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Regional Bank Efficiency and its Effect on Regional Growth in "Normal" and "Bad" Times

UNIVERSITÄT DUISBURG ESSEN

#586

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

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Ruhr Economic Papers #586

Responsible Editor: Volker Clausen

ISSN 1864-4872 (online) – ISBN 978-3-86788-680-2

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Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

http://dx.doi.org/10.4419/86788680
ISSN 1864-4872 (online)
ISBN 978-3-86788-680-2

Ansgar Belke, Ulrich Haskamp, and Ralph Setzerg[1]

Regional Bank Efficiency and its Effect on Regional Growth in "Normal" and "Bad" Times

Abstract

The financial crisis affected regions in Europe in a different magnitude. This is why we examine whether regions which incorporate banks with a higher intermediation quality grow faster in "normal" times and are more resilient in "bad" ones. For this purpose, we measure the intermediation quality of a bank by estimating its profit and cost efficiency while taking the changing banking environment after the nancial crisis into account. Next, we aggregate the efficiencies of all banks within a NUTS 2 region to obtain a regional proxy for financial quality in twelve European countries. Our results show that relatively more profit efficient banks foster growth in their region. The link between financial quality and growth is valid in "normal" and in "bad" times. These results provide evidence to the importance of swiftly restoring bank protability in euro area crisis countries through addressing high non-performing loans ratios and decisive actions on bank recapitalization.

JEL Classification: G21, 016, 047, 052

Keywords: Bank efficiency; financial development; regional growth; europe

October 2015

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1. Introduction

Growth divergences across European regions have been large and persistent. Some European regions have been experiencing steady growth, while in others growth has remained anaemic (Quah, 1996; Cuaresma et al., 2014). One of the reasons for this finding could be that banks perform differently in their financial intermediation function across regions. For example, easier access to credit increases resources that could be channeled into investment. There are many studies which analyzed the relationship between financial volume and growth in cross-country studies (Levine, 2005). However, Hasan et al. (2009) criticize, firstly, that cross-country studies suffer from sample heterogeneity as they cover very different economies. Therefore, a solution is to concentrate on regions to use also within-country variation (Higgins et al., 2006).[2]

Secondly, Hasan et al. (2009) argue that financial development cannot only be measured by the credit to GDP ratio - a financial *volume* measure. In fact, Rousseau & Wachtel (2011) show there has been only a weak link between financial volume and growth in developed countries over recent times. Therefore, Hasan et al. (2009) provide another channel of the influence of banks on regional productivity growth. Specifically, they showed for eleven European countries over the period 1996-2004 that the intermediation ability of a bank should not be assessed alone by the volume of funds which are shifted from savers to borrowers, but also by its *quality*, i.e. by its ability to channel funds to its most productive uses at a reasonable interest rate. A bank's intermediation quality can be measured by its efficiency in converting inputs into outputs while either minimizing costs or maximizing profits. A more efficient bank is assumed to foster growth as it is able to select the optimal projects to fund while calculating the optimal cost of lending given the projects' risks.

These considerations are supported by the recent financial crisis in the euro area which was driven by financial intermediaries' inefficient allocation of resources to sectors where the marginal product of capital was low. This implied that capital accumulation was not associated with technological change and hence higher potential growth. Indeed, in a number of euro area economies capital flowed disproportionately into the non-tradable sector (construction, financial services, public sector) that pushed up wages without adequately raising productivity, and which gave rise to large intra-euro area current account imbalances, high indebtedness and major economic disruptions (Praet, 2014). Furthermore, the sluggish recovery in euro area crisis countries suggests that during the "bad time" of the crisis, there has been too little "good" deleveraging and too much ever-greening and forbearance, undermining the ability of banks to support the upswing and the reallocation of labor and capital towards more productive uses.

Firstly, we test whether Hasan et al. (2009)'s finding of a positive link between the efficiency of

[2]Further examples of studies examining the effect of financial development on regional growth are Guiso et al. (2004) and Moretti (2014) using Italian firm data, Pascali (2014) for long-term effects in Italy, Koetter & Wedow (2010) taking Bundesbank data about German banks, and Kendall (2012) examining Indian district data.

banks in a region and productivity growth holds for an updated and extended data set for twelve European countries. As our sample includes the financial crisis and its aftermath, we thereby contribute to the literature by examining whether the results of Hasan et al. (2009) are valid in "normal" as well as in "bad" times. In addition we also address the differing banking environment in European countries. After 2007 the regulation for banks was tightened and the non-performing loans ratio increased. Estimating a bank's efficiency would be biased without accounting for these changes. For example, if a government introduces a stricter banking regulation which reduces its banking sector's profits, the efficiency estimation would wrongfully account the reduced profits to inefficiency if one neglects these changes.

As a further innovation to the literature, we demonstrate that the strength of the relationship between financial quality and productivity growth is dependent on the level of development of a region. Firms in less developed regions have more problems in obtaining funding and investments have a relatively higher marginal productivity (Guiso et al., 2004; Hakenes et al., 2015). If such a region includes more efficient banks, which are able to identify the right firms to finance, it, firstly, gains credits for its firms and, secondly, catches up faster in productivity. This result bears interesting policy implications on how to increase the speed of convergence of European regions. Potential instruments to foster bank efficiency are by adjusting regulations for savings and cooperative banks, fostering investment in commercial banks' IT or, in light of the financial crisis, swiftly addressing the high non-performing loans ratios in many countries (Barth et al., 2013; Beccalli, 2007; Koetter & Poghosyan, 2009).

Our results are corroborated by several robustness tests. Firstly, we confirm our findings for an estimation which excluded financial centers to account for the fact that we assigned a bank to a region by its headquarters - a procedure which could be considered heuristic for large commercial banks which usually are operating nationwide and are based in financial centers. Additionally, we exclude either large banks or all banks but savings banks from the sample as the latter is forced by law to operate only regionally. Another approach to deal with across region spillovers is to specifically model them. We use a spatial-lag model to account for spillovers of financial development from neighboring regions. All estimations confirm our findings. As policy makers are not only interested in economic growth, but also in reducing unemployment, we also test whether fostering bank efficiency is a potential tool to do so. While we find evidence for this hypothesis using our complete sample, it cannot be said that a region with more efficient banks is more resilient against rising unemployment during a turmoil period as the recent financial crisis.

The outline of this work is as follows: Firstly, the methodology of the analysis will be presented. After an exposition and explanation of the regional growth equation and of the estimation of banks' efficiency, a description of the data follows. Secondly, empirical evidence will be presented with an additional chapter on robustness. Lastly, we conclude our results.

2. Methodology

2.1. Regional Growth Equation

The regions in Europe display different growth patterns. Furthermore, although financial regulation in the euro area is being harmonized, banks are different in their efficiency of channeling funds across regions (Bos & Kool, 2006). An example is Italy in which the amount of credit, the interest charged for loans and bank efficiency varies strongly between the northern and southern regions (Pascali, 2014; Montagnoli et al., 2015; Giordano et al., 2013). To test whether these differences in financial volume and quality of European regions affect growth, we follow Levine et al. (2000) and estimate a dynamic panel growth model of the following form:

$$\Delta Y_{r,t} = \alpha + \beta_1 \Delta Y_{r,t-1} + \beta_2 \ln FQ_{r,t} + \beta_3 \ln FV_{r,t} + \beta_4 \ln X_{r,t} + \mu_r + \epsilon_{r,t} \tag{1}$$

where ΔY is the growth rate of GDP per worker. We take GDP per worker as the variable of interest as this measure is determining the productivity of an economy. Still, we also present results for GDP per capita and unemployment as dependent variables. FQ and FV denote financial quality and financial volume, respectively. Financial quality is represented by the weighted average estimated bank efficiency of a region.[3]. The weighting was done according to a bank's market share of a region's loans. Financial volume is measured by the regionally aggregated value of loans relative to GDP. Details on the calculation of the financial development variables follow later in Section 2.3.2. The additional variables contained in X control for further regional and country-specific variables[4] and μ_r represents an unobserved region-specific effect. The subscript r indicates the European NUTS 2 region and t the year.

Equation (1) cannot be estimated with basic panel techniques as the lagged GDP variable is correlated with the unobserved region-specific effect μ_r. However, μ_r can be eliminated by taking first differences. The result is that the differenced lagged dependent variable and the differenced error term are correlated. Arellano & Bond (1991) therefore suggest to use lagged levels as instruments for the differenced lagged dependent variable, the difference GMM estimator, if the error term is not autocorrelated. For further precision, we use the system-GMM estimator of Arellano & Bond (1995), which includes additionally lagged differences of the dependent variable as instruments, as Blundell & Bond (1998) showed that this approach is more efficient than the difference GMM

[3] As we use an estimated variable in our regression, we are confronted with a generated regressors problem if the error term of the "first stage" is not normally distributed. In our case, however, we can be sure that the latter is the case as every deviation of the error term from the normal distribution is regarded as inefficiency by the stochastic frontier estimation. For details on the latter see Section 2.2

[4] As regional controls we employ the growth rate of the working population and education. The latter is measured as the share of persons between 25 and 64 that obtained tertiary education on the first or second stage. These two variables and regional GDP were obtained from Eurostat for NUTS 2 regions. The country-specific variables are capturing the differences between countries in terms of the banking sector or economic freedom.

estimator.

Our explanatory variables *financial quality* and, especially, *financial volume* may suffer from endogeneity as a growing economy can result in an increasing demand for credits and a growing financial industry. To deal with this potential reverse causality, we follow Levine et al. (2000) and specify both variables as endogenous and, thus, include their lagged levels and differences as instruments. Details follow in Chapter 3.

2.2. Estimation of Banks' Efficiency

Bank efficiency is measured by a banks' relative ability to convert its inputs into output while maximizing profits or minimizing costs. A bank is inefficient if it uses too many inputs or allocates them in wrong proportions. This relative measurement of efficiency is less affected by endogeneity criticism than financial volume measures because a bank's relative ability to convert its inputs should influence growth independently of whether the economy is growing fast or slowly. An efficient bank should support growth of an economy through its good intermediary function, i.e. by selecting the optimal projects for funding while assigning the optimal costs given risks at the same time (Hakenes et al., 2015).

In the following, we assume that banks demand as inputs fixed assets, borrowed funds and labor which can be used at given factor prices, W, to produce outputs, Y, as loans to customers and other banks, and earning assets. We also include equity, z, as a net output, and a time trend. Furthermore, we either assume that banks minimize total costs, TOC, or maximize pre-tax profits, PBT. We estimate these two concepts of efficiency making use of stochastic frontier analysis. Taking this as a starting point, we gain the following translog stochastic frontier:

$$\ln LHS_{i,t} = \alpha_i + \sum_{j}^{J} \beta_j \ln X_{i,j,t} + \frac{1}{2} \sum_{k}^{K} \sum_{j}^{J} \beta_{j,k} \ln X_{i,j,t} \ln X_{i,k,t} + \ln z_{i,t} + t + t^2 + \epsilon_{i,t} \qquad (2)$$

where LHS represents either total costs or pre-tax profits of a bank i, and X includes the previously mentioned inputs at given factor prices W, outputs Y and equity z. The error terms structure is assumed to be $\epsilon_{i,t} = v_{i,t} \pm u_{i,t}$. Therefore, profits or costs differ from the optimal point either because of random noise, $v_{i,t}$, or inefficiency, $u_{i,t}$. Random noise is assumed to be i.i.d. and $v_i \sim N(0, \sigma_v^2)$. Furthermore, we impose the usual linear homogeneity restriction for the cost function by normalizing total costs, pre-tax profits and input prices by one of the input prices. Following Restrepo-Toban & Kumbhakar (2014), we do not impose such a restriction for the profit function.

The translog specification is unproblematic for analyzing cost efficiency. For profit efficiency, however, we encounter the problem that we cannot take the log of negative profits. Hence, we follow Bos & Koetter (2011) and use a negative profit indicator approach. Thus, we do not delete bank observations with negative profits, but we specify (before taking logs) its profits to be 1 and add

an indicator variable that takes the absolute value of the losses. For banks with positive profits the indicator variable is zero in logs. Thereby, we keep the complete sample and include the important information about losses.

To improve the estimation, we follow Lozano-Vivas et al. (2002) and include country-specific differences of financial systems in the stochastic frontier. They found that neglecting such differences, which still exist between European countries, can bias the inefficiency estimates. In line with the literature, we include net output z and country-specific variables as determinants of the inefficiency distribution to capture the regulatory demand for equity as well as macroeconomic and banking-market differences between countries.[5] This is of considerable importance as the financial crisis is included in the estimation sample period which led to stricter regulation and a worse macroeconomic environment for banks.[6] Inefficiency is therefore assumed to be of the following structure: $u_i \sim N(\mu + dZ, \sigma_u^2)$. μ is the estimated mean of the inefficiency distribution and d is a vector including the estimated coefficients of Z, the country-specific variables and the bank's equity, z. We also follow the standard frontier assumption of a half normal distribution for the inefficiency term. Lastly, a bank-specific fixed effect, α_i, is introduced to capture the remaining heterogeneity. So, if a bank deviates from optimal profits or costs given its use of inputs, this is accounted to be due to inefficiency or random noise.

With this specification we estimate Equation (2) using a maximum likelihood estimation of a fixed-effects panel frontier with time-variant efficiency (Greene, 2005). Thus, we do not impose a monotonous trend for banks' efficiency, but allow for variation over time. The efficiency of the stochastic frontier can then be obtained by $exp(-u_{i,t})$. A cost efficiency value of 80% represents, for example, that a bank could have produced the same amount of outputs with the usage of only 80% of its inputs. A profit efficiency value of 60% implies that the bank could have gained 40% more profits if it had used its inputs efficiently.

2.3. Data

2.3.1. Financial Development

We have obtained unconsolidated financial data for 3,878 banks from twelve European countries between the years 2000 and 2013 from the Bankscope database. We dropped banks as central banks, securities firms and bank holdings from the sample. 2013 is the end of the sample as regional GDP data is not available for more recent years. The financial data include loans, y_1, earning assets, y_2, bank loans, y_3, other operating expenses over fixed assets, $w1$, expenses for personnel over fixed assets[7], $w2$, total interest expenditure over funding, $w3$, equity, z, total costs, TOC, and pre-tax

[5] Thereby, z is included in the kernel and as a determinant of the inefficiency distribution of Equation (2).
[6] Further details follow in Section 2.3.1.
[7] Usually, it is suggested to divide personnel expenses by the number of employees. However, if the latter is not available, it is common to divide it by fixed assets. An example for this is Lozano-Vivas & Pasiouras (2010). They

profits, PBT, allowing us to estimate cost and profit efficiency.

The country-specific variables which are used, following Lozano-Vivas et al. (2002), as determinants for the inefficiency distribution of the stochastic frontier estimation are taken from various sources. These variables control for country-specific differences in the banking industry and the macroeconomic environment. The Herfindahl index for credit institutions in regards to total assets, *HERF*, is taken from the ECB database. It measures the amount of concentration in the banking industry. The income per capita, *IC*, branches per capita, *BC*, and income per branch, *IB*, variables were taken from the OECD Banking Profitability Statistics, until it was discontinued in 2010, and were then updated with data from the ECB database. Furthermore, two economic status variables, GDP per capita and the population density were obtained from Eurostat. Both can have effects on the supply and demand of financial services. For example, in a more developed country customers demand a bigger variety of banking products. All variables are measured in real terms.

Still, we add further variables to the inefficiency distribution which in particular introduce the specific traits of the macroeconomic and regulatory environment for banks during the financial and European debt crisis. The ratio of non-performing loans (NPL) is taken from the database World Development Indicators. A higher share of NPL represents that a bank operates in a country in which borrowers default more often and the financed projects are more risky (Koetter & Poghosyan, 2009). In Figure B.1 one can see that the ratio of NPL is on average strongly increasing from 2007 till 2009 and remaining then on its high level. Furthermore, the financial crisis led to a stricter regulation for banks. This is represented by the regulation indexes we included. The index of financial freedom, *HER*, is from the Heritage Foundation and rates the financial freedom of a country. The overall inflow and outflow restrictions indexes are taken from Fernandez et al. (2015) and they assess countries' capital control restrictions. Capital controls do affect all internationally active economic entities but in particular banks which, even if small (Buch et al., 2011), hold foreign assets. That these regulations actually are affecting banks' behavior can be seen in the evolution of average held equity, z, which increased during the complete time period of our sample and particularly in the years after the financial crisis. Recall that z is included in the inefficiency distribution of the stochastic frontier estimation, too.

Together with the aforementioned country-specific variables, the obtained bank data allows for an efficiency estimation for about 3,878 banks with a total of 34,858 observations. The stochastic frontier estimated with Equation 2 assumes that all banks in the sample have a common technology regime. However, authors as Altunbas et al. (2001) or Koetter & Poghosyan (2009) argue that technology regimes may differ across banks due to ownership status or size. We account for this by estimating Equation 2 also for different groups of banks. Firstly, we choose different samples according to size. Thus, we estimate the stochastic frontier for banks with mean total assets of

also give an overview about further studies which make use of this approach.

below 7 or 2 billion Euros which correspond to the 90th or 75th percentile. We denote them as local or small local banks. Secondly, we use only local savings banks for the efficiency estimations as these banks may differ from other banking groups due to their public nature and further non-profit objectives.[8] Following Koetter et al. (2012), we additionally calculated efficiency-adjusted Lerner indexes which account for the possibility of foregone rents due to inefficiency. If one does not adjust the indexes for inefficiency, to small values of competition are obtained. In Table 1 one can see summary statistics and the stochastic frontier outcomes for the different groups of banks. The estimated values of cost and profit efficiencies do not change considerably across these groups and are comparable to Hakenes et al. (2015), Kalyvas & Mamatzakis (2014) and Koetter & Wedow (2010).

As mentioned before, we include variables as banking regulation indexes and the NPL ratio in the stochastic frontier estimation to account for the changing macroeconomic and regulatory environment for banks during the recent crisis. In Table A.7 of the appendix we show how the efficiency estimation outcomes would have been if we neglected these variables. While the results are similar for both cost efficiency estimations, they differ for profit efficiency. The results for profit efficiency do not vary in levels, but in their evolution over time. Average profit efficiency is higher in the 2007-2013 period only if we include the banking environment variables. Otherwise it stagnates as the stochastic frontier estimation neglects the adverse changes in the banking environment and accounts them to inefficiency. For example, if a government introduces a stricter banking regulation which reduces its banking sector's profits, then the stochastic frontier estimation does wrongly account this to reduced profit efficiency as long as one does not control for the adverse change in the banking environment.

2.3.2. Regional Mapping

The Bankscope database allows us to map European banks to a NUTS 2 region.[9] For most of the countries in our sample it is possible to match a bank to a NUTS 2 region by using zip codes. In all other cases the matching was done by city names. Oversea territories are dropped from the sample. In total we mapped the banks to 131 NUTS 2 regions resulting in an average number of banks per region of about 21. Bank-based economies as Germany or Italy contain relatively more banks per regions due to their large number of savings and cooperative banks.

After the mapping of banks to a region, our financial development variables can be calculated. The financial volume variable is calculated by summing up the loans of all banks within a region and dividing this sum by the region's GDP. A graphical illustration for local banks can be seen

[8] Local savings banks are in this regard only savings banks with mean total assets of below 7 billion Euros. We account thereby still for the aforementioned size concerns.

[9] A NUTS 2 region has a population between 800,000 and 3 million persons. We use the NUTS version 2010 which is the latest one for the NUTS 2 regions we are considering.

Table 1: Descriptive Statistics of Banking Groups

	All Banks	Local Banks	Small Local Banks	Local Savings Banks
Stochastic Frontier Arguments				
TOC (Total Costs)	172.92	38.61	21.27	56.78
	(1305.68)	(56.06)	(21.70)	(57.38)
PBT (Pre-Tax Profits)	24.16	5.43	3.02	6.14
	(182.64)	(10.87)	(5.49)	(7.83)
y1 (Loans)	2099.40	506.32	284.11	781.67
	(14780.17)	(742.88)	(283.68)	(811.85)
y2 (Earning Assets)	1321.27	191.50	109.07	315.94
	(16845.69)	(349.04)	(135.79)	(343.65)
y3 (Bank Loans)	940.64	130.17	61.51	140.17
	(8305.48)	(358.01)	(105.51)	(253.67)
w1 (Price of Fixed Assets)	26.56	27.18	27.63	25.23
	(40.05)	(41.12)	(41.43)	(14.28)
w2 (Price of Labor)	35.84	37.07	38.32	35.45
	(61.58)	(63.82)	(68.32)	(18.47)
w3 (Price of Borrowed Funds)	2.52	2.49	2.32	2.40
	(19.00)	(19.82)	(3.56)	(1.21)
z (Equity)	244.79	60.69	35.49	79.98
	(1704.09)	(97.54)	(41.57)	(81.66)
Stochastic Frontier Outcomes				
Profit Efficiency	57.89	58.80	58.62	60.33
	(26.41)	(26.42)	(26.31)	(26.06)
Cost Efficiency	86.65	87.06	87.47	91.13
	(11.53)	(11.46)	(10.96)	(9.57)
Lerner Index	41.00	43.18	44.50	47.04
	(9.07)	(8.25)	(7.78)	(10.50)
Observations	34858	32006	27491	8707

Notes: Monetary variables are in real values and thousands of Euros. Outputs and equity are in millions of Euros. Standard errors in parentheses. Efficiencies have been estimated for the corresponding banking groups using a stochastic frontier approach. Lerner indexes are computed using the estimated stochastic cost and profit frontiers to account for potential inefficiency. Local banks and small local banks are defined as banks with mean total assets of below 7 or 2 billion Euros, respectively.

in Figure B.2. A region's financial quality and Lerner index variables have been calculated as the weighted average of the region's banks' efficiencies and Lerner indexes, respectively. The weight each bank was assigned to is its share of loans of the total loans within the region to represent its market share. As we estimated the stochastic frontier for different groups of banks, we also calculated all the financial development variables only considering the respective banks. So, we obtained a financial volume, financial quality and Lerner index variable for each region and each considered groups of banks.

Although we present results for all groups of banks in the robustness section, we prefer our specification for local banks. Local banks, which we defined to be banks with mean total assets of below 7 billion Euros, are more likely to operate only within their respective region, compare Section 4.1 for further details, not across regions. Also, the estimated stochastic frontier is less likely to be biased by large banks which have different technology regimes while we still have a large amount of considered banks, namely 3,527. The stochastic frontier estimation is shown in Table A.8. In Table 2 regional descriptive statistics for this group of banks is presented. It can be seen that the credit-to-GDP ratio corresponds to the different banking structures of the countries. The values are higher for Germany and Italy in which the cooperative and savings banks sectors have larger market shares. An overview of empirical realizations of local banks' efficiencies by region in the years 2007 and 2010 are given in Figures B.3 and B.4 for cost efficiency and in Figures B.5 and B.6 for profit efficiency, respectively.

Table 2: Descriptive Statistics of Regions Across Countries between 2001 and 2013

	All Countries	Germany	France	Italy	Spain	Northern	Remaining
Real GDP Growth	0.69	1.13	0.48	−0.76	−0.24	1.31	1.42
	(3.48)	(2.61)	(2.38)	(2.70)	(3.90)	(6.58)	(2.62)
Cost Efficiency of Local Banks	83.81	90.75	83.14	83.07	86.96	72.64	78.27
	(10.72)	(3.14)	(10.15)	(9.41)	(6.94)	(14.18)	(10.09)
Profit Efficiency of Local Banks	59.52	59.13	69.34	62.14	64.54	50.45	52.21
	(18.71)	(12.92)	(15.12)	(19.90)	(23.06)	(21.06)	(19.53)
Credits of Local Banks to GDP	23.77	33.67	13.01	31.65	10.55	16.86	20.38
	(35.60)	(14.34)	(8.18)	(73.16)	(10.91)	(45.69)	(21.04)
Number of Banks	20.98	39.38	8.52	23.60	6.82	8.37	15.00
	(23.01)	(24.27)	(12.22)	(26.23)	(9.05)	(6.00)	(15.89)
Observations	1479	454	244	206	158	177	262

Notes: Unbalanced means across years and regions. Standard errors in parentheses. All values in percentages but the number of banks. Northern include Denmark, Finland and Sweden. The remaining group consists of Austria, Belgium, Ireland, Luxembourg and the Netherlands.

3. Empirical Evidence

We estimate Equation (1) with a system-GMM estimator to deal with the potentially endogenous relationship between financial development and productivity growth (Levine et al., 2000). This method uses internal instruments to overcome the endogeneity problem. External instruments are unfortunately not available. With the Hansen test, which can be used here as our model is overidentified, we can test for the exogeneity of our instruments.

In detail, we use the two-step estimator with heteroskedasticity and autocorrelation robust Windmeijer (2005) standard errors. The lagged dependent variable as well as the financial volume and financial quality proxies are specified as endogenous variables. As instruments we use five lags of their levels and differences. We use a collapsed instrument matrix in the system-GMM estimation to further reduce the number of instruments as the Hansen test is not robust against too many instruments (Roodman, 2009).[10] The results are displayed in Table 3. While the AR(2) statistic is never significant, the Hansen statistic is, however, only if we measure financial quality by cost efficiency.

Our control variables labor force growth, education and the Heritage index have the expected sign. Also our banking sector variables are significant in most cases. A higher concentration of banks within a country leads to lower growth, while the opposite holds true for the Lerner index.[11] Financial volume enters the equation significantly only in some specifications. This feature is not uncommon for a sample of developed countries in a post-2000 period (Rousseau & Wachtel, 2011).[12] The coefficient of the financial quality variable is strongly and significantly positive only if it is measured by profit efficiency. This finding is in line with Hasan et al. (2009) and could be explained by the lower variation across regions, shown in Table 2, or by a smaller correlation between cost efficiency and e.g. a better project selection team of a bank (Humphrey & Pulley, 1997). We focus henceforth on profit efficiency.

Furthermore, we estimate our baseline regression with more country-level control variables which should account for the specific funding situation and governmental spending in a country. We use country-level data as regional data is not available. Market capitalization shows to what extent a

[10] Roodman (2009) notes that an arbitrary rule of thumb is that the number of instruments should not exceed the number of cross-sections, but should also not converge to the number of coefficients for the Hansen test to be not weakened. We think that the number of 31 to 43 instruments in our regressions when collapsing the instrument matrix is reasonable as it lies between our number of coefficients, 22 with year dummies and all financial development variables, and cross-sections, 129 regions.

[11] There is a big literature on the effects of banking sector concentration and competition on growth with differing results. Cetorelli & Gambera (2001) find that bank concentration on average reduces growth due to the use of monopoly power. However, the results differ for young, finance-dependent firms. Zarutskie (2006) presents that banks' competition affects firm differently according to their age. Inklaar et al. (2015) found that in Germany, a country with low concentration, market power stimulates growth as banks require some mark-up to generate the information needed to select the right firms to finance.

[12] For further studies on the effect of financial volume on economic growth compare, for example: Loayza & Ranciere (2006) and Levine et al. (2000) or, more recently, Moretti (2014) for Italy and Pascali (2014) for long-term effects.

Table 3: Financial Quality of Local Banks and its Effect on Regional Growth between 2000 and 2013

		Cost Efficiency			Profit Efficiency		
	Quantity	Quality	Both	Interaction	Quality	Both	Interaction
Lagged GDP per Worker Growth	−0.025	−0.039	−0.026	−0.044	−0.035	−0.033	−0.046
	(0.038)	(0.042)	(0.044)	(0.044)	(0.034)	(0.037)	(0.035)
Control Variables							
Labor Force Growth	−0.947***	−0.949***	−0.939***	−0.936***	−0.988***	−0.971***	−0.974***
	(0.034)	(0.035)	(0.036)	(0.035)	(0.033)	(0.036)	(0.036)
Education	1.365***	0.919***	1.046***	1.046***	0.683**	0.722**	0.718**
	(0.435)	(0.232)	(0.318)	(0.302)	(0.273)	(0.355)	(0.317)
Heritage Index	2.173*	2.515*	2.439*	2.394*	6.875***	6.982***	7.254***
	(1.310)	(1.303)	(1.310)	(1.339)	(1.567)	(1.645)	(1.562)
Banking Sector Variables							
Lerner Index	2.625***	0.860	2.047**	1.942*	1.644**	3.185***	2.987***
	(0.912)	(0.717)	(0.996)	(0.999)	(0.678)	(0.940)	(0.970)
Herfindahl Index	0.037	−0.277**	−0.002	−0.125	−0.406***	−0.210	−0.175
	(0.309)	(0.133)	(0.270)	(0.252)	(0.141)	(0.272)	(0.223)
Income per Branch	1.386***	1.960***	1.581***	1.709***	1.665***	1.594***	1.640***
	(0.432)	(0.387)	(0.445)	(0.404)	(0.328)	(0.359)	(0.361)
Bank Income per Capita	−0.955**	−1.047**	−0.954**	−1.021*	−0.912**	−1.111***	−1.190***
	(0.419)	(0.440)	(0.483)	(0.593)	(0.390)	(0.400)	(0.398)
Financial Development Variables							
FV	0.929***		0.549*	0.399		0.461	0.398
	(0.358)		(0.298)	(0.287)		(0.309)	(0.303)
FQ		2.266	1.320	−0.055	2.529***	3.061***	3.189***
		(1.959)	(2.023)	(3.728)	(0.665)	(0.650)	(1.093)
FQ*FV				−0.469			0.033
				(0.871)			(0.367)
Constant	−23.574***	−32.495***	−26.858***	−25.835***	−45.593***	−42.236***	−40.587***
	(6.536)	(5.693)	(6.355)	(6.280)	(5.804)	(6.754)	(6.116)
Observations	1238	1238	1238	1238	1238	1238	1238
Regions	129	129	129	129	129	129	129
Instruments	31	31	37	43	31	37	43
Hansen statistic	18.44	22.57	27.32	27.17	12.21	18.89	24.17
Hansen p-value	0.05	0.01	0.03	0.13	0.27	0.22	0.24
AR(2) Statistic	0.33	0.17	0.31	0.16	0.16	0.24	0.11
AR(2) p-value	0.74	0.86	0.75	0.87	0.87	0.81	0.91

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. FV and FQ represent regionally aggregated credit per GDP and bank efficiency variables. The latter have been estimated for all local banks in the sample. All variables in logs, but the growth rates. The two-step system GMM estimation, using robust standard errors, incorporates five lags in the collapsed instrument matrix. FV, FQ and the interaction term have been specified as endogenous. Year dummies are included.

country's firms are using non-banking sources of funding and therefore their level of dependence on bank loans. Secondly, we used the average bank lending interest rate to non-financial corporations to not only control for the volume of credits (FV), but also for the conditions. Lastly, we incorporate governmental spending variables. We obtained government and European Union spending relative to GDP. The EU funds variable is the sum of year-specific paid out European cohesion, structural and regional development funds. The data was obtained from the InfoRegio website of the European Commission. The results, in Table A.9, show that market capitalization is entering the equation negatively. Theory does not predict the sign of market capitalization (Levine, 2005). A reason for its negative effect could be that countries with more stock market dependent financing of firms suffered more during the financial crisis due to emerging funding constraints. Also, EU funds are negatively affecting growth. Becker et al. (2012) provide evidence, using data from 1994-2006, that EU transfers only increase growth till a certain threshold is reached - potentially because of diminishing returns to investments. Albulescu & Goyeau (2014) found a negative effect for the post-crisis period in the old member countries of the EU. A reason for this could be that particular regions or countries received transfers that are vulnerable to crisis. Or, in another direction, that EU transfers benefited especially sectors, such as construction, that are correlated strongly with the business cycle. Still, our results for financial quality are robust to the inclusion of these variables.

4. Robustness

4.1. Regional Allocation

The mapping of a bank to a specific region was conducted based on the zip code or city of the banks' headquarters. This can to a certain extent be called heuristic. Koetter & Wedow (2010) analyzed exactly this problem for German banks. Their approach was to check whether a bank's branches are located in the same *Raumordnungsregion*[13], which are smaller than NUTS 2 regions. They found that 93% of all cooperative banks' branches and 97% of the savings banks' branches lie into the same *Raumordnungsregion*. For large and small commercial banks, however, this is the case only for 5% and 31%, respectively, of the branches. To account for this finding, we exclude financial centers which often host nationally operating banks from our sample. Namely, we are excluding Brussels, Frankfurt, Luxembourg, Madrid, Milan, Paris and Stockholm. The corresponding estimation can be seen in the first column of Table 4. The estimated coefficient for financial quality increased.

To further deal with the aforementioned problem, we follow Koetter & Wedow (2010) and take only specific banking groups into account for the efficiency estimation and for the aggregation of the regional financial quality and volume proxy. Firstly, we only used banks which are even smaller

[13]These are aggregations of NUTS 3 regions. They are created based on economic interdependencies between districts.

Table 4: Across Regional Spillovers

	No Financial Centers			Spatial Spillovers (Local Banks)			
	Local Banks	Small Local Banks	Savings Banks	FV	FQ	FQ*FV	All
Lagged GDP per Worker Growth	−0.036	−0.007	−0.028	−0.042	−0.029	−0.038	−0.036
	(0.040)	(0.052)	(0.050)	(0.038)	(0.035)	(0.035)	(0.037)
FV	0.767	0.864**	0.923	0.361	0.391	0.375	0.366
	(0.508)	(0.358)	(0.596)	(0.360)	(0.316)	(0.423)	(0.326)
FQ	4.345***	5.770***	2.767**	3.673***	2.851**	3.575**	2.280*
	(1.378)	(1.610)	(1.107)	(1.344)	(1.251)	(1.426)	(1.347)
FQ*FV	0.510	0.895**	0.674	0.162	0.470	0.229	0.255
	(0.489)	(0.389)	(0.411)	(0.482)	(0.363)	(0.553)	(0.416)
Spatial FV				−0.202			−0.017
				(0.297)			(0.352)
Spatial FQ					1.985**		4.100**
					(0.782)		(1.688)
Spatial FQ*FV						−0.132	0.690
						(0.251)	(0.446)
Constant	−41.674***	−28.092*	−24.065*	−47.248***	−44.132***	−42.555***	−48.049***
	(6.884)	(16.259)	(12.366)	(7.096)	(6.059)	(7.257)	(6.957)
Controls	Y	Y	Y	Y	Y	Y	Y
Observations	1113	1064	978	1178	1178	1178	1178
Regions	117	114	109	123	123	123	123
Instruments	43	43	43	49	49	49	61
Hansen statistic	23.52	30.31	20.97	28.02	31.78	28.13	49.84
Hansen p-value	0.26	0.07	0.40	0.31	0.16	0.30	0.05
AR(2) Statistic	0.35	0.48	0.19	0.23	0.40	0.32	0.22
AR(2) p-value	0.73	0.63	0.85	0.82	0.69	0.75	0.82

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. FV and FQ represent regionally aggregated credit per GDP and bank efficiency variables. The latter have been estimated for the specific groups of banks in the sample. All variables in logs, but the growth rates. The two-step system GMM estimation, using robust standard errors, incorporates five lags in the collapsed instrument matrix. FV, FQ, the interaction terms and the spatial lags have been specified as endogenous. Year dummies are included.

in size than our group of banks we defined to be local. These banks are more likely to operate only within their headquarters' region. We defined small banks to be banks with mean total assets of less than 2 billion Euros.[14] Next, we only consider local savings banks which are by law restricted to a specific region or district. The results, see Table 4, illustrate that our main findings are robust. For small local banks we also obtained a significant interaction term between financial volume and quality. Therefore, it seems that either financial volume affects growth stronger in regions with a high level of small bank efficiency or that small banks' efficiency matters more if they issue more loans. The coefficient of financial quality is smaller if we only consider savings banks. This may be due to their further non-profit objectives which lead them to finance firms also because of non-economic reasons such as electoral cycles (Englmaier & Stowasser, 2013).

Another approach to deal with spillovers is to explicitly model them. We estimate a spatial lag model in which our financial development variables are allowed to spillover to neighboring regions. Regions without neighbors are excluded from the sample. We use a contiguity matrix to weight the financial development variables of the neighboring regions and include the weighted average variables in our regression. Again our group of local banks, which are more likely to operate across regions than small banks but less likely to be nationally active, is used. The spatial lags are specified to be potentially endogenous, too. While we do not find evidence for spatial spillovers of financial volume, we do see that growth in a region is affected by its neighboring regions' financial quality.

4.2. Sample Selection and Interactions with the Regional Level of GDP

In Table 2 we showed the number of banks which are on average within a region of a specific country. The high number of banks per region in Germany and Italy represent their strong co-operative and savings banks sectors. This is contrasted by the concentrated banking markets of, for example, France and Spain. In these countries we have regions which incorporate only a low number of banks. Therefore, it could be argued that our results are driven by such regions where our financial development variables are aggregated only across a small number of banks. Therefore, we re-estimated our baseline specification for a sample of regions which include at least five banks. However, the results, depicted in Table 5, do not change by this elimination of 21 regions from the sample.

To control for whether the link between financial quality and productivity growth differs between a region's level of economic development, we add an interaction term between financial quality and a region's initial GDP per worker in Table 5. The interaction term has been specified as potentially endogenous as well. The estimated negative coefficient of the interaction term reveals that the channel between financial quality and growth is stronger for less developed European regions. This finding is comparable to Hakenes et al. (2015) who found a similar effect for Germany. Firms

[14]The 75th percentile of mean total assets is about 2 billion Euros.

in regions which are less developed have more problems in attracting funding and a potential expansion in investment has a relatively higher marginal productivity (Guiso et al., 2004; Hakenes et al., 2015). If such a region incorporates more efficient banks, which are able to identify the right firms to finance, it, firstly, gets funding for its firms and, secondly, grows faster in productivity. Thus, our finding emphasizes the importance of efficient banks for the convergence of European regions.

Table 5: Considered Regions, a GDP Interaction Term and a Crisis Sample

	No Financial Centers				Without Germany		
	Baseline	Number of Banks ≥ 5	GDP Interaction	Sample 2007-2013	Baseline	GDP Interaction	Sample 2007-2013
Lagged GDP per Worker Growth	−0.042	0.001	−0.050	−0.066	−0.060	−0.078*	−0.066
	(0.040)	(0.026)	(0.039)	(0.060)	(0.051)	(0.045)	(0.076)
FV	0.637	−0.554	0.448	0.366	0.835*	0.440	0.789
	(0.497)	(0.641)	(0.507)	(0.555)	(0.502)	(0.448)	(0.614)
FQ	3.718***	3.737**	79.386***	3.537***	2.219	82.127**	3.796*
	(1.324)	(1.755)	(28.104)	(1.229)	(1.999)	(32.254)	(2.221)
FQ*FV	0.268	0.468	0.078	0.250	−0.044	−0.324	0.355
	(0.485)	(0.771)	(0.434)	(0.431)	(0.541)	(0.459)	(0.554)
FQ*Log Initial GDP per Worker			−7.060***			−7.506**	
			(2.597)			(2.971)	
Log Initial GDP per Worker			−4.142***			−4.034**	
			(1.480)			(1.946)	
Constant	−46.831***	−49.176***	−0.802	−51.956***	−46.234***	3.868	−38.590**
	(6.951)	(8.686)	(17.083)	(10.248)	(12.543)	(24.827)	(18.529)
Controls	Y	Y	Y	Y	Y	Y	Y
Observations	1161	900	1161	732	761	761	501
Regions	122	101	122	114	85	85	77
Instruments	43	43	50	39	43	50	39
Hansen statistic	28.15	27.18	31.28	26.00	28.52	27.41	28.07
Hansen p-value	0.11	0.13	0.18	0.17	0.10	0.34	0.11
AR(2) Statistic	0.19	−1.26	0.09	0.04	0.34	0.20	0.26
AR(2) p-value	0.85	0.21	0.93	0.97	0.73	0.84	0.80

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. FV and FQ represent regionally aggregated credit per GDP and bank efficiency variables. The latter have been estimated for all local banks in the sample. All variables in logs, but the growth rates. The two-step system GMM estimation, using robust standard errors, incorporates five lags in the collapsed instrument matrix. FV, FQ and the interaction terms have been specified as endogenous. Year dummies are included.

Our sample includes the financial crisis period. Although we include time dummies in all our estimations to capture year-specific effects on economic growth, it can be suspected that the link between financial quality and economic growth is non-existent for our later sample period. Therefore, we conduct an estimation for the time period 2007-2013. The obtained coefficients are similar to our baseline estimation which used the complete sample. Therefore, financial quality fosters growth even if the economy is experiencing a crisis. So, more efficient banks are able to identify firms that increase their productivity during "normal" times and are resilient to turmoil in "bad" ones.

Our results could be driven by the dominance of German banks in the sample. German banks represent 48% of the banks in our sample. Additionally, German banks are relatively small and often savings or cooperative banks which operate only locally (either by law or due to their cooperative nature). The last columns of Table 5 show that excluding German regions does weaken our results. A reason for that can be that we are only considering local banks, as explained in Section 2.3.1. Such banks have smaller loan market shares in countries with more concentrated banking sectors, compare Table 2, and thus less influence on growth. Nevertheless, if we reintroduce the GDP interaction term or take the crisis sample, we still obtain a significantly positive result for our financial quality measure.

4.3. Other Objectives and Groups of Banks

Also other objectives than GDP per worker as a productivity measure are of importance for policy makers. Thus, we also use GDP per capita and unemployment as dependent variables for the estimation of our growth equation. Table 6 shows that the results for GDP per capita are very similar to the previous ones. However, for unemployment we only find a beneficial effect of financial quality if we do not specifically look at the crisis sample. Therefore, it cannot be said that higher financial quality shields a region against rising unemployment during a crisis, but only against economic downturn. A reason for that could be that more efficient banks finance the firms that are keeping up their productivity even during a crisis period. One way for firms to not loose productivity is by reducing their workforce. This would explain why we obtained a significantly positive coefficient for the GDP per worker growth, but not for unemployment.

Lastly, we present that our results are robust to efficiency estimations with different samples of banks. Estimating a stochastic frontier of all types and sizes of banks could lead to biased results as, for example, big banks have other technology regimes or savings banks do also have objectives next to profit maximization (Koetter & Poghosyan, 2009). To account for this, we estimated the stochastic frontier for different groups of banks. These groups consist of either all banks, local banks, small local banks or only local savings banks.[15] Recall that the efficiency results do not change considerably, compare Table 1. Our financial quality measure is still significantly positive for all specifications. The size of the coefficient, however, is smaller if a sample of all banks or savings banks is taken. For the sample of all banks this could be due to a biased stochastic frontier estimation. For savings banks this could be either due to a decreased sample size or to the fact that savings banks do not always choose the firms to finance which are the most productive but also have to take into account their other non-economic objectives (Englmaier & Stowasser, 2013).

[15] We use the following definitions: local banks are banks with less than 7 billion of mean total assets or the 90th percentile of the complete sample, small local banks are banks with less then 2 billion or the 75th percentile and local savings banks are local banks which are also savings banks.

Table 6: Other Objectives and Groups of Banks

	GDP per Capita		Unemployment		Other Groups of Banks for Efficiency Estimation			
	Baseline	Sample 2007-2013	Baseline	Sample 2007-2013	All Banks	Local Banks	Small Local Banks	Local Savings Banks
Lagged Dependent Var.	−0.021	−0.078	0.166**	0.166***	−0.028	−0.042	−0.007	−0.028
	(0.059)	(0.061)	(0.083)	(0.061)	(0.044)	(0.040)	(0.052)	(0.050)
FV	0.542	0.436	−6.336*	−4.150	0.633*	0.637	0.864**	0.923
	(0.460)	(0.492)	(3.331)	(3.449)	(0.348)	(0.497)	(0.358)	(0.596)
FQ	3.131*	3.330***	−27.415***	−15.390	2.242**	3.718***	5.770***	2.767**
	(1.600)	(1.228)	(10.538)	(11.485)	(1.011)	(1.324)	(1.610)	(1.107)
FQ*FV	0.236	0.317	−6.784**	−1.900	0.235	0.268	0.895**	0.674
	(0.539)	(0.421)	(3.055)	(3.764)	(0.537)	(0.485)	(0.389)	(0.411)
Constant	−47.960***	−59.602***	6.485	91.027	−48.114***	−46.831***	−28.092*	−24.065*
	(7.473)	(10.264)	(69.617)	(81.400)	(6.621)	(6.951)	(16.259)	(12.366)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1161	732	1149	725	1202	1161	1064	978
Regions	122	114	121	113	124	122	114	109
Instruments	43	39	43	39	43	43	43	43
Hansen statistic	31.90	27.72	47.17	29.89	35.94	28.15	30.31	20.97
Hansen p-value	0.04	0.12	0.00	0.07	0.02	0.11	0.07	0.40
AR(2) Statistic	0.33	−0.12	1.22	−0.61	0.26	0.19	0.48	0.19
AR(2) p-value	0.74	0.90	0.22	0.54	0.79	0.85	0.63	0.85

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. FV and FQ represent regionally aggregated credit per GDP and bank efficiency variables. The latter have been estimated for the respective banks in the sample. All variables in logs, but the growth rates. The two-step system GMM estimation, using robust standard errors, incorporates five lags in the collapsed instrument matrix. FV, FQ and the interaction terms have been specified as endogenous. Year dummies are included.

5. Conclusion

While most studies analyzing the link between banks and growth considered only a financial *volume* measure to assess financial development, we also include a financial *quality* measure. We used as a proxy for financial quality the estimated profit and cost efficiencies of banks within a region. For a sample of 129 regions from twelve European countries we found that the financial quality channel is stronger than the volume one. Especially profit efficiency is driving growth within a region as it is likely to be stronger correlated with attributes, as for example a better project selection team, that allow a bank to identify firms which are prospectively able to increase their productivity. Thus, more efficient banks promote growth in developed countries. Furthermore, this relationship holds not only in "normal" times, but also in "bad" ones. We examined a sample containing only the 2007-2013 crisis period and found that regions which incorporate more efficient banks are more resilient to the financial and European debt crisis.

One objective in the European Union is to promote growth in less developed regions to obtain convergence. We found in our analysis that the link between financial quality and productivity growth is stronger in regions with low GDP per worker. Thus, improving efficiency of banks which operate in such regions is a reasonable instrument to reduce economic disparity. In light of the financial crisis this includes, most importantly, swiftly addressing the high non-performing loans ratios in many countries, e.g. by providing incentives for banks to move more decisively with the workout of bad assets and by increasing the efficiency of judicial systems and insolvency frameworks.

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Appendix A. Tables

Table A.7: Mean Stochastic Frontier Outcomes of Local Banks and Accounting for the Banking Environment

	With Banking Environment Variables Included		Without Banking Environment Variables Included	
	2000-2006	2007-2013	2000-2006	2007-2013
Profit Efficiency	57.68	59.76	58.45	58.46
	(26.59)	(26.22)	(26.60)	(26.21)
Cost Efficiency	88.09	86.16	86.76	86.37
	(10.28)	(12.31)	(11.01)	(12.21)

Notes: Standard errors in parentheses. Efficiencies have been estimated for local banks using a stochastic frontier approach. Local banks are defined as banks with mean total assets of below 7 billion Euros. Banking environment variables included means that country-specific regulation variables (Heritage Index for financial freedom, overall inflow and outflow restrictions indexes, and the non-performing loans ratio) are included in the stochastic frontier estimation.

Table A.8: Stochastic Frontier Estimation for Local Banks

Variable	Cost Efficiency	Profit Efficiency
ln loss		-0.931***
ln loans (y1)	0.115***	-0.012
ln Securities (y2)	0.009	0.149**
ln interbank loans (y3)	0.106***	0.072
ln price of fixed assets (w1)	0.159***	0.337*
ln price of labor (w2)	0.332***	-0.197
ln price of borrowed funds (w3)		0.184
ln equity (z)	0.140***	1.026***
0.5 ln w1 ln w1	0.117***	-0.054*
0.5 ln w2 ln w2	0.112***	0.051
0.5 ln w3 ln w3		-0.077***
0.5 ln w1 ln w2	-0.093***	0.004
0.5 ln w1 ln w3		0.018
0.5 ln w2 ln w3		-0.006
0.5 ln y1 lny1	0.063***	0.029***
0.5 ln y2 lny2	0.024***	0.015***
0.5 ln y3 lny3	0.031***	-0.001
0.5 ln y1 lny2	-0.007***	-0.008
0.5 ln y1 lny3	-0.024***	-0.008
0.5 ln y2 lny3	-0.006***	-0.011***
ln w1 ln y1	-0.012***	0.013
ln w1 ln y2	0.003*	-0.032***
ln w1 ln y3		0.002
ln w2 ln y1	-0.026***	-0.028*
ln w2 ln y2	0.006***	0.028***
ln w2 ln y3	-0.008***	0.012
ln w3 ln y1		-0.020**
ln w3 ln y2		-0.024***
ln w3 ln y3		0.024***
t ln y1	-0.002***	-0.011***
t ln y2	-0.000	-0.002
t ln y3	0.001***	0.007***
t ln w1	0.000	-0.013***
t ln w2	-0.000	0.002
t ln w3		-0.001
t	0.036***	0.002
t t	-0.001***	0.003***
Population density	-0.130***	-0.252***
GDP per capita	0.061	1.032***
Herfindahl Index	0.943***	-0.082***
Income per Branch	0.367***	-0.178**
Income per capita	0.499***	0.460***
Capital inflow restrictions	-0.172***	0.021
Capital outflow restrictions	0.132***	-0.090***
Heritage index financial freedom	3.073***	0.303***
Non-performing loans ratio	0.335***	0.430***
z	0.136***	0.035***
Constant	-27.493***	-13.187***
Observations	32006	32006
Banks	3527	3527

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. All variables in logs.

Table A.9: Additional Country-Specific Variables

	Funding		Governmental Spending	
	Market Capitalization	Lending Rate	Government	EU Funds
Lagged GDP per Worker Growth	−0.049	−0.009	−0.036	−0.044
	(0.035)	(0.028)	(0.034)	(0.036)
FV	0.292	0.084	0.421	0.372
	(0.314)	(0.282)	(0.327)	(0.280)
FQ	3.805***	2.958**	2.851***	3.519***
	(1.209)	(1.213)	(1.102)	(1.216)
FQ*FV	0.180	−0.012	−0.042	0.143
	(0.452)	(0.426)	(0.354)	(0.398)
Market Capitalization	−0.659**			
	(0.278)			
Lending Rate to Non-Financials		−2.215		
		(1.494)		
Government Spending			−1.775	
			(1.651)	
EU Funds				−0.474*
				(0.248)
Constant	−42.613***	−47.624***	−30.626**	−24.393***
	(6.776)	(7.823)	(12.014)	(8.950)
Controls	Y	Y	Y	Y
Observations	1155	1040	1213	1238
Regions	129	116	124	129
Instruments	43	43	44	44
Hansen statistic	26.50	29.81	22.10	24.69
Hansen p-value	0.15	0.07	0.33	0.21
AR(2) Statistic	−0.14	−1.08	0.20	−0.11
AR(2) p-value	0.89	0.28	0.84	0.91

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. FV and FQ represent regionally aggregated credit per GDP and bank efficiency variables. The latter have been estimated for all local banks in the sample. All variables in logs, but the growth rates. The two-step system GMM estimation, using robust standard errors, incorporates five lags in the collapsed instrument matrix. FV, FQ and the interaction term have been specified as endogenous. Year dummies are included. Market capitalization represents the World Bank's definition. The lending interest rate of banks for loans to non-financial corporations is from the ECB. Government spending is relative to GDP as well as the EU funds variable which incorporates the amounts paid out from the European cohesion, structural and regional development funds.

Appendix B. Figures

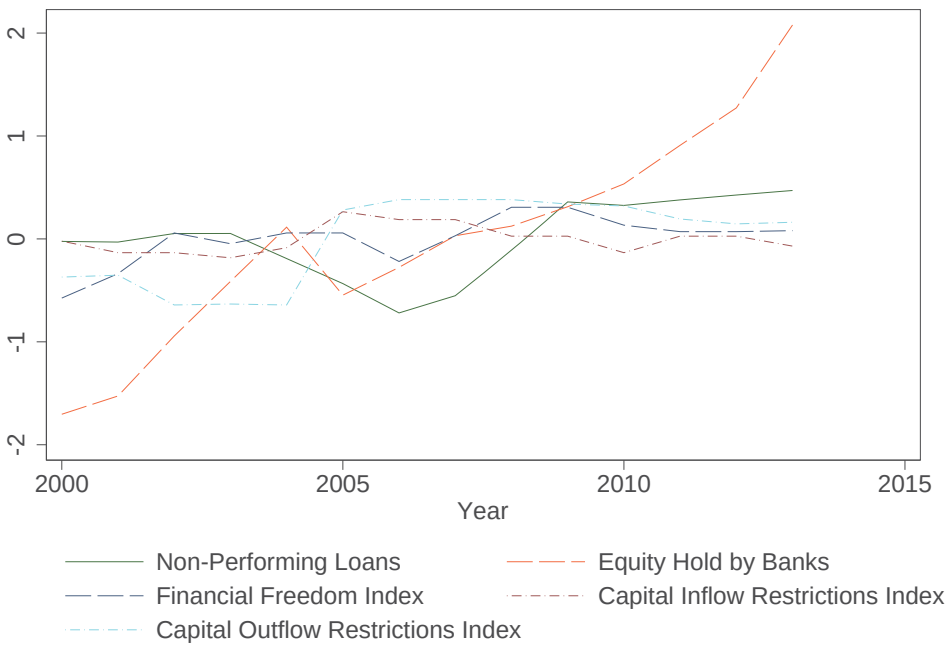

Figure B.1: All variables have been standardized to a mean of zero and a standard deviation of one for comparability. Variables show across-country means over the period 2000-2013. Higher values of the indexes represent stricter regulation. The GDP per capita and equity variables are measured in real values.

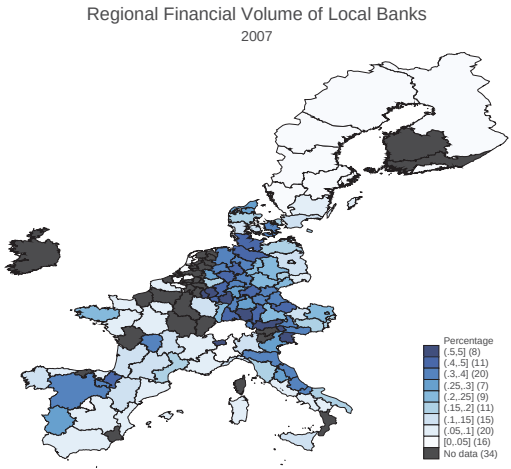

Figure B.2: Regional financial volume is measured as the ratio between aggregated loans of all local banks within a region and GDP.

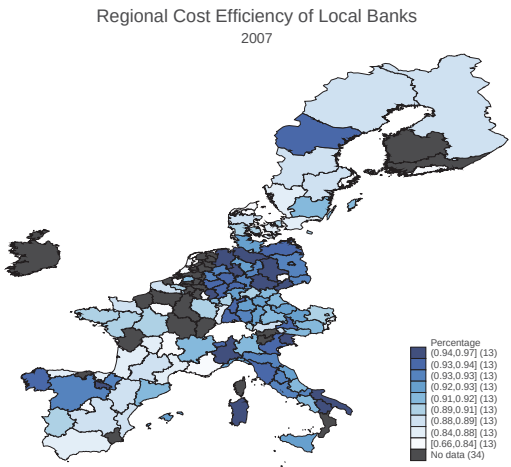

Figure B.3: Regional cost efficiency represents the average estimated cost efficiency of all local banks within a region.

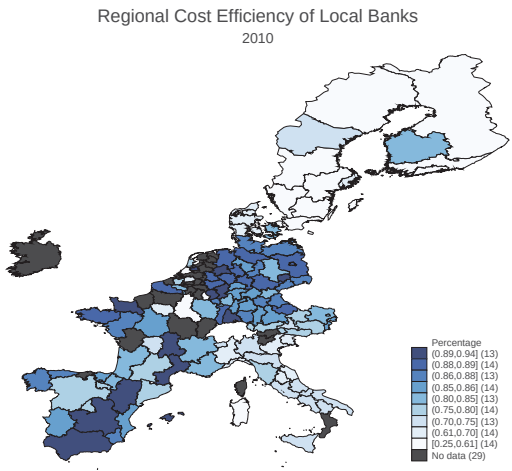

Figure B.4: Regional cost efficiency represents the average estimated cost efficiency of all local banks within a region.

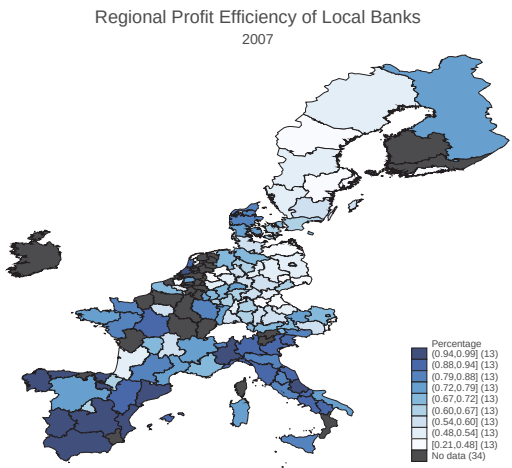

Figure B.5: Regional profit efficiency represents the average estimated profit efficiency of all local banks within a region.

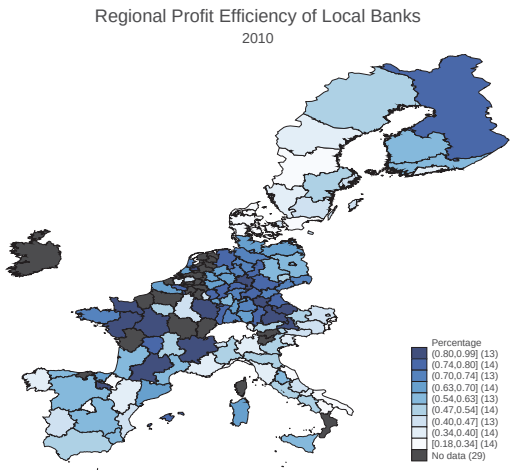

Figure B.6: Regional profit efficiency represents the average estimated profit efficiency of all local banks within a region.