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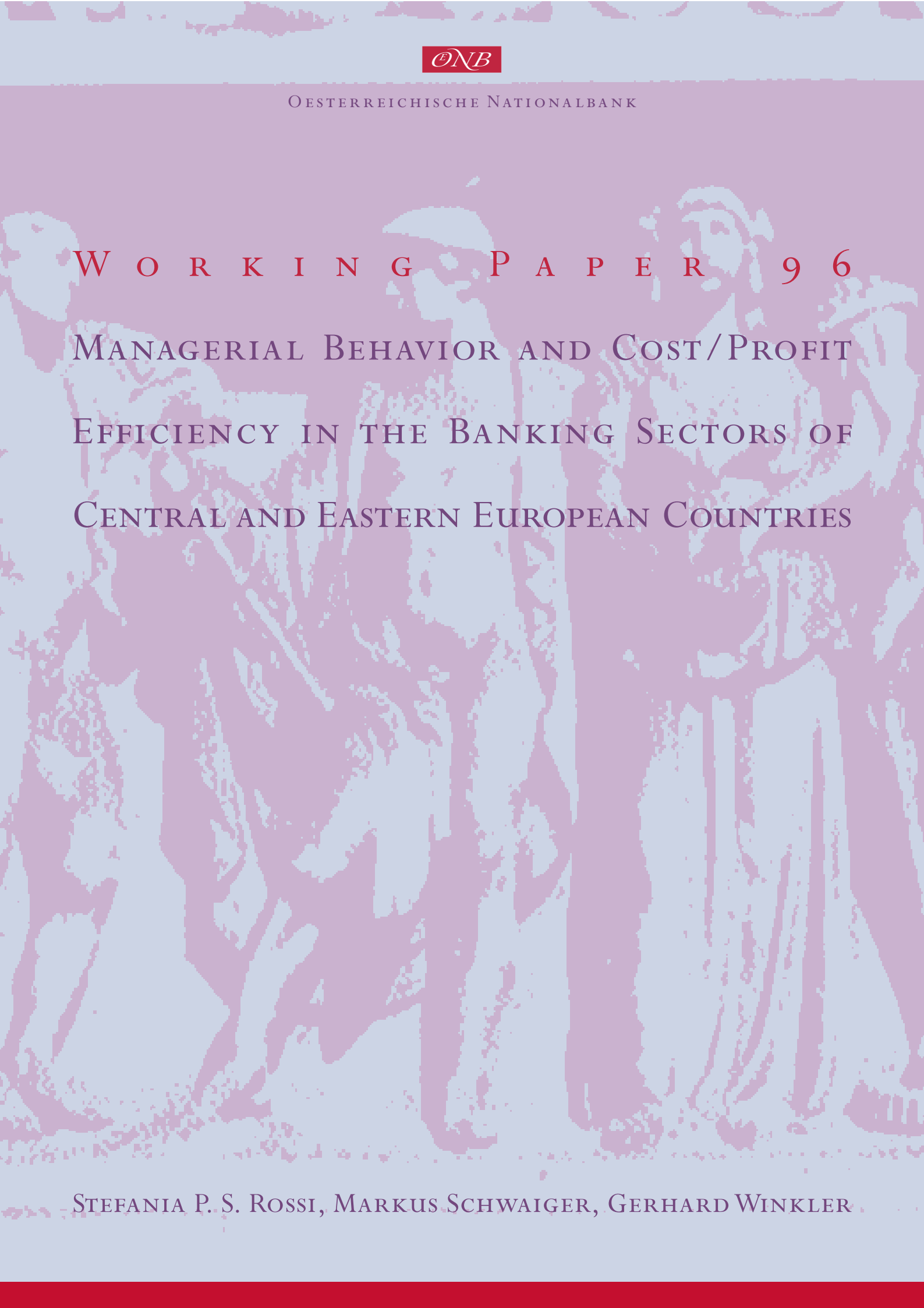

WORKING PAPER 96

MANAGERIAL BEHAVIOR AND COST/PROFIT EFFICIENCY IN THE BANKING SECTORS OF CENTRAL AND EASTERN EUROPEAN COUNTRIES

STEFANIA P. S. ROSSI, MARKUS SCHWAIGER, GERHARD WINKLER

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Editorial

In this paper, the authors analyze cost and profit efficiency level and the managerial behavior of banks in nine Central and Eastern European countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania Poland, Romania, Slovakia and Slovenia), providing cross-country and time series evidence on the period 1995-2002. A stochastic frontier analysis based on a Fourier flexible form indicates a generally low level of cost efficiency and an even lower level of profit efficiency. However, the authors also find significant differences among countries and some evidence of an increasing tendency over time in profit efficiency and, to an even stronger extent, in cost efficiency. Cost and profit efficiency scores are negatively correlated both on a country wide as well as on a bank by bank basis. Furthermore, instead of just looking at the determinants of cost and profit efficiency (e.g. asset quality, problem loans and risk), they test several hypotheses of managerial behavior using the Granger causality approach based on the inter-temporal relation between bank efficiency, capitalization and problem loans, as proposed by Berger and DeYoung (1997). Even though a static analysis shows a negative correlation between problem loan and efficiency, the authors find no evidence of bad management hypothesis. Results provide evidence for the bad luck hypothesis suggesting the exogeneity of bad loans triggering inefficiency.

March 4, 2005

Managerial behavior and cost/profit efficiency in the banking sectors of Central and Eastern European countries*

March 2005

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Abstract

This paper analyzes cost and profit efficiency level and the managerial behavior of banks in nine Central and Eastern European countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania Poland, Romania, Slovakia and Slovenia), providing cross-country and time series evidence on the period 1995-2002. A stochastic frontier analysis based on a Fourier flexible form indicates a generally low level of cost efficiency and an even lower level of profit efficiency. However, we also find significant differences among countries and some evidence of an increasing tendency over time in profit efficiency and, to an even stronger extent, in cost efficiency. Cost and profit efficiency scores are negatively correlated both on a country wide as well as on a bank by bank basis. Furthermore, instead of just looking at the determinants of cost and profit efficiency (e.g. asset quality, problem loans and risk), we test several hypotheses of managerial behavior using the Granger causality approach based on the inter-temporal relation between bank efficiency, capitalization and problem loans, as proposed by Berger and DeYoung (1997). Even though a static analysis shows a negative correlation between problem loan and efficiency, we find no evidence of bad management hypothesis. Results provide evidence for the bad luck hypothesis suggesting the exogeneity of bad loans triggering inefficiency.

JEL classification: G21; G28; C14; D21.
Keywords: Cost and profit efficiency; CEECs; Stochastic frontier analysis; Managerial behavior.

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1 Introduction

This paper aims at investigating the state and evolution of banking efficiency in Central and Eastern European countries (CEECs) with a focus on countries that have recently acceded or are in the process of accession to the European Union. The swift changes in the financial system following the collapse of the centrally planned economic systems, its catching up with EU levels and the overall transition towards a market economy make the banking systems of these countries a distinct field of research.

The analysis of banks' efficiency levels continues to be important from both a macroeconomic and a microeconomic point of view as is documented by its long tradition in literature.[1] From the micro perspective, the issue of banking efficiency is crucial, especially for transition economies of Eastern Europe, given increasing competition and strong presence of foreign banks in these countries, which, render the issue of reducing the underperformance of the banking sector one of the main priority for the financial sector. From the macro perspective, the efficiency of the banking sector influences the costs of financial intermediation and the overall stability of the financial markets. For CEECs improvements in banking can have a significant impact on the allocation of financial resources since this sector remains still the most important source of financing private investment of firms, given the underdevelopment of the financial markets (see Caviglia et al., 2002).

In line with the huge block of literature on banking efficiency in OECD countries, a fairly large amount of studies deals with banking in transition economies in CEE[2]. The application of cost efficiency frontier techniques in the empirical literature for the transition countries of Eastern Europe has been largely focused on analysis based on a single country, such as Kraft and Tirtiroglu (1998) on Croatia, Opiela (2000) and Nikiel and Opiela (2002) on Poland, or Taci and Zampieri (1998) on the Czech Republic, as well as Hasan and Marton (2003) on the Hungarian experience. A recent bulk of empirical contributes have dealt with cross country-comparisons for CEECs. In this stream Bonin et al. (2005), Green et al. (2004) and Weill (2003) analyze the effect of bank privatization on efficiency in selected Eastern European transition countries (the Czech Republic and Poland). Fries and Taci (2005) and Fries et al. (2002) also investigate the efficiency/performance of a sample of banks in transition economies. Zajc (2004) focuses on differences between foreign and domestic banks relying on the methodology of Claessens et. al (2001). Berglöf and Bolton (2002) as well as Fries and

[1] For an overview see e.g. Berger and Mester (1997).

[2] See the IMF report (2000); Thimann (2002); ECB (2004). Furthermore, a well-structured overview of recent developments in CEE banking markets can be found in Balling *et al.* (2004).

Taci (2002) deal with the effect of macroeconomic stabilization and institutional reform on the banking system. Buch (2000) compares interest rate spreads across three CEE countries (Hungary, Poland and the Czech Republic). Weill (2004) compares efficiency of banks from Western countries and Eastern European countries testing different hypothesises to explain the performance gap between them.

One of the focus of these recent contributes was to explain variation in efficiency across CEECs banks in terms of their ownership yielding often mixed or inconclusive results: Bonin et al. (2005) find that privatization by its self is not sufficient to increase bank efficiency on a sample of banks from eleven transition countries. Fries and Taci (2005) find, for a sample of banks in fifteen transition economies, that there is no significant evidence that privatization or major foreign ownership has a direct effect in boosting cost efficiency. Hasan and Marton (2003) provide evidence that higher bank foreign ownership are associated with higher efficiency in the Hungarian banking sector; Weill (2003) finds for the Czech Republic and Poland that foreign owned banks are more efficient than domestic-owned banks. Weill (2004) suggests that the gap between efficiency level of CEECs banks and Western banks could be due more to the poor management behavior, than the ownership structure.

The reason why a different ownership form can lead to a different efficiency level of banks refers mainly to the principal-agent framework: managers in foreign owned or privatized institutions are supposed to be more constraint by capital market discipline. On the contrary, a lack of owners' control makes management more free to pursue its own agenda and few incentives to be efficient[3]. However, as pointed out also in Williams (2004), the target of this bank ownership literature is to prove that financial institutions organized under one ownership model are more/less efficient than banks organized in a different way. Ownership approach could therefore provide useful suggestions for policy and bank regulation, it does however not help in understanding how managerial behavior could affect efficiency. In other words, the link between ownership and efficiency implicitly assumes a different behavior of management but does not say how managerial behavior directly affects performance and efficiency of banks.

The literature on the link between managerial behavior and efficiency is still limited (see Berger, 1995; Mester, 1996; Berger and De Young, 1997; Berger and Hannan, 1998; DeYoung et al., 2001; Williams, 2004) and to the best of our knowledge not applied to the case of CEECs.

[3] See Altunbas et al. (2001) for an extensive discussion on the issue.

By using data on risk and asset quality of CEECs banks we would provide evidence on this issue by checking the link between managerial behavior and efficiency of banks.

Therefore, the purpose of our paper is to contribute to the existing literature in two ways:

a) after having extensively analyzed the evolution and the difference in cost and profit scores across nine CEECs, by using data from 1995 to 2002, we try to verify if the management of the asset quality and the risk of the bank can explain the cost and profit performance. We base our investigation on a stochastic frontier model, in which cost and profit function are specified according the flexible Fourier function (FF) – which has been proved to give a better fit of the data than the well used Translog function (TL) – and the inefficiency/efficiency term can be modeled as an explicit function of variables which may influence the firm's efficiency.

b) Second, on the basis of the indication obtained by the static econometric analysis, we test whether the management behavior hypothesis could be the cause for the CEECs bank inefficiency. In order to do so we use the approach proposed by Berger and DeYoung (1997) based on the Granger causality test, which assumes an inter-temporal relation between efficiency (cost and/or profit), capitalization and loan loss provisions of the bank. By the means of these relations, four different kinds of management behaviors could be derived:

the *bad management hypothesis* (low cost/profit efficiency Granger causes high loan loss provisions), the *skimping hypothesis* (high cost/profit efficiency granger causes high loan loss provisions), the *bad luck hypothesis* (exogenous shocks in the level of loan loss provisions Granger cause changes in cost/profit efficiency levels) and the *moral hazard hypothesis* (thinly capitalized banks are more prone to risk taking).

The remainder of the paper is organized as follows. Section 2 provides the description of the data and some stylized facts about the CEECs banking systems. Section 3 describes the methodologies used in the analysis: in sub-section 3.1. the efficiency analysis approach is presented; in sub-section 3.2 we describe the specification of cost and profit functions; in 3.3 we present a model for analyzing the determinants of cost and profit (in)efficiency; and in 3.4 we review the econometric model of management behavior. Results are presented in section 4. Conclusions are drawn in section 5.

2 Data

Our dataset is composed of single-bank data for CEECs, consisting of annual account data derived from the financial statements of banks made available through the BankScope database of Bureau van Dijk and Fitch/Ibca. We use data for the years 1995 to 2002 for the eight CEECs that joined the EU in the first wave of accession:[4] the Czech Republic (CZ), Hungary (HU), Poland (PL), Slovakia (SK), Slovenia (SI), the three Baltic countries Estonia (EE), Latvia (LV) and Lithuania (LT) as well as for the Romania (RO) due to join in the second wave.[5] As reliable data on each bank are not available for every year, we obtained an unbalanced panel dataset consisting of 1170 observations, which refers to a sample of 278 banks belonging to the nine selected CEECs. [6] The distribution of banks across countries is given in Table 1.

Table 1: Sample size: Banks across Countries

Countries	CZ	EE	HU	LT	LV	PL	RO	SI	SK	TOTAL
Number of banks	39	14	33	12	28	72	34	19	27	278

Compared with data from the respective central banks, our sample includes banks that taken together hold more than 80% of total banking assets in the respective countries and therefore can be considered highly representative of the CEECs banking sectors.

Before going into more detail on the methodology, it seems worthwhile putting the CEECs' banking systems as a research field into perspective in terms of its idiosyncrasies.

Overall, the CEE banking market is relatively small. Its total assets (excluding Russia) are currently well below the total assets encountered in small Western European nations such as e.g. Austria.[7]

[4] In order to homogenize our sample, we excluded Malta and Cyprus because of their different levels of financial development.

[5] We intended to include also Bulgaria and Turkey in our analysis: for lack of data we had to drop the former and for the different recent development in the banking sector, we decided to not include the latter.

[6] The raw data required substantial editing to obtain a reliable database for the analysis. In a thorough review process we concentrated on choosing the most appropriate accounting standards (we preferred financial statements using IAS over those using national standards and used consolidated balance sheets whenever they were available), on avoiding double counting of institutions and on converting all the values into a single currency (i.e. USD). Furthermore, we conducted several plausibility checks regarding the completeness and consistency of the individual profit and loss accounts and balance sheets.

[7] The Austrian banking sector, as a point of reference, had total assets of EUR 605 billion on an unconsolidated basis as at the end of 2003 (Source: OeNB).

Table 2: The Banking Sector in Selected CEECs

	Total assets in bn Euro	Total assets in % of GDP	Market share of the 5 largest banks in %	Foreign-owned bank assets in %	Return on Equity (ROE)in %	Capital Adequacy Ratio (CAR) in %
CZ	78	107	66	96	23.2	14.5
EE	6	76	98	97	16.3	12.5
HU	54	70	52	83	17.6	10.7
LT	6	33	82	91	11.9	13.2
LV	9	84	63	47	18.1	11.7
PL	111	65	52	68	6.2	13.7
RO	16	12	70*	n.a	18.3*	n.a.
SI	22	87	66	19	3.7*	11.5
SL	21	93	72	96	27.9	21.7

Source: ECB (2004), Bankscope, and own calculations.
Data refers to 2003 with the exception of starred (*) values which refer to 2002.

At the same time, however, the CEE banking sector has an enormous potential for growth as documented also in the ECB report (2004). This is mainly due to the fact that the intermediation depth, measured as banking assets over GDP, although, stands at levels well below 100% – far away from the level achieved in the Euro-zone which was more than 260% in 2003 – is sharply expanding. Our data furthermore document that loan and deposit ratios are increasing as well. This is an indication that the banking sector's intermediation role is definitely rising, albeit from a low original level. Finally, the high GDP growth for these countries will also bring GDP per capita to converge to EU averages in the medium-long run.

A look at table 2 reveals that the CEE banking market is characterized by a relatively high degree of concentration and widespread presence of foreign ownership that has emerged over the last years. These two aspects are the consequence of the intense process of restructuring and growth that has led the CEE banking sector to experience an unprecedented level of consolidation through merger and acquisitions by Western financial institutions.

Furthermore, the CEE banking sector appears characterized by relatively high profitability, although data also indicate the onset of a decrease in the comparatively high interest rate margins in the CEECs (see also Walko and Reininger, 2004), which mirrors tightening competition in these markets.[8] Finally, Table 2 shows that CEE banking systems are well

[8] Many factors in the CEECs have contributed to increasing competition among financial institutions, such as the institutional upgrading in all economic sectors after the collapse of the socialist regimes, the preparation of the new Member States for joining Economic and Monetary Union, or the privatization and concentration process outlined above.

endowed with equity, as the Capital Adequacy Ratio (defined as equity capital over risk weighted assets) shows, which is an indication of the expansion of the banking sector as a whole, as an equity buffer has to be foreheld in order to finance future expansion.

3 Methodology

3.1 Efficiency Measurement

A production plan is called efficient if it is not possible to produce more with the same input or to reduce these inputs leaving the output unchanged.[9] However, observable real data of firms often move away from the optimum production plan. This is due to the fact that production plans and cost/profit levels are not the result of perfectly rational and efficient decisions: factors such as errors, bad management, lags between the choice of plan and its implementation, inertia in human behavior and distorted communication may cause what is called X-inefficiency. In order to get rid of the inefficiency component and isolate the theoretical frontier, estimation techniques must include some filter device. Two classes of models have been proposed over time. Whereas deterministic models (Aigner and Chu, 1968; Afriat, 1972; Richmond, 1974) use the residuals of the production function as a measurement for inefficiency without controlling random noise, stochastic frontier models (Aigner et al., 1977; Meeusen and van den Broeck, 1977; Stevenson, 1980; Jondrow et al., 1982; Battese and Coelli, 1988 and 1992; Coelli et al., 1998; Kumbhakar and Lovell, 2000) disentangle the error term in two components. The first one, *V,* corresponds to the random fluctuations distributed as a normal. The second one, *U*, accounts for the firm's inefficiency – e.g. factors that affect technical or allocative efficiency, which could be controlled by banks – distributed as a half normal (truncated at zero).

According to the stochastic frontier approach, the total costs/profits (*TC* and *TP*) for the *s*-th firm at time *t* assume the following specification:

$$H_{st} = H(Y_{st}, P_{st}) + \varepsilon_{st} = H(Y_{st}, P_{st}) + V_{st} + U_{st} \qquad (1)$$

where *H* is either *TC* or *TP*, *Y* is a vector of outputs of the firm; *P* is a vector of input prices; ε is the stochastic random noise. In the case of profit function (*TP*) the disturbance term is specified as $V_{st} - U_{st}$. Following the Battese and Coelli (1988 and 1992) model, the predictions of individual bank cost/profit efficiency (EFF_H) may then be written as:

[9] The duality theory (see e.g. Beattie and Taylor, 1985; and Shephard, 1970) has shown that under given conditions (exogenous prices and optimal behavior of the producer) the property of the production function can be studied indirectly through cost or profit functions.

$$EFF\_H_{st} = \mathrm{E}(H_{st}|\, U_{st}, \varphi_{st}) / \mathrm{E}(H_{st}|\, U_{st}=0, \varphi_{st}) \quad (2)$$

where φ_{st} are the regression parameters.

3.2 Cost and Profit Function specifications

In modeling banks' cost or profit function, one of the most debated questions in literature is the definition of the *inputs* and *outputs* of multi-product financial firms. The discussion concentrates particularly on the role of deposits, considering that they have both input and output characteristics. Empirical literature on banking suggests different approaches to this issue: the most used are the *production approach* (or value added approach, user cost approach) and the *intermediation approach* (or asset approach). The first underlines the role of financial institutions as providers of services for account holders. This approach argues that deposits should be considered as an output because they involve the creation of value added associated with liquidity, safekeeping and payments services provided to depositors. On the contrary, the *intermediation approach* considers financial institutions mainly as mediators of funds between savers and investors. Under this approach the funds raised (deposits) and their cost should be included as inputs in the analysis, since they constitute the raw material to be transformed in loans and investible funds.

Berger and Humphrey (1991) and Bauer et al. (1993) proposed a so called *modified production approach*, which allows both the input and output characteristics of deposits to be considered in the cost/profit functions. According to this approach the interest paid on deposits should be accounted as input, while the volume of deposits should be considered as output.

In our cost/profit specifications for the CEE banks, we employ the *modified production approach* which provide a better fir to our data-set.[10] We shape, therefore, the cost and profit functions using loans, deposits and other earning assets as outputs, and price of labor, price of capital and price of deposits as inputs. We do not account for the interbank market activities (this mainly refers to the different sorts of deposits from and with banks), since interbank market conditions should be approximately the same for all the banks. A detailed description of the variables is presented in Table 3.

[10] Our choice has been supported by an F-test procedure, which allowed us to prefer this specification versus the production and the intermediation cost and profit specifications.

Table 3: Variables Used in the Cost and Profit Functions for CEE banks

Variables	Name	Description
Exogenous variables		
Output		
y_1	Loans	Loans (performing and non-performing) with customers
y_2	Deposits	Deposits with customers
y_3	Other earning assets	Banks' investments in various types of securities (e.g. government securities, bonds, equity investments, CDS, T-bills, equity investment) not including deposits with banks
Input		
X_1	Labor	Total assets as a proxy for the number of employees due to lack of data
X_2	Capital	Adjusted value of fixed assets net of depreciation
X_3	Deposits	Customer deposits
Input prices		
W	Price of labor	Staff expenses/total assets
K	Price of capital	Cost of capital (operative costs associated with capital expenses / adjusted value of fixed assets net of depreciation)
D	Price of deposits	Total interest expenses / volume of customer deposits
Endogenous variables		
TC	Total costs	Operating expenses
TP	Total profits	Operating profit minus loan loss provisions

For our cost and profit functions[11] we use the Fourier flexible form (FF), which is a semi nonparametric form that combines the standard translog (TL) specification, nested in it, with the non-parametric Fourier form, i.e. the trigonometric terms. In other words, the FF presents the well-known advantages of being a flexible form and of including, as a particular case, the Cobb-Douglas specification. This theoretical improvement, which is able to represent a broad range of functions, has been proved to give a better fit of the data than the TL, which, conversely, does not necessarily approximate the unknown true function of an industry, as pointed out in literature (see White, 1980; Gallant, 1981; McAllister and McManus, 1993; Mitchell and Onvural, 1996; Berger and Mester, 1997).

The FF representation gives:

[11] A distinction between cost and profit efficiency arises when markets are not perfect. In the case of CEE countries it certainly is a reasonable assumption to say that given our observation period (1995 to 2002) competitive markets did not occur in the banking industry. Therefore a profit efficiency analysis brings additional insights into the workings of the industry.

$$\ln H_{st} = [\alpha_0 + \sum_{i=1}^{3} \alpha_i \cdot \ln y_{is} + \sum_{k=1}^{3} \beta_k \cdot \ln p_{ks} + \tfrac{1}{2} \sum_{i=1}^{3} \sum_{j=1}^{3} \alpha_{ij} \cdot \ln y_{is} \cdot \ln y_{js} +$$

$$\tfrac{1}{2} \sum_{k=1}^{3} \sum_{h=1}^{3} \beta_{kh} \cdot \ln p_{ks} \cdot \ln p_{hs} + \sum_{i=1}^{3} \sum_{k=1}^{3} \delta_{ik} \cdot \ln y_{is} \cdot \ln p_{ks}] +$$

$$\Sigma_i\, a_i \cos(y_i) + \Sigma_i\, b_i \sin(y_i) + \Sigma_k\, c_k \cos(p_k) + \Sigma_k\, d_k \sin(p_k) +$$

$$\Sigma_{ij}\, e_{ij} [\cos(y_i) + \cos(y_j)] + \Sigma_{ij}\, f_{ij} [\sin(y_i) + \sin(y_j)] +$$

$$\Sigma_{ij}\, g_{ij} [\cos(y_i) - \cos(y_j)] + \Sigma_{ij}\, h_{ij} [\sin(y_i) - \sin(y_j)] +$$

$$\Sigma_{kl}\, i_{kl} [\cos(p_k) + \cos(p_l)] + \Sigma_{kl}\, l_{kl} [\sin(p_k) + \sin(p_l)] +$$

$$\Sigma_{kl}\, m_{kl} [\cos(p_k) - \cos(p_l)] + \Sigma_{kl}\, n_{kl} [\sin(p_k) - \sin(p_l)] +$$

$$V_{st} + U_{st} \qquad (3)$$

where H is again either total cost TC or total profits TP[12], y_i is the i-th output and p_k is the price of the k-th input. V_{st} is the error term accounting for random noise in the data, and U_{st} refers to technical inefficiency.

The restrictions in the form of the linear homogeneity conditions and cost exhaustion are obtained by normalizing total costs/profits, the price of labor and the price of deposits by the price of capital. The symmetry conditions state that

$\alpha_{ij} = \alpha_{ji} \quad \forall\ i, j\ (i,j = 1,\ldots,n)$ and

$\beta_{ij} = \beta_{ji} \quad \forall\ i,j\ (i,j=1,\ldots,m)$.

The linear homogeneity restrictions demand that:

$$\sum_{k=1}^{3} \beta_k = 1; \qquad \sum_{k=1}^{3} \beta_{kh} = 0, \text{ for all } h; \qquad \sum_{k=1}^{3} \delta_{ik} = 0, \text{ for all } i.$$

In the FF specification, the trigonometric addends have rescaled coherently with our sample size.[13]

The FF cost and profit regressions (3) are estimated using the stochastic frontier approach with the time-varying panel model (Battese and Coelli, 1992) which allows the inefficiency term of each bank to vary over time.

The model provides maximum likelihood estimates of the following parameters:

(a) the inefficiency term, which varies over time according to the following behavior

[12] As usually done in literature (see e.g. Hasan and Morton, 2003), in the estimate of the profit function, we incorporate a constant term (which is equal to 1 plus the absolute value of the minimum profit value in the sample) into the total profit variable (TP), which avoids taking the log of a negative number.

[13] Special attention must be paid to the choice of the rescaling form for the trigonometric terms in order to coherently fix their argument in the 0-2π range. The truncation point here has been chosen according to the rule of thumb expounded in Mitchell and Onvural (1996) that the number of parameters should be set equal to the number of observations raised to the power of two-thirds in order to obtain consistent and asymptotically normal estimates. However, as suggested in Gallant (1981), the effective number of the coefficients is corrected by reducing the number of the regressors to cope with the possible multicollinearity.

$U_{st} = U_s^{(\eta\,-(t-T))}$

where U_{st} is the inefficiency term of bank s at time T (which is the last period considered) and η is a parameter to be estimated (when η is bigger then zero the inefficiency term, U_{st} , is decreasing over time; when η is smaller then zero U_{st} is increasing over time; U_{st} stays steady if η=0);

(b) the mean, μ, of the truncation at zero of a normal density distribution; μ indicates how far firms operate from the efficient frontier. Econometrically this means that if μ is significantly different from zero we reject the hypothesis that the distribution is half normal truncated and therefore efficiency is not the prevalent behavior of our bank sample.

(c) the parameter $\gamma = \sigma_u^2 / \sigma^2$; γ is the ratio between the variance associated to the inefficiency of the bank and total variance: it must varies between 0 and 1.

3.3 Determinants of (in)efficiency: the correlation between asset quality, risk and efficiency

Empirical literature has found that failing banks and banks with high level of problems loan tend to be far from the efficiency frontier (see e.g. Berger and DeYoung, 1997, which provide a good survey on the issue). Moreover, one of the implications of the recent empirical literature on CEECs is that the poor managerial performance could be a reason to explain the low efficiency level in these banking systems. With some papers arguing that foreign ownership influences the way banks are managed and therefore indirectly affects bank efficiencies (see e.g. Hasan and Marton, 2003; Weill, 2003) and others finding no statistical evidence to support a positive influence of foreign ownership on efficiency (see e.g. Fries and Taci, 2005), the way managerial behavior is linked to efficiency remains to be clarified. Recently, Weill (2004) for instance suggested, without providing any direct empirical evidence, that this hypothesis more than the bank ownership could explain the gap between CEECs and Western countries.

As a first step, we therefore look at the static model in which the X-efficiency values obtained by the estimates of eq. (3) for cost and profit can be expressed as an explicit function of a vector of variables, which may influence the firm's efficiency. In our case, we check if the management of the asset quality and capitalization of bank affect firm efficiency. In order to control for the effect of foreign ownership of bank, for the size of the bank, for the market concentration and for the trend we use control variables, specified as below:

$$XEFF_{st} = LLP_{st} + CAP_{st} + LTA_{st} + Market\text{-}share_{st} + Concentration_{st} + Ownership_{st} + Trend_{st} + \varepsilon_{st} \quad (4)$$

Where:

s identifies the cross section of banks and *t* the time component;

XEFF is cost/profit efficiency level.

LLP is a proxy for the problem loan variable. As an indicator for asset quality, we use here, for lack of data on problem loans, the loan loss provisions of each bank over the total loans.

CAP is the ratio of equity to total assets, and is a measure of bank capitalization.

LTA is the ratio of loan to total assets and can be interpreted as a measure of bank risk.

Market share is a size variable accounting for the market share of each bank, and is calculated as the ratio between the total assets of each bank over the total assets of the banking industry in the country.

Concentration is a variable accounting for the concentration of the banking market and has been calculated as the ratio between the assets of the largest 5 banks in the country and the total assets of the banking industry in the country.

Ownership is the percent of the foreign owned bank assets.

Trend account for the time.

ε_{st} is the error term.

If loan loss provisions are found to be negatively correlated to efficiency levels, it would however be premature be concluded right away that CEE-banks are faced with a bad management problem. Problem loans can for instance also increase due to the presence of exogenous factors. Regional economic recession, rate of criminality, etc., may affect the quality of customer loans and as a consequence entail higher monitoring costs and extra expenses. The increase in operating cost will in turn dampen cost and profit efficiency levels.

3.4 Modeling the management behavior

In order to clarify the causality governing the relationship between problem loans, capitalization and efficiency, we therefore have to investigate on the link between managerial behavior and bank efficiency. Following Berger and DeYoung (1997) and Williams (2004) we address the question in a direct way by linking managerial behavior to bank efficiency levels. Tests for management behavior can be analyzed as an inter-temporal relation across

asset quality of the bank, capitalization and bank efficiency, using the Granger causality approach.

Using this approach for a sample of U.S commercial banks, Berger and DeYoung (1997) checked four different kinds of management behavior:[14]

a) *bad management hypothesis*, which implies that bad managers do not adequately control for operating expenses and poorly manage loan portfolio, this may cause that the low efficiency brings greater amount of problem loans;

b) *skimping hypothesis*, which implies that quality of a banks loan portfolio is a consequence of the costs connected with the monitoring of lending activities. This will bring a positive correlation between cost efficiency and problem loans.

c) *bad luck hypothesis*, which means that unexpected and external factor increase the problem loans which in turn reduces cost efficiency as monitoring costs are increased as a consequence.

d) *moral hazard hypothesis* suggests that managers of weakly capitalized banks are less risk adverse and engage in risk taking behavior. Therefore, low bank capitalization can cause an increase in problem loans.

Each of these four hypotheses would of course also entail a different set of regulatory implications. Whereas the bad luck hypothesis would highlight the need for regulators put an effort into insulating the banking system towards external shocks, the bad management hypothesis as well as the skimping hypothesis would indicate that supervisors should focus their attention towards bank-internal credit-risk management systems. The moral hazard hypothesis would alternatively suggest a close monitoring of banks with comparatively low capitalization levels.

The model they proposed is based on the following equations:

$$LLP_{st} = f_1(LLP_{s\,lag}, XEFF_{s\,lag}, CAP_{s\,lag}, LTA_{s\,lag}, Yr_t) + \varepsilon_{1s\,t} \quad (5)$$

$$XEFF_{st} = f_2(LLP_{s\,lag}, XEFF_{s\,lag}, CAP_{s\,lag}, LTA_{s\,lag}, Yr_t) + \varepsilon_{2s\,t} \quad (6)$$

$$CAP_{st} = f_3(LLP_{s\,lag}, XEFF_{s\,lag}, CAP_{s\,lag}, LTA_{s\,lag}, Yr_t) + \varepsilon_{3s\,t} \quad (7)$$

The variables in eqs (5-7) have been defined in eq. (4) above. To account for the bank´ risk and other factors which may have an affect on the managerial behavior and the efficiency, Berger and Young (1997) and Williams (2004) use, as control variables, the ratio of loan to

[14] The same approach has been used by Williams (2004) using a sample of Western European banks.

total assets (*LTA)* and dummies for each year (*Yr)* which account for changes in the environment. The model is built in a way that each dependent variable is estimated using the lagged value of it and the lagged values of the independent variables. In this way the lagged values of the right hand side variables with lags up to time *t-n* Granger cause changes in the dependent variable at time *t*.

Equation (5) tests the following hypothesis:

a) *bad management hypothesis*, according to which we would expect a negative relation between the problem loans and the lagged X-efficiency.

b) A positive sign for the previous relation would imply the presence of the *skimping behavior*.

c) Finally, eq. (5) can also test the *moral hazard behavior*, when only a sub-sample of the low capitalized bank is used. In this case a negative sign is expected between the bad loan and the lagged value of the capitalization variables (*CAP*).

Equation (6) tests for the *bad luck hypothesis*: a negative relation is expected between the X-efficiency and the lagged value of the problem loan.

As in Berger and DeYoung (1997) and Williams (2004) equation (7) is included to complete the model and get further indications of managerial behavior, but does not check any of the aforementioned hypotheses.

4 Empirical Findings

The presentation of our results is split in two parts, in the same way as our research question was. To begin with we present cost and profit efficiency estimates for our sample of CEE-banks in order to investigate whether efficiency levels significantly differ by country and/or significantly changed over time. In the second section we discuss our findings on the management behavior.

4.1 Cost and profit estimates

The FF stochastic cost and profit estimates on the overall sample are presented in the Appendix. As far as the cost function is concerned, all the output and input price coefficients are strongly significant. The elasticity of production costs to the price of labor *(β_{p1}=0.68)* is larger than the elasticity to the capital price, *0.15 (1-β_{p1}-β_{p2} = 0.17,* due to the linear homogeneity conditions imposed). This means that the banks we investigate can more easily

control capital and deposit expenses than labor expenses when prices rise. For our sample this seems plausible, since at least in the short run, it is/was more difficult to cut labor expenses than capital costs. Looking at the outputs, all the variables present the expected positive sign.

Concerning the profit function, again all the output and input price coefficients have the correct sign and the expected magnitude. The positive and significant coefficient for deposits means that more deposits implies more capital that can be transformed into loans (which raise profits); in particular, deposits stemming from customers are usually cheaper than capital borrowed in interbank markets.

As far as the results for bank (in)efficiency are concerned, decomposing the inefficiency values obtained from the cost and profit stochastic estimates on the overall panel, yields information about the level of banking efficiency by country and by time. Tables 4 and 5 provide evidence on the cost and profit efficiency scores aggregated by country and ranked according the efficiency levels.

Table 4: Cost Efficiency Levels by Country and by Time Period

(Countries are ranked by efficiency scores)

Sample	CZ	SK	LV	RO	HU	LT	EE	PL	SI
Average 1995 2002	0.58 0.19)	0.67 (0.19)	0.71 (0.15)	0.75 (0.14)	0.75 (0.17)	0.78 (0.09)	0.79 (0.10)	0.79 (0.16)	0.89 (0.07)
N. obs 1995-2002	**148**	**68**	**136**	**94**	**107**	**62**	**59**	**287**	**109**
1995	0.47 (0.17)	0.63 (0.14)	0.64 (0.15)	0.55 (0.00) [a]	0.71 (0.18)	0.75 (0.06)	0.78 (0.11)	0.78 (0.19)	0.87 (0.09)
1996	0.55 (0.18)	0.71 (0.15)	0.64 (0.16)	0.57 (0.00) [a]	0.74 (0.17)	0.74 (0.12)	0.79 (0.09)	0.80 (0.17)	0.88 (0.08)
1997	0.56 (0.22)	0.65 (0.14)	0.66 (0.16)	0.91 (0.00) [a]	0.75 (0.16)	0.75 (0.10)	0.79 (0.10)	0.79 (0.16)	0.89 (0.08)
1998	0.54 (0.20)	0.70 (0.16)	0.70 (0.15)	0.76 (0.12)	0.73 (0.18)	0.80 (0.07)	0.78 (0.12)	0.79 (0.17)	0.88 (0.09)
1999	0.56 (0.20)	0.71 (0.15)	0.71 (0.15)	0.73 (0.15)	0.76 (0.16)	0.79 (0.08)	0.79 (0.12)	0.81 (0.14)	0.89 (0.08)
2000	0.58 (0.20)	0.67 (0.24)	0.77 (0.11)	0.74 (0.15)	0.78 (0.15)	0.80 (0.08)	0.80 (0.11)	0.78 (0.18)	0.90 (0.07)
2001	0.65 (0.18)	0.65 (0.24)	0.81 (0.09)	0.76 (0.14)	0.76 (0.21)	0.78 (0.09)	0.79 (0.10)	0.79 (0.16)	0.90 (0.07)
2002	0.64 (0.18)	0.66 (0.25)	0.77 (0.11)	0.76 (0.15)	0.79 (0.15)	0.79 (0.09)	0.80 (0.10)	0.82 (0.13)	0.92 (0.05)

Standard deviations are in parentheses. [a] Values due to only one data point.

Table 5: Profit Efficiency Levels by Country and by Time Period

(Countries are ranked by efficiency scores)

Sample	RO	HU	SI	LT	PL	EE	LV	SK	CZ
Average 1995 2002	0.29 (0.13)	0.33 (0.08)	0.37 (0.12)	0.38 (0.08)	0.38 (0.08)	0.41 (0.08)	0.45 (0.13)	0.47 (0.12)	0.57 (0.17)
N. obs. 1995-2002	**109**	**88**	**70**	**70**	**291**	**53**	**141**	**113**	**132**
1995	0.24 (011)	0.31 (0.08)	0.34 (0.05)	0.33 (0.07)	0.34 (0.07)	0.41 (0.03)	0.40 (0.13)	0.47 (0.16)	0.55 (0.15)
1996	0.25 (0.11)	0.32 (0.08)	0.34 (0.05)	0.35 (0.08)	0.36 (0.07)	0.43 (0.10)	0.44 (0.14)	0.47 (0.14)	0.53 (0.17)
1997	0.32 (0.17)	0.33 (0.08)	0.34 (0.05)	0.38 (0.08)	0.38 (0.08)	0.41 (0.11)	0.46 (0.14)	0.49 (0.12)	0.56 (0.18)
1998	0.27 (0.13)	0.33 (0.08)	0.35 (0.05)	0.39 (0.08)	0.39 (0.09)	0.38 (0.06)	0.47 (0.14)	0.47 (0.09)	0.55 (0.15)
1999	0.27 (0.13)	0.33 (0.08)	0.38 (0.10)	0.39 (0.08)	0.37 (0.07)	0.38 (0.06)	0.48 (0.14)	0.45 (0.10)	0.57 (0.17)
2000	0.27 (0.12)	0.32 (0.09)	0.39 (0.09)	0.40 (0.08)	0.39 (0.08)	0.40 (0.06)	0.45 (0.11)	0.47 (0.12)	0.57 (0.19)
2001	0.30 (0.12)	0.34 (0.08)	0.40 (0.09)	0.40 (0.08)	0.41 (0.09)	0.40 (0.06)	0.43 (0.09)	0.48 (0.12)	0.59 (0.21)
2002	0.61 (0.21)	0.40 (0.06)	0.35 (0.07)	0.41 (0.08)	0.49 (0.14)	0.41 (0.08)	0.33 (0.13)	0.47 (0.11)	0.38 (0.04)

Standard deviations are in parentheses.

To provide robust evidence on the cross-country analysis, we perform a test on the mean differences (see Table 6).[15]

[15] To control for the influence of the outliers on the results, we additionally computed efficiency levels, by countries and by time, when we truncate both tails of the distributions of the cost and profit efficiencies at the

Table 6 - Differences in mean cost and profit efficiency scores by country

	CZ	EE	HU	LT	LV	PL	RO	SK	SI
Cost efficiency									
CZ		-0.21* (-10.46)	-0.17* (-7.76)	-0.20* (-10.38)	-0.13* (-6.82)	-0.21* (-11.84)	-0.17* (-7.90)	-0.097* (-3.54)	-0.316* (-18.24)
EE			0.036*** (1.76)	0.010 (0.62)	0.074* (4.12)	-0.007 (-0.44)	0.041*** (2.14)	0.11* (4.45)	-0.10* (-7.18)
HU				-0.020 (-1.30)	0.038*** (1.88)	-0.04*** (-2.30)	0.005 (0.24)	0.078** (2.83)	-0.14* (-7.95)
LT					0.064* (3.83)	-0.017 (-1.20)	0.030*** (1.67)	0.010* (4.14)	-0.11* (-8.64)
LV						-0.08* (-5.20)	-0.033*** (-1.73)	0.039 (1.55)	-0.17* (-12.53)
PL							0.048** (2.77)	0.12* (4.99)	-0.097* (-8.13)
RO								0.073** (2.73)	-0.14* (-8.95)
SK									-0.21* (-9.31)
SI									
Profit efficiency									
CZ		0.16* (8.77)	0.23* (13.77)	0.18* (10.45)	0.11* (6.09)	0.18* (11.66)	0.27* (14.33)	0.095* (5.07)	0.20* (12.08)
EE			0.076* (5.72)	0.024*** (1.71)	-0.047* (-3.12)	0.023*** (2.04)	0.11* (7.24)	-0.066* (4.38)	0.039* (3.13)
HU				-0.052* (-4.22)	-0.12* (-8.98)	-.005* (-5.55)	0.039** (2.65)	-0.14* (10.37)	-0.037* (-3.48)
LT					-0.071* (-4.96)	-0.000 (-0.53)	0.091* (6.03)	-0.09* (6.30)	0.01 (1.31)
LV						0.07* (5.92)	0.16* (10.01)	-0.019 (-1.23)	0.08* (6.69)
PL							0.092* (7.13)	-0.09* (-7.52)	0.015*** (1.89)
RO								-018* (-11.18)	-0.076* (-5.53)
SK									0.10* (8.17)
SI									

The table reports cross country tabulation between the difference in the mean efficiency levels. In parenthesis we report the value of the t-test computed as :

$$t = (\mu_1 - \mu_2)\sqrt{\frac{N_1 N_2 g}{N_1 + N_2}} \Big/ \sqrt{(N_1 - 1)\sigma_1^2 + (N_2 - 1)\sigma_2^2}$$

where: $g = N_1 + N_2 - 2$ defines the degrees of freedom, μ_i is the mean of the *i-th* group, N_i is the number of observations in the *i-th* group and σ_i^2 is the variance of the *i-th* group.

The null hypothesis is that the mean differences are equal to zero.

*values are significant at 1%; ** values are significant at 5%; *** values are significant at 10%.

99% and 95% degrees. The evidence shows that efficiency scores are not significantly affected by the outliers and remain stable over the sub-samples. Results are available upon request.

The evidence emerging from the Tables 4, 5 and 6 can be summarized as follows:

(a) the banking systems of CEECs present, as expected, significant levels of cost and profit inefficiency, indicating that on average banks operate far above (below) from the cost (profit) efficient frontiers.[16]

(b) Overall, the profit efficiency scores are well below cost efficiency levels: CEECs banks seem to deal much better on the cost than on the profit side as their expertise in generating profits is not as developed as their ability to supply their services in a cost-saving way. As intermediation depth is still fairly low and demand for financial services of all kinds very high in CEE countries, one explanation lies in banks' expansion efforts, which have absorbed enormous resources but have only partly paid off up to now, leaving profit efficiencies behind cost efficiencies. Furthermore, given the potential reward of maintaining/expanding market shares in a rapidly growing market, banks have little incentive to maximize profits by means of full utilization of their discretionary pricing power.

(c) Inspecting the average efficiency scores by country, enables comparisons among the performances achieved by the banking systems examined and reveals that efficiency levels vary considerably across countries. These variations in cost and profit efficiency levels are significant in almost all cases.

As far as cost efficiency is concerned (Table 4) values range from 0.58 (the Czech Republic) to 0.89 (Slovenia). Already at a countrywide perspective, loan loss provisions/reserves seem to be important in the explanation of efficiency scores: Table 7 shows loan loss reserves over total customer loans for our sample of CEE-countries from 1995 to 2002. Comparing the average cost efficiency scores by country in Table 4 with these values shows that the two countries that offered the worst performance in terms of cost efficiency, the Czech Republic and Slovakia had both rather severe problems with the quality of bank's loan portfolios. On the contrary, Estonia, for example, which ranks third in terms of cost efficiency, has had historically very low levels of loan loss provisions. Section 4.2 will investigate the link between problem loans and efficiency in more detail.

[16] This evidence, obviously, is consistent with the positive value of the parameter μ in the FF cost and profit estimates reported in the Appendix.

Table 7: Share of loan loss reserves as % of total customer loans

	Loan loss reserves as % of total customer loans								
	CZ	EE	HU	LT	LV	PL	RO	SI	SK
1995	14.7%	2.3%	12.1%	18.5%	19.3%	13.7%	10.6%	12.0%	17.2%
1996	14.5%	2.2%	5.6%	21.7%	16.4%	9.0%	20.0%	12.5%	22.4%
1997	13.6%	2.0%	5.9%	13.2%	8.3%	6.0%	1.0%	9.4%	22.7%
1998	14.8%	5.1%	6.9%	6.7%	6.1%	5.3%	13.9%	8.9%	25.6%
1999	14.2%	3.6%	3.9%	4.5%	5.9%	6.7%	9.9%	8.0%	16.7%
2000	12.2%	3.2%	3.9%	4.6%	3.8%	8.9%	7.3%	9.0%	21.4%
2001	10.9%	2.4%	4.3%	3.4%	2.5%	12.6%	6.8%	11.7%	16.4%
2002	7.6%	1.6%	4.5%	1.7%	2.1%	15.9%	3.7%	10.8%	14.8%
Average	12.8%	2.8%	5.9%	9.3%	8.1%	9.8%	9.2%	10.3%	19.7%

Source: Bankscope

For its part, Slovenia's good performance despite the dominance of state-owned banks and the comparatively low market share of foreign-owned institutions may be due to the fact that the country itself has a relatively high branch density and credit growth has been weak over the last years (ECB (2004)). This would suggest that the costs for financing future growth in this market are comparatively low. As for Estonia and Lithuania, part of the reasoning behind the good cost efficiency performance may also be due to the fact that these two banking sectors are highly concentrated and largely in foreign hands (ECB, 2004).[17]

(d) Looking at the profit efficiency ranking, Table 5, the evidence shows that the order of the ranking across countries is not the same as in the cost efficiency analysis: countries that present fairly high cost efficiency scores are less performing in terms of profit efficiency, and *vice versa*. Slovenian banks, which are ranked as most cost efficient institutions, turned out to be at low end regarding profit performance. Conversely, the Czech and Slovakian banks appear to be the most efficient ones as regards their ability to maximize profits, on the contrary they presented the worse performance in terms of cost efficiency. In order to test this evidence, we also analyze for the relationship between cost and profit efficiency at bank level by means of the rank correlation between cost and profit efficiency using Spearman and Kendall correlation tests. The results of the tests suggest that the two variables are correlated;[18] furthermore the negative sign of the coefficients implies that profit and cost efficiency are negatively correlated across the banks of our sample and supports the evidence emerging from a countrywide comparison: banks which

[17] Alternatively, a simpler reasoning would suggest that some of the costs of the Estonian or the Lithuanian banking sector appear in the accounts of the parent enterprises.

[18] Both the Spearman's rho (which is equal to -0.4084 significant at 1%) and the Kendall´s score (which is equal to -136654, significant at 1%) allow us to reject the *Ho* that cost and profit efficiency are independent.

are good in controlling their cost, do not reach efficiency from the profit side equally well.[19]

(e) Looking at the evolution of efficiency for the overall sample of banks, we find a positive and significant increase over time of cost and profit efficiency, equal to 6 and 4 per cent respectively (see Table 8).[20]

Table 8. Cost and Profit Efficiency Levels by year

	Overall period	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**Increase 95-02**	**Mean test**
Cost efficiency	0.75 (0.17)	0.71 (0.18)	0.73 (0.17)	0.73 (0.17)	0.74 (0.17)	0.74 (0.17)	0.75 (0.18)	0.76 (0.17)	0.77 (0.15)	**+ 6%**	0.061* t =2.59
N. of obs.	1070	92	119	133	133	146	161	149	137		
Profit efficiency	0.41 (0.13)	0.38 (0.14)	0.40 (0.13)	0.42 (0.13)	0.41 (0.13)	0.40 (0.14)	0.40 (0.13)	0.41 (0.13)	0.42 (0.14)	**+4%**	0.038** t=2.23

Standard deviation in parenthesis. * Significant at 1%; ** Significant at 5%.

This trend is also consistent with results of Weill (2004) for a smaller sample of countries on the period 1996-2000. At a first glance, the increasing trend in the efficiency seems to hold also at country level: the evidence provided in tables 4 and 5 shows, in fact, a positive trend in efficiency, both from cost and profit side, over the eight years period.[21] However if we look more closely at the results, we find that only in few cases the increase in efficiency at country level is statistically significant (see Table 9), suggesting that the evolution of bank efficiency was not homogenous across the Eastern countries and the overall increase in cost and profit efficiency is mostly driven by few countries. From the cost efficiency viewpoint, only the Czech Republic and Latvia present a large and

[19] The duality theory would suggest, in fact, that when markets are perfectly competitive and the standard properties (linear homogeneity, cost-exhaustion) of production function hold, cost and profit functions are dual and therefore, by analyzing the cost side, one could also derive information on the profit side. From this it follows that those firms which are good in minimizing their costs, also generate higher profits. Therefore we would expect a positive sign for correlation between cost and profit efficiency if the theory assumptions are satisfied. The negative sign therefore gives an indication that market conditions were not perfectly competitive over the sample period we analyzed. Indeed, these results are not surprising for the CEECs banking sectors, since - although they have benefited with different degrees by the positive effect of the process of privatization, the foreign banking penetration and change in the institutional and legal requirements – they are still characterized by high concentration of banks and fairly scarce market competition (ECB, 2004). Alternatively, the negative correlation could also suggest that banks with relatively high cost "inefficiencies" may be able to supply a better service quality, and are in turn in a position to generate higher profits.

[20] A clear indication of this tendency shows the value of η which is positive and significant in the estimate of the stochastic cost and profit functions (see Table in the Appendix).

[21] A similar trend has also been found by Weill (2004) in the cost efficiency trend of banks belonging to a more limited number of Eastern countries (the Czech Republic, Hungary, Latvia, Poland, Slovakia and Slovenia) for the period 1996-2000.

statistically significant increase in efficiency equals to 17% and 13% respectively.[22] The positive results for the Czech Republic, which started at beginning of the period at the lowest level on the ranking, could be the result of the large process of privatization and improvement in governance as also pointed out by Weill (2004). From the profit side the trend is significant only for Latvia, Lithuania, Poland and Slovakia.

[22] This result is consistent with evidence provided by Weill (2004), who found a positive and significant increase in cost efficiency for the Czech Republic and Latvia over the period 1996-2000.

Table 9 – Evolution in cost and profit efficiency by country between 1995 and 2002.

	1995			2002			2002-1995	2002-1995
	Number of banks	Mean	Standard Deviation	Number of banks	Mean	Standard Deviation	Variation in percentage	Mean test
Cost efficiency								
CZ	11	0.47	0.17	20	0.64	0.18	+17	0.173* (2.81)
EE	9	0.78	0.11	6	0.8	0.1	+2	0.025 (-0.47)
HU	14	0.71	0.18	13	0.79	0.15	+8.7	0.087 (1.39)
LV	12	0.64	0.15	17	0.77	0.11	+13	0.134 (2.63)*
LT	4	0.75	0.06	9	0.79	0.09	+4.5	0.045 (1.07)
PL	25	0.78	0.19	30	0.82	0.13	+4	0.04 (0.91)
RO [a]	10	0.76	0.03	22	0.76	0.15	-1	-0.006 (-0.13)
SK	5	0.63	0.14	8	0.66	0.25	+3.5	0.035 (0.32)
SI	11	0.87	0.09	13	0.92	0.05	+4.4	0.04 (1.47)
Profit efficiency								
CZ	12	0.55	0.15	14	0.61	0.21	+5	0.054 (0.77)
EE	7	0.41	0.03	5	0.40	0.06	-1	-0.004 (-0.16)
HU	11	0.31	0.08	9	0.35	0.07	+3.4	0.034 (0.99)
LV	17	0.40	0.13	15	0.48	0.14	+8	0.080*** (1.63)
LT	7	0.33	0.07	9	0.41	0.08	+7.6	0.076** (2.04)
PL	28	0.34	0.07	30	0.41	0.08	+7	0.066* (3.25)
RO [a]	12	0.27	0.04	23	0.33	0.13	+5.6	0.056 (1.19)
SK	9	0.47	0.16	14	0.47	0.11	0	0.00 (-0.06)
SI	13	0.34	0.05	12	0.38	0.04	+4	0.04** (2.26)

[a] Results on Romania derive from the observations relative to 1998 and 2002, given the limited number of observation for the years 1995, 1996, 1997.

t-statistics are in parenthesis. * Significant at 1%; ** Significant at 5%; *** Significant at 10%.

The generally low level of efficiency, the significant differences in cost/profit efficiencies across countries as well as the apparently negative relationship between cost and profit efficiency scores raise questions of which type of management behavior could be made responsible for these phenomena observed with banks in the emerging market of Central and Eastern Europe.

4.2 Determinants of cost and profit efficiency

In exploring the rationale behind the results in section 4.1, we first attempt to explain the cost/profit efficiency level for the banks in CEECs by using the specification in eq. (4). The dependent variables of the two specifications are respectively the level of cost and profit efficiency, obtained by the cost and profit stochastic Fourier functions. As described before with this analysis we try to check if the management of the asset quality and capitalization of bank affect firm efficiency. In order to control our estimates for factors that may affect the cost and profit efficiency of the bank, we use some control variables such as the size of bank, the foreign ownership and level of concentration of the bank industry.

Table 10: Determinants of cost and profit efficiency for the CEECs banks

Variables	Dependent variable: **Cost efficiency**		Dependent variable: **Profit efficiency**	
	Coefficients	Z	Coefficients	Z
LLP	-.000025	-2.63*	0.000063	1.33
CAP	0.014	2.09**	0.0008	1.97**
LTA	0.0067	1.81***	0.00008	0.29
Market share	0.031	2.16**	.000588	0.53
Concentration	-0.0134	-1.56	-.0002024	-0.33
Foreign owned bank assets	-0.0012	-3.06*	.0016208	5.76*
Trend	0.0106	53.40*	.0043511	25.77*
Constant	0.76	27.12*	0.260737	13.00*
R^2	0.80		0.50	
Obs.	995		1103	
N. of Banks	232		247	

Table reports magnitude and z-statistics of random effects GLS estimates. The dependent variables in the two regressions derive from the FF stochastic cost and profit frontier estimates.
Starred values *, **, *** are significant at 1%, 5% and 10% level respectively.

These estimates provide a first insight into the managerial hypotheses we would like to test later on. Our results show that there is a negative relation, albeit the magnitude of the coefficient is very small, between loan loss reserves (proxy for problem loans) and the cost efficiency level, indicating that higher problems loans are connected with a lower level of efficiency. This evidence has also been confirmed by a Spearman´s and Kendall´s correlation

tests.[23] Note that both bad management and bad luck could hide behind these results. We also find a positive correlation between the ratio of equity to total assets (*CAP*) and cost efficiency, which is also consistent with our expectations, suggesting that banks that are well capitalizes have better space for absorbing losses coming from the loan portfolio. We furthermore find a positive correlation between cost efficiency and the ratio of loan over total assets (*LTA*), which represents a measure of the risk of the bank. Looking at the control variables, we find that the market share, which is a measure of bank's size, has a positive effect on cost efficiency. This means that large banks have a better control on the cost side and more likely they could better in exploiting scale economies. We furthermore find a negative correlation between foreign owned bank assets and cost efficiency suggesting that foreign owned assets do not itself justify higher level of cost efficiency.

Results on the profit side are less informative given the poor estimate results. The only relevant evidence we find is a positive correlation of foreign ownership and the capitalization ratio (*CAP*) with profit efficiency. The relation between foreign ownership and profit efficiency could be an indication that foreign owned banks given their constraints by capital market discipline are more focussed on the profit side than on controlling the cost side. Additionally the effects of the bank internal consolidation process going along with international mergers and acquisitions will usually be seen earlier on the profit side than on the cost side.

It is however, noteworthy that our estimates do not imply any causality between X-efficiency and managerial behaviour. We simply find a correlation between bad loan and cost efficiency, which support the view that most of the banks in CEECs are saddled with an overhang of non-performing loans which obviously affect the cost efficiency levels. Therefore, banks that were the fastest in coming to grips with bad debt were also the best in improving their overall efficiency scores.

This evidence opens the crucial question of this work: is this negative correlation between problem loans and efficiency a sign for the bad management or the bad luck hypothesis? In order to address this issue we check the managerial hypothesis using the Granger causality test, as proposed by Berger and DeYoung (1997).

4.3 Management behavior results

[23] The Spearman's rho (which is equal to -0.0195 significant at 1%) and the Kendall´s score (which is equal to -5882, significant at 1%) allow us to reject the H_o that cost and problem loans are independent; the negative signs of the tests show that the two variables are negatively correlated.

In this section we present the results of our tests to verify whether the correlation across cost efficiency, asset quality and capitalization detected in the previous analysis could be due to the management behavior. We employ the model proposed by Berger and DeYoung (1997) and used in Williams (2004), based on the Granger causality approach for testing the different management hypothesis (eqs 5-7). The three equations of the model were estimated separately using the Arellano-Bond dynamic panel data model. We chose the specification of three lagged periods, which has been supported by an *F*-test. In contrast to what we could have expected from the ownership literature, the evidence we obtain does not support the presence of the bad management hypothesis in CEE-banks, since we do not find significant values for the estimates parameters.

We test again the results using in the estimates, instead of the cost efficiency, the profit efficiency, without obtaining significantly different evidence. Moreover, we also check the model on two different sub-samples one containing banks with low foreign owner assets and the other with high foreign owned assets, to verify whether the bad management hypothesis could be checked for non-privatized banks and low foreign owned banks: again, results do not support any behavioral management hypothesis. Whereas the ownership model therefore influences whether a given bank is more/less efficient than a bank organized in a different way, we find no evidence that bad management hides behind this phenomenon.

In the same way, we also do not find any evidence for neither the skimping hypothesis nor moral hazard behavior. The skimping hypothesis would have implied a positive sign between loan loss provision and X-efficiency in eq. (5). The moral hazard hypothesis has been checked running eq. (5) on two sub samples of well and thinly capitalized banks to investigate whether banks with different capitalization react differently to the change in problem loans. In the case of thinly capitalized banks, we would have expected a negative relation between loan loss provision and lagged value of the variable accounting for the capitalization of the bank (*CAP*). Our results, however, provide support for the bad luck hypothesis given the fact that only eq. (6) provides significant coefficients which present the expected signs. In Table 11 we present the results of the dynamic Arellano Bond estimates of eq. (6) [24]. We report the three lagged coefficients of the dependent and independent variables and their respective sum. The fact that the sum of the lagged coefficients of loan loss provision (*LLP*) turns to be significant with the negative sign is an indication for the presence of the bad luck hypothesis: unexpected and external factors increase loan loss provisions, which reduce cost efficiency.

[24] For the sake of brevity we chose to present the estimation output only for the eq. (6) where we find significant results. The remaining estimates of the model are available from the authors upon request.

Table 11. Granger causality test in X-efficiency equation (6): bad luck hypothesis

Dep.var.: **Cost Efficiency**	Coefficient	Z
Constant	0.000011	6.07*
X-EFF $_{t-1}$	1.936526	206.26*
X-EFF $_{t-2}$	-0.939529	-101.62*
X-EFF $_{t-3}$	Dropped	
X-EFF $_{TOT}$	0.996997	53.50*
LLP $_{t-1}$	-0.000013	-2.12*
LLP $_{t-2}$	-0.000017	-3.47*
LLP $_{t-3}$	-0.000008	-2.73*
LLP $_{TOT}$	-0.000038	-2.72*
CAP $_{t-1}$	-0.000011	-1.19
CAP $_{t-2}$	0.000002	0.26
CAP $_{t-3}$	-0.000004	-0.46
CAP $_{TOT}$	-0.000013	-0.56
LTA $_{t-1}$	0.000018	1.61***
LTA $_{t-2}$	0.000007	1.10
LTA $_{t-3}$	0.000008	2.00**
LTA $_{TOT}$	0.000033	1.54***
Year $_{t-1}$	0.000002	1.03
Year $_{t-2}$	0.000004	1.31
Year $_{t-3}$	0.000006	1.41
N.of obs	365	
N. of banks	124	

Table reports the Arellano Bond dynamic estimates of eq. (6). Estimates are robust to the autocorrelation test obtained on the robust estimator of the variance-covariance matrix of the parameter estimates.
*Significant at 1%; **Significant at 5%; *** Significant at 10%.

Moreover, as shown by the results much of the significance of the estimates is explained by the lagged values of the dependent variables, suggesting that obviously the level of the efficiency today are affected by the past level of efficiency. The remaining coefficients including those for the loan loss provisions take on comparatively small values.

One reason why our evidence on management behavior, as cause for the low performance of the CEECs, is scarce may be due to the sample size, which of course decreases with number of lags used in estimate and the other data limitations in the Bankscope database for these countries. In fact, we also face data restrictions on problem loans, with numerous banks not reporting this figure. We use instead, as done also by Williams (2004), a proxy for them - the loan loss provision - which could contain element of endogeneity since they can be controlled

by the management. In this respect, further investigation would be necessary to further assess our evidence.

5 Conclusions

This paper attempts to investigate the cost and profit efficiency of banks in the CEECs over the period from 1995 to 2002 and to test with data on risk and asset quality whether the managerial behavior can explain the low efficiency level detected.

Not surprisingly, our findings, based on the FF stochastic cost and profit functions, show a generally low level of cost and profit efficiency for banks in the CEECs. Conversely, the results also reveal a significant tendency of efficiency (both cost and profit) to increase over time, although this trend is not equally spread over all countries. We furthermore encountered large and significant differences across countries and large gaps between cost and profit efficiency - banks in the former accession countries seem to be more efficient in controlling costs than in generating profits. Low cost efficiencies banks are even often offset by high profit efficiencies and vice versa.

We also give an insight into the determinants of X-efficiency levels in CEE-markets. In explaining cost efficiencies, we attempt to verify if the management of the asset quality and the risk of the bank can explain the cost and profit performance. The evidence provided by this static analysis is the negative correlation between cost efficiency and bad loans. When we look at the managerial behavior hidden behind this negative correlation, we find no evidence for bad management hypothesis explaining the relationship between efficiency and loan quality. By using the Granger causality approach as proposed by Berger and DeYoung (1997) we only find evidence for the bad luck hypothesis, which means that the exogeneity of bad loans is triggering inefficiency.

The fact that our data support the bad luck hypothesis suggests that high levels of problem loans, generated by external factors - such as the environmental conditions, the level of criminality, etc. - cause a decrease in the level of cost efficiency, as an increase in the cost of monitoring and in the other related expenses (e.g. a more prudent administration of the performing loans) will go along with higher provisioning. With all the caveat of our empirical investigation, our results indicate that the low level of efficiency recorded in the CEECs countries could therefore be partially ascribed to uncontrolled external factors. In terms of regulatory policy implications, this is a signal that bank inefficiency and failures in these markets are primarily associated with external shocks beyond the control of management. Regulatory and supervisory rules should therefore focus on reducing banks' exposure to these

unforeseen events. This could for instance be done by increasing the diversification of loan portfolios – limits in loan concentration, the promoting of mergers with foreign institution or an encouragement of banks toward a low risk profile by lowering the ratio between loan and total assets could be cases in point. Alternatively, higher capitalization rates are another way to increase banks' shock absorption capacity. For CEECs improvements in the efficiency of the banking systems could have a significant impact on the allocation of financial resources since this sector remains still the most important source of financing private investment of firms, given the underdevelopment of the financial markets.

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A P P E N D I X

Cost and Profit Fourier Functions Estimates – CEE banks

	Cost function		**Profit function**	
Variables	*Ln(TC)*		*Ln(TP)*	
	Coefficient	t-ratio	Coefficient	t-ratio
Ln y_1 *(loans)*	0.19	3.68*	0.12	2.3**
Ln y_2 *(deposits)*	0.36	7.41*	0.10	2.15**
Ln y_3 *(other earning assets)*	0.21	6.34*	0.14	4.01*
Ln p_1 *(labor price)*	0.68	10.95*	0.55	8.93*
Ln p_2 (*deposits price*)	0.15	2.92*	0.20	4.05*
Ln y_1^2	0.08	4.37*	0.05	2.76*
Ln y_2^2	0.16	14.54*	0.06	3.58*
Ln y_3^2	0.01	10.38*	0.02	2.09**
Ln p_1^2	0.11	4.31*	0.01	0.29
Ln p_2^2	0.14	7.03*	0.01	0.42
Ln y_1y_2	-0.07	-6.58*	-0.06	-4.33*
Ln y_1y_3	0.03	2.82*	0.01	0.84
Ln y_2y_3	-0.06	-6.54*	-0.02	-2.54*
Ln p_1p_2	-0.11	-5.45*	0.00	-0.21
Ln y_1p_1	0.02	1.58	0.01	0.8
Ln y_2p_1	-0.07	-5.23*	-0.04	-2.45*
Ln y_3p_1	0.01	0.71	0.04	3.57*
Ln y_1p_2	-0.03	-2.26**	0.01	0.43
Ln y_2p_2	0.11	9.09	0.03	2.05**
Ln y_3p_2	-0.03	-2.45*	-0.03	-2.58*
siny_1y_2	0.01	1.25	0.00	0.49
siny_1y_3	0.01	1.26	0.01	0.52
cosy_1y_3	0.00	-0.12	0.00	-0.44
difsiny_1y_2	-0.01	-0.97	0.00	-0.12
difcosy_1y_2	0.01	0.47	-0.01	-0.49
difcosy_1y_3	-0.02	-1.82***	0.01	0.64
sinp_1p_2	-0.08	-1.5	-0.04	-0.84
Cosp_1p_2	-0.08	-1.46	-0.03	-0.57
difsinp_1p_2	-0.08	-1.92**	0.02	0.53
difcosp_1p_2	-0.06	-1.26	0.04	0.94
Constant	2.35	16.24*	10.38	46.36*
μ	0.84	3.21*	0.92	5.78*
η	0.05	4.58*	0.02	3.54*
γ	0.99 (0.000)		0.75 (0.026)	
$\sigma 2$	142.48 (0.48)		0.19 (0.017)	
σ_u^2	142.42 (0.48)		0.14 (0.017)	
σ_v^2	0.05 (0.002)		0.05 (0.002)	
Obs.	1070		1105	
Number of banks	245		241	

The Table reports magnitude and *t*-statistics of the Maximum Likelihood estimates (e.q. 3) based on the Davidon-Fletcher-Powell Quasi-Newton algorithm, using the Battese and Coelli (1992) model estimated with Stata 8.1.

In parenthesis we report the standard deviation. The prefix "l" stands for natural logarithm; sum and dif, respectively, represent the sum and difference between trigonometric operators. Total costs, price of labor (p_1), and price of deposits (p_2) are normalized to the price of capital. Mixed products and squares of inputs and outputs represent the second order terms of the flexible form.

μ is the mean of the truncation at zero of a normal density functions;

$\gamma = \sigma_u^2 / \sigma^2$;

* Significant at 1% level; ** Significant at 5% level; ***Significant at 10% level.

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