivors' benefits increased from an OECD average of 6.6% of gross domestic product (GDP) to 7.7% between 2000 and 2017, for an average of 18.4% of total government spending in 2017.

Figure 5 below shows the development of government expenditure on old-age pensions and survivors' benefits. In 2017, Germany provided significantly higher government expenditure of 10.2 percent of the gross domestic product, which accounted for a share of 23.0 percent of the government budget to finance the pension system.

Figure 5: Public expenditure on old-age and survivors benefits

	Level (% of total government spending)		Level (% of GDP)						Change of level 2000-17	Level in net terms (% of GDP) 2017	Total including non-cash (% of GDP) 2017
	2000	2017	1990	2000	2005	2010	2015	2017			
Australia	12.8	10.9	3.1	4.7	3.7	3.8	4.3	4.0	-0.7	4.0	5.0
Austria	23.3	25.4	11.3	11.9	11.9	13.0	13.3	13.0	1.1	10.8	13.6
Belgium	17.8	20.2	9.0	8.8	8.9	9.9	10.5	10.5	1.7	9.3	11.5
Canada	10.1	11.8	4.2	4.2	4.0	4.3	4.7	4.8	0.6	4.5	4.8
Chile			8.0	5.0	3.7	3.4	2.9	2.8	-2.2	2.8	2.8
Colombia		13.1				5.5	5.9	5.9		5.9	5.9
Costa Rica		14.4						4.9		4.9	4.9
Czech Republic	16.8	19.8	5.5	6.8	6.6	8.0	8.0	7.7	0.9	7.7	7.9
Denmark	12.0	15.7	6.1	6.3	6.5	7.1	8.1	8.0	1.7	5.9	9.6
Estonia	16.5	16.5		6.0	5.3	7.5	6.9	6.5	0.5	6.4	6.6
Finland	15.4	22.0	7.2	7.4	8.0	9.8	11.5	11.8	4.5	9.8	13.4
France	22.2	24.2	10.4	11.5	12.0	13.2	13.8	13.6	2.2	12.3	14.1
Germany	22.8	23.0	9.5	10.9	11.2	10.7	10.1	10.2	-0.7	9.8	10.2
Greece	21.9	32.8	9.5	10.2	11.4	14.2	16.8	15.5	5.3	14.4	15.5
Hungary	15.7	18.2		7.4	8.3	9.6	9.1	8.5	1.1	8.5	9.0
Iceland	5.1	6.2	2.2	2.1	1.9	1.5	2.0	2.6	0.6	2.6	3.0
Ireland	9.3	14.2	4.8	2.9	3.1	4.8	3.6	3.7	0.8	3.6	3.8
Israel	9.9	11.9		4.5	4.7	4.8	4.7	4.7	0.2	4.7	5.3
Italy	28.9	32.1	11.3	13.5	13.7	15.4	16.2	15.6	2.2	12.8	15.7
Japan		24.2	4.7	7.0	8.1	9.6	9.4	9.4	2.4	8.9	11.3
Korea		9.4	0.7	1.3	1.4	2.0	2.8	2.8	1.5	2.8	3.0
Latvia	23.3	17.5		8.7	5.5	9.3	7.0	6.8	-1.9	6.5	7.2
Lithuania	17.9	16.7		7.1	5.7	7.7	6.7	6.2	-0.9	6.2	6.4
Luxembourg	18.8	20.2	7.8	7.1	7.8	8.0	8.4	8.5	1.4	7.0	8.5
Mexico		10.2	0.4	0.8	1.0	1.6	2.2	2.7	1.9	2.6	2.7
Netherlands	11.0	12.2	6.2	4.6	4.6	4.9	5.3	5.2	0.8	4.7	6.0
New Zealand	13.1	12.8	7.2	4.9	4.2	4.8	5.0	4.9	0.0	4.2	4.9
Norway	11.1	13.6	5.5	4.7	4.8	5.2	6.6	6.9	2.2	5.8	9.2
Poland	24.9	25.6	5.0	10.5	11.3	11.1	11.1	10.6	0.1	9.8	10.6
Portugal	18.3	28.1	4.8	7.8	10.0	12.0	13.3	12.7	4.9	12.7	12.8
Slovak Republic	11.8	17.6		6.2	6.0	6.7	7.2	7.3	1.1	7.3	7.6
Slovenia	21.8	23.8		10.4	9.8	10.9	11.1	10.4	0.1	10.4	10.5
Spain	21.5	26.5	7.7	8.4	8.0	9.2	11.0	10.9	2.5	10.4	11.4
Sweden	12.8	14.6	7.2	6.8	7.2	7.2	7.1	7.2	0.4	5.7	9.4
Switzerland	18.0	19.5	5.2	6.1	6.2	6.2	6.6	6.7	0.6	5.3	6.9
Turkey		21.5	0.7	3.9	6.0	7.4	7.1	7.4	3.5	7.4	7.4
United Kingdom	13.4	13.7	4.5	4.8	5.0	6.2	6.1	5.6	0.9	5.4	6.0
United States	16.4	18.6	5.8	5.7	5.7	6.6	7.0	7.1	1.4	6.6	7.1
OECD	16.6	18.4	6.3	6.7	6.8	7.6	7.9	7.7	1.0	7.1	8.2

Source: OECD, 2021

2.1 Projection

Figure 5 shows that public pension expenditure has increased in most OECD countries in recent decades. Long-term projections show that public pension expenditure is expected to continue to increase in 18 OECD countries for which information is available and to decrease in 11 countries. On average, public pension expenditure would increase from 9.0 % of GDP in 2018-20 to 10.4 % in 2050 in 29 OECD countries.

Figure 6 below shows the projection of public pension expenditure up to 2060 as a percentage of GDP.

In an international comparison, state pension expenditure in Germany is projected to increase by 1.6 percent to 12.5 percent of GDP for 35 years until 2060. On the other hand, the Czech Republic will have to expect an additional state burden of 3.0 percent to 11.8 percent of GDP over the same period. It should be interesting to note in the Austrian projection that the comparatively high state pension expenditure of 14.6 percent of GDP in 2025 is also expected to account for 14.6 percent of GDP in 2060.

Figure 6: Projection of public pension expenditure until 2060 as a percentage of GDP

	2018-20	2025	2030	2035	2040	2045	2050	2055	2060
Australia	2.8	2.6	2.5	2.5	2.4	2.3	2.3	2.2	2.1
Austria	13.3	14.8	15.1	15.4	15.1	14.9	14.7	14.7	14.6
Belgium	12.2	13.2	14.0	14.6	14.9	15.1	15.2	15.2	15.2
Canada	5.3	6.0	6.4	6.5	6.4	6.3	6.2	6.3	6.3
Chile									
Colombia									
Costa Rica									
Czech Republic	8.0	8.8	8.8	9.1	9.8	10.7	11.4	11.8	11.8
Denmark	9.3	8.9	8.5	8.3	8.1	7.8	7.6	7.4	7.2
Estonia	7.8	7.1	6.9	6.6	6.5	6.3	6.1	6.0	5.8
Finland	13.0	13.6	13.7	13.4	12.8	12.6	12.7	13.0	13.5
France	14.8	15.4	15.6	15.5	15.2	14.6	14.3	13.8	13.4
Germany	10.3	10.9	11.5	12.0	12.0	12.1	12.2	12.4	12.8
Greece	15.7	14.2	13.8	13.7	14.0	13.7	13.6	12.7	12.0
Hungary	8.3	8.6	8.3	8.8	9.7	10.8	11.2	11.5	11.9
Iceland									
Ireland	4.6	5.3	5.9	6.4	6.9	7.2	7.5	7.5	7.5
Israel									
Italy	15.4	16.2	17.3	17.9	17.8	17.3	16.2	15.0	14.1
Japan	10.1	9.3			9.3				
Korea	1.3	2.0	2.5	3.2	4.2	5.1	5.9	6.5	7.5
Latvia	7.1	7.1	6.9	6.8	6.6	6.3	6.3	6.4	6.2
Lithuania	7.1	7.5	7.9	8.2	8.4	8.3	8.2	8.2	8.1
Luxembourg	9.2	10.3	11.4	12.3	13.0	13.9	14.8	15.6	16.7
Mexico									
Netherlands	6.8	7.3	8.1	8.8	9.1	9.0	8.9	8.8	8.9
New Zealand	4.7	5.1	5.6	6.0	6.3	6.4	6.6	6.9	7.5
Norway	11.0	11.7	12.3	12.6	12.6	12.6	12.7	13.0	13.2
Poland	10.6	11.4	11.0	10.6	10.5	10.6	10.7	10.8	10.8
Portugal	12.7	13.3	14.2	14.8	14.4	13.7	12.6	11.4	10.5
Slovak Republic	8.3	9.7	10.2	10.7	11.6	12.5	13.4	14.2	14.5
Slovenia	10.0	10.1	10.8	12.1	13.6	14.8	15.7	16.1	16.1
Spain	12.3	12.7	12.3	12.5	12.8	13.2	13.0	12.5	11.7
Sweden	7.6	7.7	7.4	7.2	7.0	7.0	7.0	7.3	7.4
Switzerland	6.5	6.4	6.8						
Turkey									
United Kingdom	7.7	8.0	8.0	8.4	8.6	8.3	8.3	8.6	8.9
United States	5.0	5.3	5.7	5.9	5.9	5.8	5.8	5.8	5.8
OECD-29	9.0	9.5	9.7	10.0	10.2	10.3	10.4	10.4	10.4
Brazil	8.5	8.5	8.8	9.4	10.2	11.3	12.3	13.2	13.9
EU27	9.9	10.5	10.7	10.9	11.1	11.2	11.3	11.3	11.3

Source: OECD, 2021

3 Results

This paper addresses the central question of why demographic development is crucial for the future viability of pay-as-you-go pension systems. To this end, the factors influencing demographic development in this context were examined. The key figures of birth rates, life expectancy and old-age dependency ratios were explained as a principle for the financing ratio of pensioners to the working population and what effects the state budget will be threatened with in the future.

First of all, it should be noted that all OECD countries - including Germany - will have to adjust to an ageing society in the coming decades due to increasing life expectancy and low birth rates. Even if the causes of societal ageing are identical in all countries, the intensity of the ageing process is very different. As Figure 4 shows, the old-age dependency ratio, i.e. the number of people over 65 years of age per 100 people aged between 20 and 65 years, will increase significantly in all countries studied by 2060.

With an old-age dependency ratio of about 30, most countries still have a relatively similar age structure in 2020, according to Figure 3.

However, the future development of old-age dependency ratios shows considerable differences between the individual countries. For Germany, the old-age dependency ratio is expected to rise to just under 60 by 2080. This already shows the increasing burden on the state budget as the old-age dependency ratio rises, namely that fewer working people will have to finance more pensioners. The gaps in pension expenditure will inevitably have to be compensated by state funds.

After many extensive emergency, rescue, and economic stimulus packages after the Corona pandemic, it is still time to deal again with the longer-term challenges that Germany faces, which have faded into the background.

One development trend that will undoubtedly have severe effects in the economic-social sphere is the aging process of the population that will inevitably take place in the coming decades - and not only in Germany but in almost all developed industrial countries. From the point of view of both social insurance schemes and public budgets, this development is so problematic because expenditure in these systems will rise disproportionately with an aging population. At the same time, the labor force potential - and thus an essential determinant of the revenue base - tends to decrease. An important component that has not yet been considered here is the development of the labor market.

On the one hand, it becomes clear that Germany is not alone in its pension reforms but that the other states must adapt their systems to demographic developments.

In this context, however, there is unequal pressure for reform in the respective countries due to the different effects of the demographic effect.

In conclusion, it can be said that demographic trends are crucial for the sustainable financing of a pay-as-you-go pension system. Rising life expectancy and low birth rates have a negative impact on the old-age dependency ratio, which is decisive for the financing ratio between pensioners and the working population. This is because a low old-age dependency ratio, i.e. a ratio of more working people financing fewer pensioners through contributions, relieves the state budget. This ratio would be considered sustainable.

Thus, based on the present results, a pay-as-you-go pension system can be maintained in the long term if the gap in pension income caused by rising old-age dependency ratios is compensated by increasing state contributions.

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Benefits and risks of crowdfunding: literature review

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Abstract

Crowdfunding has become a popular tool for raising capital for new projects and business ventures in recent years. This paper presents a comprehensive review of the current literature on the risks and benefits of crowdfunding, aiming to provide a comprehensive view of the risks and benefits that this method of financing brings. Through analysis of academic journals, key factors that influence the success of crowdfunding campaigns are identified, as well as the impacts on investors, projects and the economy. The results show that the main benefits of crowdfunding include lowering barriers to entry, democratizing funding, fostering innovation and supporting community projects. At the same time, however, the literature highlights potential risks associated with lack of regulation, information asymmetry, the potential for fraud and project failure. Particular attention is paid to the role of trust and transparency as key factors in ensuring campaign success and minimizing risks. This article thus contributes to a better understanding of crowdfunding and its impacts on different stakeholders and provides important suggestions for future research and policy action.

Keywords

crowdfunding, risks, benefits, modern financing, literature review

JEL Classification

G3, G21, L21

1 INTRODUCTION

Crowdfunding has developed rapidly over the past decade as an alternative funding method for start-ups, non-profit organizations, artists and others. This method of funding involves raising small amounts of money from a large number of people, usually through online platforms such as Kickstarter, Indiegogo or GoFundMe. As a result of its low-threshold approach and its potential for democratising funding, crowdfunding has gained considerable attention from the public, the media and the academic world. This paper aims to provide a comprehensive review of the current literature on the risks and benefits of crowdfunding, taking into account its impacts on investors, project developers and the wider economy. This review helps to identify the key factors that influence the success of crowdfunding campaigns, and to explore how these factors change depending on different types of projects and market conditions.

In theoretical background, we first look at the historical development of crowdfunding and its main characteristics. We then present the current state of research in this area. Subsequently, the main methodological approaches and theoretical frameworks used in previous studies will be described, allowing us to identify gaps in the literature and suggest directions for future research. In the next part of the paper we will systematically analyse the risks and benefits of crowdfunding, focusing on topics such as regulation, information asymmetry, trust, transparency and social impact. We then conclude by summarising the main findings,

discussing their practical implications and suggesting areas for further research to better understand the dynamics, challenges and opportunities that crowdfunding offers.

2 THEORETICAL BACKGROUND

2.1 Crowdfunding

Crowdfunding (CF) is a modern and innovative way of raising funds for various business ventures, which has been gaining massive popularity in recent years. (Moran, 2017) The crowdfunding market can be seen as a "two-sided market" because it connects two groups of people. The first are project creators, i.e. owners of small and medium-sized enterprises. The second are the investors, who fund the creators' projects through the platform. (Lacan and Desmet, 2017) In recent years, the volume of crowdfunding in the world has at least doubled every year; in 2014, the crowdfunding market was \$17.25 billion in North America, \$85.74 million in South America, \$6.84 billion in Europe, \$24.16 million in Africa, \$10.54 billion in Asia, and \$68.60 million in Oceania. (Cumming et al, 2019) The global value of crowdfunding transactions reached USD 6923.6 million in 2019 and is expected to reach USD 11985.6 million by 2023 with an annual growth rate of 14.7%. (Guo et al, 2021) The principle of crowdfunding is based on the idea that collecting small amounts from a large number of investors can generate sufficient capital to implement projects. (Viotto da Cruz, 2018) This method allows project creators to present their business plan to the public and receive support from potential investors and on the other hand, crowdfunding provides an opportunity for investors to support projects that interest them and want to participate in their implementation. (Schwienbacher and Larralde, 2010) Crowdfunding is based on several basic principles and mechanisms. The first one is collective effort, which consists of many people contributing small amounts to a project to achieve the necessary financial goal. (Guo et al., 2020) The second principle is transparency, which allows investors to monitor the progress of the project. Another important mechanism is the communication between project developers and investors. Project creators need to effectively communicate their idea, its benefits, plans, and risks in order to gain the trust and (financial) support of investors. At the same time, they must be able to ensure sufficient interaction with investors over time to maintain their interest in the project (Stando and Henard, 2017).

The crowdfunding process involves several key steps:

Project Preparation: the project creator must prepare a detailed business plan, determine the target amount they need to raise, and possibly prepare investor rewards.

Presentation of the project: the project is presented on a dedicated crowdfunding platform where it is accessible to the general public. The project creator must convince potential investors of the validity of his idea and his ability to successfully implement the project. (Cumming et al., 2019)

Soliciting contributions: investors can financially support a project through the platform, often in exchange for pre-determined rewards or other benefits. The process of soliciting contributions takes a limited amount of time, usually a few weeks or months. (Cumming et al., 2019)

Project implementation: when the project reaches its target amount, the project creator raises funds and begins implementation. If the project does not receive sufficient funding, contributions are usually returned to the investor. (Mollick, 2014) Internet and technology play a key role in the crowdfunding process. Online platforms such as Kickstarter, Indiegogo and GoFundMe allow project creators to present their ideas to the general public and receive support

from investors around the world. Thanks to technology, information about projects spreads quickly. In addition, modern payment systems such as PayPal or mobile payments make it easy to send financial contributions instantly, reducing transaction costs (Cheng et al., 2019).

There are four main types of crowdfunding, which differ from each other in their objectives and rewards for investors.

Equity crowdfunding, or equity-based crowdfunding, is a financing method that allows small and medium-sized businesses to raise capital through the offering of shares in a business. (Mamonov and Malaga, 2020; Vulkan et al., 2016) Equity crowdfunding is therefore a process in which businesses raise finance from the public through the sale of shares or stakes in their business. (Hornuf, 2018) Investors who participate in equity crowdfunding receive a stake in the business that is proportional to the size of their investment. In doing so, they become shareholders or partners of the business and are entitled to a portion of the profits that the business generates. (Caputo, 2022) It is believed that platforms that offer shares with voting rights are generally more successful in achieving their financial goal. (Hornuf et al., 2022) Peer-to-Peer (P2P) crowdfunding is becoming increasingly popular and is bringing radical changes to traditional funding models. The principle of P2P is to invest small amounts with the expectation of a return in the future (Kraus et al., 2016) It is a decentralized funding model where there is no central authority to manage or guarantee the funding. P2P crowdfunding platforms such as Kickstarter, Indiegogo or GoFundMe provide a means of showcasing projects and mediating between investors and those seeking funding. (Nisar, 2020) Donation crowdfunding is an innovative way of funding charitable and philanthropic projects through online platforms that allow individuals or organizations to raise funds from donors without having to offer any material or financial return. (Perez et al, 2023) Donation crowdfunding is based on connecting individuals or organizations that need financial support for their projects with donors who are willing to provide funds without the expectation of any profit or reward. Examples of donation crowdfunding platforms are GoFundMe, JustGiving, or DonorsChoose. (Van Teunenbroek et al., 2023) Reward-based crowdfunding works on the principle that project creators raise funds from investors in exchange for rewards that vary depending on the size of the investment. (Mollick, 2014) These rewards can include products, services, experiences, thank-you notes, or other forms of recognition. Platforms such as Kickstarter, Indiegogo and Patreon allow creators to showcase their projects and mediate between them and potential investors. On the Kickstarter platform, rewards of \$25 are the most popular tier, while the average contribution is about \$70 and the ideal number of prize tiers is 9 to 11 (Ryu et al., 2020).

2.2 Development

Crowdfunding is nowadays often seen as a modern way of raising funds for projects. Although crowdfunding only became popular with the advent of the internet and social media, its roots go much deeper back in history. Crowdfunding has its roots in the 18th and 19th centuries, when people began to come together to raise funds for various projects. One of the most famous examples is the funding of the Statue of Liberty in 1885. (Zhao et al., 2018) When the French government donated the statue to the United States, the American government did not have enough funds to build a pedestal for the statue. Therefore, a campaign was launched to raise the necessary funds through public collections and small contributions from citizens. (Stemler, 2016) Theoretically, the collection of Czech citizens for the construction of the National Theatre can also be considered crowdfunding.

During the 20th century, crowdfunding became more common, especially in the field of culture and art. Artists, writers, and musicians started asking their fans for financial support in order to

realize their projects. One such example is the British rock band Marillion, who successfully raised money from their fans in 1997 to record an album and tour. (Kallio and Vuola, 2020) A watershed moment in the history of crowdfunding was the advent of the internet and social media at the turn of the 20th century. Crowdfunding began to expand rapidly due to the ability to disseminate information quickly and the ease of access to large numbers of people. In 2003, ArtistShare was founded and is considered the first internet crowdfunding platform. ArtistShare allowed artists to raise funds for their projects from fans and contributors, which was the basic principle of crowdfunding today. (Kallio and Vuola, 2020) Since the establishment of ArtistShare, other specialized platforms began to emerge and gained popularity among creators and contributors. Some of the most well-known platforms include Kickstarter (founded in 2009), Indiegogo (2008), GoFundMe (2010) and Patreon (2013). These platforms have allowed creators to present their projects to the general public and to receive support from contributors around the world. The different platforms specialise in different areas such as technology, culture, art, science, social projects and many more. (Hobbs et al., 2016) With the growing popularity of crowdfunding and increased number of investments came the need for regulation and investor protection. Laws and rules began to emerge in various countries that sought to protect the interests of investors while allowing creators the widest possible range of options for raising funds. (Stemler, 2016) One important milestone in crowdfunding regulation was the introduction of the JOBS Act (Jumpstart Our Business Startups) in the United States in 2012, which made it easier for small businesses to raise funds through crowdfunding while establishing rules to protect investors. (Kukk, 2022; Mollick, 2014)

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

3.1 RESEARCH OBJECTIVE

The main objective of this paper is to systematically analyse the available literature on crowdfunding with respect to the following aspects:

1. Identifying the benefits of crowdfunding for investors: Evaluating how crowdfunding can provide benefits for investors.
2. Identifying the risks of crowdfunding for investors: Analysing the potential risks associated with investing in projects funded through CF.
3. Identifying the benefits of crowdfunding for projects: Assessing how CF can contribute to the success of projects.
4. Identifying the risks of crowdfunding for projects: Assessing the potential risks associated with using CF to finance projects.
5. Identifying the market and economic impacts of crowdfunding: Analysing how CF can impact the market and economy.

As a result, the paper will provide a comprehensive overview of the benefits and risks of crowdfunding for investors, projects, the market and the economy, providing a holistic view of the topic and identifying key factors that should be considered when considering the use of crowdfunding as a source of finance. This analysis will be of practical relevance to investors, entrepreneurs, policy makers and other stakeholders concerned with crowdfunding and its impact on different segments of the economy. In addition, the paper will make a theoretical contribution to further research by identifying gaps in the literature and outlining possible directions for future research in the area of crowdfunding. This review can serve as a basis for

further empirical studies that could explore the specific benefits and risks of crowdfunding in different contexts, sectors and countries.

3.2 METHODOLOGY

A literature review is a fundamental and essential part of scientific research that allows for a systematic review and analysis of the available literature on a particular topic or question. This chapter focuses on the methodology used in this research paper, which aimed to conduct a comprehensive literature review to identify key concepts, theories, evidence and gaps in knowledge. It also describes the literature selection process, the evaluation criteria and the synthesis of the information found. Literature selection is the first step in the literature review methodology was to determine the objectives and questions that were explored through the analysis of the available literature. Subsequently, a search for relevant literature was conducted in databases, libraries and other sources of information. Keywords and combinations of keywords were used for the search to ensure a wide range of sources relevant to the topic. The selection of sources was made based on several criteria such as relevance to the topic under study, quality and credibility of the source, date of publication, and availability of the full text. Preference was given to literature published in the last 10 years, but important classic works were also included. Once potentially relevant sources were identified, a critical analysis of each source was conducted to assess its value to the study. The assessment included the following aspects: relevance: the relevance of each source was assessed in relation to the objectives and questions of the literature review. Quality: the quality of the source was assessed in terms of its scientific contribution, methodology, credibility of authors and citations. Consistency: the consistency and coherence of arguments, theories and evidence within and between sources were analysed. Knowledge gaps: Knowledge gaps were identified that could be the subject of further research or discussion. The literature review was followed by an information synthesis process that involved summarizing, categorizing, and interpreting the information gathered. This process included: Source sorting: the literature was sorted according to the key themes, concepts, theories and evidence that were identified during the analysis. This sorting enabled a better understanding of the connections between the different sources and facilitated the identification of key points for synthesis. Identification of main themes: Based on the literature sort, the main themes and issues that were discussed in the literature were identified. These themes and issues were used as the basis for structuring the results of the literature review. Information integration: the process of information integration involved combining information from different sources that addressed the same themes or issues. The aim was to provide a comprehensive and integrated view of the topic, taking into account different perspectives, arguments and evidence. Interpretation of results: the main results of the literature review were interpreted based on the synthesis of information. This interpretation included an evaluation of the evidence, concepts and theories, identification of the links between them and discussion of implications for further research and practice.

3.3 DATA

Risks for investors

Project failure and loss of investment is one of the biggest risks for investors in crowdfunding campaigns. Start-ups and new businesses often face a high degree of uncertainty, which can lead to failure and loss of investment. Investors should carefully consider the risks associated with a project and conduct thorough research before deciding to invest. (Maier, 2016; Walker, 2017) Expert sources suggest that investors in reward-based crowdfunding fail to receive a

product less than 5% of the time. (Mollick, 2014; Lacan and Desmet, 2017) Lack of liquidity can manifest as a risk of crowdfunding investments as they may be less liquid than traditional investments. This means that investors may not be able to sell their investments if their financial situation changes or if they need access to funds. When investing in crowdfunding projects, investors should consider their ability to bear the risk of lack of liquidity. (Sachse et al., 2012) Crowdfunding projects can suffer from information asymmetry when investors do not have enough information or understanding about the project, its business model or market. This can lead to incorrect investment decisions and increased risk of loss. Investors should look for projects that provide transparent information and allow them to conduct thorough research. (Belleflamme et al., 2014) Crowdfunding is still a relatively new method of financing and the regulatory environment can vary depending on the jurisdiction and type of project. Investors should be familiar with the rules and regulations that apply to crowdfunding projects in their jurisdiction to be able to properly assess and manage regulatory risks. Non-standardization of rules and procedures between different crowdfunding platforms can also make it difficult to compare investment opportunities and adequately manage risks. (Wasiuzzaman et al., 2021) The risk of fraud and unethical practices means that crowdfunding projects may be susceptible to fraud or unethical practices by the creators or the platform itself. Investors should be careful in choosing the projects and platforms in which they invest and conduct thorough research on the project creators and their past projects (if any). (Cumming and Johan, 2020) Trusted platforms should have policies and procedures in place to help identify and prevent fraudulent or unethical practices. Expert sources suggest that fraud is now more or less rare. (Ellman and Hurkers, 2019) Investing in individual crowdfunding projects can lead to a concentration of risk if investors do not diversify their portfolios. To manage risk, it is important that investors ideally spread their investments across different projects, sectors and geographies. Diversification can help reduce the impact of failed projects on overall portfolio performance.

Risks for projects

One of the biggest risks for projects using crowdfunding is not meeting their funding targets. If a project fails to reach its funding goal, it can lead to a lack of funds needed to complete the project. (Hobbs, 2016) This can cause delays in delivery, cancellation of the entire project, or the need to seek other/additional sources of funding. The success or failure of a crowdfunding campaign can have a significant impact on the reputation of the project and its creators. Unsuccessful campaigns or problems with the delivery of promised rewards can lead to investor dissatisfaction and negative public perception of the project. (Lacan and Desmet, 2017) Projects need to carefully plan and manage their crowdfunding campaigns to minimize potential reputational risks. (Gerber and Hui, 2013) Projects that use crowdfunding need to be familiar with the legal and regulatory requirements that apply to them in the field. This includes laws related to taxes, consumer protection, intellectual property, and others. Failure to meet these requirements can lead to legal problems, fines, or other serious consequences for the project. (Axelton and Chandna, 2023) Crowdfunding projects must carefully manage investor expectations and commitments to investors. This includes ongoing communication about project progress, transparency about problems and difficulties, and adherence to promised rewards and timelines. Miscommunication or failure to deliver on promises can lead to investor dissatisfaction and a negative impact on the project. (Gelfond & Foti, 2012) Projects that use crowdfunding may depend on platforms that provide these services. Projects must carefully consider the costs associated with using these platforms. (Chemla & Tinn, 2020) When project information is published on a platform, project creators may be at risk of intellectual property theft or competitors copying their ideas. Projects should consider legal measures to protect their intellectual property, such as patents, trademarks or copyrights, before launching a campaign.

(Yeoh, 2014) During the duration of a crowdfunding campaign or project implementation, changes in the market or competitive environment may occur that may negatively affect the project. This means loss of market share, changes in demand or development of new technologies and innovations. Projects must be prepared to respond to these changes and adapt to new market conditions (Walker, 2017).

Risks for the market

The rapid growth of crowdfunding can cause instability in the market, especially if it becomes the main source of funding for certain sectors or market segments. Instability can arise if too many projects rely on crowdfunding at the same time, which can lead to resource overload and possible collapse. (Lee and Chiravuri, 2019) Crowdfunding can attract many new and inexperienced projects, increasing the risk of failure and loss of investment. Investors may face an increased risk of losing their money if they invest in projects that are unable to meet their commitments or achieve their goals. (Jaziri and Miralam, 2019) These risks can affect investor confidence in the overall market and reduce the volume of investment in crowdfunding. (Walker, 2017) Due to the rapid growth and development of crowdfunding, regulators face a challenge in establishing adequate rules and regulations for this field. Regulation must ensure that investors and consumers are protected without hindering innovation and the natural growth of the market. If regulation fails to keep pace with market developments, legal ambiguities and potential abuses may arise. (Valančienė and Jegelevičiūtė, 2013) The rapid growth of crowdfunding may lead to greater competition between projects, which may make it more difficult for new and smaller projects to obtain funding. In addition, the influx of projects and investment opportunities may lead to market saturation, which means that some projects may not be able to get enough attention and support from investors. This phenomenon may result in increased pressure on projects to differentiate themselves and offer more attractive rewards, which could lead to increased risks for investors. (Attuel-Mendès, 2017) The rise in popularity of crowdfunding may contribute to the creation of bubbles in the market if investors enter the industry en masse with the hope of above-average returns. Bubbles can cause market overheating and subsequent collapse, which would have a negative impact on the entire economy. Projects and investors need to be cautious when entering markets that appear overheated or unstable. (Attuel-Mendès, 2017) The growing popularity of crowdfunding may also affect traditional sources of funding. Some investors and funding institutions may prefer to invest in crowdfunding instead of traditional funding sources, which could limit access to these resources for projects that need them. This trend may result in an uneven distribution of capital and resources in the market (Gallemore et al., 2019).

Risks to the regulatory environment

One of the main risks to the regulatory environment associated with crowdfunding is the lack of clarity in the regulatory framework. The rapid development and innovation in crowdfunding may render existing regulatory frameworks unable to adequately adapt. (Brand, 2021) This can lead to legal ambiguity, making it difficult for legislators to protect investors and consumers without hindering innovation and market growth. (Lv et al, 2023) Regulators must ensure that consumers and investors are protected from unfair business practices. This includes ensuring transparency and compliance with rules for informing investors about the risks, progress and outcomes of project finance. If the regulatory environment fails to provide sufficient protection, it can lead to a loss of investor confidence and a negative impact for the entire market. (Cicchello, 2020) Crowdfunding can be misused for money laundering or financing terrorist

activities. Regulators must ensure that crowdfunding platforms have adequate controls and procedures to prevent and detect these illegal activities. This includes identifying and verifying users, monitoring transactions, and cooperating with law enforcement authorities. (Teichmann et al., 2022) Crowdfunding is often considered a global phenomenon that crosses national borders. As a result, it is important for regulators to cooperate internationally and seek regulatory coordination and harmonization. This will prevent the creation of regulatory inconsistencies and abuses that could negatively impact the entire market. (Stemler, 2016) Regulators must strike the right balance between promoting innovation and protecting investors and consumers. Too strict regulation can hinder innovation and growth of the crowdfunding market, while too lax regulation can lead to unfair practices and loss of public trust. Regulators must be open to dialogue with the market and respond flexibly to developments and new challenges (Marakkath and Attuel-mendes, 2015).

Benefits for investors

Crowdfunding allows investors to diversify their portfolio by offering access to a wide range of projects in different sectors and stages of development. Portfolio diversification is essential to reduce risk and achieve balanced returns. (Attig et al., 2023) By investing in a variety of projects through crowdfunding, investors can minimize the impact of the failure of one or more projects on the overall value of their investment. (Wasiuzzaman et al., 2021) Traditional methods of investing, such as stocks, bonds, or mutual funds, often require high minimum investments and management costs. Crowdfunding offers lower investment thresholds, allowing even small investors to enter the market and make investments. In addition, management and transaction costs are often lower than traditional investment methods, increasing potential returns. (Camilleri and Bresciani, 2022) By investing through crowdfunding, investors can directly support innovation, entrepreneurship and the development of new technologies and products. This allows investors to be part of the growth and success of projects that they find interesting and socially desirable. (Hervé and Schwienbacher, 2018) Investors can thus contribute to the development of the economy and the creation of new jobs while receiving returns on their investments. (Hervé, 2018; Stanko and Henard, 2017) Crowdfunding platforms often provide transparency about the projects seeking funding. Investors can follow the progress of projects, communicate with the creators, and participate directly in decision-making processes. (Guillonoche, 2022) This transparency and control can be important for investors because it allows them to better understand the projects they are investing in and to have greater certainty about the development and management of these projects. (Hu et al, 2015) Crowdfunding can offer the potential for higher returns than traditional investment vehicles, especially when investing in start-ups or innovative projects with high growth potential. (Mollick, 2014) However, it is important to remember that with the potential for higher returns comes a higher risk of loss. Investors should carefully consider the risks and expected returns before investing in crowdfunding. Crowdfunding offers investors the opportunity to support projects with a positive social or environmental impact. (Bento et al., 2019) Investors, especially those interested in sustainability or social change, can invest in projects that have a positive impact on society and the environment through crowdfunding. In this way, investors can not only achieve financial returns but also contribute to their personal and ethical goals. (Messeni Petruzzelli et al., 2019)

Benefits for projects

Traditional funding sources such as bank loans can be difficult to access for many projects. (Belleflamme et al., 2015) Crowdfunding offers an alternative source of funding that is readily

available for a wide range of projects, including start-ups, creative projects and social projects. In this way, projects can obtain the capital they need to develop and expand without having to meet the stringent requirements of traditional funding sources. (Hasan et al., 2021) Crowdfunding allows projects to obtain funding more quickly and flexibly than traditional funding methods. With online platforms, creators can launch and close campaigns quickly, allowing for faster capital raising and easier adaptation to market changes. In addition, creators can adjust the goals and terms of the campaign (even during) to better suit the needs of the project. (Kshetri, 2015; Burtch et al., 2013) Crowdfunding not only helps to raise funding, but also builds a community around the project and serves as a marketing tool. (Chen et al., 2023) A successful crowdfunding campaign can gain the attention of the media, customers, and potential partners, which can contribute to the growth and success of the project. Additionally, creators can use feedback and community support to improve products or services and identify new market opportunities. (Eisenbeiss et al., 2022) Projects funded through crowdfunding often gain increased visibility and publicity as information about them is spread through the media to the general public. Thus, crowdfunding can serve as an effective marketing tool that raises awareness of the project, its creators, and their intentions. (Stevenson et al., 2022) In addition, crowdfunding campaigns can provide valuable feedback from potential customers and users, helping the project to better adapt to market needs, even if the project is not successful in the end. (Stevenson et al., 2022) Crowdfunding can serve as a catalyst for innovation and creativity, as it allows for the financing of projects that would otherwise have no chance of being bankrolled. This allows creators to experiment with new ideas and approaches, often leading to the creation of novel and original solutions. Thus, crowdfunding contributes to the development of new technologies, products and services that can improve people's quality of life and contribute to sustainable development. (Messeni Petruzzelli et al., 2019; Stanko and Henard, 2017) Crowdfunding also allows the risk associated with a project to be diversified among many individual investors. Investors typically invest smaller amounts, which means that the risk to individuals is dramatically reduced. This also encourages investment in higher risk projects that would otherwise not be able to receive funding (Profatilov et al., 2014).

Benefits for the economy

Crowdfunding represents a significant opportunity to support entrepreneurship and SME growth, especially for those who have difficulty obtaining funding from traditional sources. With easier access to finance, SMEs are able to expand and grow their businesses faster, contributing to economic growth and job creation. (Kshetri, 2018) Crowdfunding enables the financing of projects that would otherwise have no chance of getting funding in the traditional market. Thus, it encourages innovation and the creation of new products, services, jobs and technologies that can improve the quality of life and contribute to sustainable development. (Hervé and Schvienbacher, 2018) At the same time, it contributes to increasing competition in the market, which can lead to lower prices and higher quality products and services. (Stanko and Henard, 2017; Lehner & Nicholls, 2014) Crowdfunding enables the financing of a wide range of projects across different sectors, which contributes to the diversification of economic activities. This increases the resilience of the economy to economic shocks and instability as risks are spread across multiple sectors and businesses. Diversification also promotes the growth of new industries and helps reduce the economy's dependence on single industries. (Jung et al., 2022) Crowdfunding allows the general public to invest in projects and businesses, making investment opportunities available to people who would otherwise not have access to traditional investment vehicles. This can lead to greater financial literacy among investors and awareness of the risks associated with investing as ordinary people become more active participants in financial markets. It also allows the general public to share in the profits of

successful projects, widening the distribution of wealth and income. (Mollick, 2014) Crowdfunding is also an ideal way to fund social, charitable and environmental projects that often face barriers to obtaining funding from traditional sources. (Laurell et al, 2018) In this way, projects aimed at solving social problems or protecting the environment can be implemented, which has a positive impact on society as a whole and contributes to its sustainable development. (Valančienė and Jegelevičiūtė, 2013)

4 RESULTS AND DISCUSSION

This chapter presents and discusses the results obtained from the analysis of the literature on the risks and benefits of crowdfunding (CF) for investors, projects, the market and the economy.

Benefits of crowdfunding for investors: The analysis of the literature showed that the main benefits of crowdfunding for investors include: **Portfolio diversification:** CF allows investors to expand their portfolio by investing in a wide range of projects and businesses, which reduces the risk of loss from a single investment. **Access to new investment opportunities:** CF provides investors with access to innovative projects and businesses that might otherwise be difficult to access. **Opportunity to share in the success of the business:** Investors have the opportunity to share in the success of the business they have backed, either through financial appreciation or intangible benefits. **Reduced transaction costs:** CF simplifies and cheapens the investment process by eliminating the need for intermediaries and providing direct contact between investors and projects.

Risks of crowdfunding for investors An analysis of the literature revealed the following risks associated with investing in CF: **Risk of project failure:** projects funded through CF face a high failure rate, which can lead to loss of investment. **Lack of liquidity:** CF investments can be less liquid than traditional investments, which can make it difficult to sell or move the investment. **Limited regulation:** CFs often face limited regulation, which can create uncertainty and risk for investors. **Information asymmetry:** Investors may not always have sufficient information about the projects they invest in, which can lead to poor investment decisions. **Potential for fraud:** CF is prone to fraud and collusion, which can jeopardise investment and investor confidence.

Benefits of crowdfunding for projects. The main benefits of CF for projects include: **Improved access to finance:** CF enables projects to raise funds that might otherwise be difficult to access, which can accelerate the growth and development of projects. **Increase project visibility:** CF increases the visibility of projects by introducing them to the general public and potential investors. **Getting feedback from investors and the public:** CF allows projects to get feedback from investors and the public, which can lead to improvements in the project and its strategy. **Strengthening confidence in the project:** Successful financing through CF can strengthen public and investor confidence in the project and its ability to succeed.

The risks of crowdfunding for projects. The risks associated with using CF for project finance include **Dependence on an unstable source of finance:** CF can be an unstable source of funding that depends on economic conditions, public interest and the success of marketing strategies. **Difficulty of marketing and communication efforts:** CF requires projects to make significant efforts in marketing and communicating with the public and investors, which can be costly and time consuming. **Legal and tax issues:** Projects funded through CF can face complex legal and tax issues that can affect their success and profitability.

Potential loss of project control: CF-financed projects may lose control of their ownership and decision-making if a large number of investors are involved in the financing. **The impact of crowdfunding on the market and the economy.** The literature analysis revealed the following impacts of crowdfunding on the market and the economy: **Fostering innovation:** CF can foster

innovation by enabling the financing of new and experimental projects that might otherwise have difficulty in obtaining funding from traditional sources. Increase competition: CF can increase competition in the market by enabling new businesses and projects to obtain funding and enter the market, which can lead to better products and services for consumers. Financing new market segments: CF can enable the financing of projects and businesses in new market segments that may otherwise be neglected by traditional investors and financial institutions. Changing traditional financial structures and models: CF can change traditional financial structures and models by introducing alternative sources of finance and enabling a wider range of people to participate in investing and financing projects.

5 CONCLUSION

Meeting the objective of the work

The aim of the thesis was to identify the benefits and risks of crowdfunding for investors, projects, the market and the economy. After a thorough study of the literature and analysis of the information found, we can conclude that the objective of the thesis has been successfully met. The thesis provides a comprehensive overview of various aspects of crowdfunding and its impact on investors, projects, market and economy.

Main research findings

The main findings of the research include:

Identification of the main benefits and risks of crowdfunding for investors such as portfolio diversification, access to new investment opportunities, ability to participate in the success of the business, reduction of transaction costs, risk of project failure, lack of liquidity, limited regulation, information asymmetry and possibility of fraud.

Identify the main benefits and risks of crowdfunding for projects, such as improving access to finance, increasing the visibility of the project, getting feedback from investors and the public, building trust in the project, dependence on an unstable source of finance, difficulty of marketing and communication efforts, legal and tax issues, and the possibility of losing control of the project.

Identify the market and economic impacts of crowdfunding, such as fostering innovation, increasing competition, financing new market segments and changing traditional financing structures and models.

Research limitations and direction for further research

Although the aim of the thesis has been met, the research has several limitations. The research focused on analysing the available literature, which may limit the scope and depth of the findings, especially in areas that have not yet been thoroughly explored. In addition, the research results may be influenced by the selection of the sources examined and possible biases of the authors of the original studies.

Another limitation is related to the fact that the research was conducted in the form of a literature review and did not involve actual data collection or empirical analysis. This means that the findings are based on already published studies and may not fully cover the wide range of potential benefits and risks of crowdfunding in all contexts.

Despite these limitations, the paper provides a comprehensive overview of the benefits and risks of crowdfunding and suggests a direction for further research. Future studies could explore the benefits and risks of crowdfunding in different sectors, market segments, countries and regions, which could provide new insights and deepen our understanding of the impact of crowdfunding on the economy and society. Furthermore, it would be useful to conduct empirical research that could better quantify and measure the benefits and risks of crowdfunding.

In addition, further research could explore the impact of different forms of crowdfunding (debt, equity, reward, donor) and how their specific benefits and risks differ. Studies could also focus on the impact of regulation on crowdfunding and how different regulatory frameworks affect the benefits and risks for investors, projects and the market.

Conclusion

The paper "Benefits and risks of crowdfunding: literature review" presents a comprehensive overview of the benefits and risks of crowdfunding for investors, projects, the market and the economy. The literature analysis reveals the main findings in these areas, but also points to gaps in existing research and the need for further studies. Despite the limitations of the research, the thesis provides important information for various stakeholders such as investors, entrepreneurs, policy makers and others, and can serve as a basis for future research on crowdfunding and its impacts on the economy and society. Translated with www.DeepL.com/Translator (free version).

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Managerial market timing: How is the playground for making use of a superior information set? A comparison of U.S. and German financial and ad-hoc reporting regulations and insider laws

Jan Vogt

Abstract

This paper discusses the prerequisites for the successful timing of firms' capital market activities (a.k.a. managerial market timing) and delineates the relevant laws and regulations. U.S. and German regular and ad-hoc reporting requirements, insider trading laws, and the enforcement of those are compared based on actual laws and regulations and existing research. The aim of the contribution is to determine the playground for exploiting superior information by firm management. This regulatory or legal playground is important to understand to assess firm management's actions in light of (potential) costs and benefits. It is demonstrated that – although having different approaches and histories regarding the regulatory framework of insider trading – Germany and the U.S. both prohibit insider trading. Thus, theoretically, observable successful market timing must be based solely on the market's misinterpretation of available information. Not always perfect enforcement of the ban on insider trading, and difficulties in proving when material information was first available to decision-makers might allow for assuming that the mispricing of already published information is not the only value driver...

Keywords

Financial Markets, Regulation, Insider Trading, Corporate Finance

JEL Classifications

K22, G30, G38

1 INTRODUCTION

Managerial market timing is to be understood as firm management's behavior of buying back shares when the share price is seen undervalued, while issuing shares when seen overvalued (Stein, 1996). By linking this behavior with capital structure Baker and Wurgler (2002) founded the third important and more recent capital structure theory (Abeywardhana, 2017) in addition to Trade-Off- (Kraus and Litzenberger, 1973) and Pecking Order theory (Myers and Majluf, 1984). Based on their empirical analysis Baker and Wurgler concluded that capital structure is the cumulative outcome of firm management's market timing behavior. Multiple evidence allows for the assumption that managers chase (believed) attractive opportunities and pursue managerial market timing.

"[A] variety of evidence suggests that equity market timing is an important aspect of real financial policy. This evidence comes from analyses of actual financing decisions, analyses of long-run returns following equity issues and repurchases, analyses of realized and forecast earnings around equity issues, and surveys of managers."

(Baker and Wurgler, 2002, 29)

Supplementary to the multiple evidence of prevalent market timing behavior, Baker and Wurgler also see the prerequisites for potentially successful market timing given (Baker and Wurgler, 2013): On the one hand capital markets are not entirely informationally efficient, on the other hand managers are 'smart', i.e., they are able to identify mispricings. In addition to being eager to beat the market and having the information and skills to do so, managers need flexibility (Graham and Harvey, 2001) with respect to timing and size for the firms' capital market activities. This means the cash situation of the firm does have to allow for buying back shares, postponing intended issues and for variations in intended repurchase and issue volumes. Likewise, internal and external regulations⁴¹ must allow decision-makers to apply market timing. If all these conditions are met, successful market timing should be feasible.

Success would, however, be interesting, since it would imply either that capital markets systematically misvalue public information or that managers trade on nonpublic material information – a practice forbidden by laws and regulations in both the United States and Europe (Ventoruzzo, 2015).

Dong et. al. (2012) demonstrate based on 1,271 corporate equity issues and 1,071 intended share repurchases of Canadian firms between 1998 and 2007 that financially unconstrained firms issue (repurchase) equity when their shares are overvalued (undervalued) and that overvalued issuers earn lower post-announcement long-run returns (see figure 1).

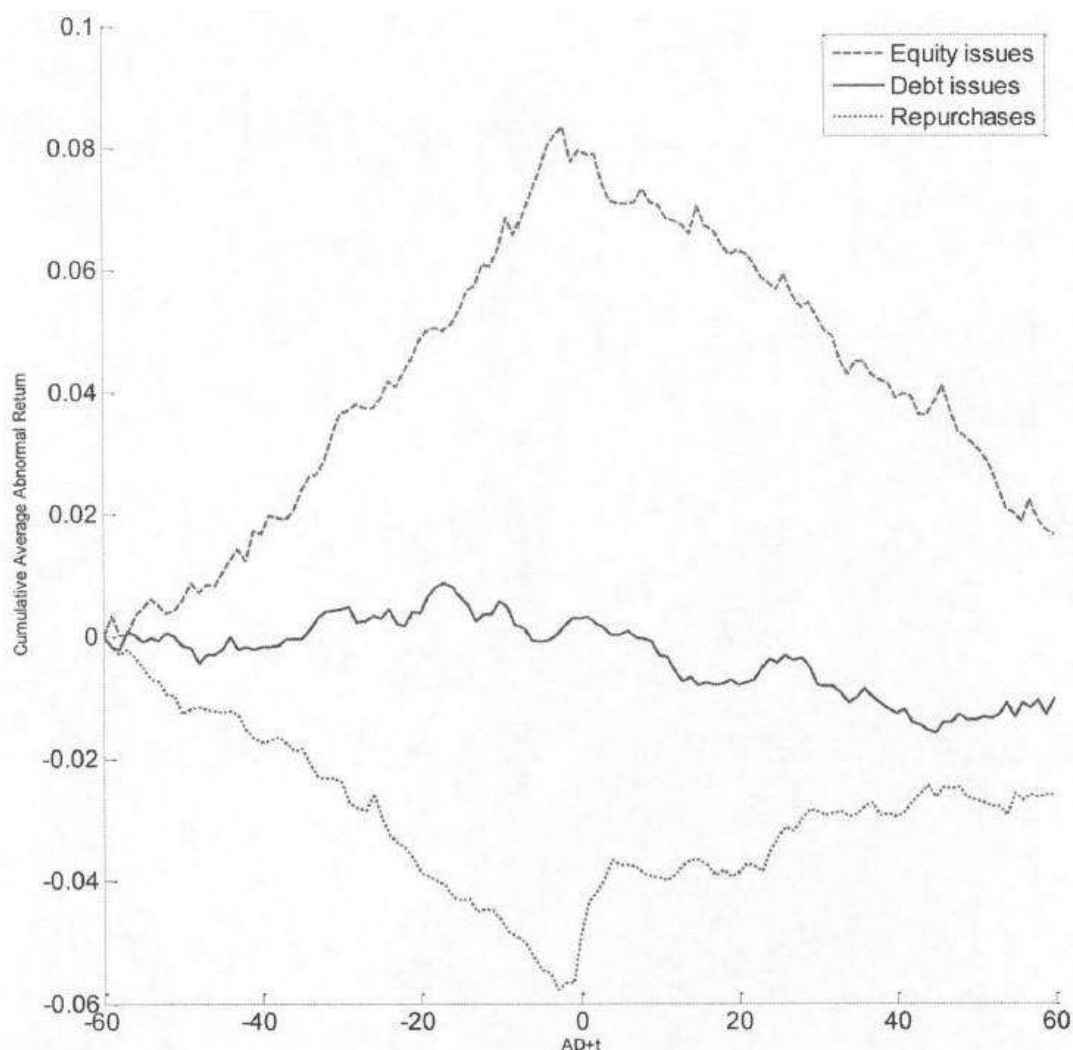
Sloan and You (2015) remarkably demonstrate that success in market timing is feasible. The authors quantify asset transfers from new or departing shareholders to a company's long-term shareholders due to mispriced equity. They empirically show that these asset transfers can be an essential component in value development from the perspective of long-term shareholders (1.79 % of pre-transaction market capitalization per company year) and that these capital transfers are predictable.

Given that background, this paper delineates the legal framework within which market timing can develop for the United States of America and Germany, as one representative of the rule-set of the European Union. Disclosure requirements in the context of regular financial reporting and rules on ad-hoc reporting for companies are of particular relevance. Furthermore, the rules concerning market abuse or insider trading will be addressed.

⁴¹ As far as internal and external regulations are concerned, which limit the management board in capital market activities, there may be considerable differences due to the articles of association, the approval requirements of the supervisory board or the annual general meeting, as well as legal regulations. In contrast to the required approval in Germany by the annual general meeting for a share buyback (see excerpt of German stock corporation law below), approval by the board of directors is sufficient in the USA. The legal basis for share buybacks in the USA is regulated in state corporate law and is, therefore, inhomogeneous (cf. Seifert, 2006, pp. 32–35). Aktiengesetz as of September 6, 1965 (BGBl. I S. 1089), lastly modified by article 9 on July 17, 2017 (BGBl. I S. 2446):

Share issues (§ 202): Articles of association might allow the board to issue shares for at max. 5 years; at least 75% of present shareholder voting rights are required for the authorization. The amount of shares to be issued must not exceed 50% of ordinary share capital. New shares can only be issued with approval of the supervisory board. Share repurchases (§ 71) – are only allowed for one of the following reasons/in the following circumstances: to avert severe damage to the company, to obtain stock for employees, to compensate shareholders in transformations, if free of charge or completed by a financial institution, in context of legal succession, following a resolution of the annual general meeting to decrease ordinary share capital, for trading purpose in case the firm is of type financial institution with a maximum share of 5%, based on a resolution of the annual general meeting valid for maximum 5 years limited to 10% of (trading as purpose is not allowed).

Fig. 1: Mean cumulative yield difference between the share price of companies with share issues, bond issues and share buybacks and the market return (cumulative abnormal returns) in the period 60 days before and 60 days after the announcement date of the capital market transaction (Dong et al., 2012, p. 650)



2 LEGAL FRAMEWORK IN THE USA

The legal framework in the USA consists of provisions at the federal level through the Code of Federal Regulations (CFR), specific rules of the various stock exchanges, and a large number of court decisions according to the "case law principle". At the federal level, chapter II of regulation 17 within the Code of Federal Regulations⁴² constitutes the provisions of the Securities Exchange Commission (SEC).⁴³ In particular, part 240, which contains general rules and regulations and the "Securities Exchange Act of 1934"⁴⁴ as the most important set of rules, is relevant⁴⁵. Furthermore, part 243 gains particular importance with the so-called "Regulation

⁴² It comprises the administrative ordinances issued at federal level. The individual administrative regulations are referred to as "Title" and divided into "Volumes", "Chapters" and "Parts".

⁴³ See U.S. Government Publishing Office (2017).

⁴⁴ See U.S. Securities and Exchange Commission (2012).

⁴⁵ See U.S. Securities and Exchange Commission (2017).

FD", which regulates the distribution of relevant information to the capital market and the public ("fair disclosure").

Regular reporting: In the USA, domestic and foreign issuers of securities have extensive requirements regarding regular reporting under the "Securities Exchange Act of 1934" (cf. Ventrizzo, 2015, p. 571). An issuer's requirements for the necessary reports result from CFR 17, chapter II, part 240, section 13 A (U.S. Government Publishing Office, 2017), while part 249 defines the filing formats ("forms"). For domestic issuers, the requirement to file an annual report⁴⁶ (Form 10-K) and a quarterly report⁴⁷ (Form 10-Q) apply. For foreign issuers, annual reports⁴⁸ (Form 20-F) and all information published in the domestic market (Form 6-K) must be published (see part 249 (U.S. Government Publishing Office, 2017)). In 2003, the SEC issued an obligation for domestic and foreign companies to publish realized stock repurchases in the annual and quarterly reports starting in March 2004 (Dittmar and Field, 2015, pp. 263–264).

Ad-hoc reporting: In the USA, domestic issuers must comply with the requirement of disclosing material events⁴⁹ (Form 8-K), which includes a continuous obligation to update the published information ("duty to update") and thus implies extensive reporting (cf. Ventrizzo, 2015, p. 571). Although the number of reportable events defined by the SEC as material events increased between 2005 and 2015, there is no obligation for companies in the U.S. to publish all internally available material information before their next quarterly reporting (cf. Ventrizzo, 2015, p. 571). Regulation F.D. regulates the publication of material, non-public information, which must take place simultaneously with capital market participants (cf. CFR 17, chapter II, part 243 (U.S. Government Publishing Office, 2017)). However, in the case of a non-disclosure agreement, it is permissible for tangible, non-public information to be selectively shared. This implies that certain groups of investors may have an information advantage (cf. Gomes and Phillips, 2012, pp. 620–621).

Insider-Trading: With regard to insider trading, the legal situation in the USA is very complex due to various SEC regulations that have developed since 1960 until today, and due to case-law court rulings that are not always aligned (cf. Ventrizzo, 2015, p. 556). The starting point of the resulting set of rules is the predecessor of today's Rule 10b-5 defined by the SEC in part 240 of title 17⁵⁰ from 1948, which does not use or define insider trading conceptually, but

⁴⁶ According to title 17, chapter II, part 240, section 13 – § 240.13a-13. The quarterly report must be published between 40 to 45 days (U.S. Securities and Exchange Commission, 2009a).

⁴⁷ According to title 17, chapter II, part 240, section 13 – § 240.13a-13. The quarterly report must be published between 40 to 45 days (U.S. Securities and Exchange Commission, 2009a).

⁴⁸ to be published within 6 months after the end of the respective fiscal year.

⁴⁹ According to title 17, chapter II, part 240, section 13 – § 240.11. Report 8-K – the "Current Report" – has to be used to report "major events that shareholders should know about" at the latest 4 business days after the occurrence of the respective event (U.S. Securities and Exchange Commission, 2009b). Such events could occur in the following areas: "Registrant's Business and Operations", "Financial Information", "Securities and Trading Markets", "Matters Related to Accountants and Financial Statements", "Corporate Governance and Management", "Asset-Backed Securities", "Regulation FD", "Other Events", "Financial Statements and Exhibits" (U.S. Securities and Exchange Commission, 2009b).

⁵⁰ "Employment of manipulative and deceptive devices. It shall be unlawful for any person, directly or indirectly, by the use of any means or instrumentality of interstate commerce, or of the mails or of any facility of any national securities exchange, (a) To employ any device, scheme, or artifice to defraud, (b) To make any untrue statement of a material fact or to omit to state a material fact necessary in order to make the statements made, in the light of the circumstances under which they were made, not misleading, or (c) To engage in any act, practice, or course of business which operates or would operate as a fraud or deceit upon any person, in connection with the purchase or sale of any security. (Sec. 10; 48 Stat. 891; 15 U.S.C. 78j) [13 FR 8183, Dec. 22, 1948, as amended at 16 FR 7928, Aug. 11, 1951]" (U.S. Government Publishing Office, 2017).

represents a general anti-fraud clause (cf. Ventruruzzo, 2015, p. 557). In 1960, the SEC first used this rule⁵¹ to punish insider trading (cf. Ventruruzzo, 2015, p. 557).

"SEC sanctioned Cady, Roberts & Co., arguing that a violation of Rule 10b–5 had occurred because Gintel traded while in possession of material, non-public information. [(cf. U.S. Securities and Exchange Commission, 1961, p. 909)] This was the first instance in which the Commission introduced the concept of 'disclose or abstain', and was based on the principle of equal access to information, according to which trading on the basis of material, non-public information was fraudulent under Rule 10b–5. [(cf. U.S. Securities and Exchange Commission, 1961, p. 911)]" (cf. Ventruruzzo, 2015, p. 558).

In 1963, the SEC litigated a case concerning insider trading, in which the SEC's position that inside information must either be disclosed or may not be traded ("disclose or abstain") was upheld by the Second Circuit Court (U. S. Court of Appeals Second Circuit, 1968). The decision aimed to ensure that all investors had access to similar information when trading (cf. Ventruruzzo, 2015, p. 559). In another case from 1980 (U. S. Supreme Court, 1980), the U.S. Supreme Court did not confirm in the same way the fact that trading using non-public information is not permissible ("disclose or abstain"), but defined as an additional necessary condition for prohibited insider trading the existence of a fiduciary breach of duty⁵² towards the transaction partner (cf. Ventruruzzo, 2015, p. 560). With this and other similar judgments, insider trading was inextricably interwoven with the elusive concept of fiduciary breach of duty. As a result, there were many cases with a complicated legal situation and a mutually influencing effect of court rulings and regulations by the SEC to concretize the prohibition of insider trading (cf. Ventruruzzo, 2015, p. 560). Thus, in Rule 14-e3 (cf. U.S. Government Publishing Office, 2017, § 240.14e-3), the SEC has determined trading to be illegal if material, non-public information in connection with a tender offer is known – regardless of the existence of a fiduciary breach of duty (cf. Ventruruzzo, 2015, p. 561).

Enforcement: Overall, insider trading-related laws and regulations in the U.S. form a system that is fragmented, complex, and in parts irrational, and that poses challenges to enforcement (Ventruruzzo, 2015, p. 570). In addition to the previously mentioned legal obligation due to administrative regulations of the SEC and existing court decisions, the admission requirements of the trading venues oblige companies to publish private information as far as possible if it appears material to a reasonable investor. However, the SEC does not consistently pursue these rules (cf. Ventruruzzo, 2015, p. 572).

3 LEGAL FRAMEWORK IN GERMANY

The legal framework in Germany is determined by the national laws of the German Civil Code (BGB), the German Stock Corporation Act (AktG), the Securities Trading Act (WpHG), the Stock Exchange Act (BörsG), and the Financial Services Supervision Act (FinDAG), by EU framework legislation, by implementing provisions and implementing regulations of the EU, regulations, and directives at the national level as well as other regulations of the stock exchanges.⁵³ In the following, those provisions relating to disclosure obligations and insider

⁵¹ In re Cady, Roberts & Co.; File No. 8-8925. Promulgated November 8, 1961.

⁵² This includes the "misappropriation theory" defined by the SEC, which states: "whenever a fiduciary uses information belonging to his principal for personal gain, without disclosing the use, he commits fraud in connection with the purchase or sale of a security and is liable under Rule 10b–5." (cf. Ventruruzzo, 2015, p. 562).

⁵³ Buck-Heeb shows the legal basis of capital market law, current developments, and the interplay between private, public and criminal law (cf. Buck-Heeb, 2019, pp. 8–24).

dealing will be focused on, whereas provisions that specify supervisory issues and define claims for damages and penalties will not be examined in more detail.⁵⁴ In 1994, Germany was the last country of the then European Economic Community (EEC) to create legal regulations on insider trading (cf. Bhattacharya and Daouk, 2002, pp. 80–81; Thompson, 2013, pp. 11–12), although the "Council Directive 89/592/EEC of 13 November 1989 coordinating regulations on insider dealing" (Europäische Wirtschaftsgemeinschaft, 1989) and Article 14 thereof required the Member States of the EEC to implement the measures defined therein⁵⁵ by June 1, 1992. The lack of regulation of insider trading, in addition to other reasons – such as the widespread use of alternative forms of company to the stock corporation, the risk preferences of investors, and tax aspects – is an influencing factor that led to weak development of the capital markets in Germany relative to economic performance (cf. Warren, 1991, p. 1039):

"The development of the German capital markets has lagged far behind the industrialization of the country. This situation has adversely affected the ability of German corporations to finance their expansion through equity capital, forcing them to be overly dependent on banks and debt financing. One way of developing and strengthening the German capital markets is to increase their attractiveness to the individual outside investor. This is dependent, in part, on demonstrating that there is equal opportunity for all market participants. Effective control of insider trading would be an important step in this direction. [...] If the German authorities are serious in their desire to prevent insider trading, significant structural reforms will have to be instituted. To this end, serious consideration should be given to adopting a statutory scheme similar to those in force in France, the United Kingdom, Japan, and the United States. Failure to prevent insider abuses will only serve to injure the long-term interests of German industry and society." (Blum, 1986, pp. 530–531)

Since July 26, 1994, the German Securities Trading Act (Wertpapierhandelsgesetz, WpHG), which received a new version on September 17, 1998 (Bundesanzeiger Verlag, 1998) and has been amended several times in recent years⁵⁶, has regulated the terminology relating to insider trading, the supervision of securities trading, the notification and publication obligations of listed companies, the rules of conduct and the provisions on penalties and fines (Bundesanzeiger Verlag, 1994). In the period between the founding of the European Union (with the Treaty of Maastricht on February 7, 1992) and its reform with the signing of the Treaty of Lisbon on December 13, 2007, further regulations⁵⁷ were created, which expanded the topic of insider trading with regard to the trading venues concerned, supplemented the

⁵⁴ Kitanoff provides an overview of the legal aspects of share buybacks in Germany up to 2008 (cf. Kitanoff, 2009, pp. 208–230).

⁵⁵ Essentially, Member States were required to prohibit non-public information influencing prices from being used for the benefit of insiders to ensure that insider information cannot be selectively disclosed and that listed firms are required to disclose non-public information influencing prices. The motivation for the implementing regulation was to establish a uniform framework of the converging capital markets of the Member States and thus to create confidence among market participants and investors (cf. Warren, 1991, p. 1039). Measured against this, Warren judges the directive to be unsuccessful: "The EC hardly succeeds in these purposes. The directive grants the member states a wide margin of discretion in transforming the directive into their national laws. It fails to label insider trading as a crime and prescribes no penalties or civil remedies. At best, the directive establishes a new moral: Insider trading is now, for the first time, a European sin and, henceforth, a public wrong for market participants. At worst, the directive merely assists the EC in promoting dangerous imagery of regulation: the directive's denunciation of insider trading conveys the false impression of a comprehensively-regulated marketplace." (cf. Warren, 1991, p. 1040).

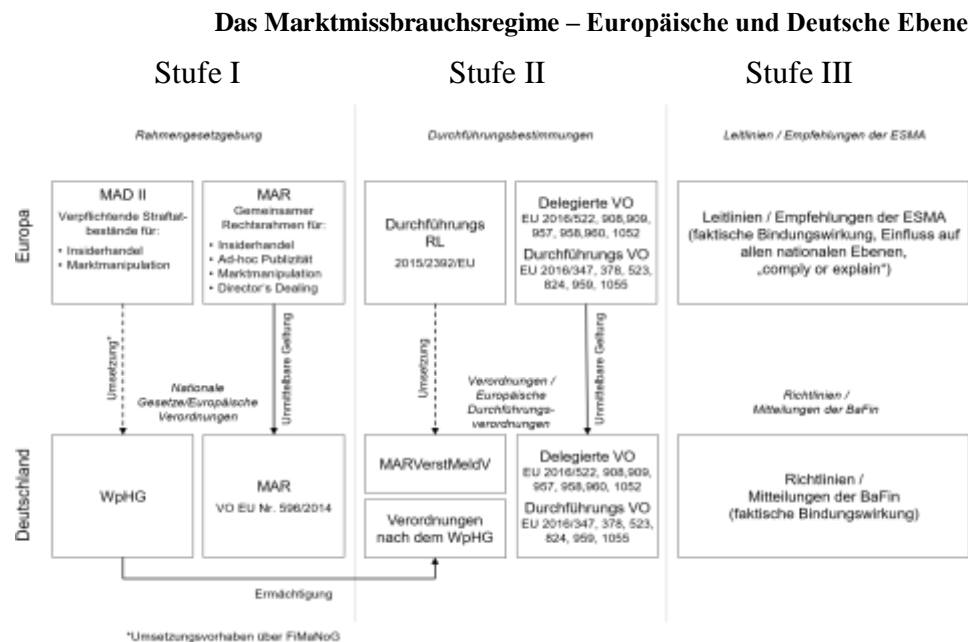
⁵⁶ <https://www.buzer.de/gesetz/1262/1.htm> – Buzer.de is a private initiative providing up-to-date and complete information on current and previous federal legislation free of charge (cf.

<https://www.buzer.de/h.htm>).

⁵⁷ Guidelines 2003/6/EG, 2004/72/EG, 2003/125/EG, 2003/124/EG, provision (EG) Nr. 2273/2003.

aspect of market manipulation and defined terms, standards, and exceptions. These regulations were valid until July 3, 2016. Since then, the current legal framework for market abuse in the EU has been defined by the Market Abuse Regulation⁵⁸ (MAR) and the Market Abuse Directive⁵⁹ (MAD II) (Möllers, 2016b). The MAR has direct legal force as a regulation in the European Union member states, while MAD II had to be implemented as a directive in Germany via the Securities Trading Act.⁶⁰ Figure 1.1 shows the relationship between the multi-level regulations at the European level, from the framework laws to the implementing provisions to the guidelines, the effect at the German level, and the national laws, regulations, and directives. The MAR regulates insider trading and market manipulation terminology and defines both activities as prohibited. It also regulates ad-hoc disclosure requirements and defines reporting requirements with regard to director's dealing (Europäische Union, 2014), while MAD II establishes mandatory criminal offenses for insider dealing and market manipulation (Europäische Union, 2019).

Fig. 2: Overview of European and German regulations in connection with market abuse based on Möllers (Möllers, 2016b).



⁵⁸ Market Abuse Regulation: EU-Provision Nr. 596/2014 as original version (Europäische Union, 2014), that has been modified (Europäische Union, 2016a; Europäische Union, 2016c; Europäische Union, 2016b) and complemented since (cf. Möllers, 2016b).

⁵⁹ Market Abuse Directive in its original version (Europäische Union, 2019), which was transposed into German law on July 2, 2016 via the “Finanzmarktnovellierungsgesetz” (Möllers, 2016a). In the aftermath of the financial crisis, the European legislator took initiatives in numerous areas of capital markets law to improve the transparency and integrity of markets and investor protection. In order to implement the relevant directives and ordinances, the Securities Trading Act and the Banking Act, in particular, must be adapted. In addition, there are changes in the Stock Exchange Act, the Insurance Supervision Act, and the Capital Investment Code, among others. An overview of the numerous regulations can be found in the recommendation for a resolution and the report of the Finance Committee of the German Bundestag, available as a printed matter 18/8099, Part A General part, Section II “Essential content of the bill” (pp. 97 ff.). The transposition into national law takes place in the First Act on the Amendment of Financial Market Regulations based on European Legal Acts (First Financial Market Amendment Act – 1. FiMaNoG) of June 30, 2016 (BGBl. I S. 1514). (Bundesfinanzministerium, 2016).

⁶⁰ The Regulation is of general application. It shall be binding in its entirety and is in force with immediate effect in all member states. A directive is binding for each member state to which it is addressed as to the result to be achieved but leaves it to the national authorities to choose the form and methods. (Treaty on the Functioning of the European Union, part 6, title I, chapter 2, section 1, article 288).

Regular reporting: Section 114 of the German Securities Trading Act (WpHG) requires companies that have issued securities in Germany to publish an annual financial report no later than four months after the end of the financial year. This annual financial report shall comprise annual financial statements and a management report and, in the case of publicly traded companies⁶¹, shall be prepared under international accounting standards (IFRS/IAS) from January 1, 2005 following Article 4 of EC Regulation 1606/2002 (Europäische Gemeinschaft, 2002). Section 115 of the German Securities Trading Act (WpHG) requires a half-year report, which includes condensed financial statements, and an interim management report⁶² no later than three months after the end of the reporting period. With that, the post-admission obligations of the "General Standard" segment of the Frankfurt Stock Exchange regarding regular reporting (Deutsche Börse, 2019a) are covered. For the "Prime Standard", quarterly statements⁶³ must be published no later than two months after the end of the reporting period (Deutsche Börse, 2019b).

Ad-hoc reporting: According to article 7, paragraph 1 of the MAR, inside information is defined as information of a precise nature that has not been made public, which relates directly or indirectly to one or more issuers or one or more financial instruments and which, if it were made public, would be likely to determine the price of those financial instruments to have a significant impact. According to paragraph 2, information is to be regarded as precise if it refers to a series of circumstances that already exist or which can reasonably be expected to occur in the future or an event that has already occurred or can reasonably be expected to occur in the future, and that information is sufficiently specific; in order to allow conclusions to be drawn as to the possible effect of that series of circumstances or events on the prices of the financial instruments. Article 17 requires issuers of securities to make inside information available to the public as soon as possible (Europäische Union, 2014, Kapitel 3, Artikel 17).⁶⁴

Insider trading: According to article 8 of the MAR, insider dealing occurs when a person possesses inside information and directly or indirectly acquires or disposes financial instruments to which the information relates, using it for his account or the account of others. The use of inside information in the form of cancellation or modification of an order concerning a financial instrument to which the information relates shall also be considered insider dealing if the order was placed before the inside information was obtained; article 14 prohibits, on the one hand, insider dealing or attempts to do so and, on the other hand, recommending or inciting third parties to engage in insider dealing. It also prohibits the unlawful disclosure of inside

⁶¹ See the German Commercial Code, § 264d HGB, for the definition of "kapitalmarktorientierte Kapitalgesellschaft".

⁶² For minimum requirements of interim financial reports see IAS 34.

⁶³ According to § 53 of the Exchange Rules of the Frankfurt Stock Exchange, the quarterly statement should enable the assessment of the development of the issuer's business activities during the period under review. Significant events affecting the financial position and results of operations must be described. If the situation has changed significantly compared to the last management report and forecasts no longer appear appropriate, this must be reported (cf. Frankfurter Wertpapierbörse, 2019, pp. 39–40). In addition to reporting, at least one analyst conference per financial year must be conducted, and the corporate calendar must be continuously updated and published (Deutsche Börse, 2019b).

⁶⁴ Paragraph 4 of article 17, chapter 3 of the MAR allows the postponement of the publication of inside information at the risk of the issuer if the legitimate interests of the issuer would be harmed (e.g. in the context of negotiations in connection with M&A, in the event of a threat to intellectual property rights in connection with new product developments, in the event of a threat to the financial viability of the issuer in the context of negotiations outside insolvency law (cf. European Securities and Markets Authority, 2016, pp. 4–5)), the public is not misled, and the secrecy of the information can be ensured (Europäische Union, 2014). Publication must ensure that the public is able to have complete and accurate information and that an assessment is possible 'in good time' (Europäische Union, 2014, Kapitel 3, Artikel 17).

information, which is defined in Article 10 as the disclosure of inside information outside the normal employment or performance of a person's duties.⁶⁵

Enforcement: Although Germany has been too slow in introducing insider trading laws and has less experience compared to the US (Ventoruzzo, 2015, p. 555), improvements have been made: the legal framework has been created, sanctions have been defined, and the first violations of the MAD have been punished (cf. Aussenegg, Jelic, and Ranzi, 2017, p. 34). However, Germany is, with a score of 1, at the lower end of the peer group with Switzerland (0), Austria (1), the Netherlands (2), Belgium (4), France (5), and Italy (6) in the Insider Trading Enforcement (ITE) Index (cf. Aussenegg, Jelic, and Ranzi, 2017, p. 35), which takes into account the number of cases penalized, the published information on sanctions, penalties imposed and the capacity of financial supervision. Further, Germany exhibits statistically significant abnormal returns around days with insider trading (cf. Aussenegg, Jelic, and Ranzi, 2017, p. 7).

4 RESULTS AND DISCUSSION

With regard to regular reporting, there are more extensive requirements in the USA due to mandatory quarterly reports (which are only required in the "Prime Standard" in Germany) and an obligation to update published information continuously. Due to the longer history of legal regulation of insider trading in the USA vis-à-vis the countries of the European Union, insider trading in America is traditionally met much more strongly and successfully. However, with the introduction of the MAR and MAD II and the adaptation of national laws, the countries of the EU have brought about significant improvements in the meantime (Ventoruzzo, 2015, p. 555). In the US, case law and SEC regulations have resulted in an overly complex structure of insider trading rules. The violation of a fiduciary relationship as a precondition for insider trading has led to inconsistent rules that contradict the fundamental argument for a prohibition of insider trading and have made it difficult to enforce that prohibition (cf. Ventoruzzo, 2015, p. 556). The EU takes a more straightforward, more elegant, and more effective approach to its regulatory framework, following the principle of "parity of information", whereby insiders must either publish non-public information or refrain from trading related securities (cf. Ventoruzzo, 2015, p. 556). In contrast to the parity of information approach, there is no general obligation to publish all material information in the USA, despite the extensive requirements for regular reporting and a continuous obligation to update published information (cf. Ventoruzzo, 2015, p. 571). Another key difference between the US and Germany is the definition of market abuse. While in the USA, trading in the presence of inside information already constitutes market abuse (cf. Ventoruzzo, 2015, p. 580), article 8 of the MAR states that insider dealing occurs when inside information is available to a person, and this information is used when traded.⁶⁶ Due to the condition of a fiduciary breach of duty, regulation in the USA appears to be less

⁶⁵ Paragraph 1 of article 5, chapter 1 of the MAR defines buyback programs and stabilization measures as exceptions to the prohibitions of insider dealing and market manipulation defined in chapters 14 and 15. As exemptions for buyback programs eligible are: Previously disclosed buyback programs for capital reduction, buyback programs to meet obligations under debt securities, or buyback programs from the allocation of shares to employees (Europäische Union, 2014). Stabilization measures constitute temporary purchases, or offers of securities disclosed to the competent authority of the trading venue with the sole purpose of supporting the market price in the event of selling pressure (Europäische Union, 2014; Buck-Heeb, 2019, p. 135). Thus, these defined exceptions do not apply to the activities related to market timing considered in the context of this work.

⁶⁶ The European Court of Justice has interpreted MAR with its judgment in the case of Spector Photo Group similar to the American definition of market abuse (Europäischer Gerichtshof, 2009). "The recent decision in Spector Photo Group by the European Court of Justice (ECJ) has redefined the scope of the European insider trading prohibition. The court held that a person in possession of inside information and trading with relevant securities is presumed to have infringed the insider trading prohibition" (Langenbacher, 2010, p. 452).

suitable for promoting efficient capital markets compared to the current European approach based on "parity of information" (cf. Ventrizzo, 2015, p. 571). Nevertheless, the enforcement of the ban on insider trading in the USA is by no means ineffective and "still appears to many as more effective than in Europe" (Ventrizzo, 2015, p. 593). From a practical point of view, the two approaches to regulating prohibited activities related to insider trading no longer differ significantly (cf. Ventrizzo, 2015, p. 593).

4 CONCLUSION

The considerable potential and empirically demonstrated value of market timing for long-term shareholders should – given the legal framework – be solely based on the market's misjudgment of already published information. However, in view of not always perfect enforcement of the ban on insider trading, the difficulties in proving when material information was first available to decision-makers in capital market transactions, and the challenges in analyzing omitted or postponed planned capital market transactions, it can be assumed that mispricing of already published information is not the only value driver...

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