# *The Connection between Banking Systems and the Economy*

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# Contents

# List of Abbreviations

| | |
|---|---|
| ATM | Automated Teller Machine |
| CEO | Chief Executive Officer |
| CRD | Capital Requirements Directive |
| CRE | Correlated Random Effects |
| CS | Cross Section |
| DALAHO | Hohenheim Datalab |
| EBA | European Banking Authority |
| EBT | Earnings Before Taxes |
| EC | European Commission |
| EDIS | European Deposit Insurance Scheme |
| EMU | Economic and Monetary Union |
| ESRB | European Systemic Risk Board |
| Eurostat | European Statistical Office |
| FE | Fixed Effects |
| GDP | Gross Domestic Product |
| GL | Guidelines |
| G-SII | Global Systemically Important Institutions |
| H1 | Hypothesis 1 |
| H2 | Hypothesis 2 |
| HICP | Harmonized Index of Consumer Prices |
| LEI | Legal Entity Identifier |
| LLC | Limited Liability Company |
| Ln | Natural Logarithm |

| | |
|---|---|
| Max. | Maximum |
| Min. | Minimum |
| Mn. | Million |
| MREL | Minimum Requirement for Own Funds and Eligible Liabilities |
| NPL | Non-Performing Loan |
| Numb. Of Obs. | Number of Observations |
| NUTS | Nomenclature of Territorial Units for Statistics |
| Obs. | Observations |
| O-SII | Other Systemically Important Institutions |
| OTC | Over the Counter |
| p.c. | Per Capita |
| PLC / AG | Public Limited Company |
| POLS | Pooled Ordinary Least Squares |
| PPHI | Primary Private Household Income |
| R2 | R-Squared Measure |
| RE | Random Effects |
| ROA | Return on Assets |
| SME | Small and Medium-sized Enterprises |
| Std. Dev. | Standard Deviation |
| SyRB | Systemic Risk Buffer |
| UR | Unemployment Rate |

# List of Symbols per Chapter

## Chapter 2

| | |
|---|---|
| $Y_{i,t}$ | is the dependent variable, thus either economic wealth measured by GDP per capita or inequality measures, namely unemployment rate, or primary incomes of private households per capita. |
| $\boldsymbol{\alpha_i}$ | denotes region-specific effects. |
| $\boldsymbol{\beta, \gamma, \delta}$ | are vectors of regression coefficients. |
| $\boldsymbol{BankSystem_{i,t}}$ | gives different regional bank specific variables characterizing the local banking system: net loans relative to total assets, total assets as well as equity to total assets. |
| $\boldsymbol{NumbOfBanks_{i,t}}$ | indicates the number of different bank types within a region. Included are all banks incorporated as private banks (PLCs and LLCs), co-operative banks and savings banks. |
| $\boldsymbol{X_{i,t}}$ | gives a set of control variables. |
| $\boldsymbol{d_t}$ | denotes time-specific effects. |
| $\boldsymbol{u_{i,t}}$ | gives the idiosyncratic error term. |

## Chapter 3

| | |
|---|---|
| $Y_{i,t}$ | is the dependent variable. As measurements of firm performance, I use return on assets as well as earnings before taxes as dependent variables. To be able to analyse the effects on SMEs in particular, there are separate regressions for all firms and only SMEs. |
| $\boldsymbol{\alpha_i}$ | denotes region-specific effects. |
| $\boldsymbol{\beta, \gamma, \delta}$ | are vectors of regression coefficients. |
| $\boldsymbol{BankSystem_{i,t}}$ | gives different regional bank specific variables characterizing the local banking system: total assets as well as equity to total assets. |

$\boldsymbol{NumbOfBanks_{i,t}}$ indicates the number of different bank types within a region. Included are all banks incorporated as private banks (PLCs and LLCs), co-operative banks and savings banks.

$\boldsymbol{X_{i,t}}$ gives a set of control variables.

$\boldsymbol{d_t}$ denotes time-specific effects.

$\boldsymbol{u_{i,t}}$ gives the idiosyncratic error term.

# Chapter 4

$Indicator_{i,k}$ refers to the value for indicator $k$ of institution $i$. (The EBA suggests those indicators, e.g. total assets.)

$\sum_{j=1}^{n} Indicator_{j,k}$ denotes the sum over all values for indicator $k$ of all banks within a member state, where $n$ is the number of banks in the respective country $j$.

$I_{i,k}$ is the indicator score for every indicator $k$ per individual institution $i$ in basis points.

$Criterion_{i,b}$ is the criterion score for each criterion $b$ of each institution $i$ and can be calculated by taking the average of the indicators per criterion.

$M$ denotes the number of indicators within the respective criterion.

$OSII\ Score_i$ gives the average of the criterion scores $Criterion_{i,b}$, hence the overall score per institution $i$ in basis points.

$Score_{i,t}$ is the overall $OSII\ Score$ value of institution $i$ for year $t$.

$\boldsymbol{\rho_i}$ denotes the constant.

$\boldsymbol{\gamma, \mu}$ are vectors of regression coefficients.

$\boldsymbol{Authority_j}$ is a dummy variable per country $j$, which takes the value 1 if the national authority deciding on the O-SII buffer is a supervisory authority and zero if it is a central bank.

| | |
|---|---|
| $u_{i,t}$ / $u_{j,t}$ | gives the idiosyncratic error terms. |
| $Buffer_{i,t}$ | is the O-SII buffer in year $t$ for institution $i$ in percentage points. |
| $\theta_{i,t}$ | denotes the assigned average buffer per score value (multiplied by 10,000). |
| $\varphi_{j,t}$ | gives the sum over all buffer per score values ($\theta_{i,t}$) of all O-SII institutions in a country $j$, divided by the number of O-SII institutions $z$ in one country $j$. |
| $\beta_{0,\dots,8}$ | denotes regression coefficients. |

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# List of Appendices per Chapter

# 1 General Introduction

Banks fulfil various tasks within an economy. They pool usually small deposits because loan amounts are generally larger than investment volumes (lot size transformation). They execute term transformation because investments typically need long term financing, while funds or deposits are generally short term. Banks try to diversify their portfolio and limit their risk on an institutional level (risk transformation) and therefore bank deposits are mostly safe investments.[1]

Furthermore, banks act as financial intermediaries in an economy. Without banks every single investor would have to monitor each individual investment. Without banks, companies and private households would have to hold a lot of liquidity as companies have stochastic needs for liquidity and individuals have uncertain consumption wishes. Without banks, every investor would have to create and conclude contracts and renegotiate debt contracts if necessary. As a result, the literature surrounding financial intermediation describes banks as delegated monitors (Diamond 1984, 1996), delegated contractors (Burghof 2000) and liquidity providers (Diamond and Dybvig 1983).

While the functions of banks are comparable around the world, the banking business organisation and banking systems are not. For example, Germany has a great diversity of different banking forms, a decentralized banking system and a large number of mostly small individual banks. Conversely, the United Kingdom only has a few big players who dominate the banking market. Hackethal and Schmidt (2000) compare financial systems and conclude that the UK and the USA have a higher relevance of market mechanisms but a low degree of stability, whereas in Germany the opposite is true.

In addition, the way in which banks conduct their business differs greatly depending on the legal structure of the institute. Most public savings banks and co-operative banks – and to a certain degree also most private banks - were founded a long time ago for different reasons, and their varying business purposes reflect that even today.[2] Furthermore, on the one hand there is transaction banking with a deal based "arm's length" focus (Boot and Thakor 2000) and therefore rather distanced bank to customer connections, and on the other hand, there is relationship

[1] In the current environment of a long-lasting low interest rate period, it may not be obvious that customer deposits at a bank are in fact investments. Not only do customers invest in the banking business, they also indirectly invest into private and commercial loans.

[2] For example, public savings banks in Germany were mostly founded to develop solutions for people with lower income and to support local business.

lending (Greenbaum, Kanatas and Venezia 1989). Within a bank-client relationship, banks learn more about their private and corporate customers (Sharpe 1990). Durable bank-borrower relationships can be welfare enhancing and profitable for customers as well (Boot and Thakor 1994). This is especially the case for small firms who benefit from a lower borrowing rate in longer banking relationships (Berger and Udell 1995), and higher availability of credit (Petersen and Rajan 1994).[3]

Given the important role of banks as well as the variety of banking systems and business models, analysing their influence on the economy and on firms is a relevant task of modern research. The literature suggests that smaller regional banks behave differently to large private corporations. Stein (2002) proves that a decentralized banking industry with smaller institutions performs better in analysing "soft" (i.e. not directly verifiable) information while larger hierarchical firms are superior in working with "hard" (i.e. quantitative or balance sheet) information.

My starting point for this dissertation was the diverse German banking system. Not least since the financial crisis, the structure of financial systems and banking regulation are frequently discussed and current topics. Germany was one of the countries that survived the financial crisis fairly well. Although politicians had to commit to guarantees for depositors and capital injections for bigger banks, the small German banks, which are a unique characteristic and part of Germany's financial environment, were stable and safe.[4] Germany shows very good growth prospects as well as continuing economic development. This growth, in part, is supported by the rather crisis proof (Berlemann, Jahn and Lehman 2020) and innovative (Berlemann and Jahn 2015) German "*Mittelstand*": small and regional producers of high technologies, engineering and specialized products which are export oriented and matched by their local and regional house banks. Despite such obvious connections between the German financial institutions and the German corporate landscape, some European politicians have claimed that the German banking sector is overbanked and inefficient, and therefore in desperate need for consolidation to become internationally competitive and more stable.[5]

To be able to make more general statements about banking systems, I directly extended my research for this dissertation to more countries and chose a European approach to answer the overall research question of this thesis: How are banking systems and the economy connected?

[3] Of course, the aforementioned sources are only examples, as there is extensive literature on this topic.
[4] Which corresponds to the observations by Hackethal and Schmidt (2000) mentioned above.
[5] "The German model of three pillars—private banks, co-operatives and [state-owned] savings banks—is outdated", Neelie Kroes, the former EU competition commissioner, told a German newspaper in 2010. "It does not correspond to the role that the German economy plays and should play." (See Gammelin and Winter, 2010).

The following three chapters coincide with the three papers written for this cumulative dissertation. The papers are formally revised for the thesis.

In this dissertation, I analyse how diverse regional banking systems influence the economy. My contribution to the literature is threefold. (1) I show that the presence of public savings banks and co-operative banks improve regional wealth and reduce inequality. (2) Furthermore, the presented evidence explains how those banking types enhance the performance of local firms, especially small and medium-sized enterprises. Moreover, I evaluate the connection between banking systems and the economy from a different angle. (3) I outline the impact of economic factors on regulatory capital requirements for large banks. The results suggest that banking regulation is not completely politically independent and differs between European states. I show that national economic preconditions change the parameters for banking business within a country.

My thesis provides an improved insight for researchers and practitioners to better understand the value of local banking systems. It highlights how banks can influence the economy as well as how the economy might be indirectly influencing the regulatory environment for banks.

The purpose of **Chapter 2** is to examine how local banking systems impact regional economies. It includes the academic article "*Banking Systems and Their Effects on Regional Inequality and Wealth*", co-authored by Hans-Peter Burghof and Marcel Gehrung.[6] We combine bank balance sheet information from Moody's Analytics BankFocus provided by the DALAHO and economic data from Eurostat to create a unique data set. As we want to focus on regional information, we aggregate the information on NUTS 2 levels of Austria, France, Germany, Italy and Spain. We choose these countries as all of them have banks within the European associations of savings banks, co-operative banks, as well as private banks. We use the legal form to identify the different banking structures and count the number of each legal corporation within a NUTS 2 region. The results provide evidence for the positive influence of co-operative banks, public savings banks and LLCs on regional economic wealth and income inequality. In addition, the analyses show the enhancing effects of smaller banks on local economies. Finally, the outcome suggests that regional banking systems with an on average higher ratio of equity to total assets

[6] I am the main corresponding author of this paper. My contribution to this paper was the development of the initial idea, the literature review, the elaboration of the fundamentals, the data acquisition, the empirical research design, the analytical framework, the empirical analyses, the interpretation of the results and helping with the data preparation in addition to co-writing every chapter.

enhance wealth and reduce inequality significantly. Our work shows that diverse regional banking systems have a positive influence on local economies.

Reasons for the positive influence of regional banking systems on the economy, among others, are their contributions to effective capital allocation and the supply of credit. Based on the literature which explains the advantages of relationship lending, it is likely to assume that one of the main positive influences of diverse regional banking system is their impact on small and medium sized enterprises. **Chapter 3** consists of my single authorship article "*The Impact of Regional Banking Systems on Firms and SMEs – Evidence from five European Countries*". This project analyses how regional banking systems affect local firms as well as small and medium-sized enterprises. To execute the respective analyses an extension of the data in Chapter 2 is necessary. Therefore, I add firm balance sheet information from almost 850,000 companies to the already existing bank and economic data on the NUTS 2 level in five European countries. To analyse the influence of regional banks on firms and SMEs, I detach the latter to create separate variables just for SMEs. I include different characteristics of diverse regional banking systems in the regressions such as the corporate forms of banks (PLCs, LLCs, co-operative banks, public savings banks) or the bank size (total assets). My results show the positive influence of local banking systems consisting of smaller banks on the profitability of firms in the respective region. Co-operative banks, LLCs and public savings banks improve the performance of local firms within their regions. The results apply to small and medium-sized enterprises in particular.

Considering the importance of banks for the economy it is necessary to ensure a stable financial system which is the primary task of banking regulation. As explained in the first chapters, financial intermediaries influence wealth and firm performance. Therefore, governments might want to support banks and give them a (national) comparative advantage. **Chapter 4** outlines that regulators manually create a connection between the economy and equity requirements. Apparently, financial stability does not seem to be most important for European regulators. The chapter includes the academic article "*The Influence of Economic Factors on the Capital Buffer Calibration for Systemically Important Institutions in the EU*", co-authored by Hans-Peter Burghof and Julia Juric.[7] As financial institutions fulfil several essential roles in the economy, their stability is key to prevent severe crises. Since banks are specialists in credit business and

[7] I am the main corresponding author of this paper. I contributed to this paper by developing the initial idea based on input from practitioners, the development of the fundamentals, the data acquisition, collection and helping with data preparation. Moreover, I was responsible for the empirical research design, the integration of the research into the literature, the interpretation of the results and co-writing every chapter.

are therefore leveraged companies, capital requirements are one of the key elements in banking regulation. The connection between financial institutions and the real economy results in a possible contagion of the failure of a systemically important institution to the whole economy. As a result, such systemically important institutions have to meet special regulations, including more comprehensive capital requirements. Equity can contribute to the stability of a credit institution but also might limit its ability to fulfil its role as financial intermediary, for example limit their lending business. The availability of bank financing has a major influence on the performance of firms and economies. This assumed influence could be an incentive for national regulators to adopt multinational, i.e. European rules on capital requirements, less strictly on a country level. For our research, we create a unique data set consisting of information manually collected from regulatory reports, bank balance sheet information from Moody's Analytics BankFocus and economic variables from Eurostat. Hence, we are able to show the influence of economic factors on the capital buffer calibration for Other Systemically Important Institutions (O-SII). The scoring process to identify and rank O-SII is shown to be comparable within Europe, but the equity requirements assigned to similar banks in different countries are not. Nations with higher unemployment as well as a higher amount of non-performing loans implement capital rules less stringently. Systemically important banks in those countries need to fulfil lower capital ratios than in states with sound economic development. As such, their country average of capital buffer requirements per score depends on the economic situation rather than the scoring process.

In **Chapter 5**, I summarize and connect the main results of the three academic articles. I show how they contribute to the topic of this dissertation and the literature in general. Furthermore, I give an outlook and present ideas for the development of this research.

# Banking Systems and Their Effects on Regional Wealth and Inequality

Hans-Peter Burghof[8]
Marcel Gehrung[9]
Daniel Alexander Schmidt[10]

**Abstract**

Our paper examines how the characteristics of banking systems impact regional economies. We analyse a new and unique data set consisting of bank balance sheet information of banks in five European countries combined with their legal forms, and with regional economic data on NUTS 2 levels. It is demonstrated that the presence of headquarters of co-operative banks as well as public savings banks and private banks in the respective region has a positive impact on economic wealth and reduces income inequality. Furthermore, regional banking systems consisting of smaller banks have positive effects on the local economy. Finally, we find that banks with a higher ratio of equity to total assets go along with higher wealth and reduce inequality significantly. Our work shows that diverse regional banking systems have a manifold positive influence on local economies.

*Keywords*: Banking Systems, Small Banks, Inequality, Wealth, Co-operative Banks, Savings Banks, Regions

*JEL Classification*: P34, P43, G15, G21

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# 2 Banking Systems and Their Effects on Regional Wealth and Inequality

## 2.1 Introduction

There have been better times for small European banks. Starting with the financial crisis of 2008 and the following sovereign debt crisis, European banks face greater regulatory burdens and challenges. Persistently low interest rates are a major problem for the numerous small and regional banks, which in the past relied heavily on income from the interest rate margin. In this paper, we analyse whether the unique diverse structure of the different European banking systems benefits the respective economies and enhances economic growth. To address this aim, we investigate banking in 108 European regions in five European countries (Austria, France, Germany, Italy and Spain) with regard to the degree of centralization (i.e. the number and size of the banks) and diversity (i.e. the different legal forms and ensuing different business objectives). We ask ourselves how these dimensions of a regional banking system might influence credit allocation, economic growth[11] and income inequality. The five countries were chosen, as their banking systems contain a sufficient number of banks for an empirical analysis, and because we can find public savings banks, co-operative banks and private banks, i.e. a sufficient degree of diversity with regard to the legal form.

The previous literature on the role of financial systems on economic development states that financial development is either supply-leading or demand-following. The first means that more financial institutions and services offer financing opportunities for entrepreneurs and companies that result in an increase economic growth. The latter points at growing economies needing more financing to satisfy their increasing demand for production. In our paper, we follow the first hypothesis that financial development causes economic growth and can close the income gap. In this respect, relationship lending (e.g. Petersen and Rajan 1994) and the use of soft information (e.g. Stein 2002) might give small and regional banks an advantage over bigger banks which are further distanced from their customers and can only rely on hard information. If this is the case, regional banks granted more loans, which improves capital allocation to peo-

[11] In our growth specifications, we analyse the effects of regional banking systems on the level of GDP per capita such that financial systems effect the growth in absolute terms of GDP. We, therefore, sometimes use the term 'economic growth' interchangeably for increases in economic wealth.

ple who would otherwise have gone without financing. This increased lending improves economic growth and the incomes of the lower part of the income distribution. Furthermore, regional banks could act as delegated monitors, benefit from their long-term relationships with customers and prevent capital drains from small and relatively poor regions.

In our analysis, we rely on a unique and manually collected dataset of balance sheet data from Orbis Bank Focus[12], combined with macroeconomic data from Eurostat. Special about our new dataset is that we do not focus on the national comparison of banking systems, but rather look at a more granular level of different regions. We concentrate on NUTS 2 regions[13], which are administrative units just below province or state level. One motivation for this approach is the different development between boom and bust regions and the resulting discrepancies within countries. We tackle this issue with a cross regional analysis and apply panel regressions for the time span of 2011-2016.

Our results suggest that bigger banks are not associated with increased economic growth in regional areas. This finding relates to the theoretical foundation of our analysis and indicates that the decentralized banking sector dominated by small banks significantly improves the economic growth prospects of the underlying regions. Additionally, banks granting more loans relative to their total assets further increase economic wealth. And in particular, co-operative banks boost economic growth. This same pattern is also present for the usually small limited liability companies (LLCs) and public savings banks but the results are not as clear as for the positive impact of co-operative banks. Our analyses indicate that the capital structure of a regional banking system is important as the equity ratio delivers significant positive effects for the local economies.

To investigate the relationship between regional banking and income inequality, we run regressions with the unemployment rate and the primary private household income per capita of local regions as dependent variables. We find evidence of co-operative banks and LLCs reducing the unemployment rate in the region, whereas larger banks are associated with a higher unemployment rate. However, we see the strongest results when highlighting the positive influence of public savings banks and banks with a higher ratio of equity to total assets on unemployment rate.

[12] Now called “Moody's Analytics BankFocus”.
[13] NUTS means “Nomenclature of Territorial Units for Statistics”.

We obtain similar results when we look on the effects of regional banking on the primary private household income per capita in the regions. The results suggest that co-operative banks, public savings banks and especially LLCs increase income per capita. The lending behaviour of banks also matters, as banks granting more loans in relation to their total assets have a positive effect on household incomes. Additionally, there is a connection between larger banks and a lower household income.

Overall, our results show that a diverse local financial system with banks of different legal forms is beneficial for the local economy. In general, these results also highlight the importance and explanatory power of regional banking systems for economic growth and inequality regressions. This has implications for policy makers and future European regulation. Small, diverse, regional and geographically widespread banks show positive economic effects. Consequentially, further mergers and consolidations might be harmful.

The paper is structured as follows: in section two we explain how banking systems can influence the economy. We present the motivation for our analysis and lay the foundation for the causal interpretations made in the later analysis. Section three introduces the current state of the literature. Section four depicts our dataset, and section five describes the methodological approach of our analysis. Section six shows our empirical findings and interpretations, before we conclude in section seven.

## 2.2 The Importance of Diverse Regional Banking Systems

A local banking system contains both the branches of large banks, usually headquartered in one of the leading financial centres, and local banks headquartered in the respective region. In our paper, we focus on banks that are actually domiciled in the respective region. There are two reasons for this approach, a practical and a conceptual: Firstly, data on the regional allocation of business activities of large banks is not available on a sufficiently disaggregated level. Secondly, we argue that the presence of responsible managing directors within a region has an impact that cannot be fully replicated through mere branch managers. To some degree, our results support this approach, as they show that the existence of local banks, and consequently the presence of banking entrepreneurs within a region, make a difference to local economies.

Studies on financial systems that split up national levels of analysis to different regions or states are not completely new to the academic discussion.[14] However, to the best of our knowledge, our study is the first to examine regional banking systems in multiple European regions. We characterize a diverse regional banking system as a system with a set of different banks within a region. As there are banks with varying legal forms and business goals, their influence on the regional economy should also be different. Additionally, we analyse the average size of banks within a region, as on average smaller banks leave more room for a diverse local banking system. Furthermore, the equity ratio is used as a proxy for stability which should foster stable and lasting customer-bank relationships. We conclude the analyses with net loans to total assets as proxy for a regional financial system concentrated on credit business.[15]

As stated above, we assume that decentralized banks with local CEOs behave differently from large centralized banks. As an explanation for this difference, Stein (2002) argues that a decentralized banking industry is better in analysing soft information, while larger banking firms with a hierarchic structure perform better when all relevant information is available in a "hard", i.e. quantitative form. There is some empirical support for this consideration in the literature, in particularly when dealing with loans to small and medium sized businesses (Lehman and Neuberger 2001). Large banks rely on standardized quantitative information whereas smaller banks with a more direct link to their customers probably take also the bank clerks' more subjective assessment of the clients into account (Cole, Goldberg and White 2004). Thus, the consolidation that occurred in many banking systems, which goes with a larger geographical distance to firms, results in financing constrains especially for smaller businesses (Alessandrini, Presbitero and Zazzaro 2009). Another result of the different behaviour is that large banks will interact more impersonally with their borrowers and grant less loans when a company has a difficult or opaque informational situation (Berger et al. 2005). This might disproportionally affect new companies with little or no available financial information.

The study by Hakenes et al. (2015) argues very much along our line. They show that the existence of small banks has a positive influence on local economic development, as, due to asymmetric information and credit rationing, capital tends to flow to the centres. Consequently, we get a tendency for overinvestment in the centres and for underinvestment in the regions beyond the large financial centres. Small banks, through the creation of local capital circles, can help to overcome both effects and thus increase welfare. Hakenes et al. (2015) find some empirical

[14] See, e.g. Beck, Demirgüç-Kunt and Levine (2007) or Beck, Levine and Levkov (2010), dealing with differences in banking across U.S. federal states.
[15] Rather than e.g. commission or investment business.

confirmations for their results through the analysis of data from regional savings banks in Germany (*Sparkassen*) from 1995 to 2004. In their study, they track the influence of local bank market shares and bank efficiency on GDP growth and the growth rate of new business registrations within counties (*Kreise*), i.e. regions on the NUTS 3 level. Therefore, their data has another cross-sectional as well as another time dimension as ours, and it is limited to Germany. Furthermore, in our study, we use other dependent and independent variables, as we concentrate on the effects of a diverse regional banking system with the focus on the number of different banking types, and we apply the average size of banks as well as net loans to total assets as further explanatory variables. Whereas, they concentrate strongly on bank efficiency and bank market shares and not the institutional structure of the local banking systems as such.

Our paper is also related to the literature on banks' relationship lending. One of the most important roles of banks in the economy is the one as delegated monitor. The theoretical approach by Diamond (1984, 1996) shows that it is efficient to pool money using a financial intermediate who then grants loans. It would be less efficient to finance large projects directly. This is due to the reduction of monitoring costs by banks, since banks analyse the borrower once so there is no need for several lenders to monitor the same borrower multiple times. A close and long-term relationship between a bank and a borrower will support the bank`s capability to act as a delegated monitor and can reduce asymmetric information (Boot and Thakor 2000). A simple example for the improved screening capability is that a bank can observe payment transactions of borrowers over a long period of time (Elsas 2005).

The costs of banks to screen their possible lenders, and the customer's commitment to a long-term relationship, are connected to the theory of incomplete contracts. The majority of contracts does not include rulings for all possible future scenarios, and often contracts are even vague on several significant matters. One reason for this incompleteness could be transaction costs (see e.g. Williamson 1979) or the disability of agents to forecast their possible future payoffs (Maskin and Tirole 1999). It might also be the case that contract parties cannot describe all future states of nature ex ante (Hart and Moore 1999), and might even want to renegotiate their contracts (Maskin and Tirole 1999). One way to reach a desirable co-operative behaviour of all contracting parties are long-term relationships. Such relationships require that deviations from the implicit contractual agreement can be punished in a credible way, and it therefore does not payoff to deviate (Radner 1981, 1985).

Relationship banking improves the investment decisions of banks and customers in particular if banks can ensure that they will not exploit their informational advantage (Sharpe 1990). Such

a successful relationship depends on implicit contracts and the transmission of information of the good behaviour of a bank to other potential partners. A long-term relationship between a bank and a customer includes the idea of a long-term commitment between those parties. This results in an implicit liquidity insurance for the customer in situations of unexpected decline of the borrower's creditworthiness and (internal) rating (Elsas and Krahnen 1998; Cotugno, Monferrà and Sampagnaro 2013). One consequence of this insurance is that the availability of credit for companies is positively linked to the time they spend in a relationship with one bank (Petersen and Rajan 1994). However, this approach even underestimates the true effect, as the duration of the relationship is not a good proxy for the degree of commitment within a relationship construct such as a "*Hausbank*" relationship (Elsas and Krahnen 1998). Boot and Thakor (2000) also show that relationship lending improves the value of the customer in an environment with competition for relationship lending from the capital market.

We argue that in an environment with incomplete contracts, a diverse banking system is helpful. This holds not only because of the implicit insurance and because of the reputational equilibrium between customers and their long-term bank, but also because of the greater variety of choices of different banking types. Different types of banks behave differently in situations when contractual relationships become incomplete, e.g. if they have to choose between a restructuring or liquidation of a credit relationship. Some might be willing and able to renegotiate contracts, whereas other might not have acquired the respective capacity (Schäfer 2002). Furthermore, banks might differ with regard to the methods and objective of renegotiation and/or the liquidation processes. Consequently, different types of banks create different contractual relationships. In this sense, markets are more complete with a menu of different types of potential financing partners. The prospective debtors can choose their financing partners in accordance with the individual characteristics and needs of their project. Therefore, diversity in the banking system should lead to economic growth even on a local level, as it provides access to a wider range of types of banks. Furthermore, since different banking types will address different customer layers, a diverse system with, e.g. public savings banks, co-operative banks and private banks should reduce inequality.

We build on the existing research by empirically indicating that a decentralized banking system as well as small banks with a comparably larger amount of relationship lending have a positive influence on local economies. We provide evidence that this is in particular the case in economies where, in contrast to a geographically centralized banking system, we can find diverse system with different financial institutions in the different regions. We add a comprehensive

empirical study of European banking data and economic information to the literature and analyse the effect of different regional banking systems on economic wealth and income inequality.

## 2.3 Literature Review and Hypotheses

Within the existing literature, inequality is regarded as a major influence on the economic wealth and growth prospects of economic agents (Kuznets 1955; Alesina and Rodrik 1994; Aghion, Caroll and Garcia-Penalosa 1999). However, inequality itself is driven by many different factors, such as financial development. Credit constraints can severely limit economic agents from reaching their optimal level of credit, to become entrepreneurs and improve their incomes, or in reaching their optimal level of human capital to improve income and wealth (Galor and Zeira 1993; Galor and Moav 2004; Banerjee and Newman 1993). Barriers to obtaining credit can widen the income gap between the poor and the already wealthy, who have been endowed with more wealth from the beginning.

One way to improve financial development and reduce credit constraints is with a more developed financial sector and banking system. Burghof and Gehrung (2020) show that financial development in the form of a further integrated European Single Market improves economic growth and closes the gap between high and low incomes. Specifically, financial integration benefits the lower end of the income distribution, while top incomes stay mostly unaffected. In this discussion, the supply-leading hypothesis of financial development is contrasted by the demand-following hypothesis (by e.g. Robinson 1952). Both views stress the importance of banks and financial intermediaries granting loans to economic agents, and their ability to improve incomes across the whole distribution. However, the mere existence of both theories also hints at the potential for reverse causality. It is possible that banks spur economic growth across the whole income distribution by granting more loans and improving the credit allocation. Yet, at the same time, a faster growing economy could require and provoke the opening of more financial institutions to support increased production and new entrepreneurs.

A very convenient way to measure the effects of financial development on economies is the use of natural experiments. Many researchers, including Jayaratne and Strahan (1996), Kroszner and Strahan (1999), Beck, Demirgüç-Kunt and Levine (2007), Beck, Levine and Levkov (2010), or Zou, Miller and Malamud (2011), thoroughly analysed the deregulation of bank branch restrictions in the U.S. during the 1970s with regard to economic performance and its

effects on inequality. By abolishing local monopolies, deregulation leads to a significant entry of new banks into local markets (Amel 1993), consolidation of smaller banks into larger holdings (Savage 1993; Calem 1994), and the conversion of existing bank subsidiaries into branches (McLaughin 1995), which all have major effects on the growth performance of the respective US states. However, these findings for the consolidation in the US do not contradict our results as they involve the special case of binding legal branch restrictions prohibiting (local) competition. Such laws to completely prohibit interstate or interregional banking are not common in Europe. Although, there is the regional principle in Germany which pushes the numerous public savings banks to focus their business on their operating area, but they are not completely forbidden to conduct business with customers living outside their district. The German regional principle ensures competition between banking groups even within regions and therefore ensures efficiency (Conrad, Neuberger and Trigo-Gamarra 2014). Hence, this is not comparable to the abolishment of the US branch restrictions as the latter aimed to remove local monopolies. The initial situation in Europe was and is different to the US, thus, a similar natural experience in Europe is not possible.[16]

Meanwhile, financial development can also come in the form of different designs and characteristics of banking systems. Most countries developed different types of banks, in particular private banks serving the interests of their owners, public banks that act on behalf of some local or national authority and ideally the public welfare, and co-operative models where groups of people come together in a club-like setting to enhance their access to financial services and markets. However, countries differ with regard to the degree of centralization within this framework, and with regard to the relative weight of the three components. In recent decades, banking reforms often led to more centralization and strengthened the private banking sector to the detriment of public and co-operative banks.

In this respect, the German banking system is sometimes called anachronistic[17], as it still contains the three banking types with similar weight. And although European regulation after the financial crisis of 2008 and the sovereign debt crisis has taken its toll on the many small independent German banks, which had to consolidate with other institutes, the degree of decentralization of German banking still stands in stark contrast to many other European systems (Ferri,

[16] Another branch in the literature about natural experiments is the increased presence of foreign banks through financial liberalization or development (e.g. see Gormley (2010) or Ang (2010) for the case of India or Sturm and Williams (2004) for Australia).

[17] "The German model of three pillars—private banks, co-operatives and [state-owned] savings banks—is outdated", Neelie Kroes, the former EU competition commissioner, told a German newspaper in 2010. "It does not correspond to the role that the German economy plays and should play." (See Gammelin and Winter, 2010).

Kalmi and Kerola 2014; Chiaramonte, Poli and Oriani 2015). For example, the banking system of the UK was always been marked by the dominance of the London financial centre, and its concentration on a few large banks (see e.g. Beck, Demirgüc-Kunt and Levine 2006), in particular with regard to retail banking and loan supply to small and medium sized companies. In line with their political structure, Spain and Italy are characterized by a more diverse and decentralized banking system, but have recently transitioned away from this concept to a system with fewer big and mainly profit-oriented financial institutions (Flögel and Gärtner 2018). Meanwhile, the structure of the Austrian banking system remains similar to the German role model but features co-operative and public savings banks, which operate more internationally and do not value the regional principle as highly as their German counterparts. The French banking system shows many similarities with regard to bank types, but differs since the major market shares are concentrated on only few large banks. Unluckily, even though the UK is the prototype of a concentrated banking system within one of the most regionally unbalanced countries (McCann 2020), we are not able to include it in our data set, as the concentration of bank headquarters in only few regions (i.e. in London and Edinburgh) would distort our results. Thus, in the UK, there are too few regional banks outside the financial centres that could have an effect on regional economies.

There are different measures of the structure of a banking system. We define diverse banking systems by the legal and organisational form of the banks within the system. The number of public savings banks, co-operative banks and private banks with their different business objectives can characterize a banking system and proxy the influence of more diversity on the economy. Herbst and Prüfer (2016) suggest that firms, non-profits and co-operatives behave differently. They show the level of quality is highest for non-profit organisations but the efficiency of the products depends on the competitive environment as well as the decision-making costs. Maurer (2019) gives evidence that the different legal forms in fact also lead to different behaviour by the players in the banking sector. He shows that bankers at German co-operative banks are very honest in doing business. In contrast, Cohn, Fehr and Maréchal (2014) analyse a large international bank and find a business culture that favours dishonest behaviour of the employees. In addition to the legal form, we use the average banking size, equity to total assets and average net loans to total assets within a region to define a diverse banking system and to capture these cultural aspects of banks in different regions.

From these considerations from the existing literature, we derive the first Hypothesis (H1):

*H1: A more diverse banking system fosters economic growth within a region.*

When testing this hypothesis, we are especially interested in whether more public savings banks, co-operative banks or private banks increase the GDP per capita in our respective NUTS 2 regions. In addition, we analyse whether small and local banks that concentrate on credit business are better for the regional GDP per capita.

Of course, there are other ways to characterize banking systems which we do not address in this paper and have scope for further research. To analyse bank concentration, there is the share of assets held by the biggest banks in a market relative to the whole banking markets total assets, or a Herfindahl-Hirschman index for the respective banking sector (Chiaramonte, Poli and Oriani 2015). Additionally, variables like the number of bank branches, actual bank offices, accounts at banks or the number of ATMs can also measure the access to financial services and, therefore, the degree of financial development (Berger et al. 2008; Gehrung 2021). These forms of financial development stem from economic distress which led to a redesign of the banking sector (like in India and Australia) or the reduction of local monopolies and improvement of credit allocation (like the U.S.) or are grown historically (like the German banking sector).

There are also other recent events that might significantly shape the financial environment and as a result economic growth and possibly inequality. The 2016 US elections or the Brexit referendum in the UK have shown that inequality is not just a cross-national phenomenon but reaches to the very regional level. Inequality separates the southern U.S. states from the North, the poor suburbs from the French metropoles, or East from West Germany still some 30 years after reunification. This shows that countries, despite many programmes to converge different regions and nations, are heterogeneous in many ways. Therefore, in contrast to the existing literature on national levels, we concentrate on regional banking systems and their influence on local economies. Previous research by e.g. Burgess and Pande (2005) has shown that the regionality of a banking system and its reach across an economy can have positive effects on the incomes of the poorer population. Claessens and Perotti (2007) or Rajan and Zingales (2003), meanwhile point at the possibility of rich elites capturing the benefits of financial development, while leaving the poor behind. The relationship between financial development and inequality is, therefore, a question of regional banking systems and their possible effects, which we will investigate in the following section.

To test these considerations, we formulate our second Hypothesis (H2):

*H2: A more diverse banking system reduces inequality.*

We specifically ask the question, whether more public savings banks, co-operative banks or private banks within a NUTS 2 region reduce local unemployment and increase primary private household income. In addition, we analyse whether well capitalised small banks focused on credit business are better in doing so.

## 2.4 Data and Summary Statistics

We are, to the best of our knowledge, the first to create a novel dataset based on balance sheet data taken from the Orbis Bank Focus dataset by the Bureau van Dijk, and complemented it manually with information on the NUTS-classifications and legal forms of the respective banks. The NUTS classifications divide a country in governmental districts and allow us to identify to which region within a country a bank belongs. On the highest level, the NUTS 1 regions represent provinces, main regions, or the respective states in the case of federal republics. In our study, we take a closer look at regional differences through the analysis of NUTS 2 regions.[18] Such smaller regions can be assumed to be more homogenous than the rather large NUTS 1 regions, and at the same time still contain a sufficient number of banks for our analysis. The analysis of NUTS 2 regions has already been applied in a paper on regional inequality and wealth (Braml and Felbermayr 2018), but to our knowledge is a fairly new approach with regard to banking. Our analysis rests on bank data from Austria, France, Germany, Italy and Spain, since these banking systems show some similarity and all contain, besides private banks, some version of public savings banks and co-operative banks (although with different weights). A comparison to, e.g. the very different banking systems of the UK or the US is tempting, but would presumably require the definition of different bank categories, and might not be able on a NUTS 2 or similar level. This is due to the high degree of concentration of banks in few financial centres and the small number of banks in the regions beyond. We based our assignment of a bank to the respective group on information of Orbis Bank Focus, and complemented missing information in ambiguous cases according to the List of credit institutions provided for

[18] There are also NUTS 3 regions, which is a governmental level below the NUTS 2 regions we use. NUTS 3 regions might be counties or municipal districts. However, it is not reasonable to use the NUTS 3 regions for our analysis, as there are on the one hand too many NUTS 3 regions with only a few banks and on the other hand not enough economic data available on Eurostat on this level.

in Article 14 of Directive 2006/48/EC (2010/C 293/01) of the European Commission. All economic dependent and independent variables originate from Eurostat.

We employ the unemployment rate and the incomes of private households to investigate the effects of regional banking systems on the labour force and on different parts of the income distribution. To describe banking systems within a NUTS 2 region, we use the total numbers of public savings banks, co-operative banks, banks with the organizational form of PLCs and as LLCs. Furthermore, we measure the degree of lending within a region by the value of net loans relative to total assets. We proxy the size of banks by their total assets, and their equity structure by equity to total assets. Therefore, we describe the banking system and environment in a NUTS 2 region by averaging balance sheet data of all banks headquartered in the respective region.

*Table 1 – Variable definitions and summary statistics*

| Variable | Definition | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| ***Bank-specific*** | | | | | | |
| Co-operative banks | No. of co-operative banks within a region | 648 | 21.19444 | 29.58491 | 0 | 156 |
| Savings Banks | No. of public savings banks within a region | 648 | 5.175926 | 7.225443 | 0 | 31 |
| PLCs | No. of banks with the legal form PLC within a region | 648 | 9.546296 | 19.08739 | 0 | 165 |
| LLCs | No. of banks with the legal form LLC within a region | 648 | 2.138889 | 4.993582 | 0 | 35 |
| Net Loans to Total Assets | Bank lending behaviour indicated by the average net loan to total assets of all banks within a region | 567 | 59.47279% | 13.27716% | 1.672 | 88.926 |
| Total Assets | Bank size indicated by the average total assets of all banks within a region | 567 | 35.92 billion USD | 141.96 billion USD | 111.36 million USD | 1675.15 billion USD |
| Equity to Total Assets | Equity structure of a banking system indicated by the average ratio of equity to total assets | 567 | 11.64856 % | 5.545609% | -.373% | 51.186% |
| ***Region-specific*** | | | | | | |
| Unemployment Rate | Unemployment rate within a region | 432 | 10.44699 % | 7.30355 % | 2.1% | 36.2% |
| Human Resources in Science and Technology | Persons with tertiary education and/or a job in science or technology. | 432 | 574349.5 | 547355.4 | 20000 | 4150200 |
| GDP p.c. | GDP per capita | 648 | 29726.07 | 8496.207 | 15058.09 | 61777.53 |
| Priv. Household Income p.c. | Primary private household income per capita | 569 | 14496.87 | 3985.106 | 6331.076 | 24647.75 |

Table 1 reports the definitions and main characteristics of our data set. The four different legal forms represent the total number of banks with the specific legal form within a NUTS 2 region. The data set consists of 4203 banks within 108 NUTS 2 Regions across the years 2011-2016.[19]

[19] Since we have a relatively large cross-sectional data set but only a few years for our time-series, this results in a short panel.

There are no banks located on the islands of Corsica and Mayotte and no banks within the Spanish exclaves of Ceuta and Melilla. In addition, there is no bank in the region of La Rioja. Only three NUTS 2 Regions have just one bank: Haute-Normandie, French Guiana and Navarre. On average, there are approximately 39 banks located in a NUTS 2 Region. The data set includes 15 regions with more than 80 banks: Carinthia (82), Dusseldorf (86), Salzburg (92), Madrid (93), Tirol (100), Bolzano (105), Styria (130), Stuttgart (131), Lower Austria (134), Lombardy (139), Upper Bavaria (151), Vienna (155), Darmstadt (i.e. Frankfurt) (159), Upper Austria (169) and Île-de-France (259).

To quantify lending behaviour of banks within the regions, we calculated the mean values of the ratios of net loans to total assets of all banks within a region. Therefore, a large number of net loans to total assets indicated that the banks in a NUTS 2 region, on average, grant more loans in relation to their total assets. In our data, all observations (except 5) are at least around a 30%-level and no observation is higher than 89%. Almost every observation above 74% is in France, with the largest numbers in Reunion and Martinique.

Another indicator for the capital structure of banks within a region is the ratio of equity to total assets. As with net loans to total assets, we calculated the mean value of all banks within a region. This means a high value indicates that the individual banks have on average a larger amount of equity in relation to their total assets.

As proxy for the average size of the banks within a region, we calculate the mean values of all banks' total assets within a NUTS 2 region. A large number of total assets indicate that the banks in a region are on average classified as a large bank. In our data, 36 observations are under 500 million USD and 88 under 1 billion USD. 35 observations are over 100 billion USD and 200 observations over 10 billion USD. Larger numbers can be found, but are not limited to the financial centres. The smallest numbers are in Italy, Germany and Austria. A clear pattern is not visible, but we see that even the average size of banks differs greatly between the different NUTS 2 regions.

The region-specific economic data are the standard indicators provided by Eurostat for the specific region. We calculate GDP per capita based on the information on GDP and inhabitants within NUTS 2 regions. GDP per capita has a minimum value of 15,058 Euro, with the lowest values recorded in French overseas territories, Spain and Italy. The maximum value is 61,777 Euro, with the highest values in France and Germany. The unemployment rate has a minimum of 2.1 % with the lowest values in southern Germany and Austria. The maximum unemployment rate is 28.9% with the highest values in French overseas territories and southern Italy.

Another indicator for inequality is the primary private household income per capita. The primary private household income includes the salary, the earnings of self-employed people as well as the investment income. It does not include social benefits or taxes and is therefore comparable and adjusted for purchasing power. This is also in line with our goal to identify the effects of the banking system on the income prospects of households and entrepreneurs. Including transfers and taxes would bias the results, as the banking system obviously has no direct impact on social benefits and taxes. We divide the given information for the primary household income by the inhabitants, both provided by Eurostat. Eurostat is also the source for human resources in science and technology, the only variable we exclusively use as a control variable.[20] It denotes the number of persons with tertiary education and/or a scientific-technical job.

## 2.5 Methodology

With the data described above, we run the following panel-estimation

$$Y_{i,t} = \alpha_i + \boldsymbol{\beta} \cdot \boldsymbol{BankSystem_{i,t}} + \boldsymbol{\gamma} \cdot \boldsymbol{NumbOfBanks_{i,t}} + \boldsymbol{\delta} \cdot \boldsymbol{X_{i,t}} + d_t + u_{i,t}$$

where $Y_{i,t}$ is the dependent variable, thus either economic wealth measured by GDP per capita or inequality measures, namely unemployment rate, or primary incomes of private households per capita. Since we use the GDP, we do not measure economic growth in a traditional sense by using a growth rate, but rather look at the level of wealth in the different regions. A positive coefficient in our analysis actually shows an improvement in economic wealth and not just an increase or reduction in economic growth, which in absolute terms, still might be positive. The vector $\boldsymbol{BankSystem_{i,t}}$ gives different regional bank specific variables characterizing the local banking system: net loans relative to total assets, total assets as well as equity to total assets. $\boldsymbol{NumbOfBanks_{i,t}}$ indicates the number of different bank types within a region. Banks are categorized in accordance with their major operating goal and the legal form; thus, they are either profit-maximizing (PLCs and LLCs), working for the public good (public savings banks), or maximizing profits for their members (co-operative banks). $\boldsymbol{\alpha_i}$ and $\boldsymbol{d_t}$ denote region- and time-specific effects. $\boldsymbol{X_{i,t}}$ finally gives a set of control variables and $\boldsymbol{u_{i,t}}$ gives the idiosyncratic error term.

[20] We use the GDP p.c. once as dependent variable and twice as independent variable. We use the unemployment rate once as dependent variable and once as independent variable.

For estimation, we implement the correlated random effects (CRE) regressions. The CRE model (Chamberlain, 1982, 1984; Mundlak 1978) is an alternative to standard random-effects (RE) and fixed-effects (FE) models. The standard RE model allows to include variables with no or little variation over time, but it assumes that unobserved individual effects are uncorrelated with explanatory variables. In economics, this is rarely the case, so the FE model is more convincing. Furthermore, a Hausman test recommends the use of fixed effects in our case. Unfortunately, the drawback of the FE model is that all variables with not enough variation over time are omitted. In our case, it would be the number of banks with a specific legal form within a region. Since it is only rarely the case that a bank changes its legal form, and as not enough new banks are founded, there is not enough variation within our relatively short observation period.

In contrast to the FE model, the CRE model allows to include time-invariant variables. But as shown by Wooldridge (2010, Chapter 10), CRE estimators and FE estimators are in fact identical (see also e.g. Hsiao 2014). Therefore, it allows to control for (unobserved) regional- and time-specific effects, which the standard RE model does not. We estimate the model according to Schunck (2013). Additionally, all regressions are run with cluster robust standard errors.

## 2.6 Results and Interpretation

Our empirical results confirm the idea that a diverse regional banking system with on average smaller banks improves the wealth of the region they are headquartered in. To avoid multicollinearity, we did not use the unemployment rate as well as private household income as control variables in every regression, as the unemployment rate is strongly correlated with GDP per capita and private household income is strongly correlated with human resources in science and technology. All results show a sufficient number of observations as well as a satisfying overall $R^2$.

The results in Table 2 show the estimations of the correlated random effects regressions with GDP per capita as a dependent variable. Co-operatives have a clear statistically significant positive impact. This means in regions with a larger number of banks that have a co-operative legal form, there is a higher GDP per capita. It is also economically significant, as one additional co-operative banks within a NUTS 2 region is on average connected to a higher GDP of 91.23 per capita including all control variables, 149.8 excluding controls. Considering for example the case of Spain, one extra co-operative bank is linked to a higher GDP per capita between about

0.3 % and approximately 0.6 % depending on the region and year. Excluding all control variables, the percentage rises to values between about 0.5 % and 1.0 %. Having in mind that the annual GDP per capita growth rate in the country Spain in our observation period was between -3 % and +4 %, the results are highly economically significant. This also holds for public savings banks, but this relationship loses statistical significance when control variables are included. In addition, the presence of LLCs seems to have a positive influence. In contrast to the significant connection of co-operative banks, PLCs have no significant positive influence on GDP per capita.

The actual business model of banks also has an effect on GDP. The more a bank concentrates on credit business the better for the region. Granting more loans (in relation to total banking assets) increases the GDP per capita. Very interestingly, there is also the first evidence that the size of a bank is important. The larger the total assets of all banks in a region are on average, the lower GDP per capita is. However, this coefficient loses significance with the inclusion of control variables.

In summary, our results show that our first Hypothesis H1 is confirmed:

A more diverse banking system fosters economic growth within a region.

Our controls show the expected signs: GDP is lower in regions with higher unemployment, and there are more human resources in science and technology in wealthier regions. This is due to the fact a larger amount of people with tertiary education and/or a scientific-technical job in a region should positively influence GDP per capita.

*Table 2 – Regional Banking Systems Economic Wealth*

| GDP p.c. = Gross Domestic Product per capita | GDP p.c. | GDP p.c. | GDP p.c. |
|---|---|---|---|
| Co-operative Banks | **149.8*** ** (5.53) | **94.80*** ** (4.48) | **91.23*** ** (4.33) |
| Public Savings Banks | **236.2*** ** (2.82) | 31.14 (0.52) | 56.81 (1.01) |
| LLCs | **369.7*** ** (2.79) | **155.8*** (1.78) | 120.3 (1.23) |
| Total Assets (billion USD) | **-1.569** ** (-1.98) | -0.0452 (-0.01) | 0.0697 (0.02) |
| Equity to Total Assets | **53.13*** ** (2.74) | **28.92*** (1.81) | **29.18*** (1.81) |
| Net Loans to Total Assets | **32.95*** ** (3.03) | **50.46** ** (2.11) | **50.61** ** (2.12) |
| Human Resources in Science and Technology | | 16.42*** (6.35) | 16.43*** (6.37) |
| Unemployment Rate | | -255.9*** (-5.48) | -255.9*** (-5.47) |
| PLCs | | | 32.05 (1.17) |
| Constant | 14986.5*** (4.92) | 23819.6*** (10.45) | 23848.5*** (10.48) |
| Numb. Of Obs. | 567 | 428 | 428 |
| Overall $R^2$ | 0.5534 | 0.7705 | 0.7727 |

*This table reports results of correlated random effects regressions with robust standard errors. GDP per capita as an indicator for wealth is the dependent variable. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The unemployment rate as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

One possible interpretation of these results is that small banks with a regional foundation know their customers and can benefit from soft information. The positive and significant coefficient of the number of loans relative to total assets supports this finding. While larger banks struggle with processing soft information and solely rely on hard, quantifiable data, smaller banks profit from the relationships they build over decades with the regional economy and their customers, and can improve credit allocation to people who otherwise would not have received a loan. Furthermore, small banks attract capital to their respective regions and prevent them from being

underfunded. These two aspects improve economic growth or wealth in these regions. Our interpretation gets further support from the following results.

Table 3 shows regressions with the unemployment rate as a dependent variable, and indicates that co-operative banks as well as LLCs are connected with a lower regional unemployment rate. Public savings banks in particular have a strong, significant influence on reducing unemployment even when including different sets of control variables.[21] Here, the unemployment rate can also be seen as a proxy for inequality within a region. Large proportions of citizens without a job will mean that these economic agents have only limited incomes, and thus cannot optimally invest in human capital allocation or entrepreneurial aspirations. Small banks seem to facilitate people getting jobs and to improve their incomes this way, ultimately closing the income gap. As in the regressions before, large banks do not seem to have a good impact on regional unemployment. A high number of average total assets increases the unemployment rate but loses significance when including controls. Net loans to total assets seem to have no significant influence.

More equity to total assets is linked to a higher GDP per capita (as seen above) as well as a lower unemployment rate. This is unusual since one theoretical approach to a banks' equity is that it restricts their ability to grant loans. Higher equity ratios demanded by the regulator might lead to a reduction in risk taking. Conversely it could be, that a lower equity rate and therefore a wider credit allocation due to more loans puts more people into work, ultimately improving their income prospects. Berger and Bouwman (2009) find that in the US between 1993 and 2003, bank capital had a positive influence on liquidity creation for large banks, no significant effect on medium sized banks and even negative effects for smaller banks. Ben Naceur et al. (2018) present evidence that capital requirements have significant negative impacts on credit business of large European banks. Using data from 2008 to 2015, they also show that small US banks strengthen their equity while expanding credit business. The later would be in line with our results for the five European states contained in our analyses, and support our line of argumentation. Since small banks might take similar actions in Europe as in the US, equity has a positive influence on wealth and equality. One interpretation of these results could be that a bank with sufficient equity reserves signals the market it is stable. As a result, it should get cheaper refinancing opportunities as it involves less risk. Since this also holds for equity costs as such, overall cost of capital should be lower at those banks. In addition, banks with higher

[21] In the regression with the most extensive set of variables, the influence of savings banks is statistically significant just slightly below the 10% level.

equity in the first place might be able to perform better in times of crises as they have a higher risk buffer. This is connected with the preconditions for long-term relationships between banks and their customers described in section two. Stable banks are better partners in long-term relationships which might otherwise not exist.

Furthermore, one argument could be that a stable regional financial system, characterized by an on average high equity ratio, contributes to a sound economy in general. In addition, banks with higher equity might invest in less risky businesses because more capital of the equity holders is at stake (Bhattacharya and Thakor 1993). This could be the traditional banking business of lending money.[22]

[22] Rather than e.g. off-balance sheet business.

*Table 3 – Regional Banking Systems and the Unemployment Rate*

| UR = Unemployment rate | UR | UR | UR |
|---|---|---|---|
| Co-operative Banks | **-0.0858*** ** (-5.41) | 0.0206 (1.04) | 0.0194 (0.99) |
| Public Savings Banks | **-0.200** ** (-2.44) | **-0.106** ** (-2.10) | **-0.0937**$^{+}$ (-1.63) |
| LLCs | **-0.342*** ** (-3.19) | -0.0657 (-0.98) | -0.0815 (-1.13) |
| Total Assets (billion USD) | **0.00610*** (1.68) | 0.00213 (0.72) | 0.00223 (0.77) |
| Equity to Total Assets | **-0.123*** ** (-5.86) | **-0.0959*** ** (-4.62) | **-0.0957*** ** (-4.60) |
| Net Loans to Total Assets | 0.0339 (0.78) | 0.0439 (1.13) | 0.0441 (1.14) |
| Human Resources in Science and Technology | | -0.00244 (-0.55) | -0.00244 (-0.55) |
| GDP p.c. | | -0.000468*** (-5.10) | -0.000467*** (-5.09) |
| PLCs | | | 0.0153 (0.67) |
| Constant | 15.34*** (3.74) | 24.49*** (7.07) | 24.57*** (7.13) |
| Numb. Of Obs. | 428 | 428 | 428 |
| Overall $R^2$ | 0.2953 | 0.6342 | 0.6348 |

*This table shows the impact of different banking structures on the unemployment rate, which is a proxy for inequality. It reports results of correlated random effect regressions with robust standard errors. Independent variables include the number of banks with the specific legal form in one region as well as banks balance sheet information indicating the structure of the banking system (equity to total assets, net loan to total assets, total assets) and also control variables (human resources in science and technology as well as GDP per capita). Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level;* $^{+}$ *denotes significance just slightly below the 10% level.*

Table 4 now switches to private household income as dependent variable and shows that co-operative bank, especially public savings banks and even more LLCs increase household income. A banking system with on average more loans in relation to their total assets leads to higher household income but this loses significance when including controls. A high average of total assets of banks within a region reduces household income. The results can be interpreted as larger banks increasing income inequality within and across regions. This interpretation is backed by the empirical outcome that larger banks reduce household income, especially by the

negative coefficient of PLCs. This is in line with Gimet and Lagoarde-Segot (2011) who compare countries and show that the banking sector has a strong causal impact on income distribution, and the influence depends mainly on the structure and less on its size.

Table 4– Regional Banking Systems and Private Household Income

| PPHI = Primary Private Household Income | PPHI per capita | PPHI per capita | PPHI per capita |
|---|---|---|---|
| Co-operative Banks | **55.73*** ** | -0.627 | 1.609 |
| | (5.88) | (-0.05) | (0.14) |
| Public Savings Banks | **146.6*** ** | **61.31** ** | 38.31 |
| | (3.38) | (2.10) | (1.19) |
| LLCs | **209.5*** ** | **75.00** ** | **103.9*** ** |
| | (3.06) | (2.11) | (2.72) |
| Total Assets | **-0.643*** | **-2.079*** | **-2.217** ** |
| (billion USD) | (-1.66) | (-1.92) | (-2.02) |
| Equity to Total Assets | 18.48 | 4.088 | 3.914 |
| | (1.17) | (0.94) | (0.90) |
| Net Loans to | **19.74*** ** | 1.660 | 1.747 |
| Total Assets | (3.76) | (0.43) | (0.45) |
| Human Resources in Science and Technology | | 0.972 | 0.968 |
| | | (1.60) | (1.58) |
| GDP p.c. | | 0.412*** | 0.411*** |
| | | (18.16) | (18.12) |
| PLCs | | | **-27.77*** |
| | | | (-1.87) |
| Constant | 7588.0*** | 1969.7 | 1820.0 |
| | (3.97) | (1.25) | (1.13) |
| Numb. Of Obs. | 488 | 349 | 349 |
| Overall $R^2$ | 0.4483 | 0.7348 | 0.7431 |

*This table shows the impact of different banking structures on the primary private household income divided by the inhabitants within a NUTS 2 region, which is a proxy for equality and wealth. It reports results of correlated random effects regressions with robust standard errors. Independent variables include the number of banks with the specific legal form in one region as well as banks balance sheet information indicating the structure of the banking system (equity to total assets, net loan to total assets, total assets) as well as control variables (human resources in science and technology and GDP per capita). Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

We again find empirical evidence for our hypothesis when we look at different measures of inequality as dependent variables. The effect of relatively more loans to total assets of banks in

a region show that small and regional banks effectively use their advantage of utilizing soft information and grant loans, that otherwise would be denied. This improvement of the capital allocation helps more people to invest in their human capital or entrepreneurial ideas and thus increases their incomes, which is what eventually closes the gap between top and bottom incomes.

As a result, our analyses show that our second Hypothesis H2 is verified:

A more diverse banking system reduces inequality.

Finally, there remains the question of causality. Do banks improve economic growth or do more wealthy regions attract more financial institutions? Since the shape and characteristics of banking sectors in the regions under investigation are grown over several decades and even centuries and, therefore, were established well before the data availability of our dependent variables, causality running from finance to growth is detectable. The history of the German banking system is a practical example to support this argumentation. The first public savings bank in Germany was founded in 1778, and most savings banks were established in the 19th century as crucial financier for the German industrial revolution (Deutscher Sparkassen- und Giroverband 2018; Lehmann-Hasemeyer and Wahl 2021).[23] In Württemberg, the savings banks formed a state-wide network with many local residents as savers. There existed 64 district savings banks (*Oberamtssparkassen*) and one state savings bank with agencies in every district (*Landessparkasse* in Stuttgart). The deposits grew between 1887 to 1912 significantly (Neumayer and Proettl 2021). In addition, with the first German co-operative bank founded in 1850, the 1870s saw the establishment of co-operative federations, and signing into effect of the co-operative law in 1889 (DGRV - Deutscher Genossenschafts- und Raiffeisenverband e.V. 2020). As a result, the demand-following hypotheses can be rejected. To our knowledge, there is no argumentation for the case that banks were founded in the 19th, 20th or even 21st centuries because they expected a positive development of the wealth within a region during our observed timespan (2011-2016). To the contrary, they contributed to the development of the economy within a region long before our observed timespan, e.g. by financing small business or infrastructure (Proettel 2016). In our analyses, causality follows the supply-leading hypotheses. More and better developed financial systems result in a more efficient capital allocation, resulting in higher wealth

[23] Up until a treaty between Germany and the EU in 2001, the regional governments as the owners of savings banks guaranteed for their credit. This included liabilities with maturity up until 31 December 2015. It supports our argument that there is no reverse causality.

and a closing of the income gap. This is in line with the Stein-Modell as well as the theory about relationship lending.

Since the European banking landscape is facing a consolidation already seen in the last couple of years and not a large number of new banks were established, reverse causality is negligible. Furthermore, we saw that smaller banks, and particularly co-operative banks, can be found in regions with better economic conditions. However, the business activities of these banks are linked to their members, thus they would not move headquarter to more promising regions. We would rather expect private banks to move and choose wealthy regions to maximize their profits.[24]

In summary, it is remarkable that on average larger banks in a region seem to have no significant positive or even a negative effect on the region where they have their headquarters. This can be expressed in a mirroring argument. Larger banks reduce economic wealth in a region or seem to have at least no positive effect, while smaller banks improve economic growth. This is in line with the theoretical foundation we presented, especially with regard to the use of soft and hard information and the model as well as the empirical results of Hakenes et al. (2015). Additionally, since public savings banks as well as co-operative banks and LLCs have different positive effects, we present evidence that a diverse banking system is important. Having banks with different legal forms within a region will enhance economic wealth and reduce inequality.

In the light of our results, the current economic and regulatory situation seems counterproductive. The enduring low interest situation is dangerous for banks who concentrate on credit business. This is not only the case when the yield curve is too flat to generate profit out of term transformation, but also if the interest rates will rise again. As soon as the latter happens, the book values of all non-variable credit contracts that the bank agreed on during this low or zero interest rate period will fall. Furthermore, the regulatory burdens for banks have been growing over the last years and decades. This affects especially smaller banks, because regulatory costs are often overheads with a strong fixed-costs component. Therefore, small banks concentrating on credit business are facing difficult challenges, caused by regulatory and monetary politics.

[24] Seemingly, it is difficult to change headquarters to e.g. financial centres. The employees and managers appear not to be transferred arbitrarily. Anecdotal evidence suggests that even large banks will not necessarily change their headquarters to the large financial centres of their countries. Examples are the private Banca Monte dei Paschi di Siena in Italy, the large co-operative Crédit Mutuel in France or the large public Landesbank Baden-Württemberg in Germany who all still have their headquarters in their historic place of foundation. Even some very large international private banks have their legal headquarters in their traditional place of foundation, e.g. Banco Santander in Santander or Banco Bilbao Vizcaya Argentaria (BBVA) in Bilbao, both in Spain.

This is also regrettable because smaller banks are usually not the source for systemic instability that justifies the strong supervisory interference into the market.

Our results are robust to different econometric methods. In the Appendix, we repeat every regression using pooled ordinary least squares (POLS) (e.g. Vithessonthi 2016) as well as cross-sectional regressions, both with robust standard errors.[25] To estimate cross-sectional results, we first calculate the mean values of all observed years for all individual regions. Therefore, we eliminate the time dimension, assuming an average value over time instead of different values every year. Of course, in this case we only have 108 observations, since we have 108 NUTS 2 regions. Appendix A shows that POLS supports all our previous results and suggests that we have probably an even stronger positive influence of co-operative banks, public savings banks and LLCs with sufficient equity and loans to total assets on GDP per capita than reported using correlated random effects. Appendix B also supports our results concerning GDP per capita and stresses the relevance of banks' equity. Appendix D and E show that the presence of public savings banks indeed reduces the unemployment rate. Appendix G and H highlight the positive influence of public savings banks, LLCs and net loans to total assets on the primary private household income per capita. Not surprisingly, our results also hold when dropping the observations of the NUTS 2 regions with the large financial centre of Frankfurt (i.e. Darmstadt), and even when dropping Île-de-France (including Paris) as well as Lombardy (including Milan).

## 2.7 Conclusion

In this paper, we investigate the effects of regional banking systems on economic growth and inequality. Motivated by the literature on relationship lending, soft and hard information, delegated monitoring and capital drains from small and poor regions, we follow the supply-leading hypothesis of financial development.

With a unique dataset for Austria, France, Germany, Italy and Spain, which focuses on separate regions instead of wholesome nations, we employed CRE panel regressions to investigate the effects on economic growth or wealth measured by GDP per capita, inequality measured by the unemployment rate as well as private household income per capita.

[25] For completion, we also report the results for simple random effects regressions with robust standard errors in the appendix. But in line with Mateut and Chevapatrakul (2018) and our explanations in section 5, there is no additional explanatory value from these results.

Our results show that with respect to the different legal forms of banks, co-operative banks and LLCs significantly increase economic wealth. Co-operative banks in particular have a strong positive influence. The coefficient of net loans relative to total bank assets, furthermore, indicates that granting more loans in an economy increases GDP per capita. Additionally, the capital structure of banks is important as higher relative equity is related to higher regional wealth. Another interesting result is the negative coefficient of a bank's total assets on GDP. In summary, those coefficients point at larger banks reducing economic growth, while smaller banks (i.e. LLCs and co-operative banks) increase economic growth.

Co-operative banks, LLCs and most importantly public savings banks significantly reduce the unemployment rate within regions. There are weak indications that larger banks lead to higher unemployment. We get a very significant positive influence of a diverse regional banking system with a higher ratio of equity to total assets on unemployment. Reasons for this could be that relatively stable banks contribute to a sound economy and serve as a reliable partner in long-term financing relationships. Private household income is positively influenced by a banking system with sufficient equity and negatively influenced by on average larger banks within a region. The results are robust to the inclusion of fixed effects, as well as to clustered standard errors and multicollinearity tests.

These results allow the conclusion that a further consolidation of the European banking system is counterproductive. A diversified regional banking system creates wealthier local economies, while centralized banking systems cause more inequality between regions. A diverse local banking structure, including banks with different legal forms, improves regional supply of financial intermediation. It is the basis for more relationship lending and a more efficient capital allocation. Decentralized banks have a countercyclical influence in case of a recession or a crisis, and are a supplement to large centralized banks. In addition to the economic analyses, the results of this paper have strong implications for future policy decision and financial regulation. The currently ongoing process of market consolidation and the resulting decline of banks and business models have to be questioned.

# Appendix Chapter 2

*Appendix 2—A - Effects on GDP p.c. using Pooled Ordinary Least Squares (POLS)*

| GDP p.c. = Gross Domestic Product per capita | GDP p.c. (POLS) | GDP p.c. (POLS) | GDP p.c. (POLS) |
|---|---|---|---|
| Co-operative Banks | **148.7*** ** (13.14) | **106.0*** ** (9.81) | **102.9*** ** (9.58) |
| Public Savings Banks | **242.1*** ** (6.49) | 55.47 (0.52) | **79.29** ** (2.45) |
| LLCs | **353.8*** ** (6.67) | **160.7*** ** (3.57) | **127.6** ** (2.56) |
| Total Assets (billion USD) | 2.576 (1.33) | **6.228*** ** (3.46) | **6.355*** ** (3.43) |
| Equity to Total Assets | **220.3*** ** (3.21) | **226.5*** ** (3.68) | **233.3*** ** (3.74) |
| Net Loans to Total Assets | **99.57*** ** (5.95) | **73.53*** ** (3.97) | **74.20*** ** (3.99) |
| Human Resources in Science and Technology | | 3.081*** (5.69) | 2.364*** (5.78) |
| Unemployment Rate | | -624.7*** (-16.49) | -622.3*** (-16.46) |
| PLCs | | | **29.40** ** (2.00) |
| Constant | 16234.2*** (13.89) | 24857.4*** (20.26) | 24854.0*** (20.28) |
| Numb. Of Obs. | 567 | 428 | 428 |
| Adjusted $R^2$ | 0.540 | 0.740 | 0.741 |

*This table reports results of pooled ordinary least squares estimations with robust standard errors and GDP per capita as dependent variable. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The unemployment rate as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—B – Effects on GDP p.c. using Cross-Sectional Regressions (CS)*

| GDP p.c. = Gross Domestic Product per capita | GDP p.c. (CS) | GDP p.c. (CS) | GDP p.c. (CS) |
|---|---|---|---|
| Co-operative Banks | **152.3*** ** (5.48) | **92.93*** ** (4.40) | **88.98*** ** (4.22) |
| Public Savings Banks | **226.2*** ** (2.70) | 25.97 (0.44) | 54.32 (0.96) |
| LLCs | **366.2*** ** (2.76) | **153.1*** (1.77) | 113.7 (1.16) |
| Total Assets (billion USD) | 4.108 (0.79) | **5.010*** (1.92) | **4.831*** (1.96) |
| Equity to Total Assets | 285.4 (1.24) | **449.5** ** (2.43) | **460.3** ** (2.48) |
| Net Loans to Total Assets | **115.1** ** (2.39) | **67.15*** (1.79) | **66.97*** (1.79) |
| Human Resources in Science and Technology | | 3.035*** (2.96) | 2.184*** (3.14) |
| Unemployment Rate | | 640.2*** (-7.94) | -637.5*** (-7.90) |
| PLCs | | | 35.40 (1.36) |
| Constant | 14257.8*** (4.58) | 22871.6*** (9.81) | 22906.2*** (9.80) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.534 | 0.753 | 0.754 |

*This table reports results cross-sectional regressions with robust standard errors and GDP per capita as dependent variable. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The unemployment rate as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—C – Effects on GDP p.c. using Random Effects Regressions (RE)*

| GDP p.c. = Gross Domestic Product per capita | GDP p.c. (RE) | GDP p.c. (RE) | GDP p.c. (RE) |
|---|---|---|---|
| Co-operative Banks | **148.7*** ** (5.64) | **119.0*** ** (5.62) | **125.4*** ** (5.72) |
| Public Savings Banks | **246.3*** ** (2.88) | 61.81 (0.83) | 26.33 (0.35) |
| LLCs | **346.0*** ** (2.91) | **232.0*** ** (2.62) | **293.1*** ** (3.39) |
| Total Assets (billion USD) | **-1.471** ** (-2.02) | -0.311 (-0.08) | -0.142 (-0.04) |
| Equity to Total Assets | **56.28*** ** (3.12) | 19.02 (1.15) | 19.13 (1.16) |
| Net Loans to Total Assets | **35.12*** ** (3.39) | **57.25*** ** (2.62) | **57.70*** ** (2.64) |
| Human Resources in Science and Technology | | 5.295*** (6.79) | 6.279*** (5.04) |
| Unemployment Rate | | -398.8*** (-9.95) | -394.9*** (-9.76) |
| PLCs | | | -51.87 (-1.58) |
| Constant | 22049.5*** (24.19) | 24346.3*** (15.32) | 24120.6*** (14.80) |
| Numb. Of Obs. | 567 | 428 | 428 |
| Overall $R^2$ | 0.5258 | 0.6883 | 0.6792 |

*This table reports results of random effects regressions with robust standard errors and GDP per capita as dependent variable. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The unemployment rate as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—D – Effects on the Unemployment rate using Pooled Ordinary Least Squares (POLS)*

| UR = Unemployment rate | UR (POLS) | UR (POLS) | UR (POLS) |
|---|---|---|---|
| Co-operative Banks | **-0.0805*** ** | **0.0222*** | **0.0214*** |
| | (-10.16) | (1.96) | (1.92) |
| Public Savings Banks | **-0.195*** ** | **-0.100*** ** | **-0.0919*** ** |
| | (-5.06) | (-3.55) | (-2.85) |
| LLCs | **-0.347*** ** | **-0.0923** ** | **-0.103*** ** |
| | (-6.56) | (-2.41) | (-2.60) |
| Total Assets | **0.00477*** | **0.00623*** ** | **0.00629*** ** |
| (billion USD) | (1.74) | (2.66) | (2.65) |
| Equity to Total Assets | **0.213*** ** | **0.259*** ** | **0.262*** ** |
| | (3.61) | (4.69) | (4.69) |
| Net Loans to | **-0.101*** ** | -0.00608 | -0.00566 |
| Total Assets | (-3.52) | (-0.26) | (-0.24) |
| Human Resources in Science and Technology | | 0.00313*** | 0.00289*** |
| | | (7.09) | (4.88) |
| GDP p.c. | | -0.000667*** | -0.000669*** |
| | | (-10.49) | (-10.41) |
| PLCs | | | 0.00999 |
| | | | (0.80) |
| Constant | 17.21*** | 26.10*** | 26.14*** |
| | (8.29) | (14.67) | (14.72) |
| Numb. Of Obs. | 428 | 428 | 428 |
| Adjusted $R^2$ | 0.299 | 0.599 | 0.598 |

*This table reports results of pooled ordinary least squares estimations with robust standard errors. The unemployment rate is the dependent variable and a proxy for inequality. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional inequality. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—E – Effects on the Unemployment rate using Cross-Sectional Regressions (CS)*

| UR = Unemployment rate | UR<br>(CS) | UR<br>(CS) | UR<br>(CS) |
|---|---|---|---|
| Co-operative Banks | **-0.0858*****<br>(-5.37) | 0.0203<br>(1.00) | 0.0188<br>(0.93) |
| Public Savings Banks | **-0.207****<br>(-2.54) | **-0.114****<br>(-2.23) | **-0.0991***<br>(-1.70) |
| LLCs | **-0.350*****<br>(-3.26) | -0.0722<br>(-1.09) | -0.0906<br>(-1.27) |
| Total Assets<br>(billion USD) | **0.00532***<br>(1.80) | **0.00568****<br>(2.55) | **0.00560****<br>(2.58) |
| Equity to Total Assets | **0.307***<br>(1.87) | **0.480*****<br>(4.18) | **0.487*****<br>(4.29) |
| Net Loans to<br>Total Assets | -0.0861<br>(-1.50) | 0.00508<br>(0.11) | 0.00541<br>(0.12) |
| Human Resources in Science and Technology | | 0.00318***<br>(3.80) | 0.00277**<br>(2.48) |
| GDP p.c. | | -0.000727***<br>(-6.37) | -0.000731***<br>(-6.33) |
| PLCs | | | 0.0176<br>(0.77) |
| Constant | 15.47***<br>(3.74) | 24.48***<br>(6.91) | 24.58***<br>(6.95) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.283 | 0.618 | 0.615 |

*This table reports results of cross-sectional regressions with robust standard errors. The unemployment rate is the dependent variable and a proxy for inequality. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The unemployment rate as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—F – Effects on the Unemployment rate using Random Effects Regressions (RE)*

| UR = Unemployment rate | UR<br>(RE) | UR<br>(RE) | UR<br>(RE) |
|---|---|---|---|
| Co-operative Banks | **-0.0696*** ** | 0.0173 | 0.0159 |
| | (-4.09) | (1.01) | (0.93) |
| Public Savings Banks | -0.141 | -0.0711 | -0.0631 |
| | (-1.52) | (-1.04) | (-0.89) |
| LLCs | **-0.346*** ** | -0.127 | -0.140 |
| | (-2.92) | (-1.52) | (-1.59) |
| Total Assets | **0.00854** ** | **0.00693*** ** | **0.00690*** ** |
| (billion USD) | (2.11) | (2.85) | (2.83) |
| Equity to Total Assets | **-0.116*** ** | **-0.0728*** ** | **-0.0728*** ** |
| | (-5.23) | (-3.11) | (-3.11) |
| Net Loans to | 0.0106 | 0.0376 | 0.0376 |
| Total Assets | (0.31) | (1.18) | (1.18) |
| Human Resources in Science and Technology | | 0.00310*** | 0.00287*** |
| | | (3.87) | (2.84) |
| GDP p.c. | | -0.000593*** | -0.000592*** |
| | | (-6.99) | (-6.97) |
| PLCs | | | 0.0109 |
| | | | (0.51) |
| Constant | 13.98*** | 25.33*** | 25.35*** |
| | (6.04) | (9.36) | (9.32) |
| Numb. Of Obs. | 428 | 428 | 428 |
| Overall $R^2$ | 0.2289 | 0.5462 | 0.5456 |

*This table reports results of random effects regressions with robust standard errors. The unemployment rate is the dependent variable and a proxy for inequality. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—G – Effects on the Primary Private Household Income p.c. using Pooled Ordinary Least Squares (POLS)*

| PPHI = Primary Private Household Income | PPHI per capita (POLS) | PPHI per capita (POLS) | PPHI per capita (POLS) |
|---|---|---|---|
| Co-operative Banks | **53.41*** ** | 1.146 | 3.428 |
| | (12.64) | (0.18) | (0.54) |
| Public Savings Banks | **142.5*** ** | **67.11*** ** | **43.93** ** |
| | (7.02) | (3.92) | (2.32) |
| LLCs | **200.9*** ** | **85.53*** ** | **116.5*** ** |
| | (7.03) | (4.61) | (5.94) |
| Total Assets | 1.054 | 0.850 | 0.603 |
| (billion USD) | (1.04) | (0.97) | (0.71) |
| Equity to Total Assets | 30.85 | **-148.8*** ** | **-161.3*** ** |
| | (1.00) | (-4.41) | (-4.76) |
| Net Loans to | **71.72*** ** | **60.68*** ** | **59.26*** ** |
| Total Assets | (5.98) | (4.94) | (4.79) |
| Human Resources in Science and Technology | | 0.285 | 0.971*** |
| | | (1.42) | (3.30) |
| GDP p.c. | | 0.376*** | 0.382*** |
| | | (14.43) | (14.16) |
| PLCs | | | **-28.13*** ** |
| | | | (-3.48) |
| Constant | 7492.6*** | 830.5 | 761.9 |
| | (8.48) | (0.98) | (0.88) |
| Numb. Of Obs. | 488 | 349 | 349 |
| Adjusted $R^2$ | 0.429 | 0.739 | 0.746 |

*This table reports results of pooled ordinary least squares estimations with robust standard errors. Primary private household income per capita is the dependent variable and a proxy for equality and wealth. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—H – Effects on the Primary Private Household Income p.c. using Cross-Sectional Regressions (CS)*

| PPHI = Primary Private Household Income | PPHI per capita (CS) | PPHI per capita (CS) | PPHI per capita (CS) |
|---|---|---|---|
| Co-operative Banks | **56.98*** ** | 1.249 | 3.162 |
| | (5.93) | (0.11) | (0.27) |
| Public Savings Banks | **139.2*** ** | **52.13*** | 32.47 |
| | (3.28) | (1.84) | (1.03) |
| LLCs | **205.5*** ** | **73.00** ** | **97.82*** ** |
| | (3.07) | (2.16) | (2.64) |
| Total Assets | 1.941 | 0.271 | 0.369 |
| (billion USD) | (0.75) | (0.30) | (0.40) |
| Equity to Total Assets | -9.291 | **-115.4** ** | **-124.8** ** |
| | (-0.13) | (-2.33) | (-2.54) |
| Net Loans to | **85.17*** ** | **43.77** ** | **43.32** ** |
| Total Assets | (3.28) | (2.19) | (2.14) |
| Human Resources in Science and Technology | | 0.213 | 0.769 |
| | | (0.63) | (1.52) |
| GDP p.c. | | 0.364*** | 0.370*** |
| | | (7.30) | (7.21) |
| PLCs | | | -23.73 |
| | | | (-1.63) |
| Constant | 7205.0*** | 1926.1 | 1796.2 |
| | (3.77) | (1.23) | (1.11) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.430 | 0.717 | 0.720 |

*This table reports results of cross-sectional regressions with robust standard errors. Primary private household income is the dependent variable and a proxy for equality and wealth. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 2—I – Effects on the Primary Private Household Income p.c. using Random Effects Regressions (RE)*

| PPHI = Primary Private Household Income | PPHI per capita (RE) | PPHI per capita (RE) | PPHI per capita (RE) |
|---|---|---|---|
| Co-operative Banks | **50.03*** ** | -12.91 | -8.665 |
| | (5.39) | (-1.40) | (-0.94) |
| Public Savings Banks | **132.2*** ** | 27.14 | 10.31 |
| | (3.26) | (0.83) | (0.31) |
| LLCs | **202.6*** ** | **65.11** ** | **99.95*** ** |
| | (3.21) | (2.06) | (2.85) |
| Total Assets | **-0.633*** | **-2.546*** ** | **-2.292** ** |
| (billion USD) | (-1.68) | (-2.94) | (-2.52) |
| Equity to Total Assets | 18.75 | 2.472 | 2.640 |
| | (1.23) | (0.62) | (0.66) |
| Net Loans to | **21.22*** ** | 3.073 | 3.507 |
| Total Assets | (4.17) | (0.84) | (0.97) |
| Human Resources in Science and Technology | | 0.382 | 0.825** |
| | | (1.12) | (2.13) |
| GDP p.c. | | 0.413*** | 0.410*** |
| | | (20.46) | (20.14) |
| PLCs | | | **-29.48** ** |
| | | | (-2.07) |
| Constant | 11064.4*** | 2094.4*** | 2110.9*** |
| | (20.17) | (3.70) | (3.76) |
| Numb. Of Obs. | 488 | 349 | 349 |
| Overall $R^2$ | 0.4102 | 0.7067 | 0.7159 |

*This table reports results of random effects regressions with robust standard errors. Primary private household income per capita is the dependent variable and a proxy for equality and wealth. It shows the impact of lending behaviour (net loans to total assets) as well as bank size (total assets) and the equity structure (equity to total assets) on regional wealth. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

# The Impact of Regional Banking Systems on Firms and SMEs – Evidence from five European Countries

Daniel Alexander Schmidt[26]

**Abstract**

Banks perform similar functions all over the world. Nevertheless, the banking systems around the world are very different. This paper analyses how the difference affects local firms as well as small and medium-sized enterprises. For my project, I combine banking and economic data of five EU countries on NUTS 2 level. I focus on different characteristics of regional banking systems such as the corporate forms of banks (private banks, co-operative banks, public savings banks) or the bank size. I combine this data set with information from almost 850,000 companies in these countries. My results show that regional banking systems, with smaller banks on average, lead to better profitability of enterprises in the respective region. Co-operative banks, LLCs and public savings banks foster local firm performance. The results apply to small and medium-sized enterprises in particular.

*Keywords*: Small Banks, Savings Banks, Co-Operative Banks, Private Banks, Small firms, SME, Local Economy, Regional banks, Firm Performance

*JEL Classification*: G21, P34, P43, G15, L25, L33, D73

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# 3 The Impact of Regional Banking Systems on Firms and SMEs – Evidence from five European Countries

## 3.1 Introduction

Banks perform similar functions all over the world. These include lot size transformation, term transformation, risk transformation, delegate monitoring, delegated contracting and acting as liquidity provider. Nevertheless, the banking systems around the world are very different. For example, the United Kingdom has few but very large commercial banks. In contrast, Germany with its numerous co-operative banks, public savings banks and special banks has many credit institutions, but almost no large banks. Not only does the number of institutions differ, they also have different characteristics. About 20 years ago, Allen and Gale (2000) already described that financial markets play a central role and bank finance is less relevant in the USA and UK, whereas financial markets are more or less unimportant in France and Germany as bank financing is more relevant. They conclude that the Anglo-Saxon systems are better built for efficiency and competition, and the central European tradition leads to more insurance and stability.

At about the same time Hackethal and Schmidt (2000) also compared financial systems, and explained that Germany and Japan have a low relevance of market mechanisms and a high degree of stability, while the USA and UK have a low degree of stability and a high relevance of market mechanisms. They conclude that there is no other consistent combination of those two elements. Hence, there is no combination of a high relevance of market mechanisms and a high degree of stability.[27]

Up until today, the German banking system is indeed marked by a great diversity of sometimes very peculiar institutions. It has a low degree of alignment with the dominant Anglo-Saxon model, high competition and low banking profits, and until 2007, a high degree of stability. The development of this system goes far back in history. For example, in 1818, Queen Catharina of Württemberg established the "*Württembergische Spar-Cassa"* as a response to the severe famine of the previous years in the kingdom of Württemberg. This bank was intended to support

[27] And vice versa.

the local economy and to initiate the transition from farming and agriculture to a more industrial state of Württemberg.

In many elements, the German banking system mirrors the structure of the German economy. It is spatially decentralized, based on many small and medium sized firms (SMEs)[28], which lack equity and need reliable debt financing. Those SMEs are still very loyal to their primary bank (Schwartz and Gerstenberger 2019a) and prefer face-to-face contact with their bank consultant (Schwartz and Gerstenberger 2019b). As there seems to be a strong connection between the structure of a banking system and the structure of the real economy, it is valuable to analyse how both affect each other. In fact, the purpose of this paper is to identify the effect of different banking systems on firm performance.

To the best of my knowledge, my focus on regional banking systems within NUTS[29] 2 regions and the analyses of their effects on firms within the respective region is unique. I use the NUTS 2 regions which represent administrative regions below the state-level. I believe that nations are too heterogeneous to aggregate all information on a national level. The European Union designed the NUTS regions specifically to analyse the diverse EU territories. In addition, my analyses are based on a unique data set. I use the database introduced by Burghof, Gehrung and Schmidt (2021a) and combine it with the information from almost 850,000 companies in Austria, France, Germany, Italy and Spain.

I find evidence that a diverse banking system with different institutions has a significant positive effect on firm performance on a regional level. I show that banks incorporated as PLCs do not support the return of companies within the region of their respective headquarters. My strongest results are in the field of SMEs. The normally small co-operative banks and public savings banks, as well as LLCs improve firm performance significantly, whereas PLCs reduce it.

The paper commences as follows: in section two, I will explain why relationship lending and soft information matter in a bank-firm liaison. I also present the theoretical motivation for my analysis and lay the foundation for causal interpretations. In section three I present the current state of the literature relevant for my application and outline the hypotheses. Section four describes my unique dataset before the methodological approach of my analysis is explained in

[28] The so-called "*Mittelstand*"
[29] NUTS means "Nomenclature of Territorial Units for Statistics"

section five. Section six shows my empirical findings and interpretations, as well as robustness checks. Section seven concludes.

## 3.2 Why Relationship Lending and Soft Information Matter

Two theories lay the background for my analyses: the benefits of relationship lending and the influence of soft information on decision making according to the well-known model by Stein (2002). The following extensive literature review explains the theoretical connection between the banking system and firms, as well as the possible channel how one might influence the other.

Especially when considering small businesses and start-ups, perfect markets are unrealistic because such firms probably have a worse informational situation than large and listed companies.[30] This could include financial information or information about the managers' capability. Since large banks give less credit to firms with an opaque informational situation, small or newer firms might have a comparative disadvantage in an environment with fewer small banks (Berger et al. 2005). This disadvantage might be the result of the different loan approval processes where smaller banks rely to a greater extent on soft information about the customer (Cole, Goldberg and White 2004). As in every principal agent setting, there is also an information asymmetry between the borrower and the lender. Berger and Udell (2002) argue that this asymmetry is smaller in banks with fewer managerial layers. As opposed to this, there is evidence from the USA that the foundation of new companies is negatively connected with the share of small banks (Black and Strahan 2002). Hence, the influence of small banks in the economy is disputed and therefore an important area of research.

Stein (2002) proves that banking systems which have a decentral organisation are better in analysing soft information. Whereas larger banks, having a hierarchical structure, are more specialised in analysing hard information. This specialisation on hard information means they perform better with hard, quantifiable information. Based on this theory, I concentrate on the main location of the bank, i.e. the headquarters of the bank. I think the closer contact to the deciding management, which has the bank's ultimate decision authority, makes a difference. This is in

[30] Of course, even when only considering large publicly listed companies, perfect markets are unrealistic as not all information about every aspect of all companies are publicly available.

line with Liberti and Mian (2009) who prove that a greater hierarchical and geographical distance between loan officers and bank managers hamper the use of soft information for decision-making. Skrastins and Vig (2019) show that an increase in organizational hierarchy negatively affects lending and leads to the standardization of loan contracts.

From an economist's perspective, one of the most important tasks of banks is to act as delegated monitors. Without this function, depositors would have to search for (and invest in) projects directly, resulting in monitoring costs for every individual and every investment asset. Banks bundle these deposits and as a result substitute direct financing (Diamond 1984, 1996). In addition, banks act as delegated contractors (Burghof 2000) because they reduce transaction costs through specialisation and build up a renegotiation and restructuring competence.

The theory about relationship lending is closely linked to the banks' capability to act as delegated contractor and delegated monitor. This is because both capabilities, especially delegated monitoring, improve over time. This means the longer a relationship between a bank and its customer, the better. As a close and long-term relationship improves the bank's ability to act as delegated monitor, it also reduces asymmetric information (Boot 2000). This is linked to the fact that a bank in a long-term relationship can observe payment transactions of borrowers over a long period of time and therefore improve its screening capabilities (Elsas 2005). Those better screening capabilities using soft information are especially important when dealing with borrowers of lower credit quality (Iyer et al. 2016). Lenders are better able to produce information about the borrowers within a longer relationship and are more likely to secure future business with its borrowers (Bharath et al. 2007). Weaker relationships between customers and banks might lead to a destruction of soft information and a surge in consumer bankruptcy (Allen, Damar and Martinez-Miera 2016).

Puri, Rocholl and Steffen (2011) show empirically that Banks rather approve loans to relationship customers, and this effect in Germany was even larger after August 2007. In the USA, small businesses profit from relationship lending connections as credit is granted when it is most needed, i.e. during the financial crisis (DeYoung et al. 2015). Previous research has shown that other forms of relationship lending, such as contractual savings for housing, is beneficial for lender and borrower and can improve allocative efficiency (Kirsch and Burghof 2018). In addition, the loan spreads are lower for customers who regularly borrow from the same bank (Bharath et al. 2011).

Of course, there are also drawbacks to relationship banking. For example, it is not as scalable as transaction-oriented banking (Boot 2011). In addition, the before mentioned lower loan

spreads are disputed. Zarutskie (2013) found that between 1976 and 2003, smaller banks in the USA charged higher interest and fees, which might be connected to the fact that smaller and older banks made relatively more unsecured loans compared to larger or younger banks. Rajan (1992) questions the relative efficiency of relationship-based banking for firms, as banks might control firms' investment decisions and extract additional rents.[31] Analysing the Bolivian credit registry between 1999 and 2003, Ioannidou and Ongena (2010) show that switching to a new bank results in a drop of loan costs, which they connect to the hold-up costs in close bank-firm relationships.

To sum up, the majority of literature has shown that transaction costs are reduced by long-term banking relationships because a bank learns more about their customers over time than banks with no interaction with those customers (Sharpe 1990). This is supported by the findings that the availability of loans for firms is linked to the time they work together with one bank (Petersen and Rajan 1994). The task of banks as delegated contractors corresponds to the idea that relationship banking is based on a long-term commitment between two parties. This includes an implicit liquidity insurance in situations of unexpected decline of the borrowers rating (Elsas and Krahnen 1998; Cotugno, Stefanelli and Torluccio 2013; Beck et al. 2018).[32] One reason for this implicit insurance could be that the relationship between a bank and a borrower needs to be of long endurance in order for the bank to add value resulting from a relationship loan (Song and Thakor 2007). Those points combined lead to the fact that relationship lending is positive for the customer even when considering the alternative of the capital market (Boot and Thakor 2000).

## 3.3 Literature Review and Hypotheses

Bank lending to companies fosters economic growth and reduces inequality (Beck et al. 2012). This effect is especially the case in regions with a diverse banking system with smaller banks incorporated as co-operatives, public savings banks and LLCs (Burghof, Gehrung and Schmidt 2021a). In addition, the economic success of states depends on the development of their finan-

[31] Rajan (1992) assumes lock-in effects where a firm has only a relationship to one single bank.
[32] Carvalho, Ferreira and Matos (2015) dispute this liquidity insurance. Concentrating on publicly listed firms during the 2007-2009 financial crisis, they provide evidence that strong bank-firm relationships lead to stronger equity valuation losses and investment cuts to borrower firms.

cial system, e.g. in the form of availability of ATMs, bank accounts and bank branches (Gehrung 2020). A reduction in credit constrains is linked to the development of the financial sector in general and the banking system in particular. Burghof and Gehrung (2020) explain that an integrated European Single (banking) Market fosters economic growth and reduces inequality. Beck et al. (2008) prove that financial development has a disproportionally positive effect on SMEs.

Based on the before mentioned literature I want to provide evidence that a diverse banking system is better for local business. As the different legal form of banks signal different business models and targets, they should also have different strengths and weaknesses. If companies are able to choose between several local banks and banking products offered by those banks, this should improve resource allocation. Since firms can pick the best fitting partner, efficiency should be improved by a diverse banking system. To proxy such a diverse banking system, I use the number of banks incorporated as co-operatives, public savings banks as well as LLCs and PLCs within a region. In addition, I include the mean total assets of all banks within a region to show the influence of average banking size.

Not only is the diversity of a banking system important, also the geographical distance of a bank to a firm matters. Especially smaller businesses face financing constrains with larger distance to their bank (Alessandrini, Calcagnini and Zazzaro 2008). Agarwal and Hauswald (2010) prove that distance between firms and banks erodes the quality of soft information, and even technological progress is only partially a substitute to compensate for larger distances to customers. Furthermore, cultural distance also matters as it might lead to less credit to firms with a more difficult informational situation (Mian 2006). The presence of small banks should therefore be more important in peripheral areas, hence a decentralized economy. Regional economic disparities can be reduced by local banks (Gärtner and Flögel 2014). These findings show that it is important to analyse banking systems on local levels, i.e. in the area of the respective firms. To account for the importance of geographical distance, I use NUTS 2 regions as the cross-sectional dimension of my regressions.

In fact, it is important to have a more detailed look on economies than just the national level as states are not homogenous. Election results differing fundamentally within democracies are proof for that. It is obvious from e.g. the US elections in 2016 or the Brexit referendum, that a deep divide is shown in those countries. Even in highly developed countries, there are boom and bust regions, hence, regions where wealth is accumulating and regions left behind. In addition, economic differences within nations become evident when looking at the differences

between East and West Germany, the northern and southern states of the US, or the French metropoles and suburbs. Concentration on regional levels of analysis is not completely new to the academic discussion but done rarely. Hakenes et al. (2015) prove that small banks enhance the real economy because in times of credit rationing capital will flow from poor to rich regions. Small and decentralized banks can reduce this effect.

As a result, smaller banks should be superior in lending to SMEs and larger banks should prefer to work with larger companies, but when expending the review to the more firm concentrated literature, conclusions about the importance of the firm-bank relationship can be drawn. Over 100 years ago, Schumpeter (1911) emphasized the importance of financial institutions for technological innovations. Demirgüc-Kunt and Maksimovic (1998) also point out the importance of financial systems for the development of firms but concentrate more on stock markets. Of course, it seems obvious that potentially lower financing costs have a positive effect on firm performance (Chirinko and Elston 2006). However, not just the capital costs matter, also the availability of credit is important. Fast developments of innovations and upgrades need reliable financing. Capital shortages would have negative impacts on companies and should be avoided in all regional areas (Cable 1985). This is especially true since those companies might be competing with similar firms with better capital availability.

This is linked to the third role of banks as financial intermediaries[33], i.e. liquidity providers. According to Diamond and Dybvig (1983) the need for liquidity is not perfectly predictable, but holding large cash reserves, or the liquidation of long-term investments, is costly. Therefore, banks pool stochastic liquidity needs of companies as well as individuals, and the banking system as a whole pools the stochastic liquidity needs of separate banks. As a result, cash reserves can stay at a low level as long as the system works properly. This reduction of unnecessary liquidation of long-term investments and the reduction of the need of self-financing promotes growth (Bencivenga and Smith 1991). The role of banks as liquidity providers is also linked to relationship lending: within a multiperiod implicit relationship, deposits by customers protect banks (up to a certain level) from exogenous market interest rate shocks and as a result protect borrowers from credit shocks (Berlin and Mester 1999). Iyer and Puri (2012) report similar results and explain that bank-depositor relationships mitigate bank runs.

That my five specific European countries have different bank types is not just a side note. It should matter for the firms and especially the SMEs in the regions. For example, when looking

[33] The two others are already mentioned before, i.e. delegated monitor and delegated contractor.

at the German banking system it is obvious that the different banks have different strengths and weaknesses. As their explicit business goals differ, their behaviour should differ too. Private banks want to maximize profit and pursue a shareholder or stakeholder-approach to business. Public savings banks have a social mandate, and must ensure credit supply and foster savings and wealth of their regions. Co-operative banks have the furtherance of their members as explicit goal. These three types of banks constitute the three pillars of the quite unique German banking system, and can be described as a decentralized system (Ferri, Kalmi and Kerola 2014; Chiaramonte, Poli and Oriani 2015).

As a result of the laws where each legal form is based upon, the decisions in the banks are made by various bodies. In a theoretical model of Herbst and Prüfer (2016), they show that non-profit organizations provide high levels of product quality. The efficiency as such depends on the costs of decision making within the three different organisational forms.[34] They prove that an increase in competition improve the quality offered by co-operatives as well as profit-oriented firms. The reason for this improvement is, to keep up with the high quality of the non-profit organizations.

In economics, there is often the assumption of efficient markets where all information is available to everyone. If this would be the case, my analyses of different structures of banking systems would be redundant (Chirinko and Elston 2006). However, efficient markets are of course just a model based on assumptions. Therefore, it is sensible to test theories empirically. I build on the existing research described in this chapter, because I want to show that a decentralized banking system as well as small banks with a comparably larger amount of relationship lending have a positive influence on local economies. I believe that this is especially the case in local economies where you have a diverse system with different financial institutions, and that this theory still holds in modern times.

This review of theoretical and empirical literature leads to the derivation of two hypotheses:

*H1: Diverse regional banking systems foster firm performance within a region.*

*H2: Diverse regional banking systems foster firm performance of SMEs in particular.*

[34] I.e. Non-profits, co-operatives, profit-oriented firms.

## 3.4 Data and Summary Statistics

I combine multiple datasets for my econometrical analyses. For the independent variables describing the regional banking systems and the regional economic variables, I use the same data as Burghof, Gehrung and Schmidt (2021a). In this paper, the banking data is taken from Orbis Bank Focus[35]. Within this data there are several variables relying on bank balance sheet information, such as total assets and equity to total assets. They assign every bank to a NUTS 2 region and add the legal forms of all banks; the latter can be used to identify the business purpose of the respective bank, i.e. profit maximizing, co-operative or non-profit. Five European countries are included: Austria, France, Germany, Italy and Spain. All have private banks, co-operative banks as well as public savings banks, i.e. each country has banks that are members of the Euro Banking Association and the European Savings and Retail Banking Group as well as the European Association of Co-operative Banks. The data set consists of 4203 banks within 108 NUTS 2 Regions. They present a short panel, as the time series covers the years 2011-2016. Regional economic variables provided by the European Statistical Office (Eurostat) are also included into the data set. I use the Gross Domestic Product per capita (GDP p.c.) as well as human resources in science and technology as control variables.

The NUTS regions are defined by Eurostat specifically to allow socio-economic analyses of regions. There are three levels: NUTS 1 consists mostly of local counties, NUTS 2 of larger governmental districts and NUTS 3 of states within a country. I concentrate on the analyses on the level of NUTS 2 regions to have enough banks within a region but also to be able to account for differences between regions within a state. Most publications in my research area concentrate on comparing countries on national level, so my approach is fairly new. Nevertheless, there are already projects applying NUTS 2 regions in economic analyses (e.g. Braml and Felbermayr 2018), which shows that this is a profound way to compare regional differences. Since the economic variables are given for the whole NUTS 2 region, Burghof, Gehrung and Schmidt (2021a) calculate the mean variables of the balance sheet information of all banks. This is reasonably, as it is necessary to analyse the impact of the complete local banking sector as a whole. They add up the number of banks as well as the legal forms of the banks within a region. Combining balance sheet information with the legal forms of banks allows to describe the competitive environment of a regional banking system and its structure. As a result, it is possible to identify the influence of different local banking systems on other economic factors. Splitting

[35] Now called Moody's Analytics BankFocus.

up national levels of analysis is not completely new to the academic discussion. However, to the best of my knowledge the closer look at different European regions is quite new and closes a gap in the literature concerning the structure of banking systems and firm performance.

One concern with this data set might be that it includes neither the number of branches of banks nor their location. The lack of branches in the data set is the reason why I include PLCs only in the third step of each regression. It is most likely that large banks have a positive or negative influence not only in the region where their headquarters are located, but also everywhere where they are represented with a branch. This problem is less severe with co-operative banks as they are mostly small banks. The area where they concentrate their business on and where they have branches is almost exclusively within a single NUTS 2 region. As a result, their influence is directly linked to the region. The same holds for most public savings banks. They are in general bigger than most co-operative banks but their business area usually also do not spread over several NUTS 2 regions. Because banks incorporated as LLCs are normally smaller than PLCs, the argumentation holds for them, too.

I also needed firm specific data for three reasons: first to identify the dependent variables, second to distinguish between SMEs and larger companies. Third, it is necessary to use the average total assets of all firms within a region as a control variable, because especially in the regression with earnings before taxes (EBT) as dependent variable, the size of the companies within a region matters. I use the Orbis dataset to gather balance sheet information about 843,884 firms within five European countries. In Germany, there are over 250,000 firms, in Italy about 225,000, in Spain more then 200,000, in France almost 120,000 and in Austria almost 45,000 firms.[36] The available data about my firms include different balance sheet positions. I use return on assets as indicator for firm performance. I complement this ratio with the absolute number of average earnings before taxes as the second dependent variable.

[36] All information of a firm is assigned to the region where the company headquarters are located.

*Table 5 – Variable definitions and summary statistics*

| Variable | Definition | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| ***Bank-specific*** | | | | | | |
| Co-operative banks | No. of co-operative banks within a region | 648 | 21.19444 | 29.58491 | 0 | 156 |
| Public savings banks | No. of public savings banks within a region | 648 | 5.175926 | 7.225443 | 0 | 31 |
| PLCs | No. of banks with the legal form PLC within a region | 648 | 9.546296 | 19.08739 | 0 | 165 |
| LLCs | No. of banks with the legal form LLC within a region | 648 | 2.138889 | 4.993582 | 0 | 35 |
| Bank's Total Assets | Bank size indicated by the average total assets of all banks within a region | 567 | 35.92 billion | 141.96 billion | 111.36 million | 1675.15 billion |
| Equity to Total Assets | Equity structure of a banking system indicated by the average ratio of equity to total assets | 567 | 11.64856% | 5.545609% | -0.373% | 51.186% |
| ***Region-specific*** | | | | | | |
| Human Resources in Science and Technology | Persons with tertiary education and/or a job in science or technology. | 432 | 574349.5 | 547355.4 | 20000 | 4150200 |
| GDP p.c. | GDP per capita | 648 | 29726.07 | 8496.207 | 15058.09 | 61777.53 |
| ***Firm-specific*** | | | | | | |
| Firm's Total Assets. | Average firm size indicated by the mean total assets of all firms within a region | 648 | 57.61977 million | 135.9121 million | 2.423333 million | 1672.943 million |
| ROA of SMEs | Mean return on assets of all small and medium-sized enterprises within a region | 540 | 5.798497 | 1.984664 | 0.458641 | 12.20132 |
| ROA of all firms | Mean return on assets of all firms within a region | 540 | 5.602141 | 1.813157 | 0.5516489 | 11.89955 |
| EBT of SMEs | Average earnings indicated by the mean earnings before taxes of all small and medium-sized enterprises within a region. | 540 | 460.7278 thousand | 469.9102 thousand | -34.30383 thousand | 5901.653 thousand |
| EBT of all firms | Average earnings indicated by the mean earnings before taxes of all firms within a region. | 540 | 3160.87 thousand | 4829.059 thousand | -1695.102 thousand | 40619.83 thousand |

Important for my analyses is not only the detailed focus on regions rather than states or even nations, but also the distinction between large companies and SMEs. To identify SMEs, I follow the recommendation of the European Commission of 6 May 2003 (EU recommendation 2003/361.). Unfortunately, I do not have enough complete information about most firms' employees. Therefore, I only assign a company as SME if they have a balance sheet total below or equal to 43 million Euro, as well as a turnover below or equal to 50 million Euro.[37] Because of this distinction, I can separately analyse the effect of regional banking systems on all firms and just SMEs within the NUTS 2 region.

## 3.5 Methodology

I use correlated random effects regressions (Chamberlain, 1982, 1984; Mundlak 1978) to analyse my short panel data set. I cannot use standard fixed effects estimation as I have variables that do not have enough variance over time (i.e. the number of banks with the same legal form within a region) and therefore would be omitted in the analyses. Nevertheless, I need to apply a method controlling for unobservable time-invariant characteristics, as the regressions would otherwise be biased. A solution to this problem is the correlated random effect regression, which includes fixed effects as well as random effect components in the model. It considers the possibility that the individual effect might correlate with the explanatory variables. This is very likely the case in my data, as I cannot control for all characteristics of a region. I include cluster-specific means of all time periods of all time-variant explanatory variables. It is shown by Wooldridge (2010, Chapter 10) that this inclusion of averages over the time dimension delivers the same results as applying fixed effects estimation for all time-varying explanatory variables (see also e.g. Hsiao 2014, Chapter 6.9). In addition to that, I still control for unobserved heterogeneity over time, which is not correlated with the independent variables as the standard random effects regression is applied. The method was already successfully applied to analyse banking and finance data in the existing literature (e.g. Mateut and Chevapatrakul 2018).[38]

[37] In the EU recommendation, SMEs have less than 250 employees as well as one of the following: turnover not exceeding 50 million Euro or balance sheet total not exceeding 43 million Euro.
[38] Schunck (2013) explains one way of executing the necessary computations in Stata.

As a result, I run the following correlated random effects panel-estimation

$$Y_{i,t} = \alpha_i + \boldsymbol{\beta} \cdot \boldsymbol{BankSystem_{i,t}} + \boldsymbol{\gamma} \cdot \boldsymbol{NumbOfBanks_{i,t}} + \boldsymbol{\delta} \cdot \boldsymbol{X_{i,t}} + d_t + u_{i,t}$$

where $Y_{i,t}$ is the dependent variable. As measurements of firm performance, I use return on assets as well as earnings before taxes as dependent variables. To be able to analyse the effects on SMEs in particular, there are separate regressions for all firms and only SMEs. A positive coefficient in this analysis therefore shows an improvement in average firm performance within NUTS 2 regions. The vector $\boldsymbol{BankSystem_{i,t}}$ gives different regional bank specific variables characterizing the local banking system: total assets as well as equity to total assets. $\boldsymbol{NumbOfBanks_{i,t}}$ indicates the number of different bank types within a region. Included are all banks incorporated as private banks (PLCs and LLCs), co-operative banks and public savings banks. $\boldsymbol{\alpha_i}$ and $\boldsymbol{d_t}$ denote region- and time-specific effects. $\boldsymbol{X_{i,t}}$ finally gives a set of control variables (Human Resources in Science and Technology, GDP per capita and the mean total assets of all firms within a region as a proxy for the average firm size) and $\boldsymbol{u_{i,t}}$ gives the idiosyncratic error term.

There might be the concern of reverse causality. The question could be proposed whether banks systematically switch their headquarters to regions with already successful firms. Such an effect would bias the results and would limit the results to identifications of correlation rather than causation. However, this concern is unlikely true as most banks were founded years or decades before the relevant time span of my data set. In addition, most banks are enrooted within the area where they were founded. There is extensive literature within the area of economic history about this topic. For example, many now still existing public savings banks that were established in Prussia between 1816 to 1875 already helped in financing the industrial revolution (Lehmann-Hasemeyer and Wahl 2021). Apparently, even as early as within the 19th century, those public savings banks were important in regions with a large proportion of SMEs. The same applies for the co-operative banks as they have been predominantly founded in the 19th and 20th century (Lomi 1995; Giagnocavo, Gerez and Sforzi 2012).

## 3.6 Results and Interpretation

My empirical analyses show different connections between the regional banking system and local firms. Table 6 describes its influence on the return on assets of SMEs. Strong results are presented for the positive economic and econometric influence of co-operative banks, public

savings banks and LLCs. All results also hold when including a set of different control variables. In the third step, I included PLCs. There is a significant negative connection between the headquarters of a PLC within a region and the return on asset of SMEs in the respective region. This negative connection is in line with research of Berger et al. (2005) who show that large banks do not alleviate credit constraints for firms with a more opaque informational situation as effectively as small banks. The first regression also shows a positive influence of a banking system with an on average higher equity to total assets ratio, but this loses significance when including controls. The results correspond with prior empirical research on more aggregated levels using different data and different methods (e.g. Cole, Goldberg and White 2004). The control variables have the expected impact.

I can therefore conclude that a diverse banking system with different legal forms of banks has a positive influence on smaller firms. The more co-operative or savings bank or banks incorporated as LLCs are in a NUTS 2 region, the better SMEs' return on assets in the respective region. Those results are in line with my theoretical argumentation in section two of this chapter. Small business in particular should be able to profit from a long-term relationship with a bank that offers personal contact in the region of the firm.[39] In addition, hard information is most likely better available when dealing with larger firms. Therefore, decentralized local banks should be better able to work with small companies where their strength, i.e. analysing soft information, gives them a comparative advantage. The logical consequence is a positive influence for small companies by the mostly decentralised public savings banks, co-operative banks and LLCs.

This influence corresponds with the results of Hakenes et al. (2015). They show theoretically, and with an empirical analysis in Germany, that small regional banks are important funding providers especially in, but not limited to, areas with relatively low access to finance[40] in a credit-rationing environment. They focus on the market share and efficiency of different banking types and its influence on GDP per capita and regional business registration. Their results suggest that one reason for the positive influence of small banks on economic development is the stronger focus of small banks on local SME finance. With my analyses, I can support this suggestion.

[39] Assuming that firms are distributed over different regions and are not accumulated in a single (capital) city.
[40] Such areas with a relatively low access to financial are in areas with a certain geographical distance from the main finance centres.

*Table 6 – Regional Banking Systems and ROA of SMEs*

| ROA = Return on assets | ROA SMEs | ROA SMEs | ROA SMEs |
|---|---|---|---|
| Co-operative Banks | **0.0137**** | **0.0144***** | **0.0162***** |
| | (2.52) | (2.59) | (3.02) |
| Public savings banks | **0.0413*** | **0.0546***** | **0.0375*** |
| | (1.81) | (2.93) | (1.89) |
| LLCs | **0.106***** | **0.113***** | **0.135***** |
| | (3.26) | (2.80) | (3.76) |
| Banks Total Assets (billion USD) | -0.000569 | 0.00321 | 0.00269 |
| | (-0.86) | (0.94) | (0.77) |
| Equity to Total Assets | **0.0385*** | 0.0260 | 0.0250 |
| | (1.76) | (0.77) | (0.73) |
| Mean Total Assets of all firms | | 0.448 | 0.429 |
| | | (0.81) | (0.77) |
| GDP p.c. | | 0.000382*** | 0.000380*** |
| | | (6.53) | (6.50) |
| Human Resources in Science and Technology | | 0.00482** | 0.00483** |
| | | (2.25) | (2.25) |
| PLCs | | | **-0.0209*** |
| | | | (-1.85) |
| Constant | 5.303*** | 5.079*** | 4.947*** |
| | (11.46) | (8.32) | (8.03) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Overall $R^2$ | 0.2201 | 0.3844 | 0.4050 |

*This table reports results of correlated random effects regressions with robust standard errors. Return on assets of SMEs as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 7 shows the results for the same regressions as in Table 6, but with the mean return on assets of all firms within a region, not only SMEs. Therefore, the average return on assets of all firms within a NUTS 2 region is the dependent variable. This average also includes the SMEs but not exclusively as in Table 6. Even with these values, there is still a positive influence of public savings banks but this connection loses significance when including controls. I also see that banking systems with on average larger banks reduce return on assets. However, this only holds without controls and the economic significance is questionable as the coefficient is very

low. The mean total assets of all banks within a NUTS 2 region measures the average size of banks within the respective region.

Even in this regression, PLCs have negative influence on the average return on assets of all firms in general. As the time span of my data covers the aftermath of the financial and European debt crises, those results are in line with the research by Huber (2018). He used the Commerzbank AG[41] as an example to show that losses on international markets during the financial crises caused lending cuts to firms, which resulted in an extended hangover to both, firms working with and counties depending on Commerzbank.[42] This example confirms my argumentation that there is a causal influence of banks on firms and no reverse causality.

Additionally, I see co-operative banks have a negative influence on the return on assets of all firms while they had a strong significant positive influence on return on assets of SMEs. This contradiction might be an indication that small banks, as co-operative banks usually are, benefit first and foremost small businesses, not large companies. The connection between small banks and small businesses makes sense, as individual small banks do not have the capacity to fulfil the financial needs of large businesses.[43]

Another surprising result is that a banking system with on average higher equity leads to better performing firms. In theory and the existing literature, the general understanding is higher equity ties bank capital and as a result, higher equity to total assets reduces their capability of granting loans (e.g. Berrospide and Edge 2010, 2019). This argumentation is supported by the fact that some credit categories like treasury bonds are considered less risky as others, e.g. commercial loans. As a result, higher equity requirements should lead to a shift away from commercial loans in favour of state financing[44] which should have a negative impact on companies (Berger, Herring and Szegö 1995; Roulet 2018). In addition, a too high fraction of equity, i.e. too much tied capital, ought to be a limitation to the role of banks as liquidity providers as explained by Diamond and Dybvig (1983). There is also the argument that higher capital ratios are unlikely to prevent a financial crisis (Jordà et al. 2017).

On the other hand, an undercapitalized banking system is not stable and could be linked to excessive risk taking (Acharya and Steffen 2015). One reason for my results could be that equity

[41] Which is a PLC.
[42] Huber (2018) used the counties distance to the former head offices of Commerzbank in either Düsseldorf, Frankfurt or Hamburg as a proxy for dependence.
[43] Small banks usually only lend money to large businesses within a consortium.
[44] Which are mostly more liquid and are treated more favourable than other asset classes from a regulatory point of view.

enlarges the risk-bearing capacity of banks and as a result enables them to produce more loans (Berger and Bouwman 2009). Another reason for my results could be the risk-limiting factor of equity ratios. Higher capital requirements might prevent banks from taking excessive risks and as a result force them into selecting their business carefully (Hellmann, Murdock and Stiglitz 2000, Repullo 2004). Another explanation is that banks with less risk should be able to receive cheaper refinancing, have lower cost of capital and can pass on this advantage to their customers. In addition, equity could be a signal to create trust not only for the capital market but also for customers and therefore reduce the probability of bank runs (Cooper and Ross 2002). This stability of banks is necessary to form long-term relationships between banks and customers as it reduces the risk of an early termination of this relationship due to insolvency.

Even though my data set includes a comprehensive number of firms across all industries, I use earnings before taxes as another performance indicator to extend the analyses. This extension is useful as it could be argued that return on assets variability differs across industries[45] and time[46] (Selling and Stickney 1989). To address this concern, I also analyse the impact of regional banking systems on the average earnings before taxes of firms and SMEs separately. In contrast to return on assets, earnings before taxes is an absolute value. This might be an issue as regions with on average larger firms probably also have a higher mean EBT value. To address this issue, I control for the mean total assets of all firms within a region, i.e. the average firm size within a NUTS 2 region.

Table 8 shows the results for my regressions with earnings before taxes of SMEs as dependent variable. Confirming the positive influence of the presence of co-operative banks, the regressions reveal economically and statistically significant connections. The special link between co-operative banks and SMEs shown by both regressions using return on assets as well as earnings before taxes is in line with Hasan et al. (2017). They used Polish data showing a strong position for local co-operative banks favours growth for SMEs. An even stronger influence is identified for LLCs. Therefore, my second hypothesis H2 is confirmed.

In contrast to the weak positive connection of equity to return on assets of small firms, equity seems to have a negative influence on small firms' earnings. The positive influence of banks

[45] For example: According to the operating leverage.
[46] For example: According to the different stages of the product life cycle.

total assets can be ignored as econometric significance is weak and economic significance is questionable.[47] All controls have the expected signs.

*Table 7 – Regional Banking Systems and ROA*

| ROA = Return on assets | ROA all firms | ROA all firms | ROA all firms |
|---|---|---|---|
| Co-operative Banks | 0.00333 | **-0.0131*** ** | **-0.0115** ** |
| | (0.89) | (-2.59) | (-2.39) |
| Public savings banks | **0.0495** ** | 0.0232 | 0.00776 |
| | (2.07) | (1.30) | (0.44) |
| LLCs | 0.0520 | 0.00136 | 0.0209 |
| | (1.33) | (0.06) | (1.06) |
| Banks Total Assets (billion USD) | **-0.00142** ** | -0.00107 | -0.00156 |
| | (-2.40) | (-0.72) | (-1.00) |
| Equity to Total Assets | **0.0540*** ** | **0.0241** ** | **0.0232** ** |
| | (4.73) | (2.27) | (2.15) |
| Mean Total Assets of all firms | | 0.132 | 0.113 |
| | | (0.29) | (0.25) |
| GDP p.c. | | 0.000461*** | 0.000459*** |
| | | (7.82) | (7.74) |
| Human Resources in Science and Technology | | 0.00136 | 0.00138 |
| | | (0.60) | (0.60) |
| PLCs | | | **-0.0189** ** |
| | | | (-2.35) |
| Constant | 5.465*** | 3.509*** | 3.390*** |
| | (11.42) | (5.19) | (4.89) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Overall $R^2$ | 0.1289 | 0.4029 | 0.4231 |

*This table reports results of correlated random effects regressions with robust standard errors. Return on assets as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

[47] This is because when including controls, an increase of one billion in average total assets of a regional banking system leads to less than 1,000 Euro more in average EBT.

*Table 8 – Regional Banking Systems and EBT of SMEs*

| EBT = Earnings before taxes | EBT SMEs (tsd.) | EBT SMEs (tsd.) | EBT SMEs (tsd.) |
|---|---|---|---|
| Co-operative Banks | **5.280*** ** | **3.409** ** | **3.455** ** |
| | (5.05) | (2.31) | (2.42) |
| Public savings banks | -3.800 | -5.395 | -5.844 |
| | (-0.80) | (-1.19) | (-1.27) |
| LLCs | **21.46*** ** | **15.98** ** | **16.53** ** |
| | (2.97) | (2.19) | (2.25) |
| Banks Total Assets (billion) | -0.124 | **1.021*** | **0.992*** |
| | (-1.26) | (1.89) | (1.78) |
| Equity to Total Assets | 3.817 | **-6.246** ** | **-6.299** ** |
| | (1.58) | (-2.02) | (-2.03) |
| Mean Total Assets of all firms | | 456.0 | 454.8 |
| | | (1.57) | (1.57) |
| GDP p.c. | | 0.137*** | 0.137*** |
| | | (3.49) | (3.48) |
| Human Resources in Science and Technology | | 0.301 | 0.303 |
| | | (0.35) | (0.35) |
| PLCs | | | -0.553 |
| | | | (-0.26) |
| Constant | 349.6*** | 53.46 | 50.15 |
| | (4.95) | (0.43) | (0.40) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Overall $R^2$ | 0.1633 | 0.2978 | 0.2981 |

*This table reports results of correlated random effects regressions with robust standard errors. Earnings before taxes as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 9 confirms my predictions in the first regression. Co-operative banks, public savings banks and LLCs have a positive influence on earnings before taxes of all firms not only including SMEs. However, this loses econometric significance when I consider some control variables. In opposite to co-operative banks and public savings banks, LLCs become econometrically significant again when including PLCs into the regression. In addition, the presence of PLCs within a region is negatively connected to earnings of firms as in the regression with return on assets as dependent variable. Average banks total assets reduce earnings but the effect

turns when including controls. The opposite is described by banks' capital, as it increases earnings without controls and decreases earnings with all variables in the regression. Therefore, my first hypothesis H1 is verified to a limited extend.

As robustness checks I used additional methods to test whether other econometrical approaches deliver the same results as the correlated random effects regressions. In the first step, I calculated the mean values over all yearly periods to use the averages of the variables for cross-sectional analyses. As a second step, I applied pooled ordinary least squares regressions as in e.g. Choi (2006) or Stack and Pentecost (2010). Both methods were executed using robust standard errors. The results depicted in appendices A and B confirm the results of Table 6. It is obvious that there is an empirically and econometrically strong positive connection between the presences of co-operative banks, public savings banks and banks incorporated as LLCs and the return on assets of SMEs. The regressions results illustrated in Appendices C and D confirm the results of the analyses in Table 7. Appendices E and F approve the regression outcomes depicted in Table 8, and Appendices G and H endorse Table 9.[48]

The results have important political implications. The ongoing challenges for the whole banking system burdens especially smaller banks. This is because they mainly rely on credit business and because of their organisational structure. Interest focused business is becoming less attractive than in the past decades due to the enduring low interest rate period. Combined with growing and more complex regulation may lead to less smaller banks, even though their equity reserves are usually solid. One reason is, regulation affects small banks disproportionally as the differentiation of the regulatory requirements are not perfect. Especially in regulation, one size does not fit all. Another reason is, banks become more and more the performing agent of politics, e.g. in fulfilling secondary tasks of banking regulation or promoting favourable behaviour such as sustainability. Furthermore, there are ideas by the regulatory bodies to force financial institutions to measure and reveal climate risks not only within the bank but also indirectly within its credit and investment portfolio (Schäfer and Vohrer 2020). Additional reasons could be, there are considerations to centralize the European banking systems. One example for this is the European Deposit Insurance Scheme (EDIS). As my research suggests the importance of small banks especially for small business, their importance should be considered by politics too. If the streamlining within the European banking system continues, this might disproportionally effect SMEs.

[48] Only the positive influence of banks' equity capital is not confirmed by the robustness checks.

*Table 9 – Regional Banking Systems and EBT*

| EBT = Earnings before taxes | EBT all firms (tsd.) | EBT all firms (tsd.) | EBT all firms (tsd.) |
|---|---|---|---|
| Co-operative Banks | **43.53*** ** | 3.943 | 7.855 |
| | (3.21) | (0.29) | (0.56) |
| Public savings banks | **154.6*** | 93.32 | 54.80 |
| | (1.94) | (1.36) | (0.78) |
| LLCs | **226.4**** | 114.2 | **162.4**** |
| | (2.03) | (1.54) | (2.51) |
| Banks Total Assets (billion USD) | **-3.878*** ** | **13.19*** ** | **11.42*** ** |
| | (-3.35) | (2.89) | (2.68) |
| Equity to Total Assets | **33.28*** | -16.66 | **-20.18*** |
| | (1.92) | (-1.48) | (-1.84) |
| Mean Total Assets of all firms | | 7652.3** | 7583.8** |
| | | (2.16) | (2.15) |
| GDP p.c. | | 0.856*** | 0.851*** |
| | | (5.92) | (5.88) |
| Human Resources in Science and Technology | | -1.058 | -1.014 |
| | | (-0.16) | (-0.15) |
| PLCs | | | **-47.29*** ** |
| | | | (-2.68) |
| Constant | -122.8 | -3283.1*** | -3572.8*** |
| | (-0.12) | (-3.53) | (-3.71) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Overall $R^2$ | 0.3719 | 0.6004 | 0.6178 |

*This table reports results of correlated random effects regressions with robust standard errors. Earnings before taxes as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

## 3.7 Conclusion

The purpose of this paper is to analyse the impact of regional banking system on firms within this system. I use the number of different kinds of banks as well as the banking size and their equity structure to analyse the effect on return on assets and earnings before taxes as proxies for firm performance. The data and research approach are an extension to Burghof, Gehrung and Schmidt (2021a). My unique data set include balance sheet and legal information about banks and firms assigned to the NUTS 2 region where they have their headquarters in. In the

cross-sectional dimension, the database includes regions within Austria, France, Germany, Italy and Spain, and the observed time are the years 2011-2016. The kinds of banks are indicated using the number of banks incorporated as co-operative banks, public savings banks, LLCs and PLCs. Due to the different business objectives, the presence of such banks influences the companies in the respective regions. I describe a banking system with a larger number of those banking types and on average smaller banks within a region as a diverse banking system. To the best of my knowledge, my analyses is the first using this unique data set to identify the effect of various banking types on firms.

Especially the usually smaller co-operative banks, but also the in general relatively small public savings banks and most LLCs, should have an influence on SMEs. In fact, my analyses show that those local banks have a positive impact on the performance of SMEs in the NUTS 2 region where they are situated. This clear relationship is not given when including all firms, i.e. also larger firms, into the regression. PLCs have either no or significantly negative influence or on firm performance. Anecdotal evidence is presented for the positive impact of banks' equity on firm profitability, which could be a starting point for further research. Further research might also include very centralized banking system such as the UK.

This paper contributes to the literature in highlighting the positive influence of smaller regional banks on local firms in the aftermath of the financial and European debt crisis. As no other research concentrates on regional levels to analyse the connection between banking types and firms as well as SMEs in particular, this paper closes a gap in the existing literature.

My results have several policy implications. They highlight the importance of small banks and a diverse banking system. Therefore, politics should refrain from measures to streamline the European banking system. This streamlining could also be indirectly the case. An enduring low interest phase or a non-proportionality in banking regulation might lead to a declining number of small banks relying mainly on credit business. Additionally, the results support the view that not only profit maximizing companies deliver the best agent-customer relationship. Such banks incorporated as public savings banks or co-operatives have a profound raison d'être especially when considering their positive partnership with SMEs. A centralization of the European banking system should not be the goal of politics.

# Appendix Chapter 3

*Appendix 3—A – Effects on ROA of SMEs using Cross-Sectional Regressions (CS)*

| ROA = Return on assets | ROA SMEs | ROA SMEs | ROA SMEs |
|---|---|---|---|
| Co-operative Banks | **0.0142**** | **0.0158***** | **0.0179***** |
| | (2.57) | (2.65) | (3.12) |
| Public savings banks | **0.0438*** | **0.0715***** | **0.0505**** |
| | (1.90) | (3.64) | (2.40) |
| LLCs | **0.109***** | **0.117***** | **0.144***** |
| | (3.24) | (2.72) | (3.81) |
| Banks Total Assets (billion USD) | 0.000837 | **0.00852***** | **0.00873***** |
| | (0.72) | (3.49) | (3.67) |
| Equity to Total Assets | -0.0239 | -0.0163 | -0.0264 |
| | (-0.58) | (-0.36) | (-0.57) |
| Mean Total Assets of all firms | | -8.037*** | -8.149*** |
| | | (-2.87) | (-3.01) |
| GDP p.c. | | 0.0000285 | 0.0000349 |
| | | (1.02) | (1.25) |
| Human Resources in Science and Technology | | -0.00102*** | -0.000416 |
| | | (-3.56) | (-0.88) |
| PLCs | | | **-0.0257**** |
| | | | (-2.09) |
| Constant | 5.290*** | 4.962*** | 4.792*** |
| | (11.58) | (7.88) | (7.46) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.219 | 0.314 | 0.344 |

*This table reports results of cross-sectional regressions with robust standard errors. Return on assets of SMEs as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—B – Effects on ROA of SMEs using Pooled Ordinary Least Squares (POLS)*

| ROA = Return on assets | ROA SMEs | ROA SMEs | ROA SMEs |
|---|---|---|---|
| Co-operative Banks | **0.0138*** ** | **0.00996*** ** | **0.0119*** ** |
| | (5.08) | (3.05) | (3.76) |
| Public savings banks | **0.0380*** ** | **0.0450*** ** | **0.0260** ** |
| | (3.31) | (4.13) | (2.19) |
| LLCs | **0.110*** ** | **0.103*** ** | **0.127*** ** |
| | (6.64) | (5.24) | (6.82) |
| Banks Total Assets (billion USD) | 0.000618 | **0.00315*** ** | **0.00296*** ** |
| | (1.02) | (4.02) | (3.98) |
| Equity to Total Assets | 0.0104 | 0.0179 | 0.0114 |
| | (0.46) | (0.63) | (0.39) |
| Mean Total Assets of all firms | | -0.843** | -0.766* |
| | | (-2.00) | (-1.81) |
| GDP p.c. | | 0.0000348** | 0.0000388** |
| | | (2.31) | (2.54) |
| Human Resources in Science and Technology | | -0.000819*** | -0.000267 |
| | | (-4.98) | (-1.04) |
| PLCs | | | **-0.0231*** ** |
| | | | (-3.51) |
| Constant | 4.908*** | 4.459*** | 4.321*** |
| | (19.46) | (10.98) | (10.46) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Adjusted $R^2$ | 0.205 | 0.253 | 0.277 |

*This table reports results of pooled ordinary least squares regressions with robust standard errors. Return on assets of SMEs as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—C – Effects on ROA of all firms using Cross-Sectional Regressions (CS)*

| ROA = Return on assets | ROA all firms | ROA all firms | ROA all firms |
|---|---|---|---|
| Co-operative Banks | 0.00419 | **-0.0138**** | **-0.0120**** |
| | (1.11) | (-2.45) | (-2.23) |
| Public savings banks | **0.0534**** | 0.0310 | 0.0136 |
| | (2.20) | (1.52) | (0.67) |
| LLCs | 0.0568 | 0.00659 | 0.0291 |
| | (1.39) | (0.23) | (1.17) |
| Banks Total Assets | **-0.00239***** | **-0.00507***** | **-0.00489***** |
| (billion USD) | (-3.85) | (-3.06) | (-2.74) |
| Equity to Total Assets | -0.0282 | **-0.0627*** | **-0.0710*** |
| | (-0.75) | (-1.72) | (-1.89) |
| Mean Total Assets of all firms | | 3.179* | 3.086 |
| | | (1.74) | (1.59) |
| GDP p.c. | | 0.000117*** | 0.000123*** |
| | | (4.85) | (4.91) |
| Human Resources in Science and Technology | | -0.000248 | 0.000248 |
| | | (-1.08) | (0.64) |
| PLCs | | | **-0.0212**** |
| | | | (-2.21) |
| Constant | 5.520*** | 3.080*** | 2.940*** |
| | (11.72) | (4.30) | (3.98) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.106 | 0.281 | 0.304 |

*This table reports results of cross-sectional regressions with robust standard errors. Return on assets as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—D – Effects on ROA of all firms using Pooled Ordinary Least Squares (POLS)*

| ROA = Return on assets | ROA all firms | ROA all firms | ROA all firms |
|---|---|---|---|
| Co-operative Banks | 0.00296 | **-0.0154*** ** | **-0.0135*** ** |
| | (1.51) | (-5.06) | (-4.61) |
| Public savings banks | **0.0450*** ** | **0.0253** ** | 0.00668 |
| | (3.78) | (2.51) | (0.66) |
| LLCs | **0.0537*** ** | 0.00207 | **0.0263** ** |
| | (2.83) | (0.15) | (2.14) |
| Banks Total Assets (billion USD) | **-0.00263*** ** | **-0.00453*** ** | **-0.00471*** ** |
| | (-5.90) | (-4.44) | (-4.48) |
| Equity to Total Assets | 0.0185 | -0.0198 | **-0.0261** * |
| | (1.44) | (-1.35) | (-1.69) |
| Mean Total Assets of all firms | | 1.238** | 1.313** |
| | | (2.20) | (2.24) |
| GDP p.c. | | 0.000120*** | 0.000124*** |
| | | (8.83) | (8.84) |
| Human Resources in Science and Technology | | -0.000331*** | 0.000208 |
| | | (-2.81) | (1.14) |
| PLCs | | | **-0.0225*** ** |
| | | | (-5.26) |
| Constant | 5.025*** | 2.730*** | 2.595*** |
| | (26.28) | (6.77) | (6.29) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Adjusted $R^2$ | 0.116 | 0.298 | 0.327 |

*This table reports results of pooled ordinary least squares regressions with robust standard errors. Return on assets as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—E – Effects on EBT of SMEs using Cross-Sectional Regressions (CS)*

| EBT = Earnings before taxes | EBT SMEs (tsd.) | EBT SMEs (tsd.) | EBT SMEs (tsd.) |
|---|---|---|---|
| Co-operative Banks | **5.253*** ** | **3.385** ** | **3.509*** ** |
| | (4.95) | (2.59) | (2.74) |
| Public savings banks | -3.624 | -3.961 | -5.164 |
| | (-0.76) | (-0.87) | (-1.09) |
| LLCs | **21.52*** ** | **17.44** ** | **19.00*** ** |
| | (2.95) | (2.42) | (2.63) |
| Banks Total Assets (billion USD) | -0.132 | 0.548 | 0.560 |
| | (-1.15) | (1.40) | (1.43) |
| Equity to Total Assets | -1.954 | -5.437 | -6.016 |
| | (-0.37) | (-0.93) | (-1.02) |
| Mean Total Assets of all firms | | -735.8* | -742.2* |
| | | (-1.67) | (-1.69) |
| GDP p.c. | | 0.0166*** | 0.0170*** |
| | | (3.44) | (3.48) |
| Human Resources in Science and Technology | | -0.0926* | -0.0582 |
| | | (-1.79) | (-0.73) |
| PLCs | | | -1.470 |
| | | | (-0.65) |
| Constant | 349.0*** | 18.51 | 8.806 |
| | (4.94) | (0.15) | (0.07) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.203 | 0.250 | 0.245 |

*This table reports results of cross-sectional regressions with robust standard errors. Earnings before taxes of SMEs as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—F – Effects on EBT of SMEs using Pooled Ordinary Least Squares (POLS)*

| EBT = Earnings before taxes | EBT SMEs (tsd.) | EBT SMEs (tsd.) | EBT SMEs (tsd.) |
|---|---|---|---|
| Co-operative Banks | **5.224*** ** | **2.646*** ** | **2.800*** ** |
| | (7.31) | (2.69) | (2.89) |
| Public savings banks | -4.110 | **-5.932*** | **-7.458**** |
| | (-1.34) | (-1.87) | (-2.30) |
| LLCs | **21.37*** ** | **12.43*** ** | **14.41*** ** |
| | (5.49) | (3.12) | (3.56) |
| Banks Total Assets (billion) | **-0.146**** | -0.377 | -0.392 |
| | (-2.14) | (-1.31) | (-1.35) |
| Equity to Total Assets | 0.604 | **-6.217**** | **-6.735**** |
| | (0.19) | (-2.13) | (-2.26) |
| Mean Total Assets of all firms | | 232.0 | 238.2 |
| | | (0.97) | (0.99) |
| GDP p.c. | | 0.0182*** | 0.0185*** |
| | | (4.97) | (4.97) |
| Human Resources in Science and Technology | | -0.0702** | -0.0260 |
| | | (-2.48) | (-0.54) |
| PLCs | | | -1.845 |
| | | | (-1.32) |
| Constant | 320.8*** | -23.96 | -35.05 |
| | (7.18) | (-0.29) | (-0.41) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Overall $R^2$ | 0.154 | 0.204 | 0.204 |

*This table reports results of pooled ordinary least squares regressions with robust standard errors. Earnings before taxes of SMEs as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—G – Effects on EBT of all firms using Cross-Sectional Regressions (CS)*

| EBT = Earnings before taxes | EBT all firms (tsd.) | EBT all firms (tsd.) | EBT all firms (tsd.) |
|---|---|---|---|
| Co-operative Banks | **43.49*** ** | 2.664 | 6.825 |
| | (3.16) | (0.18) | (0.47) |
| Public savings banks | **150.5*** | 87.16 | 46.84 |
| | (1.84) | (1.26) | (0.66) |
| LLCs | **237.4*** | 87.64 | **139.9**** |
| | (1.98) | (1.27) | (2.27) |
| Banks Total Assets (billion USD) | **5.532*** ** | **-20.10*** | **-19.69*** |
| | (3.80) | (-1.83) | (-1.84) |
| Equity to Total Assets | 71.35 | 1.885 | -17.50 |
| | (0.89) | (0.02) | (-0.24) |
| Mean Total Assets of all firms | | 30406.3** | 30191.6** |
| | | (2.35) | (2.38) |
| GDP p.c. | | 0.187*** | 0.199*** |
| | | (5.31) | (5.44) |
| Human Resources in Science and Technology | | -0.627 | 0.526 |
| | | (-1.33) | (0.74) |
| PLCs | | | **-49.26*** ** |
| | | | (-2.85) |
| Constant | -52.75 | -3867.7*** | -4192.8*** |
| | (-0.05) | (-3.79) | (-4.01) |
| Numb. Of Obs. | 108 | 108 | 108 |
| Adjusted $R^2$ | 0.374 | 0.598 | 0.617 |

*This table reports results of cross-sectional regressions with robust standard errors. Earnings before taxes as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

*Appendix 3—H – Effects on EBT of all firms using Pooled Ordinary Least Squares (POLS)*

| EBT = Earnings before taxes | EBT all firms (tsd.) | EBT all firms (tsd.) | EBT all firms (tsd.) |
|---|---|---|---|
| Co-operative Banks | **43.02*** ** | 5.435 | 10.28 |
| | (5.74) | (0.65) | (1.21) |
| Public savings banks | **164.1*** ** | **118.0*** ** | **69.85*** |
| | (4.07) | (2.99) | (1.76) |
| LLCs | **228.5*** ** | **115.8** ** | **178.4*** ** |
| | (3.97) | (2.35) | (4.02) |
| Banks Total Assets (billion USD) | **3.858** ** | -3.836 | -4.300 |
| | (2.49) | (-0.68) | (-0.76) |
| Equity to Total Assets | **78.56*** ** | -29.06 | -45.38 |
| | (2.77) | (-1.05) | (-1.60) |
| Mean Total Assets of all firms | | 11904.5** | 12099.4** |
| | | (2.44) | (2.47) |
| GDP p.c. | | 0.207*** | 0.218*** |
| | | (7.47) | (7.66) |
| Human Resources in Science and Technology | | -0.762** | 0.632 |
| | | (-2.48) | (1.47) |
| PLCs | | | **-58.21*** ** |
| | | | (-5.30) |
| Constant | -141.6 | -3968.7*** | -4318.6*** |
| | (-0.37) | (-5.67) | (-6.09) |
| Numb. Of Obs. | 500 | 428 | 428 |
| Adjusted $R^2$ | 0.354 | 0.533 | 0.559 |

*This table reports results of pooled ordinary least squares regressions with robust standard errors. Earnings before taxes as an indicator for firm performance is the dependent variable. It shows the impact of average bank size (total assets) and the equity structure (equity to total assets) on regional firm performance. Further explanatory variables are the number of banks of different types (i.e. legal forms) in a region. The mean total assets of all firms within a NUTS 2 region and GDP p.c. as well as human resources in science and technology are control variables. Z statistics in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

# The Influence of Economic Factors on the Capital Buffer Calibration for Systemically Important Institutions in the European Union

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**Abstract**

Capital requirements are key elements in banking regulation. As the failure of a systemically important institution poses a risk to the whole economy, they have to meet special regulations. Our research uses a unique data set to show the influence of economic factors on the capital buffer calibration for Other Systemically Important Institutions (O-SIIs). We show that the scoring process to identify and rank O-SIIs is comparable in the different countries of the EU, but the respective equity requirements are not. Nations with higher unemployment and a higher amount of non-performing loans demand less capital from their banks. Hence, their country average of capital buffer requirements per score depends on the economic situation rather than the scoring process as such.

*JEL Classification*: E5, E58, G21, G18, G28

*Keywords*: banking regulation, systemically important institutions, equity buffer, economic influence on regulation, buffer calibration

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# 4 The Influence of Economic Factors on the Capital Buffer Calibration for Systemically Important Institutions in the European Union

## 4.1 Introduction

Systemically important banks play a central role in banking supervision. As financial intermediaries perform crucial functions in the economy, the collapse of a bank is dangerous, but the collapse of a very large bank is catastrophic. It is not without reason that the term "too big to fail" often came up, especially during the financial crisis. However, also other factors such as interconnectedness with other banks, dependence on the financial market or internationalization play a major role in classifying a financial institution as "systemically important". A financial intermediary that has been classified as systemically important in the EU is subject to special regulations. One important aspect is capital adequacy, the exact design of which is to some degree left to the discretion of the EU member states. In this project, we investigate whether the individual states impose different levels of strict regulations on their systemically important banks and, if so, which factors play a role in doing so.

Not only does the behaviour and performance of banks as such depend on the boundaries set by regulators, their task to act as financial intermediary might depend on it as well. A sound banking system that is able to grant sufficient amount of loans is important for the general economy (see e.g. Burghof, Gehrung and Schmidt 2021a) and the performance of firms in particular (Schmidt 2021). Research on the effects of capital regulation on credit business suggest that higher capital requirements might reduce the amount of loans granted by banks (see e.g. Ben Naceur et al. 2018). As a result, regulators might have the incentive not to impose new rules very strictly. This should be the case especially when the economic situation of a country is difficult. Governments and politicians depend on re-election, which is influenced by, among others, the performance of the national economy. The strictness of the implementation of rules should depend on the ability of government bodies to influence the work of financial regulators. Of course, such influencing of equity requirements is easier for governments if the degree of capital regulation depends, at least to a certain degree, on national rather than multinational rules.

Our research shows that nations do have the right and the inclination to customize capital requirements of Other Systemically Important Institutions (O-SIIs) in Europe. Furthermore, we present empirical evidence that the actual national capital regulations depend on the level of unemployment, as well as the amount of non-performing loans within the respective country. Therefore, equity requirements are influenced by economic as well as bank specific factors. As a result, O-SIIs might have a comparative advantage in some countries within the EU due to regulatory differences.

Our results lead to several political implications. Firstly, a predefined scoring process, which is applied uniformly in the EU, does not necessarily lead to the same regulation in all states. Secondly, large banks of the O-SII category face different equity regimes within Europe even though the idea was to harmonize regulation. Especially as the harmonization of the solvency regime is a core component of both the Basle process and the European Banking Union, and particularly relevant with regard to large banks that might provoke cross border systemic risk. Especially the correlation between economic and bank specific variables and the national capital requirements is worrisome. Thirdly, national differences lead to varying market preconditions for banks in Europe, which might give some a comparative advantage or disadvantage.

Our paper proceeds as follows: section two gives a brief literature overview on the topic. Section three presents the legal framework and the scoring process. Section four presents our data set, and section five explains our methodology. Section six then presents our results, and section seven concludes.

## 4.2 Literature Review

The asset quality of banks matters not only for the institutions themselves, but also for the economy as a whole. Early detection of expected losses can contribute to the stability of a bank, whereas an overwhelming volume of non-performing loans (NPLs) impose a threat to financial stability which might result in a long-lasting debt crisis (Bholat et al. 2018). A large number of NPLs over a long-time span can prevent banks from fulfilling their role as financial intermediary (Dimitrios, Helen and Mike 2016). Hence, NPLs are an indicator for the situation of the banking system within a country (Kauko 2012). The state of the banking system affects all sectors, as banks are crucial for the sound operation of the real economy (Lončarski and Marinč 2020). A high volume of NPLs might also increase the incentives for bank employees to gamble

for resurrection. Considering the moral hazard hypothesis, a higher NPL ratio leads to riskier lending which can contribute to systemic instability (Zhang et al. 2016). Additionally, a high volume of NPLs can influence the equity of banks.

Louzis, Vouldis and Metaxas (2012) show that NPLs in Greece between 2003 and 2009 are especially driven by macroeconomic variables such as GDP, unemployment and public debt. Ghosh (2015) show the same influence of those macroeconomic factors on NPLs within banks in the US between 1984 and 2013. The literature on this topic is extensive. Messai and Jouini (2013) explain a similar correlation in Italy, Greece and Spain between 2004 and 2008. Škarica (2014) evaluates this effect in central and eastern European countries between 2007 and 2012 and Szarowska (2018) between 1999 and 2015.[52]

The relationship between NPLs and the economy might result in a vicious circle. As described above, economic factors might influence the volume of NPLs within a banking system. In addition, NPLs negatively affect the stability of banks and the whole banking system. Thus, it endangers financial intermediation within an economy. This is important since the quality of financial institutions and their ability to act as financial intermediate improves economic growth (Hasan, Koetter and Wedow 2009; Koetter and Wedow 2010). Economic growth or the state of the economy as such will influence the situation of banks and their NPLs, as they operate within the respective economy.

As a result, governments might want to support banks experiencing a large volume of NPLs. We argue that one way governments execute such a support is through diminishing the rigour of implementing capital requirements for systemically important institutions. This argument is supported by the fact that regulatory bodies are likely to set rules favourable for the financial industry in their home countries (Bengtsson 2013). That governments might be interested in doing so is obvious, not only because of the negative economic effect of NPLs, but also because of their belief that government intervention might work. Barseghyan (2010), who uses the case of Japan, shows a significant volume of NPLs, combined with a delay in bank bailouts from the state, results in a long-lasting economic decline. Vithessonthi (2016) focuses on Japan and proves large banks being the drivers for the correlation between NPLs and credit growth.[53] Hence, our focus on systemically important institutions is justified.

[52] See also Tanasković and Jandić (2015) or Makri, Tsagkanos and Bellas (2014).
[53] In detail, there is a positive connection between credit growth and NPLs before the financial crisis of 2007 and a negative connection afterwards.

Another incentive for governments to influence the performance of banks and bank loans is the effect of the financial system on unemployment. Evidence from different recessions shows, reductions in loan supply are one of the key drivers of unemployment, which is in line with the credit constraints hypothesis (see e.g. Duygan-Bump, Levkov and Montoriol-Garriga 2015). As politicians' job performance ratings depend on the unemployment rate in the state (Jonung and Wadensjö 1981; Hansen 1999; Feld and Kirchgässner 2000) their re-election might crucially depend on it as well (Johnston and Pattie 1992).[54]

From these considerations, we derive our Hypothesis 1:

*H1: States within the European Union impose different capital buffer requirements for their O-SIIs, even though the scoring process is comparable between those states.*

If this is the case, our Hypothesis 2 is as follows:

*H2: The capital buffer calibration for O-SIIs depends on the economic situation of the respective states.*

We argue that governments or regulatory bodies adjust the actual implementation of capital requirements according to the economic situation of their country. The motivation for this behaviour is probably to improve the banks' ability to act as financial intermediary and expand lending. We call this hypothesis '*loan reducing equity*'. This hypothesis indicates a direct regulatory link to the reduction of loan portfolios and lending (Peek and Rosengren 1995), where tightening of capital requirements reduces loan supply (Aiyar, Calomiris and Wieladek 2015). Capital-tightening hits poorly capitalized firms the hardest (Holmstrom and Tirole 1997), which will disproportionally affect younger and very small companies.

Thakor (1996) shows that especially the exclusive link between capital requirements and credit risk reduces lending significantly (see also Coffinet et al. 2012; Aiyar, Calomiris and Wieladek 2016). There is evidence connecting tighter capital regulations to negative effects on bank lending of large banks, whereas liquidity indicators might not have the same effects (Roulet 2018; Ben Naceur et al. 2018). Gorton and Winton (2017) show in their model that higher bank capital regulations push banks to either reduce short-term lending or acquire nonbank equity. Repullo (2013) explains in his model that capital requirements should be lowered in case of a shock to bank capital supply.

[54] There is extensive literature that politicians do exploit their influence to improve their re-election probabilities in some cases (see e.g. Englmaier et al. 2017; Burghof, Gehrung and Schmidt 2021b).

In contrast to the '*loan reducing equity*' hypothesis, Berger and Bouwman (2009) find that especially large banks create more liquidity with higher capital ratios.[55] We call this hypothesis '*loan raising equity*'. Higher capital ratios might support lending especially during crises periods (Carlson, Shan and Warusawitharana 2013; Louhichi and Boujelbene 2017) as they can absorb risk (Fungáčová, Weill and Zhou 2017). Furthermore, capital requirements reduce the incentive for banks to take excessive risk (Repullo 2004). Higher capital ratios can reduce the pro-cyclicality of banks' credit supply (Gambacorta and Mistrulli 2004) or speed up recoveries from financial crisis recessions (Jordà et al. 2017) and reduce the output cost of crises (Angkinand 2009). Strengthening capital restrictions might even improve bank efficiency (Chortareas, Girardone and Ventouri 2012). If this were the case, a lax implementation of capital requirements for systemically important institutions would, at least in the long run, be counterproductive.

Most likely, there is an overall trade-off between the effects that higher capital requirements reduce lending but also might reduce risk, hence improve financial stability (Horváth, Seidler and Weill 2014; Fu, Lin and Molyneux 2016; Le 2018). A fall in capital might push banks to reduce risky loans and concentrate on more conservative lending business (Mora and Logan 2012).

Even though there is some evidence that the German government usually opposes high capital requirements (Howarth and Quaglia 2013), we present evidence that well performing economies, such as Germany, implement existing rules more strictly than countries with a higher volume of NPLs and a higher unemployment rate. Mazzaferro and Dierick (2018) already point out that there are significant differences in the national approaches to exercise supervisory judgements, especially in the context of the O-SII buffer calibration due to a lack of detailed guidance. Therefore, this setting of financial regulation is a good case to analyse whether the situation of the banking system and economic factors can influence the implementation of multinational banking regulation on a national level.

The paper closest to ours is Sigmund (2020). He also analyses the O-SII buffer assignments within Europe. In line with our research, he finds the scoring process as such is similar within the European Union. Sigmund (2020) shows that the capital requirements depend less on the final score and rather on the country where each bank has its headquarters. Building on this

[55] With the opposite relationship for small banks. The same negative effect of capital on liquidity creation of small banks is suggested by Horváth, Seidler and Weill (2013).

existing research, we focus on the influence of economic factors on the capital buffer calibration. Our analyses cover the political dimension of the regulatory requirements as well as the economic strength of the respective nation. We calculate how large the equity buffer per score is on average within the country to compare the national distinctions. Using a new empirical approach to the analyses, we control for several micro- and macroeconomic factors as well. Our new unique panel data set consists of regulatory, economic and bank specific variables in 30 countries between 2015 and 2019. We show that the unemployment and the NPLs within a nation significantly reduce the buffer per score assigned to the O-SII on average. We perform several robustness checks to show the validity of our results.

## 4.3 Legal Framework and Scoring Process

### 4.3.1 Identification as O-SII

At the European level, the regulations on identifying both globally and other systemically important institutions are defined in Article 131 of Directive 2013/36/EU. First, it is defined by which authority an institution is considered to be globally or otherwise systemically important. This is not done on a European level instead the responsibility falls to each member state. Therefore, each member state of the European Union designates an authority that carries out the classification as G-SII or O-SII (Article 131 (1) of Directive 2013/36/EU).

In Article 131 (2) of Directive 2013/36/EU the criteria for the identification as G-SII and in Article 131 (3) of Directive 2013/36/EU as O-SII are listed. Four criteria are applicable for an institution to be classified as O-SII: (a) size, (b) importance for the economy of the Union or of the relevant member state, (c) significance of cross-border activities and (d) interconnectedness of the institution or group with the financial system. As these criteria are not further defined by the European legislator, the European Banking Authority (EBA) is mandated to establish guidelines on the criteria for the assessment of O-SIIs. In December 2014, the EBA has fulfilled this mandate by publishing the “Guidelines on the criteria to determine the conditions of application of Article 131 (3) of Directive 2013/36/EU (CRD) in relation to the assessment of Other Systemically Important Institutions (O-SIIs) (EBA/GL/2014/10)”. With these guidelines the assessment as O-SII should be made comparable, transparent and comprehensible

(EBA/GL/2014/10, p.5). Since, in addition, Union and national specificities are also to be taken into account, the guidelines provide scope in the assessment process at several points.

For each criterion set by the legislator, the EBA defines at least one indicator by which the criterion can be measured and compared (see Table 10). For example, the size criterion is measured by total assets, the complexity criterion, among others, by the value of OTC derivatives. In the assessment, each criterion is weighted equally high, i.e. it accounts for 25% of the overall assessment. In addition, within each criterion, each indicator is given equal weighting.

The assessment is expressed in terms of scores or basis points. The relevant authority calculates the score annually on at least the highest legal entity, i.e. the ultimate parent company within the respective country, which falls under its jurisdiction (EBA/GL/2014/10, p. 8).

*Table 10 - Criteria and indicators on identifying an O-SII*

| **Criterion** | **Indicators** | **Weight** |
|---|---|---|
| Size | Total assets | 25.00% |
| Importance (including substitutability/financial system infrastructure) | Value of domestic payment transactions | 8.33% |
| | Private sector deposits from depositors in the EU | 8.33% |
| | Private sector loans to recipients in the EU | 8.33% |
| Complexity/cross-border activity | Value of OTC derivatives (notional) | 8.33% |
| | Cross-jurisdictional liabilities | 8.33% |
| | Cross-jurisdictional claims | 8.33% |
| Interconnectedness | Intra financial system liabilities | 8.33% |
| | Intra financial system assets | 8.33% |
| | Debt securities outstanding | 8.33% |

*Source: EBA/GL/2014/10, Annex 1, p.12*

The first step of the assessment is to determine the share of each institutions' indicator value compared to the indicator values of all institutions within a member state (EBA/GL/2014/10, p. 9, No. 8 (a) and (b)). The resulting percentage is then multiplied by 10,000 so that the indicator score $I_{i,k}$ for every indicator $k$ per individual institution $i$ can be expressed in basis points:

$$I_{i,k} = \frac{Indicator_{i,k}}{\sum_{j=1}^{n} Indicator_{j,k}} * 10{,}000$$

where $Indicator_{i,k}$ refers to the value for indicator $k$ of institution $i$ and is divided by the sum over all values for indicator $k$ of all banks within a member state, where $n$ is the number of banks in the respective country $j$.

The criterion score for each criterion $b$ of each institution $i$ can then be calculated by taking the average of the indicators per criterion (EBA/GL/2014/10, p. 9, No. 8 (c)):

$$Criterion_{i,b} = \frac{\sum_{k=1}^{M} I_{i,k}}{M}$$

where $M$ is the number of indicators within the respective criterion.

By taking the average of these four resulting criterion scores, the overall score per institution $i$ is obtained (EBA/GL/2014/10, p. 9, No. 8 (d)), expressed in basis points:

$$OSII\ Score_i = \frac{\sum_{b=1}^{4} Criterion_{i,b}}{4}$$

Consequently, the calculated value can range from 0 to 10,000 basis points. The higher the value, the more systemically relevant is the institution.

Although the calculation method for the score is very straightforward, each member state has a certain degree of freedom in the involvement of the institutions to be considered in the calculation. If the relative size in terms of the proportion of total assets of an institution does not exceed 0.02% and if the assessing authority classifies the institution as unlikely to pose a threat with systematic risk, the institution can be generally excluded from the calculation (EBA/GL/2014/10, p. 9, No. 10). This is intended to take account of national specificities, i.e. for the case of banking structures characterised by a high number of small institutions.

After the scores have been calculated for each institution, the identification as O-SII can be carried out. The EBA specifies a two-step procedure for this. The first stage is primarily quantitative and requiring those relevant legal entities that achieve a score of more than 350 basis points are automatically classified as O-SII. Again, the national characteristics of each member state will be taken into account, allowing the assessing authority to lower this threshold to 275 basis points or raise it to 425 basis points (EBA/GL/2014/10, p.9, No.9).

Step two provides for a more qualitative approach: the relevant authority may decide, on the basis of further optional indicators, that additional institutions should be classified as otherwise systemically relevant, even if they do not exceed the 350 basis points of step one. In this case,

however, the respective institutions must reach at least a 4.5 basis points limit (EBA/GL/2014/10, p.10, No.13).[56]

The approach and the result must be provided by each member state by the 1st December each year, valid for the following year. In each case, it must be stated when and why the basic procedure was deviated from and the possible leeway was used, for example if the 350-threshold was adjusted. For the first time, the assessment was submitted in 2015, with validity for 2016.

Though each member state has a certain amount of freedom to include optional indicators in the assessment, the requirements are quite consistent and the total score of the different institutions can be compared with each other in general terms (see Results 4.6.1).

### 4.3.2 Buffer Application

The O-SII buffer is in principle only one of several capital buffers that banks may have to cover. Besides the O-SII buffer, there is also the G-SII buffer for global systemically important institutions and the Systemic Risk Buffer (SyRB) to mitigate systemic or macro prudential risks.

According to Article 131 (5) of Directive 2013/36/EU, the responsible authority may require a buffer consisting of Common Equity Tier 1 capital of up to 2% of the total risk exposure amount (calculated in accordance with Article 92 (3) of Regulation (EU) No 575/2013) for an O-SII. If an institution is classified as both globally and otherwise systemically important, the higher buffer should be applied (Article 131 (14) of Directive 2013/36/EU). The buffer for G-SIIs can lie between 1% and 3.5%, whereas the buffer for O-SIIs can reach a maximum of 2%.[57] For this study, we will primarily consider the O-SII buffer and how it is determined.[58]

Although the European legislator states that the criteria for the identification as O-SII should be considered when determining the buffer (Article 131 (5) of Directive 2013/36/EU), it does not define the scope of this determination. Article 131 (7) of Directive 2013/36/EU merely states that the relevant delegated authority of the member state must justify why the buffer has been set at the respective level, why it is effective in reducing the risk

[56] The EBA provides a list of optional indicators in Annex 2 of the guidelines EBA/GL/2014/10 to be included in the assessment of this second step.
[57] Some countries require additional SyRB, which would be accumulated with O-SII or G-SII buffers (Article 131 (15) of Directive 2013/36/EU).
[58] Despite this may not be the total additional buffer that the institution in question has to meet, as the other buffers mentioned above might also affect it.

and what impact this level has on the internal market. Consequently, the member state or the national competent authority is responsible for setting the buffer level for each O-SII, not a European authority.

In 2015, the responsible authority for the first time decided which institutions are to be classified as otherwise systemically important and set the level of the buffer. The institutions concerned must then meet buffer requirements from 2016 onwards. However, there is still a phase-in period from 2016-2019. Accordingly, there is a stepwise implementation of the buffer, so institutions do not have to comply with the full level of the buffer immediately. To simplify matters and ensure comparability, we use the theoretical actual buffer level in this study and do not consider the phase-in period.

While the procedure for identifying O-SIIs[59] results in scores that can be compared with each other on a national level, the calibration is not uniformly defined. It is therefore not clear which buffer is to be set at which score in different countries. It can therefore happen that institutions from different countries have the same score and can thus be compared in terms of their systemic relevance, but they are not required to have the same buffer. This is due to the fact that the determining authority is not constrained to specific assignments of scores to buffer levels. Apparently, this leeway in setting the buffer can lead to considerable differences in buffer calibration between member states.

## 4.4 Data and Summary Statistics

The EBA publishes a downloadable list of reported O-SIIs on its website for each year (*https://eba.europa.eu*). This list contains the country, the Legal Entity Identifier (LEI), the name of the institution, the final O-SII buffer and the information whether the institution was identified directly, i.e. by reaching the threshold of at least 350 basis points, or by supervisory judgment, i.e. only with the help of additional criteria. Thus, these lists do not show the level of the institution's score. We have collected the buffer levels of these lists for 2015 to 2019, whereby the defined buffer level always takes effect in the following year, i.e. from 2016.

Furthermore, the European Systemic Risk Board (ESRB) provides a so-called "Notification template for Article 131 CRD - Other Systemically Important Institutions (O-SII)", which must

[59] As described in section 4.3.1.

be completed by the reporting authority. These completed templates are publicly available on the ESRB website (*https://www.esrb.europa.eu*), so there should be one completed template for each member state every year.

The template is divided into 7 sections, whereby the 4th section "Reason for O-SII identification and activation of the O-SII buffer" contains the most important information for this study: here the score of the respective institution when applying the (in 4.3.1 described) EBA guidelines are listed. However, in the template it is pointed out that detailed information can also be sent as an Excel file. As the ESRB does not publish the template files that may be attached, the scores are not publicly available for some member states and/or years.

In addition, the ESRB template also includes the category “buffer calibration”. Thus, in this respect, each member state should announce the allocation of scores to a specific buffer level. Again, there are considerable differences in the level of detail of the publication per member state and year. At this point it is often not exactly clear how high the buffer is set for a certain number of the scores. Some member states give a written, more arbitrary explanation why the buffer level is set accordingly. Other member states present the precise numbers in tables. For example, from 300-600 points a 1% buffer is necessary, then from 600-900 1.5%, etc. Obviously, this procedure is more transparent than a rather vague textual explanation.

Thus, although the stringent specifications on the content and filling of the template may suggest that comparisons between countries can be made easily, there are differences in the level of detail and availability of the data between member states. In addition, it is often unknown to what extent more detailed explanations are contained in other files that are not publicly available.

Templates have existed since 2015, whereas the respective buffer level is applied in the following year, i.e. 2016. Into the analyses, we included all available templates with a reported score per institution that were available. We have collected the score values from 2015-2019.

As shown in Table 10, each criterion for identifying an O-SII consists usually of 1-3 indicators. In section 4.6.1 we intend to verify that the scores can be compared between different member states. Thus, the differences in the buffer are the result of different calibration or allocation of the buffer to the score. To support this hypothesis, we have collected at least one indicator per criterion for every institution that is comparable to the one provided by the EBA. As not every indicator was available to us, we partly selected alternative indicators, which are listed in Table 11. The data was provided by the Moody's Analytics Bank Focus database.

To address possible causes for different buffer calibrations between countries and to measure the economic strength of each member state, we have included several macroeconomic variables per country for 2015-2019. To describe the economic situation of a country, we use the explanatory variable *Unemployment rate* as proportion of unemployed in the labour force. Unemployment is an important feature of the economic situation in a country, and can be seen as a highly relevant factor for the re-election of politicians. Thus, governments usually seek to minimize unemployment. Governments might believe that under less stringent capital requirements, banks will have the opportunity to provide more credit to the real economy, and thus help to decrease unemployment[60]. Consequently, the authorities responsible for O-SIIs in countries with higher unemployment may also have a stronger incentive to formulate the capital requirements as less stringently as possible.

*Table 11 - Overview of EBA indicators and alternatives to identify O-SIIs*

| **Criterion** | **EBA-Indicators** | **Alternative indicators** |
|---|---|---|
| Size | Total assets | Total assets |
| Importance | Value of domestic payment transactions | |
| | Private sector deposits from depositors in the EU | Total customer deposits |
| | Private sector loans to recipients in the EU | Gross loans |
| Complexity | Value of OTC derivatives (notional) | Derivatives |
| | Cross-jurisdictional liabilities | Trading liabilities |
| | Cross-jurisdictional claims | |
| Inter-connectedness | Intra financial system liabilities | Deposits from banks |
| | Intra financial system assets | Loans to banks |
| | Debt securities outstanding | |

*This table lists the four criteria for assessing whether an institution is classified as otherwise systemically important. For each criterion, there are a maximum of three indicators specified by the EBA that should be used to measure the criterion. We use at least one of these three indicators for our analysis. Data was not available for every single indicator given by the EBA. Accordingly, we have used comparable indicators for the analysis where data was not available.*

[60] See e.g. Duygan-Bump, Levkov and Montoriol-Garriga 2015.

The explanatory variable *Non-performing loans* as share of all gross loans of a country is double-faced. On the one hand, it provides further information on the economic situation of a country. A high rate of non-performing loans is a signal for frequent business failure and a general economic downturn. On the other hand, the variable signals the degree of systemic instability within the banking system. A loan is classified as non-performing if it is a legally significant loan that is more than 90 days overdue, or if it is assumed that the debtor will not settle its loan obligations in full without realizing collateral.[61]

In addition, we introduce control variables, such as *GDP per capita* as a measure of economic activity in a country, the *Export rate*, which shows a country's interconnectedness and dependence on other countries. The variable *Social benefits* measures the government monetary social benefits provided to households by collective pension schemes or government units, and the *House Price Index* captures price changes in all residential properties purchased by households. We also use *Gross debt*, which is defined under the Treaty on the Functioning of the European Union (Article 126) as the ratio of government debt at the end of the year to gross domestic product at current market prices. We include *Long-term interest rates*, for which the EMU (Economic and Monetary Union) convergence criterion on long-term interest rates takes effect. It states that the average yields for 10-year government bonds in the past year shall be at most 2% higher than the unweighted arithmetic average in the three EU member states with the lowest HICP (Harmonized Index of Consumer Prices) inflation (Article 140 of the Treaty on the Functioning of the European Union). All macroeconomic data stem from Eurostat.

Furthermore, we also include the dummy variable *Authority* as a control variable, which takes the value 1 if the deciding authority is a supervisory authority and 0 if a (presumably more independent) national central banks decide on O-SIIs.

The data is collected for each of the 27 EU member states and Great Britain, Liechtenstein and Iceland, thus for 30 countries in total. Table 12 contains an overview of the variables and summary statistics.

[61] As defined by the ECB and Eurostat.

*Table 12 - Variable Definitions and Summary statistics*

| Variable | Definition | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| **Institution specific** | | | | | | |
| O-SII buffer | Capital buffer for O-SIIs in percentage points. | 909 | 0.0087 | 0.0070 | 0 | 0.0200 |
| Overall score | Score according to EBA/GL/2014/10 representing an institutions systemic riskiness. | 612 | 1,254.98 | 1,079.19 | 1.35 | 7,519.00 |
| Buffer per score | Institutions buffer in percentage points per score value x10,000. | 610 | 0.1216 | 0.1193 | 0 | 0.7547 |
| Total assets | Sum of on-balance sheet assets in mn. EUR. | 828 | 145,549.80 | 325,394.60 | 445.88 | 2,164,713.00 |
| Total customer deposits | Total deposits from customers in mn. EUR. | 802 | 67,299.45 | 139,962.60 | 6.03 | 853,914.00 |
| Gross loans | Gross of mortgage loans, consumer loans, corporate loans and other loans in mn. EUR. | 827 | 77,018.91 | 156,152.50 | 3.71 | 959,665.00 |
| Derivatives | Derivatives amount that is net of derivative assets in mn. EUR. | 778 | 11,763.62 | 45,315.30 | 0 | 515,594.00 |
| Trading liabilities | Comprises liabilities held for trading purposes in mn. EUR. | 403 | 17,202.50 | 35,313.31 | 0 | 292,222.00 |
| Deposits from banks | Interbank deposits and amounts due to financial institutions in mn. EUR. | 817 | 17,622.29 | 40,375.91 | 0.41 | 298,572.00 |
| Loans to banks | Interbank loans and advances in mn. EUR. | 812 | 13,741.73 | 34,479.17 | 0.54 | 235,737.00 |
| Authority | Takes the value 1, if deciding authority is supervisory authority and 0 otherwise. | 940 | 0.3670 | 0.4822 | 0 | 1 |
| **Country specific** | | | | | | |
| Buffer per score country average | Average country buffer per score value. | 98 | 0.1135 | 0.0725 | 0.0323 | 0.3202 |
| Unemployment rate | Share of unemployed in the working population. | 125 | 0.0788 | 0.0443 | 0.0270 | 0.2490 |
| Non-performing loans | Country ratio of legally enforceable loans that are more than 90 days past due and/or the debtor is not expected to repay its loan obligations in full without the realization of collateral to all loans. | 120 | 0.0800 | 0.0978 | 0.0060 | 0.4680 |
| Social benefits | Benefits provided by the government to households to cover the burdens imposed by specific risks or needs. | 125 | 0.1406 | 0.0366 | 0.0590 | 0.2020 |
| GDP per capita | Ratio of GDP to the average population in a given year. | 125 | 30,112.80 | 13099.38 | 13,200.00 | 81,000.00 |
| Export rate | Share of Exports of all goods and services in %. | 120 | 4 | 6.6097 | 0.1 | 31.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Long-term interest rates | Average yield for 10-year government bonds (according to convergence criterion EMU) in %. | 115 | 1.5925 | 1.6153 | -0.25 | 9.67 |
| House Price Index | Measures the price changes of residential housing as a percentage change from a start date. | 120 | 112.5130 | 12.8906 | 98.5 | 167.58 |
| Gross debt | Ratio of government debt at year-end to gross domestic product at current market prices in %. | 120 | 71.3358 | 38.5627 | 8.4 | 181.2 |
| Authority | Takes the value 1, if deciding authority is supervisory authority and 0 otherwise. | 125 | 0.4 | 0.4919 | 0 | 1 |

## 4.5 Methodology

As explained above, the calculation of the score per institution is described very precisely by the EBA. It therefore seems plausible there should be no differences in the level of the scores between member states, i.e. equally systemically important institutions should have comparable scores. The differences in the buffer level should result either from the lack of specifications for the calibration of the scores, or from the fact that each member state can determine the buffer level itself, but has no freedom in calculating the score.

Therefore, the first step of this analysis is to outline the scores can indeed be compared. This means, for example, if an institution has higher total assets or if an institution has e.g. more OTC derivatives, it must also have a higher score. Since every indicator must have a significant positive influence on the institutions' score in order for this condition to be met, we perform the following panel regression:

$$\ln(Score_{i,t}) = \rho_i + \boldsymbol{\gamma} \ln(\boldsymbol{Indicator_{i,t}}) + \boldsymbol{\mu}\, \boldsymbol{Authority_j} + u_{i,t} \quad (1)$$

where $Score_{i,t}$ denotes the dependent variable *Score* of every institution $i$ at time $t$.[62] The vector $Indicator_{i,t}$ describes the indicator variables (e.g. total assets). We take the natural logarithm of the variables in order to make different units or levels of the variable values comparable.

We also include the dummy variable $\boldsymbol{Authority_j}$ as a control variable per country $j$, which takes the value 1 if the national authority deciding on the O-SII buffer is a supervisory authority

[62] Hence, the cross-sectional value for $Score_i$ would be equal to $OSII\ Score_i$.

and zero if it is a central bank, as central banks tend to be more independent from political interference than supervisory authorities who are usually subordinate to the finance minister.

If it is ensured that the scores can be compared with each other, the next step will show that the allocation of the buffer to a certain number of scores is not carried out uniformly between the member states. To measure the difference in the buffer calibration, we set the buffer level in relation to the score by dividing the buffer in percentage points by the score ranging from 0 to 10,000. To obtain more scalable values we multiply the result by 10,000:

$$\theta_{i,t} = \frac{Buffer_{i,t}}{Score_{i,t}} * 10{,}000$$

where $Buffer_{i,t}$ is the O-SII buffer in year $t$ for institution $i$ in percentage points and $Score_{i,t}$ the overall score value of institution $i$ for year $t$. If the distribution of the buffer in terms of the points achieved by the institution was uniform across all institutions or countries, i.e. the European legislator would set the buffer level according to a specific score level, $\theta_{i,t}$ would have to be constant across countries. However, one can see in Table 12 that this value fluctuates between 0.0323 and 0.3202. Hence, it is to be expected that this difference is due to the decision makers of each member state with respect to the buffer settling or calibration of the scores. Since the buffer per score value is only available per institution, but we would like to elaborate on the country-specific differences, we take averages of all banks considered otherwise systemically important per country:

$$\varphi_{j,t} = \frac{\sum_{i=1}^{z} \theta_{i,t}}{z}$$

where the sum over $\theta_{i,t}$ adds all buffer per score values of all O-SII institutions in a country $j$ and is then divided by the number of O-SII institutions $z$ in one country $j$.

The following two regressions, both with and without control variables, were performed to show how macroeconomic factors could affect the buffer calibration:[63]

$$\begin{aligned}\varphi_{j,t} = \beta_0 + \beta_1 Unemployment\ rate_{j,t} + \beta_2 Social\ benefits_{j,t} + \beta_3 Authority_j + \\ \beta_4 Export\ rate_{j,t} + \beta_5 GDP\ per\ capita_{j,t} + \beta_6 Long\ term\ interest\ rate_{j,t} + \\ \beta_7 House\ Price\ Index_{j,t} + \beta_8 Gross\ debt_{j,t} + u_{j,t},\end{aligned} \quad (2)$$

[63] For each regression, we performed a Hausman test for fixed effects and a Modified Wald test for groupwise heteroskedasticity. We used the appropriate models or robust standard errors accordingly. Of course, when using fixed effects models, the time- and country-specific effects have to be added to the equation. When using random effects models, the within-entity error term has to be included.

$$\varphi_{j,t} = \beta_0 + \beta_1 Non\ performing\ loans_{j,t} + \beta_2 Social\ benefits_{j,t} + \beta_3 Authority_j + \beta_4 Export\ rate_{j,t} + \beta_5 GDP\ per\ capita_{j,t} + \beta_6 Long\ term\ interest\ rate_{j,t} + + \beta_7 House\ Price\ Index_{j,t} + \beta_8 Gross\ debt_{j,t} + u_{j,t}, \quad (3)$$

where the dependent variable is the buffer per score country average $\varphi_{j,t}$. For equation 2, we take the *Unemployment rate* as an explanatory variable to describe the dependence of the buffer calibration on the economic situation of the country, since the unemployment rate is an indicator of the economic situation. In equation 3, on the other hand, we use the rate of *Non-performing loans* as an explanatory variable, which in turn shows the dependence of the buffer per score value on the situation of the banking system. The dummy variable *Authority* controls for the influence of the deciding authority on the buffer calibration and takes the value 1 if the national authority deciding on the O-SII buffer is a supervisory authority and zero if it is a central bank. In addition, the variables *Social benefits, Export rate, GDP per capita, Long-term interest rate, House Price Index* and *Gross debt* described in section 4 are used as control variables.

As robustness checks, we run regressions 2 and 3 without the G-SIIs to prevent distortion of possible outliers. We also executed the regressions with the buffer actually applied, i.e. also including the SyRB and the G-SII buffer and taking the buffer level the institution has actually to fulfil. Moreover, we also run a robustness check with country dummies by again defining the buffer per score value as the dependent variable and the country dummies as the explanatory variables to extract individual differences in score calibration per country.

## 4.6 Results and Interpretation

### 4.6.1 Score Comparability between Member States

As a first step, it is necessary to show that the scoring process is comparable across the European Union. As shown in equation 1, we run a panel regression to demonstrate the connection between the indicators and the assigned O-SII scores. Table 13 shows the correlation matrix of the indicator variables. The explanatory variables are very strongly and significantly correlated with each other, which is why we do not use them in a single regression. Instead, we perform a regression for each criterion, both with and without the control variable *Authority*.

*Table 13 - Correlation matrix of bank specific factors*

| | Total assets | Customer deposits | Deposits from banks | Gross loans | Loans to banks | Trading liabilities | Deriva-tives | Authority |
|---|---|---|---|---|---|---|---|---|
| Total assets | 1 | | | | | | | |
| Customer deposits | 0.9644*** | 1 | | | | | | |
| Deposits from banks | 0.9208*** | 0.8491*** | 1 | | | | | |
| Gross loans | 0.9597*** | 0.9820*** | 0.8434*** | 1 | | | | |
| Loans to banks | 0.8691*** | 0.7972*** | 0.9046*** | 0.7809*** | 1 | | | |
| Trading liabilities | 0.7292*** | 0.6313*** | 0.6738*** | 0.6557*** | 0.6021*** | 1 | | |
| Derivatives | 0.8035*** | 0.6832*** | 0.7620*** | 0.6383*** | 0.6989*** | 0.6766*** | 1 | |
| Authority | 0.2230*** | 0.1621*** | 0.2453*** | 0.1720*** | 0.2917*** | 0.2419*** | 0.2155*** | 1 |

*This table reports the correlation matrix of the alternative indicators described in Table 2, which were used to test the comparability of the scores, in order to avoid combining strongly correlated variables in the regression and to prevent measurement errors. ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

Table 14 shows the results from the regression for equation 1. The results show except for *Trading liabilities* and in the single factor regression *Loans and advances to banks,* all estimates are highly significant and always have a positive influence on the score. The lack of significance for *Trading liabilities* is due to the fact that there is a relatively large deviation between the alternative indicator (all trading liabilities) and the indicator required by the EBA (cross-jurisdictional liabilities). For example, one can see a 1% increase in total assets leads to an increase of 0.147% and 0.226% respectively, in the score assigned to the institution. Moreover, the dummy variable authority is also significant in each regression with a negative coefficient. This means that if the deciding authority is a supervisory authority and not a central bank, the score of an institution is lower. This could be one first indication of the political influence on the implementation of capital regulation, as central banks tend to be more independent from political interference than supervisory authorities[64] who are directly or indirectly subordinate to the finance minister.

[64] Of course, the independence of national central banks is not always perfect and debated for already a long time (Simons 1936). Even today, there is a substantial debate about the political influence on central banks (Camous and Matveev 2021).

*Table 14 - Regressions on comparability of scores between institutions*

| | ln(score) | | ln(score) | | ln(score) | | ln(score) | | ln(score) | | ln(score) | | ln(score) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ln(Total Assets) | **0.147*** ** | **0.226*** ** | | | | | | | | | | | | |
| | (-4.30) | (-6.52) | | | | | | | | | | | | |
| ln(Total customer deposits) | | | **0.158*** ** | **0.204*** ** | | | | | | | | | | |
| | | | (-4.55) | (-5.72) | | | | | | | | | | |
| ln(Gross loans) | | | | | **0.165*** ** | **0.239*** ** | | | | | | | | |
| | | | | | (-5.06) | (-6.70) | | | | | | | | |
| ln(Derivatives) | | | | | | | **0.0479** ** | **0.0735*** ** | | | | | | |
| | | | | | | | (-3.71) | (-5.40) | | | | | | |
| ln(Trading liabilities) | | | | | | | | | 0.0229 | 0.0385 | | | | |
| | | | | | | | | | (-1.27) | (-1.84) | | | | |
| ln(Deposits from banks) | | | | | | | | | | | **0.0645** ** | **0.0899*** ** | | |
| | | | | | | | | | | | (-3.30) | (-4.29) | | |
| ln(Loans and advances to banks) | | | | | | | | | | | | | 0.0341 | **0.0640** ** |
| | | | | | | | | | | | | | (-1.55) | (-2.98) |
| Authority | | **-0.836*** ** | | **-0.677*** ** | | **-0.835*** ** | | **-0.687*** ** | | **-0.495** ** | | **-0.652*** ** | | **-0.641*** ** |
| | | (-5.25) | | (-4.34) | | (-6.01) | | (-4.29) | | (-2.74) | | (-3.96) | | (-4.09) |
| Constant | **5.192*** ** | **4.669*** ** | **5.208*** ** | **4.997*** ** | **5.094*** ** | **4.674*** ** | **6.504*** ** | **6.611*** ** | **6.646*** ** | **6.775*** ** | **6.236*** ** | **6.273*** ** | **6.482*** ** | **6.497*** ** |
| | (-15.10) | (-13.75) | (-15.11) | (-15.01) | (-16.31) | (-13.69) | (-73.92) | (-79.06) | (-53.81) | (-41.40) | (-39.88) | (-39.26) | (-40.38) | (-40.37) |
| Observations | 568 | 568 | 557 | 557 | 568 | 568 | 536 | 536 | 297 | 297 | 559 | 559 | 556 | 556 |
| R-squared (overall) | 0.0654 | 0.2099 | 0.1250 | 0.2327 | 0.0877 | 0.2341 | 0.0471 | 0.1571 | 0.0243 | 0.0893 | 0.0196 | 0.1086 | 0.0186 | 0.1191 |

*This table reports the regression for comparability of the scores, where the score is taken as the dependent variable and a regression is performed with each of the explanatory variables. The explanatory variables are total assets, total customer deposits, gross loans, derivatives, trading liabilities, deposits from banks and loans and advances to banks. The dummy variable authority is a control variable and takes the value 1 if the authority in question is a supervisory authority and 0 if it is a central bank. For all regressions, the natural logarithm was used for both the dependent and the explanatory variables, so that the different levels of the parameters can be compensated for. z statistics in parentheses ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

Overall, it can be stated at this point that there are no significant differences in the allocation of scores per institution. So, if a criterion is higher at an institution, the institution also receives the higher score and vice versa. Therefore, we expect the different levels of the buffer per score result from the setting of the buffer, as there are no uniform EU regulations for its setting, in contrast to the score.

### 4.6.2 The Macroeconomic Drivers of the O-SII Buffer

Having shown that there are no significant differences in the level of scoring between member states, we take a closer look at the potential reasons for the differences in the allocation of the buffer per score. In particular, we study which macroeconomic country specific variables could have an influence on the calibration of the buffer, and whether there are advantages or disadvantages for the respective banks in some countries compared to others.

Especially in countries where the economic situation is comparatively difficult, the national authorities may have reason to be less strict on banks' capital adequacy and therefore require a lower buffer, although the score achieved would have led to a higher buffer in a more economically powerful country. As described in section 4, the explanatory variables *Unemployment rate* and *Non-performing loans* should reflect the economic situation of a country and the banking system and show whether deciding authorities have incentives to set less strict rules on buffer application. To check the interdependence between the explanatory variables and the control variables we report the correlation matrix of all variables in Table 15.

The correlation matrix shows that *Non-performing loans* and *Unemployment rate* are strongly correlated, which is why we do not use both variables in a single regression.

The results of both the unemployment rate and the NPL regression (equation 2 and 3) are reported in Table 16.[65]

[65] Due to the very high statistical significance of our results, we allocated stars (indicating econometrical significance) differently than in the first chapters of this dissertation.

*Table 15 - Correlation matrix of macroeconomic factors*

| | Unemployment rate | NPL | Social benefits | Authority | Export rate | GDP per capita | House price index | Long-term interest rate | Gross debt |
|---|---|---|---|---|---|---|---|---|---|
| Unemployment rate | 1 | | | | | | | | |
| Non-performing loans | 0.6885*** | 1 | | | | | | | |
| Social benefits | 0.4730*** | 0.2093* | 1 | | | | | | |
| Authority | -0.3572*** | -0.4059*** | 0.0460 | 1 | | | | | |
| Export rate | -0.1206 | -0.2115* | 0.2462** | 0.2199* | 1 | | | | |
| GDP per capita | -0.2564** | -0.3203*** | -0.0668 | 0.3726*** | 0.1667 | 1 | | | |
| House price index | -0.4889*** | -0.2953** | -0.3598*** | -0.0231 | -0.0633 | 0.1279 | 1 | | |
| Long-term interest rate | 0.5478*** | 0.7706*** | 0.0939 | -0.387*** | -0.2842** | -0.4709*** | -0.1644 | 1 | |
| Gross debt | 0.6923*** | 0.6644*** | 0.6304*** | -0.3105*** | 0.1492 | -0.1992* | -0.2279* | 0.4578*** | 1 |

*This table reports the correlation matrix of the macroeconomic indicators described in section 4 in order to avoid combining strongly correlated variables in the regression and to prevent measurement errors. ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

*Table 16 - The influence of economic factors on the required O-SII buffer per score*

| | Buffer per score country average | | | Buffer per score country average | | |
|---|---|---|---|---|---|---|
| Unemployment rate | **-0.3499**** | **-0.3274*** | **-0.6203**** | | | |
| | (-2.97) | (-2.11) | (-2.66) | | | |
| Non-performing loans | | | | **-0.2111**** | **-0.1720*** | **-0.3093*** |
| | | | | (-2.47) | (-2.06) | (-2.49) |
| Social benefits | | -0.1216 | 0.4566 | | -0.2037 | 0.3498 |
| | | (-0.33) | (0.92) | | (-0.57) | (0.69) |
| Authority | | 0.0103 | -0.0284 | | 0.0075 | -0.0378 |
| | | (0.38) | (-0.78) | | (0.27) | (-1.00) |
| Export rate | | **0.0051**** | **0.0062**** | | **0.0050*** | **0.0062**** |
| | | (2.63) | (2.88) | | (2.47) | (2.77) |
| GDP per capita | | | 0.0000 | | | 0.0000 |
| | | | (0.77) | | | (0.54) |
| House Price Index | | | -0.0004 | | | -0.0005 |
| | | | (-1.16) | | | (-1.19) |
| Long-term interest rate | | | **0.0127*** | | | 0.0101 |
| | | | (2.35) | | | (1.95) |
| Gross debt | | | -0.0011 | | | **-0.0013*** |
| | | | (-1.73) | | | (-2.04) |
| Constant | **0.1362***** | **0.1298**** | 0.1643 | **0.1274***** | **0.1308**** | **0.1851*** |
| | (6.90) | (2.71) | (1.95) | (7.05) | (2.68) | (2.07) |
| Observations | 98 | 95 | 86 | 95 | 95 | 86 |
| R-squared (overall) | 0.1364 | 0.3095 | 0.4144 | 0.0912 | 0.2721 | 0.3723 |

*This table reports the regression on buffer per score country average as dependent variable. As explanatory variables the unemployment rate and the non-performing loans rate are used, where, due to high correlation, not both variables are used in a single regression. The dummy variable authority is taken as a control variable, which takes the value 1 if the deciding authority is a supervisory authority and 0 if it is a central bank. In addition, the macroeconomic variables social benefits, export rate, GDP per capita, house price index, long-term interest rate and gross debt described in section 4 are used as control variables. z statistics in parentheses ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

The results show significant values for unemployment rate and NPL for all six regressions. The coefficients are always negative. This means if for example, the unemployment rate increases by 1%, the country average of the buffer per score decreases by 0.0035 in the single variable regression on *Unemployment rate*. Whereas in the multi-variable regression the coefficient is even -0.6203, which means if unemployment is 1% higher in one country, the buffer per score point is 0.0062 smaller. Thus, for a given score, less buffer has to be provided if unemployment is higher. Although this seems very small at first glance, the magnitude becomes clear when put into perspective. For example, one can consider an institution that has a score of 1,500 basis points and assume that it has a 2% buffer in a country. If the unemployment rate is 1% higher,

this would imply the institution only needs to have a buffer of 1.9% instead of 2% for the single variable regression. This effect is intensified accordingly for institutions that have a high score. For example, instead of having a 2% buffer in a country with lower unemployment, an institution with a score of 5,000 only has to have a 1.83% buffer in a country with higher unemployment, which obviously makes a rather big difference. The same results hold for the non-performing loans. If the NPL-rate increases, the buffer per score level decreases, and vice versa. Thus, if the rate of non-performing loans in a country increases by 1%, the buffer per score decreases by 0.0021 percentage points. This means that if the rate of non-performing loans is higher in a country, the banks are being rewarded because they have to maintain a lower capital buffer than in countries where there are fewer non-performing loans. These results persist also with the introduction of control variables.

As a result, we can affirm both of our Hypotheses H1 and H2:

States do impose different capital buffer requirements for their O-SIIs, even though the scoring process is comparable between the states. In fact, the capital buffer calibration for O-SIIs depends on the economic situation of the respective states.

The higher O-SII buffer also influences the *Minimum Requirement for own funds and Eligible Liabilities* (MREL) according to Directive 2014/59/EU. As a result, the difference in the buffer calibration effects European banks twice: directly via the implemented capital requirements concerning the O-SII buffer and indirectly as the level of MREL is influenced by the buffer. This connection shows the importance of a comparable equity regulation to minimize regulatory arbitrage and unfair advantages between European nations.

The O-SIIs also include institutions that are simultaneously G-SIIs. Although they achieve a comparatively high O-SII score, they cannot be allocated an adjusted buffer, as this is limited by law to a maximum of 2%. To test this effect, we also run the regressions as a robustness check without G-SIIs (Appendix Table A). In addition, we also run the regressions with the actual buffer allocated to the institutions in case they have a G-SII buffer or SyRB (Appendix Table B). In both scenarios, we find no significant deviations from the main results.

In addition, as a robustness check we run regression with country dummies, where again the buffer per score is the dependent variable (Appendix Table C). Here, we find a clear tendency for southern European countries such as Cyprus, Greece, Spain and Italy to have a negative coefficient, which lowers the buffer per score for banks and thus favours banks from these countries. Of all the countries, Germany has the highest significant positive coefficient, which

means that banks in Germany in particular have to have a higher capital buffer for the same score than in other European countries.

In summary, there are clear differences in the distribution of buffers for the O-SII score. Despite the attempt to standardize European regulations, the allocation of buffers is heterogeneous and ultimately determined by the respective national institutions in charge as well as strongly dependent on the economic situation of the country.

## 4.7 Conclusion

While there is an extensive amount of literature exploring the relationship between banking regulation and financial intuitions, only few studies look into the connection between the state of the economy and the strictness of the implementation of rules. Our study uses a unique panel data set combining bank specific and economic data between 2015 and 2019 to analyse if the scoring process to identify and quantify systemically important institutions in 30 European countries is comparable, as intended by the EBA. In a second step, we analyse if the score as such is the driver of state specific capital requirements or if the economic situation of a state influences the decision to determine equity requirements for large banks.

To the best of our knowledge, no other study addresses this question using our data set or our methodology. As far as we know, there is only one other project looking into this specific issue. In line with the findings by Sigmund (2020), our estimates suggest the scoring process between the participating member states is comparable. What differs significantly is the assigned equity which is required by the national regulators according to the calculated score. Our evidence shows that economic factors, such as the unemployment rate or the volume of NPLs within a country, influence the capital requirements of O-SIIs. Therefore, our results suggest states have the leeway to adjust the mandatory equity capital of banks and use that leeway, considering their respective (macro-)economic situation.

We argue that regulators adjust the required equity capital because they believe this might benefit the real economy. Banks could improve their lending business and create more liquidity when facing less strict regulations. However, this connection is not as evident as it seems, as there are different hypotheses concerning the relationship between banks' equity and lending discussed in the literature. If in fact higher capital requirements improve banks' lending activi-

ties, to lower capital requirements in an economical distressed situation could even be counterproductive and additionally might lead to gambling for resurrection (as suggested by Dewatripont and Tirole 2012). In fact, to accept lower capital requirements for banks in countries with higher levels of NPLs looks very counterproductive if the overarching objective of the respective regulation is to enhance systemic stability. However, there is further scope for research to identify the clear connection between capital and lending as well as to analyse where the tipping point of the possible trade-off might be.

Our results have several political implications. While the European Union managed to harmonize the scoring process to identify systemically important institutions, it did not harmonize the required amount of equity assigned to the respective score. This leads to the result that equally important institutions are treated differently across states within Europe. As a result of this national leeway, the regulators' decision to demand certain equity levels depends on the state of the economy and not solely on the actual importance of one institution to the financial stability of a country. The national distinctions lead to different market preconditions for banks in Europe, which gives some a competitive advantage or disadvantage and might also result in the possibility to extract regulatory arbitrage within the European Union.

# Appendix Chapter 4

*Appendix 4—A: The influence of economic factors on the required O-SII buffer per score (without G-SIIs)*

| | Buffer per score country average | | | Buffer per score country average | | |
|---|---|---|---|---|---|---|
| Unemployment rate | **-0.3351**** | -0.3204 | **-0.5723*** | | | |
| | (-2.82) | (-1.89) | (-2.21) | | | |
| Non-performing loans | | | | **-0.2153*** | -0.1764 | **-0.3149*** |
| | | | | (-2.56) | (-1.94) | (-2.28) |
| Social benefits | | -0.0991 | 0.6020 | | -0.1585 | 0.5011 |
| | | (-0.26) | (-1.13) | | (-0.42) | (-0.92) |
| Authority | | 0.0094 | -0.0350 | | 0.0059 | -0.0438 |
| | | (-0.33) | (-0.92) | | (-0.2) | (-1.11) |
| Export rate | | **0.0058**** | **0.0022**** | | **0.0057**** | **0.0071**** |
| | | (-2.90) | (-3.17) | | (-2.72) | (-3.03) |
| GDP per capita | | | 0.0000 | | | 0.0000 |
| | | | (-0.59) | | | (-0.34) |
| House Price Index | | | -0.0004 | | | -0.0005 |
| | | | (-1.04) | | | (-1.14) |
| Long-term interest rate | | | **0.0120*** | | | 0.0100 |
| | | | (-2.00) | | | (-1.74) |
| Gross debt | | | -0.0013 | | | **-0.0015*** |
| | | | (-1.95) | | | (-2.18) |
| Constant | **0.1385***** | **0.1270**** | 0.1629 | **0.1311***** | **0.1259***** | **0.1874*** |
| | (-6.68) | (-2.53) | (-1.80) | (-8.21) | (-2.46) | (-1.96) |
| Observations | 98 | 95 | 86 | 95 | 95 | 86 |
| R-squared (overall) | 0.1302 | 0.3365 | 0.4370 | 0.0955 | 0.3033 | 0.4015 |

*This table reports the regression on buffer per score country average as dependent variable. Institutions that are both O-SIIs and G-SIIs are omitted. As explanatory variables the unemployment rate and the non-performing loans rate are used, where, due to high correlation, not both variables are used in a single regression. The dummy variable authority is taken as a control variable, which takes the value 1 if the deciding authority is a supervisory authority and 0 if it is a central bank. In addition, the macroeconomic variables social benefits, export rate, GDP per capita, house price index, long-term interest rate and gross debt described in section 4 are used as control variables. z statistics in parentheses ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

*Appendix 4—B: The influence of economic factors on the required SII buffer per score (when having different buffers, the one which has to be applied)*

| | Buffer per score country average | | | Buffer per score country average | | |
|---|---|---|---|---|---|---|
| Unemployment rate | **-0.3490**** | **-0.3260*** | **-0.6178**** | | | |
| | (-2.96) | (-2.10) | (-2.65) | | | |
| Non-performing loans | | | | **-0.2103*** | **-0.1708*** | **-0.3071*** |
| | | | | (-2.46) | (-2.04) | (-2.47) |
| Social benefits | | -0.1247 | 0.4526 | | -0.2073 | 0.3454 |
| | | (-0.34) | (-0.91) | | (-0.58) | (-0.68) |
| Authority | | 0.0103 | -0.0284 | | 0.0075 | -0.0376 |
| | | (-0.38) | (-0.78) | | (-0.26) | (-0.99) |
| Export rate | | **0.0051**** | **0.0063**** | | **0.0050**** | **0.0063*** |
| | | (-2.64) | (-2.90) | | (-2.48) | (-2.79) |
| GDP per Capita | | | 0.0000 | | | 0.0000 |
| | | | (-0.77) | | | (-0.54) |
| House Price Index | | | -0.0004 | | | -0.0005 |
| | | | (-1.15) | | | (-1.17) |
| Long-term interest rate | | | 0.0127 | | | 0.0102 |
| | | | (-2.35) | | | (-1.95) |
| Gross debt | | | -0.0011 | | | **-0.0013*** |
| | | | (-1.72) | | | (-2.03) |
| Constant | **0.1362***** | **0.1302**** | 0.1642 | **0.1274***** | **0.1312**** | **0.1847*** |
| | (-6.90) | (-2.72) | (-1.95) | (-7.05) | (-2.69) | (-2.07) |
| Observations | 98 | 95 | 86 | 95 | 95 | 86 |
| R-squared (overall) | 0.1360 | 0.3104 | 0.4151 | 0.0911 | 0.2734 | 0.4527 |

*This table reports the regression on buffer per score country average as dependent variable. For institutions that have to fulfil more than one equity buffer (O-SII buffer, G-SII buffer or SyRB) the actual buffer the respective institution has to fulfil is used. As explanatory variables the unemployment rate and the non-performing loans rate are used, where, due to high correlation, not both variables are used in a single regression. The dummy variable authority is taken as a control variable, which takes the value 1 if the deciding authority is a supervisory authority and 0 if it is a central bank. In addition, the macroeconomic variables social benefits, export rate, GDP per capita, house price index, long-term interest rate and gross debt described in section 4 are used as control variables. z statistics in parentheses ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

*Appendix 4—C: The influence of country dummies on the required O-SII buffer per score*

| | Buffer per score country average |
|---|---|
| AT | **0.144*****|
| | (8.15) |
| BE | **0.0680*****|
| | (56.94) |
| BG | **0.0258*****|
| | (5.54) |
| CY | -0.00483 |
| | (-0.81) |
| DE | **0.235*****|
| | (101.87) |
| EE | **0.0197*** |
| | (2.22) |
| ES | **-0.0411*****|
| | (-35.97) |
| FI | **0.0324*** |
| | (2.05) |
| FR | **-0.0183*****|
| | (-7.15) |
| GR | **-0.0402*****|
| | (-54.11) |
| HR | **0.115*****|
| | (5.17) |
| HU | **0.0185*****|
| | (14.95) |
| IE | -0.000684 |
| | (-0.08) |
| IS | **-0.0119*****|
| | (-19.48) |
| IT | **-0.0372*****|
| | (-10.32) |
| LT | 0.00339 |
| | (1.92) |
| LU | **0.0607*****|
| | (5.55) |
| MT | **0.0225**** |
| | (3.06) |
| NL | **0.112*****|
| | (88.88) |
| PL | **-0.0315*****|
| | (-11.67) |
| PT | **-0.0345*****|
| | (-37.99) |
| RO | **0.129*****|
| | (6.92) |
| SE | 0.0126 |
| | (0.83) |
| SI | **-0.0465*****|
| | (-30.93) |
| Constant | **0.0812*****|
| | (133.6) |
| Observations | 98 |
| R-squared | 0.9412 |

*This table reports the regression on buffer per score country average as dependent variable. As explanatory variables 29 country dummies are used.t statistics in parentheses ***denotes significance at the 0.1% level; ** denotes significance at the 1% level; * denotes significance at the 5% level.*

# 5 General Conclusion

## 5.1 Summary of the Main Results

In this thesis, I analyse the connection between financial systems and the economy. In my first two projects, I focus on the impact of regional banking systems on local economies and local firms. The results suggest that a diverse and decentralized financial system is beneficial for the respective regions. In the third project, I focus on larger banks and show how the economic situation on a national level influences the behaviour of regulators who have the possibility to adjust capital requirements. This leads to different framework conditions for banks depending on the economic situation of their state, despite the effort to harmonize regulation within Europe. The overall results provide new insights into how banks influence the economy and how the economy (indirectly) can have influence on banks as well.

In my first project, which forms the second chapter of this dissertation, my co-authors and I use panel data on regional levels to study the influence of regional banking systems on local wealth and inequality in five European countries. We know from the literature that banks behave differently depending on their characteristics such as the size, the legal form, their business purposes and their internal company structure. As the varying banking forms have different advantages and disadvantages for customers, a diverse banking system with various banks to choose from should be beneficial. Bank balance sheet data and information on the legal forms of the banks within a NUTS 2 area (i.e. one administrative level below state level or two below the national level) is used to analyse the influence on wealth and inequality in the respective regions. The econometrical analyses demonstrate the positive impact of a multiplex regional banking system on GDP per capita, the unemployment rate and the primary private household income per capita. The results support the insights from the literature and show the positive influence of small regional banks. The outcome suggests that certain banking forms are beneficial in different situations. For example, public savings banks especially reduce local unemployment whereas co-operative banks improve regional GDP per capita, and LLCs have a particularly large impact on primary private household income per capita.

In the third chapter, I specify the influence of regional banking systems on certain participants of local economies. I extend the panel data set of Chapter 2 to include firm balance sheet data and use European criteria to filter out small and medium-sized enterprises. This is undertaken as the foundations in the literature suggest the (often smaller) regional banks should have a

particularly positive effect on smaller companies. Local and decentralized banks are better able to analyse soft information. This ability should be of advantage when working with new companies and smaller firms where, for example, the ability of the management is key for the success of such enterprises. The econometrical analyses in this chapter show the strong positive influence of public savings banks, co-operative banks and LLCs on SMEs. The evidence suggests that the positive impact of smaller banks is also apparent when observing performance of all firms within a local economy, but is clearer when looking on SMEs in particular.[66]

In the fourth chapter, the connection between financial systems and the economy is analysed from a different perspective. Progressing from a regional level of observation, we concentrate on comparing country information. This is because banking regulation usually has supranational and national aspects. The literature suggests that politicians might be motivated to influence the regulation of financial institutions to the benefit of their respective country or their own re-election. Therefore, the way capital requirements for O-SIIs are determined within Europe is an appropriate setting to test the behaviour of governments and regulators. In panel regressions including information from the EBA, bank balance sheet data and economic data, we demonstrate that the processes to identify systemically important institutions within Europe are comparable. Building on this finding, we show that national regulators adjust the equity requirements for such institutions depending on the economic situation of their respective country. Therefore, capital requirements are influenced by factors not necessarily connected to the systemic importance of large banks. This unequal treatment leads to different business environments for otherwise comparable banks, depending on the country in which they are located. Such varying business environments are relevant, especially as the target was to harmonize banking regulation for large institutions in Europe.

This dissertation has several important political implications. Firstly, the European Union has to revise their regulatory policy. Most regulatory requirements burden smaller banks disproportionately, as regulation usually causes overheads in institutions (Alessandrini et al. 2016). The increasingly complex and unclear laws, regulations and demands are particularly challenging for small banks as they cannot afford large departments to deal with them. In addition, it is worth noticing that small banks normally do not pose a threat to systemic financial stability. Secondly, the European Central bank should revise its monetary policy. Regional banks usually depend heavily on interest bearing business which results, among other things, from their close

[66] The strongest connection is presented between co-operative banks and SMEs which aligns with the historical reason why most co-operative banks were initially founded: as an institution of self-help to benefit all members of the co-operative.

link to local private and corporate customers. The very long-lasting low interest rate period makes traditional banking business unattractive, which disproportionately affects small banks. Thirdly, the European Union should think about a plan to harmonize all banking regulation and equalise the banking systems. It is worth preserving variety within banking systems as diversity improves economic and firm performance. Due to this, regulation should consider the different forms of institutions and business purposes of banks. This is evident in Europe's failure to implement equal regulations for comparable large and systemically important institutions within the different member states.

## 5.2 Outlook

The results of this dissertation also provide scope for further research. In the second chapter, I present evidence for the positive influence of smaller banks and in particular public savings banks, co-operative banks and LLCs on regional economies. The first project resulting from those insights is to analyse whether diverse regional banking systems not only enhance local economies but also lessen the negative impact of crises. Given the results of my thesis, I expect that small banks and decentral banking systems should cushion economic crises as having the proper ability to analyse soft information is helpful in such unusual situations. Furthermore, smaller banks tend to form long term bank-client relationships which result in implicit liquidity insurances for distressed times. As a matter of fact, in a project not part of this dissertation we find evidence which support the results of Chapter 2. In the paper "*Under Italy's Sun or in an Economic Shadow - The Effects of Regional Banking Systems on Economic Development in the Italian Mezzogiorno Regions*" which I wrote with Hans-Peter Burghof and Marcel Gehrung[67], we show that the decentralized regional banking systems of northern Italy help buffer economic shocks, compared to the southern Mezzogiorno regions.

A second project for further research could be to analyse the contribution of diverse banking systems to financial stability. Given the results of my dissertation, I expect decentral banking systems, with different institutions on regional levels, to improve financial stability. One reason is having various forms of banks should lead to a diversification effect on institutional level. Another reason is that local banks should be better able to evaluate the firms in their respective reasons and therefore have sound skills in separating good loans from bad loans. In a project

[67] See Burghof, Gehrung and Schmidt (2021b).

not part of this dissertation, I pursue this research idea together with Hans-Peter Burghof, Marcel Gehrung and Julia Juric.[68]

In the third chapter, I explain the enhancing effects of regional banking systems on firm performance, especially on SMEs. The evidence suggests that smaller banks have a positive influence on firms in general, but the strongest connection is presented for the impact of public savings banks, co-operative banks and LLCs on SMEs. The econometrical analyses even show that PLCs, which are usually large and hierarchically structured banks, have negative effects on firm performance in general. Considering the relation between smaller banks and smaller firms, there is scope for further research to study the influence of diverse banking systems on entrepreneurial activity. Given the results of this dissertation, I expect a significant positive correlation between the presence of different and mainly small banking institutions and the creation of new firms.[69] In a new project separate from this dissertation, I pursue this research idea together with Marco Bade from the TU Berlin and the University of Potsdam, and Nazmie Sabani from the University of Hohenheim.

In my fourth chapter, it is shown that national financial regulators adjust the capital requirements of their O-SIIs depending on their economic situation. Although the process to identify systemically important institutions is comparable, the equity requirements assigned to otherwise comparable banks are not. Countries with sound economic conditions implement capital rules stricter than countries experiencing economically difficult times. Governments try to influence the decision of regulators because they think that higher capital requirements lower the banks' ability as financial intermediary and reduce bank lending. While this assumption presents one strand within the literature, the other strand of literature shows a positive connection between equity and lending. If the latter is the case, the efforts to reduce capital requirements of some nations may even worsen their situation. Given the results of my dissertation, I believe there is a trade-off between equity and lending, with equity having a positive influence until a certain level. From this tipping point, it probably leads to less lending. In addition, I expect capital to have a different influence depending on the business structure of banks, their customer deposits and their main source of refinancing. Large institutions who are heavily active on capital markets could face different influences from higher capital requirements as equity might have a (positive) signalling effect. Smaller banks within associations where they have close ties to each other, and large central institutions within those associations, might profit less from

[68] Hans-Peter Burghof, Marcel Gehrung and Julia Juric are all from the University of Hohenheim.

[69] This connection would be in line with Hasan et al. (2017) who studied the respective influence of co-operative banks in Poland between 2006 and 2012.

higher capital as they depend to a lesser extent on the capital market. To better identify the connection between capital and lending and the influence of equity requirements on banks, I am currently working on a research project with Robert Webb from the University of Stirling, Aristeidis Dadoukis from the University of Nottingham as well as Giulia Fusi from the University of Nottingham and the European Central Bank.

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