Bank Efficiency in the Enlarged European Union[1]

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1. Introduction

The banking sectors of the European Union have faced numerous challenges in the past decade. With regard to old EU members, as a result of the Second European Banking Directive and the Single European Passport the speed of deregulation accelerated, and with the elimination or lowering of barriers market-entry costs substantially decreased, favouring competition and the creation of a Unified Banking Market. Economic and monetary union also encouraged the abolition of operational obstacles. The introduction of the euro opened the way for the further deepening of banking sector integration, whereby local banks gradually lost their competitive edge to foreign banks, mainly in terms of financial services. The rapid development of information technology, the appearance of new competitors exploiting opportunities offered by a global capital market and the creation of new markets linked to rapid innovations also promoted the intensification of competition and the accelerated consolidation of the European banking system.

Following the collapse of the centrally planned economic regime and the break-up of the mono-bank system in the new EU members, financial market liberalisation as well as economic privatisation laid the foundations of the modern financial institutional system. Considerable foreign capital inflow, market consolidation and the creation of an efficient regulatory framework contributed to the rapid transformation and development of the banking system and the market- based pricing and lending activity of banks. The integration of the banking system into the Single Banking Market commenced in parallel with the transformation of the financial intermediary system. Economic convergence, the harmonisation of regulations and the enlargement of the EU further accelerated the consolidation and integration of the banking systems of the new EU member states.

Several factors can generate efficiency differences and change their measure across banking sectors of EU members. On the one hand, discrepancies in operational environment, i.e. country-specific elements and, on the other, different managerial abilities may cause an efficiency gap. National discrepancies in operational environment can derive from macroeconomic differences or dissimilar characteristics of financial infrastructure and institutional system, as well as from other country-specific factors. Managerial ability is defined in terms of adequate resource allocation and beneficial utilisation of technological opportunities. While operational environment exogenously explains efficiency differences, the executive and professional competence of management endogenously contributes to them.

Our study focuses on the estimation of the efficiency gap between old and new EU members and the impact of exogenous (out of managerial control) and endogenous (under the control of management) factors upon it. For this purpose we attempt to separate these two types of effects by controlling for home bias.

Two types of efficiency indicators are derived: so-called X-efficiency and alternative profit-efficiency. X-efficiency gives a measure of how managers are able to minimise cost and thus maximise profit by input allocation and exploration of technological opportunities alongside given output and input prices. Alternative profit-efficiency is measured by how managers are able to maximise profit if the output price is not given. We empirically confirm that the results produced from the measurement of cost- and profit-efficiency, as well as the conclusions, vary to a major degree depending on whether exogenous factors, i.e. operational characteristics, are controlled or not.

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[1] The full paper is available on the webpage of Magyar Nemzeti Bank (www.mnb.hu). The authors assume sole responsibility for the remaining errors.

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Our study underlines the importance of accounting for heterogeneity in operational environment. Due to profit-maximisation, only managerial ability in efficiency improvement is of particular relevance from the point of view of financial stability. Due to high profitability led by an insufficient level of competition or other market distortions, management may not pay enough attention to cost rationalisation or cost reduction, i.e. cost-efficiency improvement.[3] Yet this involves risk. Only "conscious" efficiency improvement can permanently contribute to banks' income generating capability, since in the long term, as a consequence of the Unified European Banking Market, the efficiency differences caused by market distortions will probably disappear. The improvement of banking efficiency may have not only stability- but also welfare-related implications. Due to the "efficiency surplus" an efficiently operating banking sector can charge on average lower credit and higher deposit rates compared to a less efficient banking system. Owing to the important financing role of the banking sector in the economy, a narrowing net interest margin enhances investment activity and stimulates economic growth. Furthermore, it also contributes to an increase in consumer surplus, as lower credit rates entail a decreasing debt service burden and higher deposit rates trigger rising financial wealth.

The study is organised as follows: Section 2 overviews the empirical literature on efficiency measurement; Section 3 describes the framework of our empirical investigation as well as the results; finally, Section 4 summarises and concludes.

2. Overview of bank efficiency studies

The roots of efficiency research originate from the institutional approach of corporate microeconomics. The measurement of efficiency was therefore initially performed in relation to the various industrial sectors of the real economy. In the past 15 to 20 years, the focus has shifted to the financial sector, with an emphasis on researching the efficiency of banks.

The research into efficiency serves the purpose of estimating the so-called "efficient frontier" and analysing deviations from such frontier corresponding to the loss of efficiency. The methods are distinguished on the basis of the procedures applied to produce the frontier, and the assumptions made, for example, in relation to the distribution of the inefficiency term. The creation of the "efficient frontier" serves the purpose of distinguishing well performing (efficiently operating) production units from the group of poor performers. In the literature two major concepts are frequently used in generating this frontier: non-parametric and parametric approaches.

The non-parametric methods first proposed by Farrell (1957) select efficient production units in order to create the "efficient production frontier". The procedure was first applied by Charnes et al. (1978), who used linear programming techniques (DEA - Data Envelopment Analysis).[4] Parametric methods are considered to be more sophisticated compared to non-parametric techniques, whereby the estimation of efficiency is based on economic optimalisation, given the underlying assumption of a stochastic optimal frontier. Parametric methods are capable of incorporating both input allocative and technical efficiencies. The two most frequently used parametric techniques are the Stochastic Frontier Approach (SFA) and the Distribution Free Approach (DFA). The SFA was independently developed by Aigner et al. (1977) and Meeusen and van den Broeck (1977). It attempts to decompose the residual of the frontier into inefficiency and noise by making explicit assumptions about the inefficiency component's distribution. The DFA of Schmidt and Sickles (1984) and Berger (1993) is based on similar logic, though distinguished from the former method by not applying assumptions as to the distribution of the inefficiency component.

Most of the publications covering the theme study the banking system of the USA. Relatively few European studies have been published on efficiency, and the analysis of the financial systems of

[3] This is suggested by the "Quiet life" hypothesis.

[4] DEA is a non-parametric method for calculating relative efficiency scores in a multi input-output production environment. It measures the performance of all decision-making units compared to the generated efficient frontier. Best-practice banks, which construct the DEA frontier, produce given output combinations with the lowest level of inputs or achieve the highest level of output with a given level of inputs, i.e. operate with an optimal input-output combination. Firms which do not operate on the optimal frontier suffer a certain level of efficiency loss.

transition economies from an efficiency point of view has been very limited.[5] Comparative research analysing the efficiency of banking systems in different countries is also very scarce, possibly owing to the difficulty of managing problems arising from different operational environments and their impact on efficiency.

The table below provides a brief overview of the literature.[6]

Authors	Methodology	Result[1]
USA		
Sinan and Register (1989) USA	Stochastic/parametric; SFA	(1983) average X-inefficiency: 23%
Ferrier and Lovell (1990) USA	Stochastic/parametric; SFA Deterministic/non-parametric; DEA	(1984) average X-inefficiency: 26%; average technological inefficiency: 21%
Aly et al. (1990) USA	Deterministic/non-parametric; DEA	(1986) average technological inefficiency: 35%
Kaparakis et al. (1994) USA	Stochastic/parametric; SFA	(1986) average X-inefficiency: 12%
Berger (1995) USA	Stochastic/parametric; DFA	(1980-1989) average X-inefficiency: 39%
Berger and Mester (1997) USA	Stochastic/parametric; DFA	(1990-1995) average X-inefficiency: 13%; average profit-inefficiency: 9%
Developed European Countries		
Berg (1992) NO	Deterministic/non-parametric; DEA	(1984-1990) average technological inefficiency: 44%
Lang and Welzel (1996) DE	Deterministic/non-parametric; DEA	(1989-1992) average technological inefficiency: 43%
Bos and Kool (2001) NL	Stochastic/parametric; SFA	(1992-1998) average X-inefficiency: 26%; average profit-inefficiency: 44%
Koetter (2004) DE	Stochastic/parametric; SFA	(1994-2001) average X-inefficiency: 9-27%
Among old EU member states		
Allen and Rai (1996) AT, BE, DE, DK, FI, FR, GB, IT, SW	Stochastic/parametric; SFA; DFA	(1988-1992) average X-inefficiency: 20%
Bikker (1999) BE, DE, FR, IT, LU, NL, ES, UK	Stochastic/parametric; SFA	(1989-1999) average X-inefficiency: 53%
Dietsch and Weill (2000) DE, FR, IT	Stochastic/parametric; SFA; DFA	(1993-1997) average X-inefficiency: 16%; average profit-inefficiency: 17%

[5] As emphasised by Berger and Humphrey (1997), of the 122 efficiency studies, encompassing 21 countries, only roughly 5% study transition economies.

[6] In the table, transition economies in Europe comprise a separate category, irrespective of the geographical location of the country.

Authors	Methodology	Result[1]
Among old EU member states (cont)		
Lozano-Vivas et al. (2001) AT, BE, DE, DK, FI, FR, GB, IT, LU, PT	Deterministic/non-parametric; DEA	(1993) average technological inefficiency: 34%
Bikker (2002) AT, BE, DE, DK, FI, FR, GB, GR, IE, IT, LU, NL, PT, ES, SE	Stochastic/parametric; SFA	(1990-1997) average X-inefficiency: 30%
Weil (2004) AT, BE, DE, DK, FI, FR, GB, GR, IT, LU, PT, ES	Stochastic/parametric; SFA; DFA	(1994, 2000) average X-inefficiency: 35%
Transition Economies		
Tóth (1999) HU	Deterministic/non-parametric; DEA	(1996-1997) average technological inefficiency: 40%
Kasman (2002) TR	Stochastic/parametric; SFA	(1988-1998) average X-inefficiency: 25%
Hasan and Marton (2000) HU	Stochastic/parametric; SFA	(1993-1997) average X-inefficiency: 25%; average profit-inefficiency: 30%
Among Transition Economies		
Yildirim and Philippatos (2002) BU, CZ, CRO, EE, HU, KAZ, LV, LT, MAC, PL, RO, RUS, UCK, SI, SK	Stochastic/parametric; SFA; DFA	(1993-2000) average X-inefficiency: 24%; 36%; average profit-inefficiency: 38%; 54%
Grigorian and Manole (2002) ARM, BEL, BU, CRO, CZ, EE, HU, KAZ, LV, LT, MO, PL, RO, RUS, SI, SK, UKR	Deterministic/non-parametric; DEA	(1995-1998) average technological inefficiency: 47%
Among Transition and Developed Economies		
Kosak and Zajc (2004) AT, BE, CY, CZ, DE, EE, HU, IT, LT, LV, MT , NL, PL, SI, SK	Stochastic/parametric; SFA	(1996-2003) average X-inefficiency: 16.7%
Tomova (2005) BU, CRO, CZ, EE, FR, HU, PL, PT, RO, ES, SI, SK	Deterministic/non-parametric; DEA	(1993-2002) average technological inefficiency: 55%

Notes: USA (United States of America), EU (European Union), ARM (Armenia), AT (Austria), CRO (Croatia), CY (Cyprus), CZ (Czech Republic), BE (Belgium), BEL (Byelorussia), BU (Bulgaria), DE (Germany), DK (Denmark), EE (Estonia), ES (Spain), FI (Finland), FR (France), GB (Great Britain), GR (Greece), HU (Hungary), IE (Ireland), IT (Italy), KAZ (Kazakhstan), LT (Latvia), LU (Luxemburg), LV (Lithuania), MAC (Macedonia), MO (Moldova), MT (Malta), NL (the Netherlands), NO (Norway), PL (Poland), PT (Portugal) RO (Romania), RUS (Russia), SE (Sweden), SI (Slovenia), SK (Slovakia), TR (Turkey), UKR (Ukraine).

[1] The inefficiency is measured on a scale from 0 (or 0%) to 1 (or 100%). Best performing bank has inefficiency score of 0 (or 0%) and efficiency score of 1 (or 100%).

DEA: Data Envelopment Analysis; SFA: Stochastic Frontier Approach; DFA: Distribution Free Approach.

3. Empirical analysis

In the empirical analysis we first compare the operational environment of EU banking systems, then define variables used in the econometric model; after this, we describe the main characteristics of the sample. Finally, we review our empirical results.

3.1 European Union wide comparison of banking systems' operational environment

The enlargement of the EU substantially increased heterogeneity among member countries' banking systems. As a consequence of the common economic convergence path and regulatory harmonisation imposed by the "Acquis Communautaire" the integration of the newcomers' banking systems has strengthened over the last decade. However, in terms of macroeconomic and regulatory environment, depth of financial intermediation and market structure several differences across EU member countries still persist. Since the characteristics of a financial system's operational environment - often shaped independently of the "conscious" behaviour of management - may have an impact on the results and conclusions of efficiency measurement, an investigation of the main causes of home bias is required.

3.1.1 Macroeconomic environment

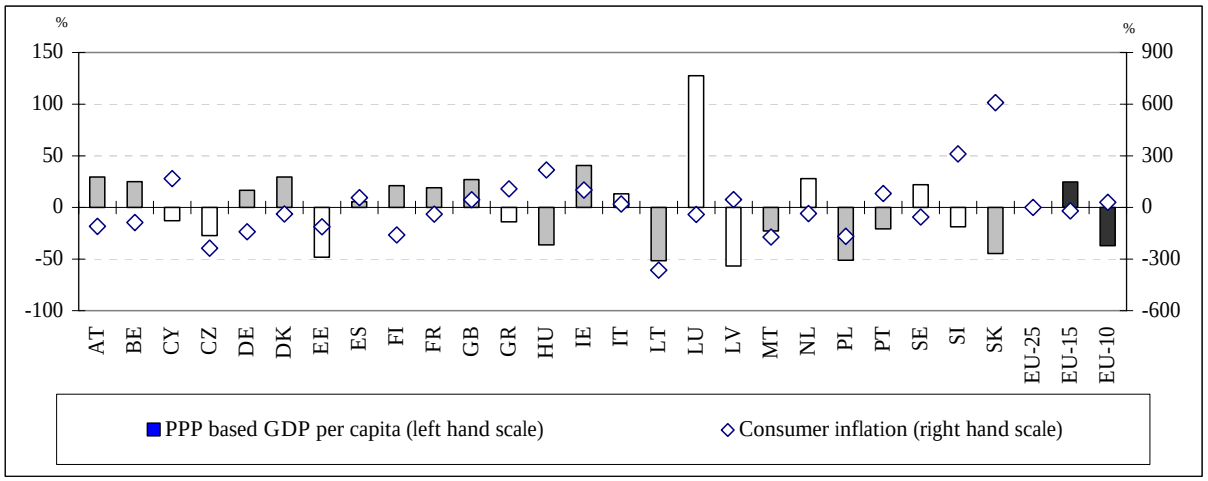
The EU member countries have entrenched macroeconomic stability over the last decade. The majority of old member states fulfilled nominal convergence, the Maastricht criteria, and introduced the common currency, the euro, in 1999. In eight of the ten new member countries the transition from a centrally planned to a market-based economic regime and the rapid economic growth accompanying it opened the way for real convergence with the EU and nominal convergence with the five pillars of euro standards (price and exchange rate stability, fiscal balance, low general government debt, convergence of long-term interest rates). However, despite the rapid catching-up process, major economic differences remain, particularly between old and new member states.

Regarding the real economic convergence it should be noted that although in the new member countries economic and productivity growth far exceeds that of the old members, the level of development still falls behind. The average level of new members' development measured with GDP per capita in PPP terms is approximately two thirds that of old ones. Only the Czech Republic, Cyprus, Malta and Slovenia pass this level.

Chart 1

Distance of economic development and inflation from the EU-25 average denoted in percentages

2003



Note: EU-15 encompasses old EU members, while EU-10 denotes new EU members.

Source: Eurostat.

With respect to the nominal convergence it should be highlighted that, prior to the introduction of the euro, the inflation of old member countries had dropped sharply and reached the level of price stability. Furthermore, over the transition period sound macroeconomic and structural policies succeeded in lowering inflation in the new member countries as well. Thus, at an aggregated level the gap between the average pace of inflation in old and new member states has substantially narrowed. However, the inflationary dispersion between member countries remains virtually unchanged in relative terms. Regarding the old members the dispersion is mainly caused by existing differences in economic

openness and competitiveness. As for the newcomers, the high relative standard deviation of inflation is explained by the fact that only six out of the ten countries (i.e. excepting Cyprus, Hungary, Slovakia and Slovenia) achieved price stability as imposed by the Maastricht criteria as early as 2003.

The common monetary policy has decreased the dispersion of interest rates across euro-area countries and led to higher price homogeneity. In relation to long-term interest rates, all new EU member states have fulfilled the convergence criteria, with the exception of Hungary. In the case of short-term interest rates, however, high variability across newcomers can still be observed due to the differences in inflation rates as well as risk premiums influenced by fiscal balance and exchange rate fluctuations.

The majority of EU countries comply with the threshold for the budget deficit and public debt ratio. In some larger old member states (Germany, France) and in half of the new member countries (Czech Republic, Hungary, Malta, Poland and Slovakia), however, a deterioration in the fiscal balance can be observed. For the old members the Stability and Growth Pact, and in the case of new members the required introduction of the euro, may curb further fiscal divergence.

3.1.2 Regulatory environment

After the 1980s the EU financial sector underwent considerable changes due to several waves of liberalisation (free flow of capital) and deregulation (establishment, activity and liquidation of credit institutions). Following the European Commission's White Paper (1986), the Second European Directive (1989) with the two parallel Directives on Solvency Ratios and Own Funds, the introduction of the Single European Licence (1993) and the Financial Service Action Plan (1999), the convergence of regulatory systems was considerably accelerated.[7] Since the new EU members already complied with the most important European directives, the EU enlargement slowed down but did not suspend the continuous harmonisation of financial regulations and the creation of a suitable supervisory architecture.[8]

It is essential to highlight that, although accomplishment of the majority of European directives has eased heterogeneity in regulation and standards in recent years, some differences still persist. The stringency of regulation shows significant dispersion among EU countries, reflecting the variety of domestic financial markets, legislations and supervisory practices.[9] In addition, within financial regulation but above the directives, i.e. over the level of minimum standards, notable differences can be observed as well. Mention can be made here of consumer protection schemes, safeguarding of minority shareholders' interests, corporate governance, stimulation of disclosure, competition and efficiency improvement.

3.1.3 The depth of financial intermediation

Among the major factors linked to the operational environment, the largest differences among EU member states arise in relation to financial intermediation. The average total loans to GDP ratio of new members (36%) is less than one third of the rate of old members (125%).

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[7] In the future the largest challenges for the EU are linked to the harmonisation of different regulations concerning mortgage lending, fund management, financial advisory services, money laundering and insurance as well as the implementation of Basel II and, in the case of new members, the adoption of the euro.

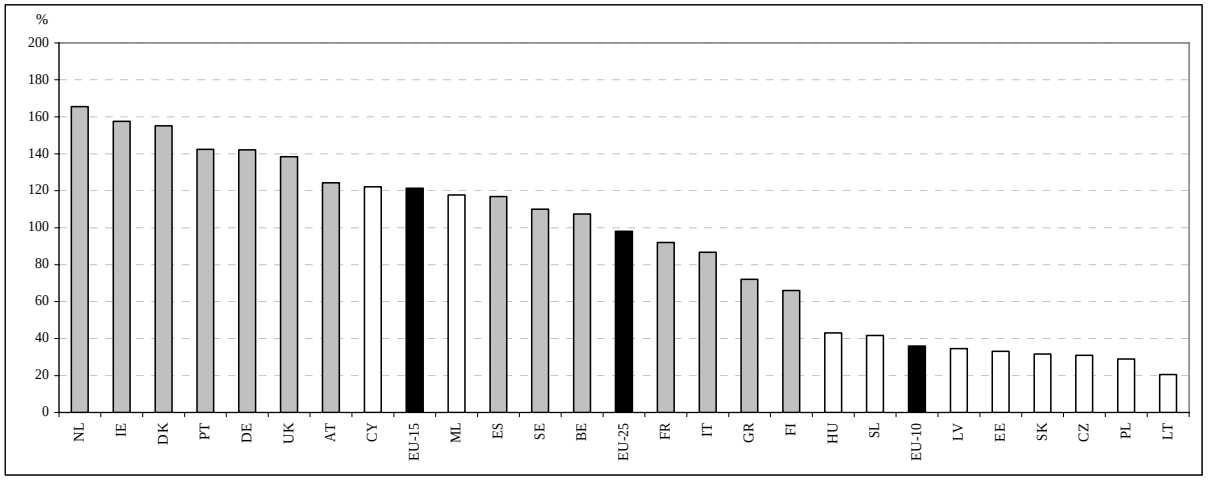
[8] However, several EU countries are yet to fully adopt common guidelines regarding credit cooperations and deposit insurance schemes. In addition, some new member states must proceed with harmonisation with European directives on regulation-related capital adequacy, operation of branches and subsidiaries, and bankruptcy laws.

[9] Cervalatti (2003) investigates this issue in detail.

Chart 2

Banks' lending to the private sector as a percentage of GDP in the member countries

2003



Note: Luxembourg was not represented in Chart 2 as in this country the private sector loans to GDP ratio is very high, above 500%.

Source: ECB: Report on EU Banking Structure (November 2004).

In terms of the level and the development of financial intermediation, new members can be divided into three well definable groups. The GDP-proportionate level of loans provided by the banking system to the private sector in Cyprus and Malta had reached the average rate of old EU member states as early as 2001. The rapid growth of the banks' economic role in these two countries is attributed to the early wave of privatisation, accelerated financial liberalisation and the stable growth rate of the economy. The second group includes the Czech Republic and Slovakia, where the depth of financial intermediation approximated the minimum level of old member states (60%) as early as 1998 due to intense financing of state-owned enterprises and early capital liberalisation. Nevertheless, private sector loans to GDP was roughly halved by 2003 (30%) due to, firstly, considerable portfolio-cleaning and tightening regulation, and secondly, the strong knock-out effect of the budgetary sector. In the third group can be ranged the Baltic countries (Estonia, Lithuania[10] and Latvia), Poland, Hungary and Slovenia, where financial intermediation has constantly gained depth only since 1999. However, despite the upward trend, the lag of these countries relative to the old members' average has not diminished measurably.

The low depth of financial intermediation witnessed in the majority of new EU members is linked to numerous common factors. The Central-Eastern European countries and the Baltic States suffered from renewed recession and experienced output loss during the transition from socialist to market economy, which weakened loan demand and also supply through the increasing level of non-performing exposure. In the stabilisation phase following the macroeconomic and bank crises, the privatisation and recapitalisation of banks and the establishment of an adequate and essential regulatory architecture consumed several years. The low depth of financial intermediation may also be explained by the fact that the banking sector is competing on the international corporate financing market, linked to the predominant role of foreign-owned multinational corporations. Furthermore, another feature of banking markets which needs to be addressed is accelerating disintermediation. Banks' intermediation on the liability side is gradually decreasing, owing to the increasing role of non-bank financial intermediation. Falling bank interest rates and the development of financial culture are resulting in growing proliferation of non-bank forms of savings.

[10] The depth of financial intermediation is the lowest in Lithuania, due - over and above the common factors - to numerous bank crises.

Finally it should be stressed that a strong discrepancy in the depth of banking intermediation can also be observed among the old EU members. The private sector loans to GDP ratio is lower in Finland, Greece and France, and higher in the Netherlands, Ireland, Denmark, Portugal and Germany compared to the average. The cross-sectional dispersion of financial depth is probably caused by the varying role assigned to the capital market in financing, the dissimilar stringency of regulation and other country-specific characteristics.

3.1.4 Market concentration

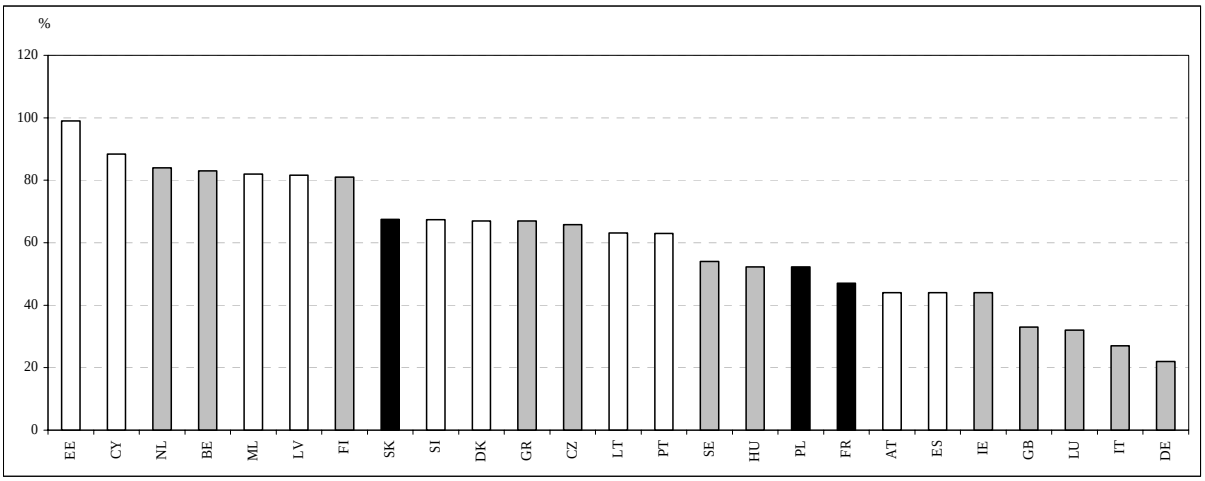
As a result of the consolidation process, the new EU member states have not only succeeded in narrowing the gap between themselves and old member states in economic and regulatory areas and in financial intermediation, but also in relation to market structure. Even so, considerable differences in market concentration still persist across the member states.

In the new member states, following the creation of a two-tier banking system the privatisation and recapitalisation of state-owned banks as well as several new entries fostered the break-up of the initial monopolistic market structure. Greater competition and the dominant degree of foreign ownership[11] encouraged the implementation of best practices (advanced risk management, corporate governance techniques and accounting methods) and the transfer of know-how and well educated labour forces enhanced productivity gains and integration.[12] In the second half of the 1990s, mergers and acquisitions as well as numerous bank liquidations suspended the falling concentration of the banking system and stabilised the oligopolistic market structure.

Chart 3

The concentration of banking systems in the EU

2003



Note: Concentration is defined as the sum of the five largest banks' market share in terms of total assets.

Source: ECB: Report on EU Banking Structure (November 2004).

By comparing the sum of the five largest banks' market share in terms of total assets, only Poland and Hungary among the newcomers have market concentration as low as that of the old member states' average owing to the relatively large size of their banking systems.[13] Mainly due to the small market

[11] Among the new members the degree of foreign involvement can be considered low (36%) only in the Slovenian banking sector. Among the rest of the new EU members, 50-99% of the banking sector is in foreign hands.

[12] The effect on efficiency of the connection between parent banks and subsidiaries can be regarded as a very important feature. This could be a theme for future research.

[13] In large countries more banks may be able to reach the adequate scale, while in small markets fewer banks may achieve the optimal scale of production.

size and an inherited distorted market structure, the rest of the new EU member countries have banking sectors characterised by strong concentration (the sum of the five largest banks' market share spreads between 63% and 100%).

The market structure of old EU member states is also undergoing transformation. Contrary to trends in the group of new EU member countries, the average concentration in old member states is at a relatively low level. However, it has constantly edged higher in recent years, in parallel with an increasing number of mergers and acquisitions aimed at boosting market power and/or improving efficiency. Nevertheless, the concentration of the old members' banking sectors remains relatively low, while dispersion (concentration ranges from 22% to 84%), which is closely related to the significant differences in market size, still exceeds that of the new members.

3.2 Sample and variables

When selecting variables the first difficulty is posed by the definition of costs, input prices and outputs, i.e. the components of bank production. In the related literature two concepts have been adopted: the "intermediation approach" and the "production approach". The intermediation approach considers banks' deposits as inputs in the production process. Contrary to the above, the production approach claims that deposits and various bank liabilities are also outputs.[14] In our study following Sealey and Lindley (1977), we employ the intermediation approach. We suppose a multi-output production model. In our model, the firms produce three outputs with three inputs. The outputs are defined as loans,[15] other earning assets and non interest revenues, while the inputs are defined as labour, physical capital and borrowed funds. As data on the number of employees are not available, labour cost for every bank is measured by the ratio of personnel expenses to total assets.[16] The price of physical capital is approximated by the ratio of the difference of non-interest and personnel expenses to fixed assets. The price of borrowed funds of a certain bank is equal to the average of the cost of funds paid by the remaining banks in the same country. Cost of funds corresponds to the ratio of interest expenses to interest-bearing liabilities.[17] The total cost is defined as the sum of interest paid, non-interest expenses, and personnel expenses for every bank. We use pre-tax profit for the estimation of the profit frontier.

In addition to the selection of output and input variables, the other major challenge is linked to the selection of the auxiliary variable serving to reduce the heterogeneity arising between countries and banks. The application of a Fourier-flexible functional form can moderate the heterogeneity related to size.[18] For the purpose of further reducing the distorting effect of varying size and other operational bias (macro and regulatory environment, market structure), the use of environmental variables, such as inflation, depth of financial intermediation, market concentration, level of liberalisation and banking reform is also warranted.[19] The first equation (uncontrolled model) only contains the input and output

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[14] A lesser known, but interesting aspect of the literature is the user cost approach. It is based on the following premise: the net income generating capability of a monetary instrument determines whether it is an input or an output in the production process. According to Hancock (1991) if the financial returns on an asset exceed the opportunity cost of funds, the given instrument is deemed to be a financial output; otherwise, it corresponds to input. The problem with this approach is that interest rates and user costs fluctuate over time. It is possible that an item which is deemed to be an input in a given period may correspond to output in another period.

[15] The database does not enable us to separate loans into categories.

[16] We assume that unit labour cost is exogenous to the banks' behaviour. The ratio of personnel expenses and the number of employees does not take the productivity of the labour force into account.

[17] We attempt to measure exogenous deposit prices. Koetter (2004) finds that average cost-efficiency is sensitive to endogenous or exogenous specifications for input prices.

[18] It is not unambiguous that in all cases the size differences bias the measurement of efficiency. A large bank compared to a small or medium sized firm might be more scale-efficient, and may attract higher qualified management. At the same time, managing a larger firm is a more complex task. The counter-effects may "extinguish" each other.

[19] Due to the strong correlation (0.8) between levels of development and depth of financial intermediation PPP based GDP per capita was not used in cost and profit function as a control variable.

variables and trigonometric terms, while the second alternative equation (controlled model) is expanded with selected country-specific variables.[20,21]

3.3 Data description

Data are taken from Bankscope [22] and cover 2459 banks from the 25 member states of the EU. Our sample includes commercial, cooperative and saving banks. We attempted to establish our database from unconsolidated data; if this was not possible we collected consolidated data. Banks whose dependent or independent variables were not available were removed from the sample. The period of observations extends from 1999 up to 2003 on account of data quality. The descriptive statistics, attached as an annex, clearly indicate that, according to the number of banks and asset size, the coverage of banking systems in the new and old member states is different. In the old member states large banks are overrepresented and small banks are underrepresented. Our sample contains 20-50% of operating banks in the old EU member states; nevertheless, the coverage of the banking system according to total assets is between 70% and 90%. Sweden and England comprise an exception, enabling coverage of only 40-50% due to insufficient data. Conclusions drawn in relation to these countries should be interpreted with caution. With regard to the new EU member states, the banking systems are well represented with respect to both bank number and balance sheet total.

3.4 Estimation results

The SFA is applied. We compute relative efficiency scores[23] from the "controlled" and "uncontrolled" models[24] for every year under investigation, assuming exponential distribution of X- and alternative profit-inefficiency components.

3.4.1 Efficiency scores

We first estimate X-efficiency scores of the individual banks generated by the "uncontrolled" model, then compose the average efficiency for the various member states as well as for the old and new member countries and for the whole EU.

Table 1 presents results which indicate that over the investigated period the banking systems of the EU witnessed an average, moderate rise in X-efficiency. Our result confirms the existence of an efficiency gap between the two regions in favour of old members.[25] In the old EU member states, a stagnation in efficiency on a high level can be experienced, while in the new member states there has been a rapid catching-up process from a relatively low level. In the period examined, the efficiency gap between the two regions experienced a sharp fall from 23 percentage points in 1999 to 15 percentage points in 2003. The mean efficiency of the whole EU and of the old and new member states amounted to 85%, 86% and 67% respectively.

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[20] In the basic equation the number of input and output variables and cross products is 20, the number of trigonometric terms is 18. In the expanded equation a further 5 parameters are estimated (parameters of inflation, depth of financial intermediation, market concentration, level of liberalisation and banking reform).

[21] If independently of the operational environment the banks' main aim is to reach the lowest cost and highest profit function as soon as possible, then in the case of using proper control variables the efficiency scores measure only managerial ability. However, if banks have other strategic aims, such as a short-term profit target, we can only partially capture exogenous effects as we cannot control for the extent of pressure on efficiency improvement explained by operational environment. Overall, in the latter case we can only capture the direct and miss the indirect effects of operational environment on efficiency.

[22] Bureu van Dijk (2004).

[23] Efficiency scores are between 0 (or 0%) and 1 (or 100%). Bank without inefficiency term has efficiency score of 1 (or 100%).

[24] We used the Maximum Likelihood method to solve the parameters.

[25] Earlier Kosak and Zajc (2004) supported the existence of an efficiency gap between the group of selected Western and Eastern European countries.

Table 1 also lists the results obtained from an alternative model, in which some "exogenous effects" that can influence costs were controlled. The mean efficiency scores of the enlarged EU and old member states exhibit stability over time. It is noteworthy, however, that in 1999, the old and particularly the new members "started" from a higher efficiency level in comparison to the previous model. The efficiency gap between the old and new member states fell from 10 percentage points in 1999 to 7 percentage points in 2003, in contrast to the previous model. In the investigated period the mean efficiency scores amounted to 89% in the EU as a whole, 90% in the old member states and 82% in the new EU countries. The banking system of the EU has still room for improvement, as it could produce the same level of output with, ceteris paribus, 12.4% lower costs or, equivalently, with the same level of cost it could produce more output. Annual cost surplus for the entire EU corresponds to 0.7% of aggregate GDP. This measure can be also interpreted as welfare loss.

Table 1

Average X-efficiency scores among EU regions and the EU

1999-2003

X-efficiency						
	uncontrolled					
	1999	2000	2001	2002	2003	Average
EU-25	0.85	0.84	0.84	0.85	0.86	0.85
EU-15	0.87	0.85	0.85	0.86	0.87	0.86
EU-10	0.64	0.65	0.67	0.69	0.72	0.67
Efficiency gap	*0.23*	*0.20*	*0.18*	*0.17*	*0.15*	*0.19*
	controlled					
	1999	2000	2001	2002	2003	Average
EU-25	0.90	0.90	0.88	0.88	0.90	0.89
EU-15	0.91	0.91	0.88	0.88	0.90	0.90
EU-10	0.81	0.82	0.80	0.80	0.83	0.82
Efficiency gap	*0.10*	*0.08*	*0.08*	*0.08*	*0.07*	*0.08*

The conclusions drawn from the controlled and uncontrolled model reveal consistency in the sense that narrowing of the X-efficiency gap is observed in both cases. Nevertheless, the size of efficiency gap is smaller in the controlled than in the uncontrolled case.

The models of the estimated alternative profit function fully correspond to the cost functions estimated in relation to X-efficiency, with the difference that in this case the dependent variable of our models is pre-tax profit.

Table 2 shows that the average profit-efficiency scores of old and new member country groups seem to be very close to each other. Therefore, the efficiency gap is consequently very small in a five year average. An interesting result was produced with regard to the uncontrolled model; the efficiency advantage of old member states was not evident in the period of 1999-2001. New member states appeared slightly more profit-efficient in all years. The profit-efficiency of the EU and sub-regions averaged at around 69-70% in the investigated period.

It is interesting to note that, in the controlled case as with the estimation of X-efficiency, a profit-efficiency gap in favour of the old member states emerges. Eliminating the home bias is likely to account for the difference between controlled and uncontrolled models. This efficiency gap between the two groups of countries slightly dropped in the period under review and averaged 4 percentage points. The average efficiency level of the EU as a whole amounted to 71% as old and new members totalled at 72% and 68% respectively. The mean score of the enlarged EU indicates an annual 40.8% loss in profit efficiency, which is equivalent to 0.5% of GDP.

Comparing the empirical findings of X- and alternative profit-efficiency estimation, it can be stated that the value of rank-order correlation of 0.7 calculated on the results of the controlled model is

considered relatively strong. This means that, taking into account only managerial ability, the majority of X-efficient countries are also more profit-efficient and vice versa.[26] In the uncontrolled case, however, the counter-effects of domestic characteristics weakened rank-order correlation to -0.1.

Table 2

Average profit-efficiency scores among EU regions and the EU

1999-2003

Profit-efficiency						
	uncontrolled					
	1999	2000	2001	2002	2003	Average
EU-25	0.69	0.69	0.68	0.68	0.70	0.69
EU-15	0.69	0.69	0.68	0.68	0.69	0.69
EU-10	0.71	0.69	0.69	0.70	0.73	0.70
Efficiency gap	*-0.02*	*-0.01*	*-0.01*	*-0.02*	*-0.03*	*-0.02*
	controlled					
	1999	2000	2001	2002	2003	Average
EU-25	0.73	0.72	0.71	0.69	0.72	0.71
EU-15	0.73	0.72	0.71	0.70	0.72	0.72
EU-10	0.68	0.69	0.67	0.67	0.70	0.68
Efficiency gap	*0.05*	*0.03*	*0.04*	*0.03*	*0.02*	*0.04*

Charts 4 and 5 give a graphical illustration of the relation between cost- and profit-efficiency. Scatter plots demonstrate the distances in X- and alternative profit-efficiency scores from the "benchmark" [27] states. The countries are sorted into the four quarters of the Cartesian plane. In the upper right part, X- and profit-efficient countries are classified. In the lower left quarter are those states that prove to be inefficient according to both indicators. The other two sections include only X- or only profit-efficient countries. Scatter plots provide evidence in support of our claim that distortion effects are of high importance. The standard deviation of efficiency scores is much lower in the controlled (Chart 5) than in the uncontrolled (Chart 4) case.

In general, countries located in the upper right part are characterised by a sustainable financial position and strong income generating capacity. By contrast, the upper and lower left as well as the lower right parts represent unsustainable states from the perspective of banks' long- term operation. X-inefficient but profit-efficient banking systems, which can be found in the upper left part of the scatter plot, may face two alternatives. By gaining a competitive edge on the X-efficiency and therefore the profit-efficiency side, banks can move to the right. If firms do not implement efficiency improvements, however, banking sectors shift into the lower left quarter as the continuous homogenisation of markets leads to the deterioration of profit-efficiency. With respect to countries lacking X-efficiency and alternative profit-efficiency, a major restructuring of the banking sector is expected in the long term.[28]

[26] If we had perfectly controlled for market distortions the rank-order correlation of X- and alternative profit-efficiencies would have approached 1.

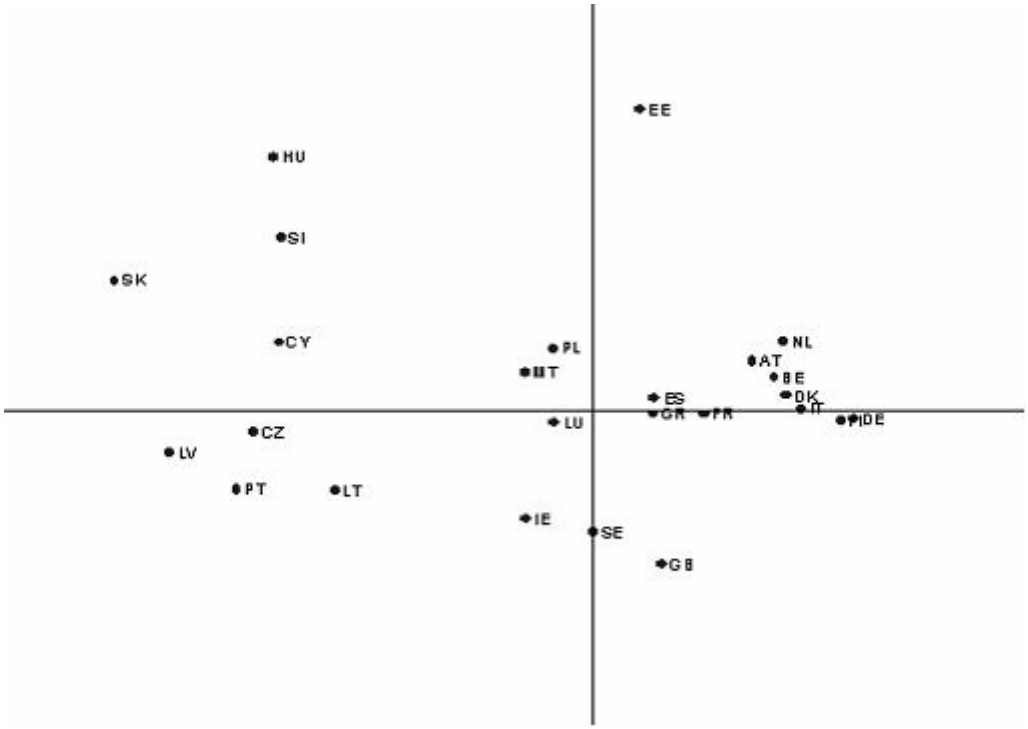
[27] The construction of the scatter plots in Charts 4 and 5 is the following: we ranked countries in relation to both X-efficiency and alternative profit-efficiency. The "benchmark" country is the one in the middle (13). Those countries' banking systems that were above this level were considered as efficient, otherwise inefficient. We subtracted the efficiency scores from this "benchmark" value and multiplied them with minus 1. The benchmark countries in the uncontrolled case were: Sweden and Italy; in the controlled case they were: Hungary and Luxemburg.

[28] In the new member countries this may be of no relevance because of the presence of subsidiaries.

Chart 4

Cross-country comparison of X- and alternative profit-efficiency in the case of the uncontrolled model

Average, 1999-2003



Note: On the horizontal/vertical axis, distances of X-/profit-efficiency from the "benchmark" are portrayed.

X-efficiency improvement allows banks to leave the lower left part of the scatter plot. More X-efficient firms are able to charge lower loan and higher deposit rates and thus produce more output as a function of demand and supply elasticity. Since X-efficiency improvement is accompanied by a profit-efficiency gain, banks can jump directly into the upper right from the lower left quarter. Equally X-efficient but, due to market heterogeneity, less profit-efficient banks can be found in the lower right part of the Cartesian plane.

In the long run, the effects of market distortions can be reduced or made to disappear, favouring the evaluation of perfect competition. Since, in a perfectly competitive case, firms are operating on the same X- and profit-efficiency level, relative efficiency scores are no longer of any relevance.

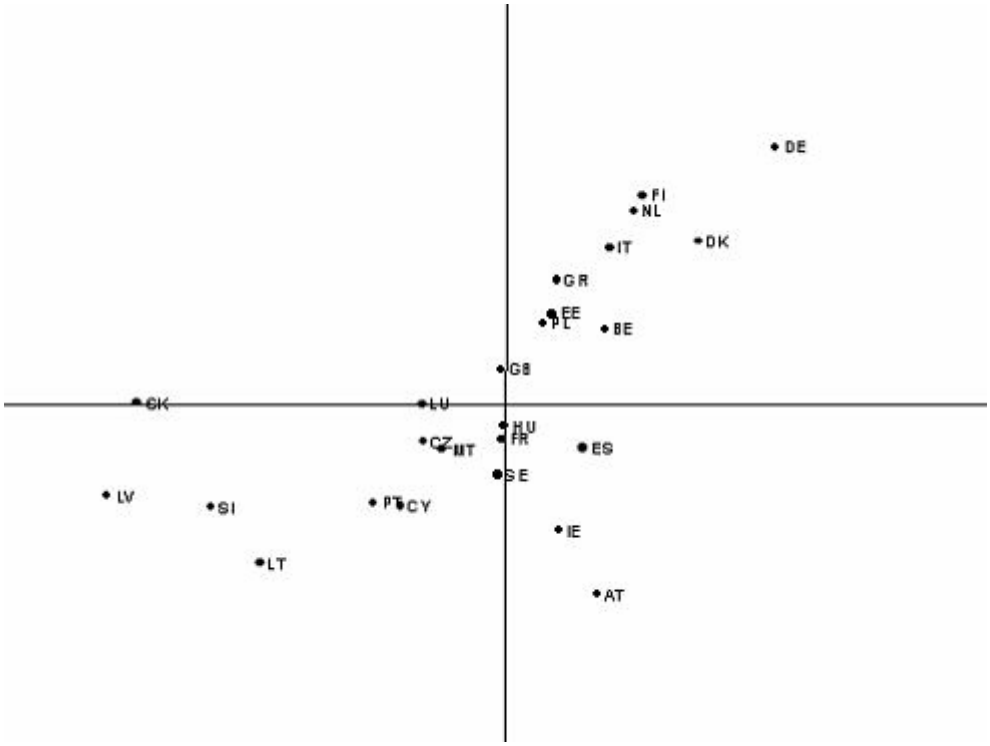
Analysing Charts 4 and 5, we primarily focus on the new EU members. Chart 4 demonstrates that the majority of new member states are located to the left of the y axis. This means that these countries produce poor efficiency in relation to both indicators, or "just" X-efficiency. Banking systems operate X-inefficiently but profit-efficiently in the Cyprus, Hungary, Malta, Poland, Slovakia and Slovenia. Managerial inefficiencies in terms of cost and profit are found in Czech Republic, Latvia and Lithuania.

A substantial restructuring can be seen in Chart 5; the results derive from models controlled in relation to the effects of distorting factors. Several countries which were previously located in the upper left quarter shift to the lower left section. This implies that should no measures be taken to improve X-efficiency in the majority of new member states, they may lose their apparent competitive edge on profit-efficiency as a result of the expected long-term elimination of the distorting factors, i.e. with the strengthening of Common European Banking Market.

Chart 5

Cross-country comparison of X- and alternative profit-efficiency in the case of the controlled model

Average, 1999-2003



Note: On the horizontal/vertical axis, distances of X-/profit-efficiency from the "benchmark" are portrayed.

4. Conclusions

In this paper, under a common best-practice frontier we estimated and ranked X- and alternative profit-efficiency scores for banking systems of the 25 EU member states between 1999 and 2003. We focused on investigating the efficiency gap between old and new member states, and analysing the related trends. In the course of producing X-efficiency and alternative profit-efficiency scores we applied Fourier-flexible cost function. Inefficiency components were modelled by the stochastic frontier approach.

Our results led us to the conclusion that controls for distorting factors (macroeconomic environment, depth of financial intermediation, market structure, regulatory regime and other country-specific factors) originating from the operational environment or the absence of such controls may modify results. When evaluating banks, we accordingly assign importance to the distinction and assessment of impacts on performance deriving from managerial ability and external environment.

Independently of the consideration of home bias our empirical findings provide evidence about the existence of an X-efficiency gap, as well as suggesting that the competitive edge of old EU members in relation to cost-efficiency is decreasing over time. Controls (or lack thereof) for distorting factors - particularly for inflation, the level of development, the closely linked depth of financial intermediation and the regulatory architecture - reduce (or increase) the size of the actual gap between the old and new member states.

As for estimating alternative profit-efficiency, a gap is also detected between the old and new member states between 1999 and 2003, but only if the impact of home market conditions on profitability is controlled. If factors originating from the operational environment are controlled, significant differences in profit-efficiency between the two regions no longer exist. Our results suggest that, with regard to several new member states, concentrated market structure is likely to allow banks to price the cost of

inefficient operation into interest rates and beyond that to earn oligopolistic rents. In these countries non-competitive pricing may have negative welfare consequences, since deadweight loss and a fall in consumer surplus may prevent an upturn in savings and investment activity, and thereby the achievement of higher economic growth.

Looking ahead, it should be highlighted that the unbiased X-efficiency gap may produce an adverse impact on the long-term competitiveness of financial systems in new EU member states. The X-efficiency gap may be narrowed through the higher “internal efficiency reserves” of banks in new EU member states compared to old ones, i.e. from a lower efficiency level, banks in new member countries have larger room for improvement. There is the risk, however, that the absence of competitive pressures may result in a lesser effort on the part of managers to minimise costs. Cost minimising pressure may be further weakened by the fact that banks of less developed countries also have high “external efficiency reserves”, for the gradual development and integration of the economy through the deepening of financial intermediation results in a “natural” efficiency gain. It is also a discouraging factor that the “conscious” improvement of efficiency involves higher expenditures in the short term and produces the desired impact only in the long term. Advantages and disadvantages associated with specific market characteristics in old and new member states are expected to ease as a result of the further integration of financial markets and the financial institutional systems within the EU. Consequently, managerial ability will gain even higher relevance in determining efficiency.

Information regarding the bank efficiency in the EU is of high relevance, as it enables policy-makers to understand deficiencies of banking operation and prioritise areas for action. Our findings stress the prime importance of policy response to enhance the efficient operation of banking systems and thereby achieve welfare gains. In the lack of pressure on efficiency improvement the cost of financial intermediation can remain relatively high particularly in the new member states which can be a drag on the evaluation of an flexible and resilient economy.

Appendix 1:
Fourier-flexible functional form

Our estimate of the Fourier-flexible cost and alternative profit function is as follows:[29]

$$(1)\quad \ln\left(\frac{\pi}{w_3}\right);\ln\left(\frac{TC}{w_3}\right)=\beta_0+\sum_m \alpha_m \ln y_m+\sum_n \beta_n \ln\left(\frac{w_n}{w_3}\right)+\frac{1}{2}\sum_m\sum_p \alpha_{mp}\ln y_m \ln y_p+\frac{1}{2}\sum_n\sum_r \beta_{nr}\ln\left(\frac{w_n}{w_3}\right)\ln\left(\frac{w_r}{w_3}\right)+$$
$$+\sum_n\sum_m \gamma_{nm}\ln\left(\frac{w_n}{w_3}\right)\ln y_m+\sum_m\left[\delta_m \cos z_m+\theta_m \sin z_m\right]+\sum_m\sum_p\left[\delta_{mp}\cos\left(z_m+z_p\right)+\theta_{mp}\sin\left(z_m+z_p\right)\right]+v\pm u$$

where TC corresponds to total cost, π is the pre-tax profit , y_m is the m^{th} output (m=1, 2, 3), w_n is the n^{th} input price (n=1, 2, 3), w_3 is the price of financial input, ε is the residual (p, r equal to 1, 2, 3 based on the number of outputs and inputs). $\varepsilon = v \pm u$, where ε is the residual, v is the two-sided random noise and u is the non-negative inefficiency component. Indices applied to banks have been omitted for the purpose of simplification. Symmetry and linear homogeneity require the following parameter restrictions:

$$(2).\ \alpha_{mp}=\alpha_{pm},\beta_{nr}=\beta_{rn},\sum_{n=1}^{3}\beta_n=1,\sum_{r=1}^{3}\beta_{nr}=0,\sum_{n=1}^{3}\gamma_{nm}=0$$

For the application of the Fourier-flexible form the scaling of data is also necessary. Normalisation of bank outputs shows the following formula:

$$(3)\ z_m=0.2\pi+(1.6\pi)\frac{\ln y_m-\ln y_{m,\min}}{\ln y_{m,\max}-\ln y_{m,\min}}$$

[29] The alternative profit function is unique in the sense that its explanatory variables correspond to its cost function; its dependent variable, however, corresponds to profit. Since profit may not be a negative value, it may cause problems in relation to logarithmisation. The problem may be remedied by adding a constant to each profit value, which is at least as high as the highest loss in the sample.

Appendix 2:
Descriptive statistics

	Number	Total assets	*Total assets*		*Loans*		*Other earning assets*		*Wage costs*		*Price of fixed capital*		*Price of int.-b. liabilities*		*Total costs*		*Pre-tax profit*		*Non interest revenues*	
	of banks	Aver. (M.)	Aver. (M.)	Rel. stdev	Aver. (M.)	Rel. stdev	Aver. (M.)	Rel. stdev	Aver.	Rel. stdev	Aver.	Rel. stdev	Aver.	Rel. stdev	Aver. (M.)	Rel. stdev	Aver. (M.)	Rel. stdev	Aver. (M.)	Rel. stdev
AT	111	460146.1	4145.5	0.3	1993.5	0.3	1843.9	0.3	0.009	0.13	1.338	0.2	0.071	0.3	222.1	0.2	17.0	0.5	128.4	0.9
BE	44	845732.8	19221.2	0.2	7780.4	0.2	10184.1	0.2	0.008	0.10	1.070	0.0	0.010	0.3	1034.9	0.2	123.6	0.3	574.6	0.0
CY	*16*	*27569.2*	*1819.9*	*0.4*	*934.2*	*0.3*	*807.3*	*0.5*	*0.014*	*0.08*	*0.854*	*0.2*	*0.112*	*0.3*	*128.6*	*0.3*	*24.2*	*1.2*	*61.9*	*0.6*
CZ	*22*	*59893.1*	*2807.4*	*0.3*	*1033.5*	*0.4*	*1465.6*	*0.4*	*0.012*	*0.09*	*1.417*	*0.6*	*0.180*	*0.4*	*238.3*	*0.5*	*-1.9*	*-4.0*	*104.9*	*0.0*
DE	1080	3267259.2	3025.2	0.2	1492.7	0.2	1420.9	0.3	0.007	0.07	2.810	0.2	0.072	0.2	180.0	0.2	10.4	1.1	45.4	1.1
DK	67	222817.6	3325.6	0.3	1484.4	0.3	1528.7	0.4	0.008	0.10	2.100	0.1	0.064	0.3	156.5	0.2	32.5	0.4	103.0	0.2
EE	*6*	*3608.5*	*605.2*	*0.4*	*354.0*	*0.5*	*208.2*	*0.5*	*0.010*	*0.11*	*1.650*	*0.2*	*0.133*	*0.4*	*42.1*	*0.3*	*13.7*	*1.0*	*17.0*	*0.2*
ES	108	1183427.9	10962.2	0.2	5967.2	0.3	3725.9	0.2	0.013	0.09	1.155	0.2	0.101	0.3	611.6	0.2	115.9	0.3	327.3	0.3
FI	6	200244.6	33374.1	0.3	20333.7	0.4	9428.7	0.3	0.008	0.35	1.230	0.8	0.112	0.3	1537.6	0.3	355.6	0.3	1339.0	0.0
FR	208	3045919.6	14643.8	0.2	5094.0	0.2	8238.1	0.3	0.007	0.07	1.500	0.1	0.041	0.2	960.5	0.2	68.8	0.6	263.6	0.9
GB	50	1975420.2	39508.4	0.3	20213.8	0.4	14869.5	0.4	0.011	0.09	0.936	0.1	0.039	0.3	2097.0	0.3	451.3	0.4	790.2	0.0
GR	16	93594.5	5925.8	0.4	2916.2	0.5	2622.2	0.3	0.015	0.07	0.781	0.1	0.113	0.5	404.0	0.3	90.5	0.7	232.0	0.0
HU	*23*	*29129.8*	*1268.9*	*0.3*	*633.1*	*0.5*	*531.4*	*0.2*	*0.014*	*0.09*	*2.300*	*0.2*	*0.135*	*0.3*	*131.2*	*0.3*	*20.5*	*0.6*	*56.6*	*0.1*
IE	21	318523.5	19712.0	0.2	8969.8	0.4	7799.0	0.3	0.010	0.28	0.605	1.0	0.080	0.3	916.8	0.3	137.5	0.5	601.7	0.0
IT	459	1520534.9	3312.7	0.2	1788.9	0.3	1171.4	0.3	0.013	0.02	1.226	0.1	0.059	0.2	206.3	0.2	26.7	0.6	49.7	0.8
LT	*9*	*3312.1*	*368.0*	*0.5*	*169.1*	*0.6*	*122.0*	*0.5*	*0.019*	*0.22*	*0.608*	*0.3*	*0.150*	*0.5*	*27.8*	*0.3*	*2.7*	*1.7*	*19.7*	*0.3*
LU	70	423150.7	6045.0	0.2	1384.6	0.3	4453.3	0.2	0.003	0.02	0.897	0.1	0.053	0.2	438.4	0.3	40.6	0.5	118.9	0.0
LV	*20*	*4477.9*	*224.9*	*0.5*	*101.1*	*0.7*	*97.8*	*0.6*	*0.013*	*0.23*	*1.105*	*0.2*	*0.135*	*0.5*	*16.5*	*0.4*	*2.4*	*2.2*	*10.0*	*0.8*
MT	*6*	*8069.2*	*1360.4*	*0.2*	*632.7*	*0.2*	*671.2*	*0.2*	*0.010*	*0.04*	*0.790*	*0.4*	*0.167*	*0.2*	*72.8*	*0.2*	*12.6*	*0.4*	*48.3*	*0.5*
NL	25	1083013.6	43320.5	0.2	26178.7	0.2	7366.4	0.3	0.012	0.03	1.136	0.2	0.077	0.3	2642.9	0.2	292.1	0.3	1083.0	0.9
PL	*34*	*87862.2*	*2608.9*	*0.3*	*1189.5*	*0.3*	*1107.2*	*0.3*	*0.019*	*0.06*	*0.962*	*0.1*	*0.110*	*0.5*	*288.4*	*0.4*	*33.9*	*0.8*	*71.5*	*0.0*
PT	15	156724.6	10448.3	0.3	5908.3	0.4	3002.7	0.2	0.007	0.07	4.138	0.2	0.053	0.2	1077.1	0.3	100.5	0.4	343.4	0.0
SE	12	242021.9	20185.7	0.2	8182.8	0.2	7880.7	0.2	0.007	0.11	2.400	0.3	0.073	0.4	1358.8	0.1	129.8	0.5	403.4	0.1
SI	*16*	*15642.5*	*982.5*	*0.3*	*485.3*	*0.4*	*291.5*	*0.3*	*0.017*	*0.18*	*2.600*	*0.2*	*0.139*	*0.2*	*83.0*	*0.3*	*13.7*	*0.6*	*37.1*	*0.1*
SK	*15*	*16960.1*	*1130.7*	*0.2*	*456.7*	*0.4*	*582.3*	*0.4*	*0.013*	*0.04*	*1.500*	*0.6*	*0.157*	*0.5*	*111.4*	*0.3*	*8.9*	*3.4*	*42.2*	*0.0*
EU-25	2459	2142075.8	6261.5	0.2	2937.4	0.2	2725.2	0.3	0.0	0.1	2.0	0.2	0.07	0.2	377.8	0.2	42.6	0.8	132.9	0.8
EU-15	2292	2295486.1	6603.8	0.2	3100.4	0.2	2872.9	0.3	0.009	0.1	2.0	0.2	0.07	0.2	394.7	0.2	44.5	0.8	138.6	0.8
EU-10	167	36587.9	1563.2	0.4	699.2	0.4	699.1	0.4	0.015	0.1	1.4	0.3	0.14	0.4	146.1	0.3	15.3	0.6	54.1	0.2

Notes: Category denoted by bold shows the period average of the sum of the banks' total assets in a given country between 1999 and 2003. Categories denoted by italic show the period average of the cross-sectional average in a given country between 1999 and 2003. Numbers are in EUR, M. is million. Aver. is abbreviation of simple mean and Rel. stdev is abbreviation of standard deviation.

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