

University of Groningen

The quality of banking and regional growth

Hasan, I.; Koetter, M.; Wedow, M.

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2007

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Hasan, I., Koetter, M., & Wedow, M. (2007). *The quality of banking and regional growth*. (Bundesbank Discussion Paper Series, serie 2 ; No. 10/2007). Deutsche Bundesbank.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

The quality of banking and regional growth

Iftekhhar Hasan

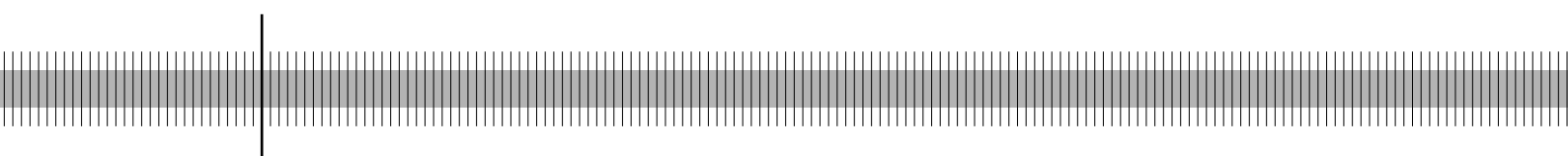
(Lally School of Management and Technology, Rensselaer Polytechnic Institute and Bank of Finland)

Michael Koetter

(University of Groningen and Deutsche Bundesbank)

Michael Wedow

(Deutsche Bundesbank)



Discussion Paper
Series 2: Banking and Financial Studies
No 10/2007

Discussion Papers represent the authors' personal opinions and do not necessarily reflect the views of the Deutsche Bundesbank or its staff.

Editorial Board: Heinz Herrmann
Thilo Liebig
Karl-Heinz Tödter

Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-1

Telex within Germany 41227, telex from abroad 414431

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

Internet <http://www.bundesbank.de>

Reproduction permitted only if source is stated.

ISBN 978-3-86558-325-3 (Printversion)

ISBN 978-3-86558-326-0 (Internetversion)

Abstract

We test whether output growth in European economic agglomeration regions depends on financial development. To this end we suggest a relative measure of the *quality* of financial institutions rather than the usual quantity proxy of financial development. In order to measure the quality of financial development we use profit efficiency derived from stochastic frontier analysis. We show that more efficient banks spur regional growth while the typically used quantity measure of financial development is negligible. Also, our results suggest an additional channel through which better banking can spur growth: the interaction of more credit with efficient banks.

Keywords: Bank performance, regional growth, bank efficiency, Europe
JEL: G21, O16, O47, O52

Non-technical summary

The creation of an efficient financial system is an explicit objective of the European Commission. Ongoing harmonization of regulation to foster an increasingly homogenous European banking system ultimately serves the purpose to enhance competition and thereby economic prosperity.

At the same time, regional differences continue to persist across European banking markets. Therefore, we investigate in this study whether regional bank efficiency has a positive impact on regional growth. We employ bank-specific data to estimate profit efficiency with stochastic frontier analysis for approximately 3,000 banks active in 160 European regions between 1997 and 2003. Our study thus analyzes if a micro-economic measure of banks' abilities to convert savings and deposits efficiently into loans suited to fund investments is positively affecting regional economic growth.

Our results confirm that higher mean profit efficiency fosters regional output growth. In particular, in Europe's fairly mature economic regions this quality channel for growth appears to be of larger importance compared to the traditionally employed quantity channel. In contrast to regional bank profit efficiency, neither the effect of credit volume relative to gross domestic product nor the interaction between quality and quantity are individually statistically different from zero.

The existence and economic significance of this quality channel of banking on growth is corroborated by our finding that it exhibits the largest positive magnitude when jointly specified with the quantity and interaction effects of financial development. Notably, in this parsimonious model all three measures affect growth significantly positive. However, the effect of improving regional profit efficiency is approximately three times as large as the respective two alternatives. We conclude that future studies on the finance-growth nexus should try to accommodate explicitly these three distinct mechanisms through which finance may foster growth.

Nichttechnische Zusammenfassung

Die Schaffung eines effizienten Finanzsystems ist ein erklärtes Ziel der Europäischen Kommission. Die Deregulierung und die Harmonisierung der Märkte für Finanzdienstleistungen haben vornehmlich zum Ziel, den Wettbewerb zu fördern und damit ökonomisches Wachstum zu unterstützen.

Gleichzeitig bleiben regionale Unterschiede innerhalb europäischer Bankenmärkte nach wie vor bestehen. Wir untersuchen deshalb in dieser Studie, ob regionale Bankeneffizienz einen positiven Einfluss auf regionales Wachstum in der EU hat. Zu diesem Zweck nutzen wir Bankdaten, um mittels der *Stochastic Profit Frontier Analysis* Profiteffizienz für etwa 3.000 Banken zu schätzen, welche in etwa 160 europäischen Regionen im Zeitraum von 1997 bis 2003 aktiv waren. Unser Beitrag untersucht somit, ob Banken durch ihre Mittlerfunktion einen positiven Wachstumsimpuls leisten können.

Unsere Ergebnisse bestätigen, dass es in Europas entwickelten Regionen insbesondere die Qualität des Bankwesens und nicht notwendigerweise die Menge an Krediten ist, welche einen positiven Einfluss auf wirtschaftliches Wachstum hat. Während individuelle Effekte einer höheren Kreditmenge relativ zum regionalen Bruttoinlandsprodukt und die Interaktion zwischen Bankeneffizienz und Kreditmenge keinen statistisch signifikanten Effekt zeigen, ist dies für das Profiteffizienzmaß der Fall.

Die Existenz und ökonomische Relevanz dieses Qualitätseffekts wird dadurch unterstützt, dass bei gleichzeitiger Spezifikation aller drei denkbaren Kanäle der Effizienzeffekt der mit Abstand bedeutsamste ist. Besonders bemerkenswert ist, dass in einer gemeinsamen Spezifikation der drei Kanäle alle einen positiven, signifikanten Effekt aufweisen. Dabei ist der Qualitätseffekt dreimal höher als die alternativen Kanäle. Zukünftige Studien zum *Finance-Growth Nexus* sollten daher diese unterschiedlichen Wirkungsmechanismen unterscheiden.

Contents

| | | |
|----------|-------------------------------------|-----------|
| 1 | Introduction | 1 |
| 2 | Methodology | 3 |
| 2.1 | Regional growth | 3 |
| 2.2 | Banking quality | 4 |
| 3 | Data and regional allocation | 6 |
| 4 | Results | 8 |
| 5 | Robustness | 11 |
| 6 | Conclusion | 13 |

The quality of banking and regional growth¹

1 Introduction

A better provision of financial services should reduce information asymmetries between lenders and borrowers and thus ease the accumulation of capital by a better selection of beneficial investment projects, improved monitoring of lenders and a mere reduction of resources wasted in the intermediation process by banks (Greenwood and Smith, 1996; Pagano, 1993).

Many studies analyze this finance-growth nexus empirically by explaining cross-country growth differentials by the volume of financial funds intermediated relative to economic output (King and Levine, 1993; Beck et al., 2000). However, a mere expansion of the quantity of credit need not indicate a qualitative improvement of intermediaries' abilities to channeling scarce financial funds from savers to borrowers. We suggest a more direct measure of the quality of finance rather than its quantity trying to address the issue of poor empirical proxies for theoretical counterparts raised by Levine (2004).

We test if bank efficiency, estimated at the firm-level, significantly spurs growth. This relative measure of bank performance gauges the *quality* of financial institutions relative to its peers instead of the quantity of financial funds intermediated. While a number of recent studies highlight the importance of local differences in the provision of financial services and the relation between financial market structure and economic growth, we are aware of only one study attempting to empirically measure the intermediation quality of banks

¹hasan@rpi.edu (I. Hasan), m.koetter@rug.nl (M. Koetter) and michael.wedow@bundesbank.de (M. Wedow). Michael Koetter acknowledges financial support from the Netherlands Organisation for Scientific Research under VENI grant number 016.075164. The paper represents the authors' personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank. All remaining errors are of course our own.

more explicitly. Lucchetti et al. (2001) confirm that regional growth in Italian provinces depends positively on mean cost efficiency of banks serving local communities. Other regional studies continue to highlight the importance to account for regional differences, but usually focus on other proxies of quality. For example, Guiso et al. (2004) use household survey data to demonstrate that the probability to obtain credit differs across Italian regions. Their results show that easier access to credit is conducive to higher regional growth rates and a larger number of new firm establishments, further underpinning the importance to account for regional financial development.

But these findings for Italy are contrasted to some extent by other studies, for example for the U.S. by Clarke (2004). She reports that the interstate branching act led to an expansion of credit provided, which is correlated with state growth. However, she also points out carefully that whether larger banking markets are a determinant or a consequence of economic growth remains a conundrum. Valverde et al. (2003) add to the ambiguity with a study on five Spanish provinces. They report that five different measures of competition are mostly related to narrowed interest margins. But Granger causality tests fail to support the hypothesis of ensuing growth spurts due to higher competition. They conclude that some of the evidence in the cross-country finance growth literature between more sophisticated measures of financial development and growth could thus be explained by unspecified third factors.

Our paper contributes on the few regional studies on financial development in two respects. First, we present evidence for the positive relation between banking quality and economic growth in European regions of 23 member countries of the European Union. Thus, we maintain the apparently important regional focus while covering a more comprehensive sample of an increasingly integrating financial system. To this end we employ bank-level data obtained from the Bankscope database, which we allocate each bank to a specific European region. Second, we hypothesize that a potential candidate for the un-

observed third factor is the economic efficiency of banks to convert scarce resources into financial products and services. More specifically, Humphrey and Pulley (1997) point out that cost efficiency alone may fail to capture a bank's ability to convert inputs efficiently into outputs since the measure focuses only on the cost aspects of banking businesses. Instead, they suggest to also assess bank's skills to maximize profits for a given production plan by estimating profit efficiency. Our study is to our best knowledge therefore the first to analyze the relation between regional growth in Europe and banks' abilities to generate profits efficiently.

The remainder of this paper is structured as follows. In section 2 we introduce our empirical approach to test whether higher regional profit efficiency fosters economic growth. Section 3 provides information on our approach to allocate banks to European regions and on the data used in this study. We discuss our results in section 4, before we conclude in section 6.

2 Methodology

2.1 Regional growth

Mora et al. (2005) identify regional growth poles as opposed to periphery regions in Europe, which exhibit significantly different growth patterns, respectively. Likewise, despite the ongoing harmonization of financial industries across European countries, the efficiency of banks to intermediate financial funds remains not only heterogeneous across national banking markets but also at the regional level within countries (Bos and Kool, 2006).

Given the importance of regional differences, we hypothesize that higher regional bank efficiency should promote regional growth, too. We specify a reduced form growth model as a dynamic panel model (Levine et al., 2000):

$$y_{r,t} = \alpha y_{r,t-1} + \beta_1 f v_{r,t} + \beta_2 f q_{r,t} + \gamma x_{r,t} + \mu_r + \epsilon_{r,t}. \quad (1)$$

Variables in lower cases are denoted in logarithms, t are time indicators and r indexes European regions at the NUTS (Nomenclature des unités territoriales statistiques) 2 level according to the taxonomy of *Eurostat*.² To eliminate μ_r , an unobserved region-specific effect, we use the GMM difference estimator of Arellano and Bond (1991) and employ lagged levels as instruments for $\Delta y_{r,t-1}$. We specify a vector of further control variables, x , the growth rate of the working population *POP*.³ Financial development is measured in two ways: the volume *FV* and the quality of financial development *FQ*. The former resembles the well-known specification of bank credit volume relative to GDP in the finance-growth literature.

2.2 Banking quality

The latter represents our approach to assess the quality of financial intermediation more directly. We measure a bank's *relative* efficiency to convert inputs into a production set while maximizing profits. Such a relative measure is conceptually less prone to reverse causality criticism. A higher ability of banks to demand inputs at given prices in optimal volumes and proportions should influence growth positively independent of whether the economy is expanding or contracting.

Secondly, a region that hosts banks that fulfil their project selection and loan monitoring functions on average more efficient relative to other regions, should benefit in terms of growth since the "right" projects receive funding at the "right" cost of lending given risk.

We assume that banks demand labor and borrowed funds at given factor

²Descriptive statistics of all data used are provided in section 3.

³Appropriate proxies of human capital were not available at the regional level.

prices w to produce customer loans y_1 and other earning assets y_2 subject to a technology constraint, which also depends on equity z , and a pricing opportunity set such that profits before tax PBT are maximized (Humphrey and Pulley, 1997). Note that in the alternative profit model, we assume that regional banks possess some pricing discretion on the output side subject to a pricing opportunity set $H(p, y, w, z)$, where p denotes output prices. $H(\bullet)$ is another constraint next to $T(\bullet)$. As noted by Altunbas et al. (2001) this model does not only allow for the reasonable assumption that banks may have some degrees of freedom in their local market, but also to circumvent well-known measurement problems with banks' output prices (Mountain and Thomas, 1999). Then, maximum profits $\pi^*(O, P, Z)$ depend on given input prices, available equity and output quantities and we write a translog stochastic profit frontier as:

$$\ln PBT_{it} = \alpha_i + \sum_{j=1}^J \alpha_j \ln x_{ijt} + \frac{1}{2} \sum_{j=1}^J \sum_{k=1}^K \alpha_{jk} \ln x_{ijt} \ln x_{ikt} + \varepsilon_{it}. \quad (2)$$

In addition to bank production data defined above, we also specify country dummies in z as well as a time trend t to account for technical change. Thus, we account for unobserved heterogeneity across European banks by controls and the bank-specific fixed effect α_i . A bank i can deviate from optimal profits before tax PBT due to random noise v_{it} or inefficiency u_{it} .

We use a recently suggested panel frontier estimator by Greene (2005), which allows for time-variant inefficiency which does not impose any monotonous trend of efficiency over time as most other estimators do. Upon estimation of equation (2), we impose homogeneity and symmetry restrictions and define the total error as $\varepsilon_{it} = v_{it} - u_{it}$ with random error term v_{it} *iid* with $v_i \sim N(0, \sigma_v^2)$. Inefficiency is *iid* with $u_{it} \sim N|(0, \sigma_u^2)|$ and independent of the v_{it} . Point estimates of efficiency are obtained as the conditional expectation of u given ε (Kumbhakar and Lovell, 2000). Hence, a value for profit efficiency PE of 80%

implies that the bank could have generated 20% more of observed profits with the given production plan, had it been employing in- and outputs efficiently

3 Data and regional allocation

We use data on financial accounts for approximately 7000 banks active in the EU-25 between 1997 and 2003 available from Bankscope. These banks are mapped to 254 NUTS 2 regions on the basis of three regional identifiers included in the Bankscope database.⁴ In addition to the country and the city, a zip code is provided for most banks. The availability of these regional identifiers eased the mapping considerably.

We proceeded to map banks to NUTS 2 regions starting with Germany, which represents the country with the largest national group of banks in the sample. The mapping of German banks is facilitated by the fact that German districts *Regierungsbezirke* correspond to NUTS 2 regions. Given that we have the postcodes of banks and matching *Regierungsbezirke*, the majority of German banks is easily allocated to NUTS 2 regions.⁵

In a similar vein, we allocate French banks to their respective NUTS region with the help of their the postcode. The NUTS 2 regions in France correspond to the 26 departements, which include several postcodes. We use the information on banks' postcodes to map banks to their NUTS 2 regions. The first two digits of the French postcode identify the NUTS 2 region. Also Italian

⁴Note there are 50 banks for which neither city nor postcode is available

⁵In order to map postcodes to *Regierungsbezirke* we relied on the so-called Regionalschlüssel which enciphers German regions via a 12 digit code. The largest territorial unit, the Federal State (Bundesland), is enciphered by the first two digits while the smallest unit, municipality (Gemeinde), is given by the 10th to 12th digit. *Regierungsbezirke* are given by the third digit. Particular care has to be taken for one case where the *Regionalschlüssel* indicates only one *Regierungsbezirk* when there are in fact two namely Brandenburg-Nordost (NUTS 2 code DE41) and Brandenburg-Südwest (NUTS code DE42).

banks are allocated to NUTS codes via their postcodes. Here, a range of postcodes corresponds to a NUTS code. The allocation of the Spanish banks was facilitated by the fact that the NUTS 2 regions coincide with the 17 Spanish autonomic regions, which are divided in 50 provinces. Given that postcodes in Spain correspond with the provinces we allocate the Spanish banks with their Nuts 2 regions. The first two letters of the postcode identify the province and consequently the NUTS region. NUTS 2 regions in Austria conform with the Austrian *Bundesländer*. The Austrian system of postcodes is linked with the 9 *Bundesländer*. Hence, the allocation of the Austrian banks could be realized by connecting the postcodes with the NUTS 2 regions.

All banks that could not be mapped via their post code are mapped manually. In this second step we used the information on the city to allocate banks to NUTS 2 regions. This procedure reduces the number of units that have to be allocated significantly. In addition we use the postcode to double-check.⁶

Eight countries comprise only one NUTS 2 region. In these cases the allocation of banks to NUTS 2 regions is straightforward given the country location of banks. These countries are Cyprus, Denmark, Estonia, Latvia, Lithuania, Luxembourg, Malta and Slovenia.

We aggregate point estimates of profit efficiency to serve as our proxy for the regional quality of financial intermediaries FQ . Our data from Eurostat is an unbalanced panel of the 254 different NUTS 2 regions in the EU-25.⁷ We regress real gross domestic product per worker on the growth of the working population and our proxies for financial development. After the exclusion of outliers, our sample includes unconsolidated financial accounts data for 23,310 universal bank-year observations between 1996 and 2003. We depict descriptive statistics on these data in table 1.

⁶Oversea and Offshore territories were omitted form the data set.

⁷Regions in Poland and Slovenia were dropped from the sample given implausible observations on bank data which are probably due to data errors. Hence our sample comprises 23 countries and 237 NUTS 2 regions.

Table 1: Descriptive statistics on regional and bank-specific data

| | 1997 | 1999 | 2001 | 2003 | Total |
|-------------------------------|--------|--------|--------|--------|--------|
| Regional Data | | | | | |
| <i>GDP per worker</i> | 42,665 | 45,619 | 48,425 | 50,434 | 47,146 |
| <i>Worker growth</i> | 3.5% | 4.6% | 4.4% | 3.2% | 4.2% |
| <i>Profit Efficiency</i> | 36.8% | 38.3% | 33.8% | 38.0% | 36.3% |
| <i>Loans and bonds to GDP</i> | 1.44 | 1.25 | 1.22 | 1.23 | 1.25 |
| <i>Regions</i> | 108 | 132 | 144 | 148 | 160 |
| Bank data | | | | | |
| <i>Personnel Expenses</i> | 1.50% | 1.45% | 1.43% | 1.41% | 1.45% |
| <i>Funding cost</i> | 4.35% | 3.29% | 3.51% | 2.60% | 3.56% |
| <i>Customer Loans</i> | 1,094 | 1,122 | 1,303 | 1,589 | 1,304 |
| <i>Other earning assets</i> | 1,157 | 1,048 | 1,081 | 1,331 | 1,181 |
| <i>Equity</i> | 119.1 | 120.7 | 155.1 | 197.9 | 152.6 |
| <i>Profits before tax</i> | 13.72 | 16.58 | 20.64 | 23.40 | 19.02 |
| <i>Gross total assets</i> | 2,401 | 2,338 | 2,583 | 3,164 | 2,675 |
| <i>No. of banks</i> | 3185 | 3318 | 3160 | 2802 | 27187 |

Notes: GDP per worker in Euros. All bank data except factor cost in millions of Euro.

4 Results

We depict parameters estimates for the regional growth model in equation (1) in table 2. Since especially the volume of financial funds may not be independent of economic growth, we specify both measures of financial development as endogenous variables and use lagged levels as instruments. This approach is supported by the Sargan specification tests.

Consider first the direct effect of regional bank efficiency in the first column of table 2. The effect of a one percent increase in regional bank profit efficiency spurs regional output growth by approximately 0.03%. Put differently, a higher ability of banks in the region to convert inputs profit efficiently

Table 2: Growth estimation on GDP per worker in European regions

| | Quality | Quantity | Both | Interaction | All |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| y_{t-1} | 0.955*** [0.035] | 0.917*** [0.032] | 0.910*** [0.043] | 0.902*** [0.046] | 0.931*** [0.038] |
| FQ | 0.026** [0.010] | | 0.027** [0.011] | | 0.051*** [0.017] |
| FV | | 0.009 [0.008] | 0.004 [0.005] | | 0.012 [0.007] |
| FQ*FV | | | | -0.010* [0.005] | 0.012** [0.006] |
| POP | -0.136*** [0.026] | -0.152*** [0.038] | -0.143*** [0.038] | -0.128*** [0.043] | -0.165*** [0.035] |
| Constant | -0.003** [0.001] | -0.004* [0.002] | -0.002 [0.002] | -0.001 [0.002] | -0.002* [0.001] |
| No. of Obs. | 954 | 995 | 945 | 945 | 945 |
| No. of Regions | 161 | 169 | 160 | 160 | 160 |
| Sargan [chi] | 45.18 | 53.75 | 53.05 | 46.49 | 55.96 |
| Sargan [df] | 33 | 33 | 39 | 33 | 45 |
| AR1 [z-value]: | -6.34 | -6.17 | -5.95 | -5.93 | -6.17 |
| AR2 [z-value]: | -1.97 | -2.64 | -2.09 | -2.28 | -1.97 |

Notes: Robust standard errors. Sargan test from two step, parameters from one-step estimation

Time dummies included but not reported. *, **, *** significant at 10%/5%/1%

into financial services and products has a positive influence on regional economic growth. Since regional mean PE is fairly low at 36%, the magnitude of the coefficient implies that already an improvement of banks operating efficiency by around one standard deviation (about 6%) would translate into 0.4 percentage points of additional economic growth. Since these economically meaningful gains could theoretically be simply accomplished by a slightly less wasteful way of banking, this result is an important indication to further foster the profit efficiency of banking in Europe.

In the second column of table 2, we next test the effect of the traditionally specified quantity variable, FV , on regional European growth. While positive, our results do not confirm a significant direct effect of larger credit volumes relative to GDP. Apparently, a mere expansion of credit volume alone does not promote growth in Europe's generally fairly mature economies. As previously, and in line with expectations, the coefficients on the lagged endogenous variable and growth of the working population are positive but smaller one and negative, respectively.

While both the quantity and the quality of the provision of financial services may have individual effects on growth, it is intuitive to also expect both effects to interact with each other. Providing more credit with low efficiency may imply a poor selection of projects. High efficiency alone, in turn, may indicate that banks scrutinize excessively their supply of loans and avoid, for example, lending to more opaque small businesses which might bear future loan write off's given a difficult and costly assessment.

Therefore, we also test if the interaction between the quality of intermediaries and the volume of intermediated funds has a significant effect on growth. The individual effect in the third column influences regional growth in Europe significantly but with a wrong sign. The negative sign, however, disappears when a parsimonious model depicted in the final column is specified. The result demonstrates that future studies on the finance-growth nexus need to account for three channels through which better banking can spur growth: a direct quality and quantity effect, respectively, as well as the beneficial interaction of more regional credit in conjunction with efficient regional banks.

Regarding the magnitude of these coefficients, we find that it is in particular more efficient banking that offers most scope to foster regional economic growth. A one percent increase in the profit efficiency of banks has approximately three times the effect on growth compared to either the same relative increase in lending volume or the interaction between both channels. We con-

clude that the quality of financial institutions in a region has a positive impact on growth independent of the quantity channel. Also after including the volume and the interaction effect, respectively, we still find a positive coefficient of bank efficiency.

The specifications in table 2 are further confirmed by the coefficient of our control variable for the growth of the working population *POP*. In line with theory, the coefficient is negative and significant across all specifications implying that an increase in the working population leads to a lower per capita income (Solow, 1956) .

5 Robustness

To check the robustness of our results we run additional estimations focusing on a subset of the regions in our data set. To begin with we use the regions in the EU 12, 15 and 19. The sample of regions in the EU 12 and 15 represent the financially more developed regions in the EU while the EU 19 also includes regions from the new accession countries. Columns 2 to 4 in Table 3 contain the results.

The results largely underpin the previously shown result, namely, financial development and particularly the quality of financial intermediation matters for economic growth. The results in column (1) further highlight that in more mature economies financial development predominantly works via the interplay of quality and quantity. We also exclude a number of regions which present financial centers and may thus bias our results.⁸ However, as column (5) shows the exclusion of financial centers only marginally affects our results. Our measure for the quality of financial development and the interaction term retain their positive and significant coefficient while the quantity measure turns in-

⁸These regions are Amsterdam, Frankfurt, London, Luxembourg, Madrid, Milan and Paris.

significant. Finally, we include a concentration ratio measured by the market share of the five largest banks within a region to check our results for a possible misspecification due to omitted variables. The result in column (6) shows that a higher concentration is positively and significantly related to growth and confirms the arguments in the literature (Cetorelli, 2001) . However, the inclusion only marginally affects our previously identified channels through which financial development affects economic growth.

Table 3: Robustness: Growth estimation in European regions

| | EU 12 | EU 15 | EU 19 | excl. Fin. Centers | incl. CR5 ratio |
|----------------|----------------------|----------------------|----------------------|-----------------------|----------------------|
| y_{t-1} | 0.845*** [0.078] | 0.847*** [0.078] | 0.811*** [0.075] | 0.940*** [0.036] | 0.922*** [0.038] |
| FQ | 0.019* [0.011] | 0.021* [0.012] | 0.038*** [0.013] | 0.046** [0.018] | 0.056*** [0.018] |
| FV | 0.01 [0.008] | 0.012* [0.006] | 0.009 [0.006] | 0.01 [0.008] | 0.015** [0.008] |
| FQ*FV | 0.010* [0.006] | 0.011** [0.004] | 0.009* [0.005] | 0.010* [0.006] | 0.014** [0.006] |
| POP | -0.263*** [0.027] | -0.150*** [0.032] | -0.137*** [0.033] | -0.163*** [0.035] | -0.166*** [0.034] |
| CR5 | | | | | 0.050** [0.020] |
| No. of Obs. | 844 | 890 | 917 | 904 | 945 |
| No. of Regions | 134 | 148 | 155 | 153 | 160 |
| Sargan [chi] | 75.24 | 64.63 | 67.56 | 58.67 | 56.97 |
| Sargan [df] | 45 | 45 | 45 | 45 | 45 |
| AR1 [z-value]: | -5.46 | -5.22 | -5 | -6.12 | -6.24 |
| AR2 [z-value]: | -1.32 | -1.63 | -1.87 | -1.66 | -1.86 |

Notes: Robust standard errors. Sargan test from two step, parameters from one-step

estimation. Constant and time dummies included but not reported. *,**,*** significant at 10%/5%/1%

6 Conclusion

We suggest a measure to assess the impact of the quality of financial intermediaries on economic growth rather than the traditionally employed quantity proxies of financial fund volumes. To this end we measure European bank's profit efficiency and allocate both financial quality and quantity indicators to the NUTS 2 region of the bank. Our results show that economic growth in the regions of the EU benefits significantly from higher regional profit efficiency.

Our results after including also the quantity channel of financial development and the interaction between both better and more banking corroborate the presence of an independent effect of profit efficiency on European economic growth. In fact, the findings highlight the importance to specify all three possible channels through which banks may foster output growth. According to our estimates improvements in efficiency have approximately three times the effect compared to both the quantity and interaction channel. Thus, we conclude that it is especially the quality of financial services provision in the vein of Schumpeter that spurs economic prosperity in Europe's relative mature economic regions.

References

- Altunbas, Y., L. Evans, and P. Molyneux (2001). Bank Ownership and Efficiency. *Journal of Money, Credit, and Banking* 33(4), 926–954.
- Arellano, M. and S. Bond (1991). Some Tests for Specification of Panel Data: Monte Carlo Evidence with an Application for Employment Equations. *Review of Economic Studies* 58, 277–299.
- Beck, T., R. Levine, and N. Loayza (2000). Finance and the Sources of Growth. *Journal of Financial Economics* 58, 261–300.
- Bos, J. W. B. and C. J. M. Kool (2006). Bank Efficiency: The Role of Bank Strategy and Local Market Conditions. *Journal of Banking & Finance* 30, 1953–1974.
- Cetorelli, N. (2001). Competition among banks: good or bad? *Economic Perspectives*, 38–48.
- Clarke, M. Z. (2004). Geographic deregulation of banking and economic growth. *Journal of Money, Credit, and Banking* 36, 929–942.
- Greene, W. (2005). Reconsidering Heterogeneity in Panel Data Estimators of the Stochastic Frontier Model. *Journal of Econometrics* 126, 269–303.
- Greenwood, J. and B. Smith (1996). Financial Markets in Development, and the Development of Financial Markets. *Journal of Economic Dynamics and Control* 21, 145–181.
- Guiso, L., P. Sapienza, and L. Zingales (2004). Does Local Financial Development Matter? *Quarterly Journal of Economics* 119.
- Humphrey, D. B. and B. Pulley, Lawrence (1997). Bank's Response to Deregulation: Profits, Technology and Efficiency. *Journal of Money, Credit, and Banking* 29(1), 73–93.

- King, R. and R. Levine (1993). Finance and Growth: Schumpeter Might Be Right. *Quarterly Journal of Economics* 108, 717–737.
- Kumbhakar, S. C. and C. A. K. Lovell (2000). *Stochastic Frontier Analysis*. Cambridge: Cambridge University Press.
- Levine, R. (2004). Finance and Growth: Theory and Evidence. *NBER Working Paper Series* (10766), 1–116.
- Levine, R., N. Loayza, and T. Beck (2000). Financial Intermediation and Growth: Causality and Causes. *Journal of Monetary Economics* 46, 31–77.
- Lucchetti, R., L. Papi, and A. Zazzaro (2001). Bank’s Inefficiency and Economic Growth: A Micro-Macro Approach. *Scottish Journal of Political Economy* 48(4), 400–424.
- Mora, T., E. Vayá, and J. Suriñach (2005). Specialisation and growth: the detection of European regional convergence clubs. *Economic Letters* 86, 181–185.
- Mountain, D. C. and H. Thomas (1999). Factor Price Misspecification in Bank Cost Function Estimation. *Journal of International Financial Markets, Institutions and Money* 9(2), 163–182.
- Pagano, M. (1993). Financial markets and growth: An overview. *European Economic Review* 37, 613–622.
- Solow, R. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics* 70, 65–94.
- Valverde, S. C., D. B. Humphrey, and F. Fernandez (2003). Deregulation, Bank Competition and Regional Growth. *Regional Studies* 37(3), 227–237.

The following Discussion Papers have been published since 2006:

Series 1: Economic Studies

| | | | |
|---|------|--|--|
| 1 | 2006 | The dynamic relationship between the Euro overnight rate, the ECB's policy rate and the term spread | Dieter Nautz Christian J. Offermanns |
| 2 | 2006 | Sticky prices in the euro area: a summary of new micro evidence | Álvarez, Dhyne, Hoeberichts Kwapil, Le Bihan, Lünnemann Martins, Sabbatini, Stahl Vermeulen, Vilmunen |
| 3 | 2006 | Going multinational: What are the effects on home market performance? | Robert Jäckle |
| 4 | 2006 | Exports versus FDI in German manufacturing: firm performance and participation in international markets | Jens Matthias Arnold Katrin Hussinger |
| 5 | 2006 | A disaggregated framework for the analysis of structural developments in public finances | Kremer, Braz, Brosens Langenus, Momigliano Spolander |
| 6 | 2006 | Bond pricing when the short term interest rate follows a threshold process | Wolfgang Lemke Theofanis Archontakis |
| 7 | 2006 | Has the impact of key determinants of German exports changed? Results from estimations of Germany's intra euro-area and extra euro-area exports | Kerstin Stahn |
| 8 | 2006 | The coordination channel of foreign exchange intervention: a nonlinear microstructural analysis | Stefan Reitz Mark P. Taylor |
| 9 | 2006 | Capital, labour and productivity: What role do they play in the potential GDP weakness of France, Germany and Italy? | Antonio Bassanetti Jörg Döpke, Roberto Torrini Roberta Zizza |

| | | | |
|----|------|--|---|
| 10 | 2006 | Real-time macroeconomic data and ex ante predictability of stock returns | J. Döpke, D. Hartmann C. Pierdzioch |
| 11 | 2006 | The role of real wage rigidity and labor market frictions for unemployment and inflation dynamics | Kai Christoffel Tobias Linzert |
| 12 | 2006 | Forecasting the price of crude oil via convenience yield predictions | Thomas A. Knetsch |
| 13 | 2006 | Foreign direct investment in the enlarged EU: do taxes matter and to what extent? | Guntram B. Wolff |
| 14 | 2006 | Inflation and relative price variability in the euro area: evidence from a panel threshold model | Dieter Nautz Juliane Scharff |
| 15 | 2006 | Internalization and internationalization under competing real options | Jan Hendrik Fisch |
| 16 | 2006 | Consumer price adjustment under the microscope: Germany in a period of low inflation | Johannes Hoffmann Jeong-Ryeol Kurz-Kim |
| 17 | 2006 | Identifying the role of labor markets for monetary policy in an estimated DSGE model | Kai Christoffel Keith Küster Tobias Linzert |
| 18 | 2006 | Do monetary indicators (still) predict euro area inflation? | Boris Hofmann |
| 19 | 2006 | Fool the markets? Creative accounting, fiscal transparency and sovereign risk premia | Kerstin Bernoth Guntram B. Wolff |
| 20 | 2006 | How would formula apportionment in the EU affect the distribution and the size of the corporate tax base? An analysis based on German multinationals | Clemens Fuest Thomas Hemmelgarn Fred Ramb |

| | | | |
|----|------|--|---|
| 21 | 2006 | Monetary and fiscal policy interactions in a New Keynesian model with capital accumulation and non-Ricardian consumers | Campbell Leith Leopold von Thadden |
| 22 | 2006 | Real-time forecasting and political stock market anomalies: evidence for the U.S. | Martin Bohl, Jörg Döpke Christian Pierdzioch |
| 23 | 2006 | A reappraisal of the evidence on PPP: a systematic investigation into MA roots in panel unit root tests and their implications | Christoph Fischer Daniel Porath |
| 24 | 2006 | Margins of multinational labor substitution | Sascha O. Becker Marc-Andreas Müндler |
| 25 | 2006 | Forecasting with panel data | Badi H. Baltagi |
| 26 | 2006 | Do actions speak louder than words? Household expectations of inflation based on micro consumption data | Atsushi Inoue Lutz Kilian Fatma Burcu Kiraz |
| 27 | 2006 | Learning, structural instability and present value calculations | H. Pesaran, D. Pettenuzzo A. Timmermann |
| 28 | 2006 | Empirical Bayesian density forecasting in Iowa and shrinkage for the Monte Carlo era | Kurt F. Lewis Charles H. Whiteman |
| 29 | 2006 | The within-distribution business cycle dynamics of German firms | Jörg Döpke Sebastian Weber |
| 30 | 2006 | Dependence on external finance: an inherent industry characteristic? | George M. von Furstenberg Ulf von Kalckreuth |
| 31 | 2006 | Comovements and heterogeneity in the euro area analyzed in a non-stationary dynamic factor model | Sandra Eickmeier |

| | | | |
|----|------|--|---|
| 32 | 2006 | Forecasting using a large number of predictors: is Bayesian regression a valid alternative to principal components? | Christine De Mol Domenico Giannone Lucrezia Reichlin |
| 33 | 2006 | Real-time forecasting of GDP based on a large factor model with monthly and quarterly data | Christian Schumacher Jörg Breitung |
| 34 | 2006 | Macroeconomic fluctuations and bank lending: evidence for Germany and the euro area | S. Eickmeier B. Hofmann, A. Worms |
| 35 | 2006 | Fiscal institutions, fiscal policy and sovereign risk premia | Mark Hallerberg Guntram B. Wolff |
| 36 | 2006 | Political risk and export promotion: evidence from Germany | C. Moser T. Nestmann, M. Wedow |
| 37 | 2006 | Has the export pricing behaviour of German enterprises changed? Empirical evidence from German sectoral export prices | Kerstin Stahn |
| 38 | 2006 | How to treat benchmark revisions? The case of German production and orders statistics | Thomas A. Knetsch Hans-Eggert Reimers |
| 39 | 2006 | How strong is the impact of exports and other demand components on German import demand? Evidence from euro-area and non-euro-area imports | Claudia Stirböck |
| 40 | 2006 | Does trade openness increase firm-level volatility? | C. M. Buch, J. Döpke H. Strotmann |
| 41 | 2006 | The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis | Kirsten H. Heppke-Falk Jörn Tenhofen Guntram B. Wolff |

| | | | |
|----|------|---|---|
| 42 | 2006 | How good are dynamic factor models at forecasting output and inflation? A meta-analytic approach | Sandra Eickmeier Christina Ziegler |
| 43 | 2006 | Regionalwährungen in Deutschland – Lokale Konkurrenz für den Euro? | Gerhard Rösl |
| 44 | 2006 | Precautionary saving and income uncertainty in Germany – new evidence from microdata | Nikolaus Bartsch |
| 45 | 2006 | The role of technology in M&As: a firm-level comparison of cross-border and domestic deals | Rainer Frey Katrin Hussinger |
| 46 | 2006 | Price adjustment in German manufacturing: evidence from two merged surveys | Harald Stahl |
| 47 | 2006 | A new mixed multiplicative-additive model for seasonal adjustment | Stephanus Arz |
| 48 | 2006 | Industries and the bank lending effects of bank credit demand and monetary policy in Germany | Ivo J.M. Arnold Clemens J.M. Kool Katharina Raabe |
| 01 | 2007 | The effect of FDI on job separation | Sascha O. Becker Marc-Andreas Müндler |
| 02 | 2007 | Threshold dynamics of short-term interest rates: empirical evidence and implications for the term structure | Theofanis Archontakis Wolfgang Lemke |
| 03 | 2007 | Price setting in the euro area: some stylised facts from individual producer price data | Dias, Dossche, Gautier Hernando, Sabbatini Stahl, Vermeulen |
| 04 | 2007 | Unemployment and employment protection in a unionized economy with search frictions | Nikolai Stähler |

| | | | |
|----|------|---|---|
| 05 | 2007 | End-user order flow and exchange rate dynamics | S. Reitz, M. A. Schmidt M. P. Taylor |
| 06 | 2007 | Money-based interest rate rules: lessons from German data | C. Gerberding F. Seitz, A. Worms |
| 07 | 2007 | Moral hazard and bail-out in fiscal federations: evidence for the German Länder | Kirsten H. Heppke-Falk Guntram B. Wolff |
| 08 | 2007 | An assessment of the trends in international price competitiveness among EMU countries | Christoph Fischer |
| 09 | 2007 | Reconsidering the role of monetary indicators for euro area inflation from a Bayesian perspective using group inclusion probabilities | Michael Scharnagl Christian Schumacher |
| 10 | 2007 | A note on the coefficient of determination in regression models with infinite-variance variables | Jeong-Ryeol Kurz-Kim Mico Loretan |
| 11 | 2007 | Exchange rate dynamics in a target zone - a heterogeneous expectations approach | Christian Bauer Paul De Grauwe, Stefan Reitz |
| 12 | 2007 | Money and housing - evidence for the euro area and the US | Claus Greiber Ralph Setzer |
| 13 | 2007 | An affine macro-finance term structure model for the euro area | Wolfgang Lemke |
| 14 | 2007 | Does anticipation of government spending matter? Evidence from an expectation augmented VAR | Jörn Tenhofen Guntram B. Wolff |
| 15 | 2007 | On-the-job search and the cyclical dynamics of the labor market | Michael Krause Thomas Lubik |
| 16 | 2007 | Heterogeneous expectations, learning and European inflation dynamics | Anke Weber |

| | | | |
|----|------|--|----------------------------------|
| 17 | 2007 | Does intra-firm bargaining matter for business cycle dynamics? | Michael Krause Thomas Lubik |
| 18 | 2007 | Uncertainty about perceived inflation target and monetary policy | Kosuke Aoki Takeshi Kimura |
| 19 | 2007 | The rationality and reliability of expectations reported by British households: micro evidence from the British household panel survey | James Mitchell Martin Weale |
| 20 | 2007 | Money in monetary policy design under uncertainty: the Two-Pillar Phillips Curve versus ECB-style cross-checking | Günter W. Beck Volker Wieland |

Series 2: Banking and Financial Studies

| | | | |
|----|------|---|---|
| 01 | 2006 | Forecasting stock market volatility with macroeconomic variables in real time | J. Döpke, D. Hartmann C. Pierdzioch |
| 02 | 2006 | Finance and growth in a bank-based economy: is it quantity or quality that matters? | Michael Koetter Michael Wedow |
| 03 | 2006 | Measuring business sector concentration by an infection model | Klaus Düllmann |
| 04 | 2006 | Heterogeneity in lending and sectoral growth: evidence from German bank-level data | Claudia M. Buch Andrea Schertler Natalja von Westernhagen |
| 05 | 2006 | Does diversification improve the performance of German banks? Evidence from individual bank loan portfolios | Evelyn Hayden Daniel Porath Natalja von Westernhagen |
| 06 | 2006 | Banks' regulatory buffers, liquidity networks and monetary policy transmission | Christian Merkl Stéphanie Stolz |
| 07 | 2006 | Empirical risk analysis of pension insurance – the case of Germany | W. Gerke, F. Mager T. Reinschmidt C. Schmieder |
| 08 | 2006 | The stability of efficiency rankings when risk-preferences and objectives are different | Michael Koetter |
| 09 | 2006 | Sector concentration in loan portfolios and economic capital | Klaus Düllmann Nancy Masschelein |
| 10 | 2006 | The cost efficiency of German banks: a comparison of SFA and DEA | E. Fiorentino A. Karmann, M. Koetter |
| 11 | 2006 | Limits to international banking consolidation | F. Fecht, H. P. Grüner |

| | | | |
|----|------|--|---|
| 12 | 2006 | Money market derivatives and the allocation of liquidity risk in the banking sector | Falko Fecht Hendrik Hakenes |
| 01 | 2007 | Granularity adjustment for Basel II | Michael B. Gordy Eva Lütkebohmert |
| 02 | 2007 | Efficient, profitable and safe banking: an oxymoron? Evidence from a panel VAR approach | Michael Koetter Daniel Porath |
| 03 | 2007 | Slippery slopes of stress: ordered failure events in German banking | Thomas Kick Michael Koetter |
| 04 | 2007 | Open-end real estate funds in Germany – genesis and crisis | C. E. Bannier F. Fecht, M. Tyrell |
| 05 | 2007 | Diversification and the banks' risk-return-characteristics – evidence from loan portfolios of German banks | A. Behr, A. Kamp C. Memmel, A. Pfingsten |
| 06 | 2007 | How do banks adjust their capital ratios? Evidence from Germany | Christoph Memmel Peter Raupach |
| 07 | 2007 | Modelling dynamic portfolio risk using risk drivers of elliptical processes | Rafael Schmidt Christian Schmieder |
| 08 | 2007 | Time-varying contributions by the corporate bond and CDS markets to credit risk price discovery | Niko Dötz |
| 09 | 2007 | Banking consolidation and small business finance – empirical evidence for Germany | K. Marsch, C. Schmieder K. Forster-van Aerssen |
| 10 | 2007 | The quality of banking and regional growth | Hasan, Koetter, Wedow |

Visiting researcher at the Deutsche Bundesbank

The Deutsche Bundesbank in Frankfurt is looking for a visiting researcher. Among others under certain conditions visiting researchers have access to a wide range of data in the Bundesbank. They include micro data on firms and banks not available in the public. Visitors should prepare a research project during their stay at the Bundesbank. Candidates must hold a Ph D and be engaged in the field of either macroeconomics and monetary economics, financial markets or international economics. Proposed research projects should be from these fields. The visiting term will be from 3 to 6 months. Salary is commensurate with experience.

Applicants are requested to send a CV, copies of recent papers, letters of reference and a proposal for a research project to:

Deutsche Bundesbank
Personalabteilung
Wilhelm-Epstein-Str. 14

60431 Frankfurt
GERMANY

