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Abstract

This paper examines the relationship between the regulatory and supervision framework and the productivity of banks in 22 countries over the period 1999-2006. We follow a semi-parametric two-step approach that combines Malmquist index estimates with bootstrap regressions. The results indicate that regulations and incentives that promote private monitoring have a positive impact on productivity. Restrictions on banks' activities relating to their involvement in securities, insurance, real estate and ownership of non-financial firms also have a positive impact. However, regulations relating to the first and second pillars of Basel II, namely capital requirements and official supervisory power do not appear to have a statistically significant impact on productivity.

Keywords: Banks, Basel II, Productivity, Regulations
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1. Introduction

The important functions performed by banks and the implications for financial stability and economic growth have resulted in a heavily regulated and supervised industry. At an international level, the most renowned example is probably the new capital adequacy framework (Basel II) that encompasses capital requirements (Pillar 1), supervision by monetary authorities (Pillar 2), and market discipline (Pillar 3). While a host of international organisations, such as the Basel Committee, the World Bank, and the International Monetary Fund promote reform programmes combined with such revised regulatory frameworks in many emerging markets, a growing number of studies suggest that there is no consensus as to what constitutes good regulation and supervision, or how specific regulations influence the performance and stability of the banking sector (see e.g. Demirguc-Kunt et al., 2008). Furthermore, economic theory provides conflicting predictions about the impact of various policies on bank performance (see e.g. Barth et al., 2004a, 2007a), while there is still only limited cross-country empirical evidence on what type of regulations and supervisory practices promote bank development and stability or facilitate efficient corporate finance (Barth et al., 2004a; Beck et al., 2006, Berger et al, 2008).

The aim of this study is to examine the impact of (i) regulatory and supervisory policies related to the three Pillars of Basel II and (ii) restrictions on bank activities, on total factor productivity (TFP) growth in banking.[1] Grifell-Tatje and Lovell (1996) in their study of Spanish savings banks highlight how deregulation can have a negative influence on bank productivity while Casu et al. (2004) illustrate the importance of analysing the productivity of banks although they note that there is little consensus as to the main sources of productivity change. Various country studies, (Worthington, 1999; Mukherjee et al., 2001; Tirtiroglu et al., 2005; and Isik, 2007), examine the determinants of bank productivity with varying results. Mukherjee et al. (2001), for example, finds that US banks located in different states do not exhibit differences in productivity growth, and Worthington (1999) also finds no difference in the productivity of banks located in different parts of Australia. These results suggest that differences in local / regional economic and regulatory environments do not influence bank productivity. Tirtiroglu et al. (2005) examines the impact of U.S. intrastate

[1] A recent group of studies has examined the impact of these regulations on the risk-taking behaviour of banks (Gonzalez, 2005), bank soundness as measured by credit ratings (Pasiouras et al., 2006; Demirguc-Kunt et al., 2008), stability and banking sector crises (Demirguc-Kunt and Detragiache, 2002; Barth et al., 2004a; Beck et al., 2006), performance as measured by financial ratios (e.g. Barth et al., 2002, 2003a; Demirguc-Kunt et al., 2004; Barth et al., 2007a) and efficiency (Pasiouras, 2008). To the best of our knowledge, no study has focused on whether they influence the productivity growth of banks.

and interstate deregulations on bank TFP growth and finds that intrastate branching liberalization had a positive long-run impact on productivity growth. Isik (2007) examines financial reform programmes that took place in Turkey during the 1980's and finds that the productivity of banks improved significantly as the reform process accelerated. Similar results were also found by Aysan and Ceyham (2008) who examined Turkish banking sector reforms post 2001.

The aforementioned literature provides some indication that deregulation may help explain bank productivity growth although there are noticeable single country exceptions (Grifell-Tatje and Lovell, 1996) as well as a paucity of cross-country evidence to support such an idea. It is also by no means certain that a country-specific experience will necessarily apply to other countries (Barth et al., 2004a). Consequently, the present analysis attempts not only to relate bank productivity to a number of determinants, but also to shed some light on the productivity-regulations nexus within an international setting. As Casu et al. (2004) state: "*Analysing productivity differences across countries may help to identify the success or failure of policy initiatives...*" (p. 2522). Barth et al. (2005) also suggest that while lessons from individual countries, along with theoretical insights and the expertise of supervisory authorities provide important implications for the formation of banking policies, information on how different countries regulate banks and assess what works best (i.e. through empirical studies), is also crucial in determining appropriate policy reforms. Thus, by examining the productivity features of 533 banks operating in 22 transition countries over the period 1999-2006, we aim to contribute to the established literature on bank TFP growth and the influence of different regulatory and supervisory regimes.

The spotlight is placed on transition countries, which have received increased attention in recent years due to the important changes that they have experienced.[2] One of the most important reforms in the financial sector of these countries has been the attempt to improve the regulatory framework. In the words of Fries and Taci (2002) *"…the state had to take on important new roles to provide effective prudential regulation and supervision of banks. This involved development of significant new state capacity in terms of the enactment of new banking laws and regulations and their effective enforcement by the supervisory authorities and the courts"* (p. 1). However, the speed and progress of these reforms differs from one country to another, while the variation in the regulatory framework across countries

[2] For example, a number of empirical studies have examined the efficiency (e.g. Bonin et al., 2005; Fries and Taci, 2005) and the risk-taking behaviour of banks (e.g. Haselmann and Wachtel, 2007) in these countries.

is still quite important.[3] Furthermore, despite the apparent success of recent financial sector reforms, financial supervision and other regulatory policies need to be further upgraded (Maechler et al., 2007). Consequently, these countries provide an excellent cross-country setting for our study.

In order to investigate the determinants of banking sector productivity we combine the recent methodologies of Simar and Wilson (2007) and Khan and Lewbel (2007). In particular, we adopt a semi-parametric two-stage approach for our empirical analysis, which (i) corrects for the problematic issue of using productivity scores obtained from linear programming methods as dependent variables and (ii) accounts for the potential endogeneity of some of the explanatory variables in the second stage of the analysis. To estimate total factor productivity growth (TFP) of banks we use the Malmquist index and in the second stage we explain productivity growth by variables related to capital requirements, official supervisory power, market discipline, and restrictions on bank activities, while controlling for country- and bank-specific characteristics. The results suggest that regulations and policies that promote private monitoring have a positive impact on productivity. Furthermore, restrictions on bank activities relating to securities, insurance, real estate and ownership of non-financial firms, also increase bank productivity. In contrast, capital requirements and official supervisory power do not appear to have a statistically significant impact on TFP growth.

The remainder of the paper is organised as follows. Section 2 reviews the background of regulation and supervision and its potential relationship with productivity. Sections 3 and 4 present the empirical methodology, data, and variables. Section 5 discusses the empirical results and, finally, Section 6 concludes the study.

2. Background – Regulation and bank productivity

Banking regulations have attracted both theoretical and empirical interest, and several studies attempt to assess whether and how the regulatory framework influences the performance and behaviour of banks. The release of Basel II has generated a lively discussion and, while around 100 countries are currently planning to adopt the new framework by 2015, there is still an on-going debate as to its costs and benefits (Herring,

[3] For example, Totev (2007) discusses the frameworks in Albania, Bulgaria, Croatia, Macedonia, Romania, Serbia and concludes that there are important differences in the national legislation relating to the taking up and pursuit of banking business and the degree of implementation of Basel II.

2005). In the following sub-sections, we review the literature that examines the impact of certain regulatory features related to restrictions on bank activities and the three Pillars of Basel II on various aspects of performance, such as profitability, efficiency, soundness and risk-taking as this provides a guide as to their potential impact on bank productivity. However, it should be emphasised that in view of the general lack of empirical evidence on the influence of regulation on productivity and the mixed results of the literature that considers other measures of performance, the expected impact of regulations on productivity is ambiguous.

2.1. Capital requirements

To the extent that bank productivity is related to the transformation of inputs like deposits to outputs like loans, capital requirements may affect productivity through various channels.[4] The first channel is through the impact of capital requirements on bank lending, which is generally supported by the theoretical literature. For example, Kopecky and VanHoose (2006) argue that capital requirements influence bank decision-making in terms of both the quantity of lending and the quality of the loans made. Their theoretical model illustrates that the introduction of binding regulatory capital requirements on a previously unregulated banking system reduces aggregate lending, while loan quality may either improve or worsen. The analysis of Thakor (1996) also indicates that aggregate lending declines. However, VanHoose (2007) suggests that, in the long-term, capital regulation will increase capital ratios, which may or may not be accompanied by an increase in total lending. As regards the quality of loans and since screening and monitoring is costly, additional resources (i.e. inputs) will be required both in monetary and labour terms to ensure that banks operate within the desired level of risk.

The second channel works through the impact of capital requirements on the decision of banks as for the assets in which they invest. VanHoose (2007) reviews the literature and suggests that in light of stricter capital standards, banks may decide to substitute loans with alternative forms of assets. Thus, banks will switch from relatively risky assets to those with lower risk weighting, such as residential mortgages, short-term interbank exposures, or government securities (Jackson et al., 1999). For example, Thakor (1996) argues that in a competitive environment, an increase in the minimum capital requirement will result in

[4] See Santos (2001) and VanHoose (2007) for surveys of studies on capital requirements.

higher loan-funding cost and lower profit from lending, since the bank is unable to pass this cost to borrowers. Thus, lending will be less attractive relative to investing in government securities, which do not require capital to be held against them. However, the mix of assets can have a substantial impact on productivity, if banks are not equally efficient in managing various categories of assets.

Productivity can also be influenced through the impact of capital requirements on the liability side of banks' balance sheets. This is based on the fact that deposits and equity may be alternative sources of funds for banks. However, because capital is more expensive than deposits, banks will generally choose to operate with the minimum capital level specified by regulators (Santos, 1999). Nevertheless, banks may be forced to substitute equity for deposits and issue new equity to meet capital adequacy requirements. Indeed, Santos (2001) points out that even though an increase in capital standards may improve bank stability, it may not be desirable since it decreases deposits. Obviously, this decrease in the level of deposits can have an impact on productivity. Furthermore, Besanko and Kanatas (1996) outline that in the case of the above scenario, where banks issue new equity, agency problems may arise, as it is likely that insiders (i.e. existing shareholders) will become less productive monitors. Differently phrased and from a corporate governance perspective, less monitoring may lead managers to allocate funds less efficiently.[5]

The empirical evidence on the influence of capital on bank efficiency provides some guidance as to whether solvency influences features of bank productivity. For example, regulators may allow relatively efficient banks to operate with higher leverage, all other things being equal (Hughes and Moon, 1995; Hughes and Mester, 1998). Hughes et al. (2001) find that when capital is included in cost functions to derive scale economies, this generally has a positive influence in terms of generating returns to scale (constant returns tend to be found when capital is excluded from their cost function estimates). Others, such as Altunbas et al. (2000), Färe et al. (2004) and Altunbas et al. (2007) also find that capital can significantly influence bank cost and profit efficiency measures. Altunbas et al. (2007) in their cross-country study of European banks, for instance, find that relatively inefficient banks appear to hold more capital, while evidence from the other literature is mixed. While this literature clearly indicates that capital influences bank efficiency it is difficult to extrapolate the expected direction of its influence on productivity, as it is very likely to

[5] Caprio et al. (2007) suggest that if bank managers face sound governance mechanisms and are well-monitored, it is likely that they will allocate capital and the savings of the society more efficiently. Therefore, it is natural to assume than in a situation with less productive monitors, the opposite will occur.

depend on the relative changes of inputs and outputs in the production process over time.[6]

Related empirical research that focuses on other aspects of banks' performance also seems to generate mixed findings. Barth et al. (2004a) find that while stringent capital requirements are associated with fewer non-performing loans, capital stringency is not robustly linked to banking sector stability, development or performance, when controlling for differences in regulatory regimes. Pasiouras et al. (2006) find a negative relationship between capital requirements and banks' soundness as measured by Fitch ratings. In contrast, Pasiouras (2008) reports a positive association between technical efficiency and capital requirements, although this is not statistically significant in all cases.

2.2. Supervisory power

Under the official supervision approach, private agents may lack the incentives and capabilities to monitor powerful banks. However, powerful official supervision can improve the corporate governance of banks (Stigler, 1971). Consequently, as Beck et al. (2006) suggest, a supervisor that has the power to monitor and discipline banks could enhance their corporate governance, reduce corruption in bank lending and improve the functioning of banks as financial intermediaries.

Yet, from another perspective, powerful supervisors may also try to maximize their own private welfare rather than the social welfare (see e.g. Becker, 1983). Barth et al. (2004a) summarize various reasons for which this can have a negative influence on bank performance. For example, politicians may use powerful supervisors to persuade banks to lend to favoured borrowers on advantageous terms. Furthermore, politicians and supervisors may use their power to benefit certain constitutes, attract campaign donations, and extract bribes (see e.g. Djankov et al., 2002). Obviously, when banks are forced under the threat of a non-compliant discipline to direct their credit to politically connected firms, they cannot use risk-return criteria (Beck et al., 2006). In addition, Levine (2003) mentions that powerful banks may, under the political/regulatory capture theory, confine politicians and induce supervisors to act in the interest of banks rather than the interest of the society (see e.g.

[6] For example, in the case of a bank with a single input (deposits) and a single output (loans), under the assumption that loan activity decreases while deposits remain constant, we will observe a decrease in productivity. The opposite will occur with a decrease in deposits, when loans remain constant. In a more realistic scenario, both loans and deposits will change and the final impact on productivity will naturally depend on their relative change. Obviously, this situation becomes more complicated in the case of multiple inputs and outputs.

Stigler, 1971). Consequently, as Levine (2003) and Beck et al. (2006) argue, under these circumstances, enhancing the power of supervisors may result in a decrease in the integrity of bank lending with adverse implications on the efficiency of credit allocation. Levine (2003) highlights that the difference between the powerful official supervision approach and the political/regulatory capture theory is that the first will lead to an increase in the flow of credit towards a few well-connected firms, while the second will impair the availability of credit to firms in general.

The empirical results are yet again mixed. Barth et al. (2004a) indicate that there is no strong association between bank development and performance and official supervisory power. However, the results of Barth et al. (2002) show that more powerful government supervisors are associated with higher levels of non-performing loans, while Barth et al. (2003b) find that official government power is particularly harmful to bank development in countries with closed political systems. The results of Pasiouras et al. (2006) also indicate a negative relationship between supervisory power and overall bank soundness (i.e. credit ratings). In contrast, after controlling for accounting and auditing requirements, Fernandez and Gonzalez (2005) report that in countries with low accounting and auditing requirements a more stringent disciplinary capacity of supervisors over management action appears to be useful in reducing risk-taking. Furthermore, Pasiouras (2008) finds a positive and statistically significant impact of supervisory power on technical efficiency in most of his specifications. On the basis of the above discussion, it seems likely that the productivity of banks will be influenced by the power of the official supervisors, although, like in the case of capital regulation, it is again difficult to predict the precise direction of this relationship.

2.3. Market discipline

According to the private monitoring approach, regulations and incentives that promote private monitoring will result in better outcomes for the banking sector. For instance, this can be achieved by requirements related to the disclosure of accurate information to the public that will allow private agents to overcome information and transaction costs and monitor banks more effectively (Hay and Shleifer, 1998). Furthermore, the existence or not of an explicit deposit insurance scheme[7] and requirements to maintain subordinated debt finance[8]

[7] Demirguc-Kunt and Detragiache (2002) show that several countries have established a system of national deposit insurance over the last 25 years, this being viewed as a way of avoiding bank runs. However, when

are expected to have an impact on private monitoring. The private monitoring approach also argues that corruption of bank officials will be less of a constraint on corporate finance (Beck et al., 2006).

Thus, under the private monitoring empowerment view, we would expect that improved private governance of banks will boost their functioning (Barth et al., 2007a) and their productivity. However, requirements for increased disclosures can also have a negative impact on productivity. As Duarte et al. (2008) mention, disclosures are costly for managers due to direct costs of making additional disclosures, additional time, effort to prepare formal disclosure documents, and the costs of maintaining investor relations departments. Furthermore, Duarte et al. (2008) point out that broad disclosure may result in the release of sensitive information to competitors.

Most of the empirical studies tend to support the view that market discipline will have a positive impact on the banking industry. Barth et al. (2004a) find that regulations that encourage and facilitate private monitoring of banks are associated with greater bank development and lower net interest margins and non-performing loans. Additional results from Barth et al. (2007a) indicate that private monitoring has a negative impact on overhead costs and enhances the integrity of bank-firm relations. Pasiouras (2008) reports a robust positive and significant relationship between disclosure requirements and technical efficiency. Demirguc-Kunt et al. (2008) find that countries where banks have to report regular and accurate financial data to regulators and market participants have sounder banks. Finally, Beck et al. (2006) show that empowerment of private monitoring facilitates efficient corporate finance and has a beneficial effect on the integrity of bank lending in countries with sound legal institutions. However, Barth et al. (2004a) indicate that there is no evidence that regulations that foster private monitoring reduce the likelihood of suffering major banking crises. Furthermore, Pasiouras et al. (2006) find a negative relationship of credit ratings with disclosure requirements, which is however significant only at the 10% level and is not robust across their specifications. To this end, again we expect the productivity of banks to be related to the level of private monitoring although we cannot be certain ex ante whether this will have a positive or negative relationship.

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deposit insurance is in effect, depositors have no incentives to monitor banks, which may result in a decrease in market discipline (Dermirguc-Kunt and Huizinga, 2004).

[8] See Calomiris (1999) and Evanoff and Wall (2000) for recent proposals under which requiring banks to maintain subordinated debt finance can be a promising reform that imposes market discipline and enhances safety nets.

2.4. Restrictions on bank activities

Barth et al. (2004a) outline several reasons for restricting bank activities as well as reasons for allowing banks to participate in a broader range of activities. On the one hand, allowing a wide range of financial activities may lead to increased risk exposure of banks, or to the establishment of complex and powerful banks that will be difficult to monitor and discipline. Furthermore, the creation of large financial conglomerates may reduce competition and efficiency. On the other hand, fewer regulatory restrictions permit the utilization of economies of scale and scope (Claessens and Klingebiel, 2000), increase the franchise value of banks and offer opportunities for income diversification.

Barth et al. (2004a) find a negative association between restrictions on bank activities and banking sector development and stability. Barth et al. (2001a) also confirm that greater regulatory restrictions on bank activities are associated with higher probability of suffering a major banking crisis, as well as lower banking sector efficiency. Lower restrictions on bank activities have also been associated with higher credit ratings (Pasiouras et al., 2006). In contrast, Fernandez and Gonzalez (2005) find that stricter restrictions on bank activities are effective at reducing banking risk, although the authors indicate that restrictions are only effective at controlling risk when information disclosure and auditing requirements are poorly developed. Demirguc-Kunt et al. (2004) report a positive and significant association between net interest margins and restrictions on activities. Finally, Pasiouras (2008) finds no significant association of restrictions on activities with technical efficiency. Given the impact reported in the majority of the studies, we expect bank productivity to be influenced by restrictions on their activities, although the extent and direction of this influence is difficult to predict.

3. Empirical methodology

To examine the impact of regulations on the productivity growth of banks we combine the methodologies proposed by Simar and Wilson (2007) and Khan and Lewbel (2007). Specifically, in a first stage of analysis, we derive input-oriented Malmquist indices to measure the TFP growth of banks. In the second stage, we regress these TFP growth scores on a number of variables (including the regulatory variables that are of central interest in this paper) using a bootstrapping procedure that accounts, inter alia, for the serial correlation of the first-stage estimates. This framework (denoted as Algorithm # 2 in Simar and Wilson)

provides a robust procedure for regressing non-parametrically derived efficiency/productivity scores on factors that potentially affect these scores.[9] Note, however, that robustness is guaranteed as long as only exogenous determinants of productivity growth are considered in the second stage regressions. To account for the potential endogeneity of some of the right-hand side variables (in particular the bank-level control variables), Brissimis et al. (2008) follow the methodology put forth by Khan and Lewbel (2007), who present an endogenous truncated regression model. Therefore, the simple truncated regression in Algorithm #2 of Simar and Wilson (2007) is replaced by the endogenous truncated regression of Khan and Lewbel (2007). Finally, note that productivity scores are derived on a country-specific basis, so as to avoid incorporating the effect of the different economic environments of our sample into the estimated scores.[10]

In this context, we use the Mamquist DEA-like method suggested by Fare et al. (1994), which is the most popular parametric method used to obtain TFP growth estimates.[11] To introduce some notation, let us assume that for *N* observations there exist *K* inputs producing *L* outputs. Hence, each observation *n* uses a nonnegative vector of inputs denoted $x^n = (x_1^n, x_2^n, ..., x_k^n) \in R_+^K$ to produce a nonnegative vector of outputs, denoted $y^n = (y_1^n, y_2^n, ..., y_l^n) \in R_+^L$. Production technology $F = \{(y, x) : x \text{ can produce y}\}$ describes the set of feasible input-output vectors, and the input sets of production technology $PT(y) = \{x : (y, x) \in F\}$ describe the sets of input vectors that are feasible for each output vector. TFP change is then estimated in the spirit of Fare et al. (1994), who defined the Malmquist index as

[9] As Simar and Wilson (2007) point out, non-parametrically derived efficiency/productivity estimates are serially correlated, and consequently standard approaches to inference in the second stage (such as censored or truncated regressions) are invalid. To overcome this problem, Simar and Wilson propose that two algorithms may be used in the second-stage regressions. Simulations reveal a preference for Algorithm #2, since it additionally corrects for bias in the estimated coefficients. The procedure starts with a simple truncated regression, whose estimates are corrected in a number of steps using bootstrapping (see pp 42-42 in Simar and Wilson, 2007).

[10] We also estimated TFP for the pooled cross-country sample. The use of these TFP estimates in the second stage of our analysis had no significant impact on our results; the significance levels for the regulation variables remain more or less the same.

[11] The Malmquist technique allows decomposition of TFP change into technological change (TC) and technical efficiency change (TEC). An improvement in TC is considered as a shift in the frontier. Also, TEC is the product of scale efficiency change (SEC) and pure technical efficiency change (PTEC). Note that this decomposition has been subject to a number of criticisms (see Casu et al., 2004), mainly in terms of the role of constant returns vs. variable returns to scale frontiers. However, there seems to be consensus that the Malmquist index is correctly measured by the constant returns to scale distance function, even when technology exhibits variable returns to scale.

$$M_0(y_s, x_s, y_t, x_t) = \left[\frac{d_0^s(y_t, x_t)}{d_0^s(y_s, x_s)} \text{ x } \frac{d_0^t(y_t, x_t)}{d_0^t(y_s, x_s)} \right]^{1/2} \quad (1)$$

where M_0 measures the productivity change between periods *s* (base period) and *t*, and $d_0^s(y_t, x_t)$ represents the distance from the period *t* observation to the period *s* technology. M_0>1 indicates positive TFP growth from period *s* to period *t*, M_0<1 indicates a decline and M_0=1 indicates constant TFP growth.

The TFP growth scores serve as the dependent variable in the estimation of the following equation:

$$M_{itc} = a_1 R_{tc} + a_2 B_{itc} + a_3 Z_{tc} + u \quad (2)$$

where the TFP growth, *M*, of bank *i* that operates in country *c* at time *t* is written as a function of time-dependent banking-sector regulation variables, *R*; a vector of bank-level variables, *B*; variables that capture the macroeconomic conditions common to all banks, *Z*; and the error term *u*.

4. Variables and data

4.1. Inputs-outputs

We select inputs and outputs for the estimation of the Malmquist index on the basis of the intermediation approach, which assumes that banks collect funds, using labour and physical capital, to transform them into loans and other earning assets. To account for the increasing involvement of banks in fee-generating services, we also include non-interest income as an additional output. Thus, we assume that banks have three outputs, namely loans, other earning assets, and non-interest income. The three inputs used to produce the above outputs are fixed assets, customer deposits & short term funding, and overhead expenses.[12]

[12] Most studies use personnel expenses rather than overhead expenses. However, owing to data unavailability for personnel expenses for a large number of observations in our sample, we rely on overhead expenses, which include personnel expenses and other administrative expenses. Our approach is consistent with the one of studies that examine the efficiency of banks in transition and other countries (see Altunbas et al 2001, Fries and Taci, 2005; Bonin et al., 2005).

4.2. Regulatory variables

For the construction of the capital requirements (CAPRQ), power of supervisory agencies (SPOWER) and private monitoring (PRMONIT) indexes, we use information provided by the World Bank database compiled by Barth et al. (2001b) and updated by Barth et al. (2006, 2007b) that provides regulator responses to a broad number of questions.

CAPRQ is an index of capital requirements that accounts for both initial and overall capital stringency. CAPRQ is constructed for each country in our sample, on the basis of the responses to the following eight questions documented in the aforementioned World Bank database: (1) Is the minimum required capital asset ratio risk-weighted in line with Basle guidelines? (2) Does the ratio vary with market risk? (3-5) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realized in accounting books? (b) unrealized losses in securities portfolios? (c) unrealized foreign exchange losses? (6) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (7) Can the initial or subsequent injections of capital be done with assets other than cash or government securities? (8) Can initial disbursement of capital be done with borrowed funds? For each question, we add 1 if the answer is yes to questions (1)-(6) and 0 otherwise[13], while the opposite occurs in the case of questions (7) and (8) (i.e. yes=0, no =1). Thus, CAPRQ can take values between 0 and 8, with higher values indicating higher capital stringency.

SPOWER is an index that reveals the power of the supervisory agency in each country. It is constructed by adding 1 if the answer is yes and 0 if the answer is no in the case of the following 14 questions: (1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the

[13] For the construction of CAPRQ, SPOWER and PRMONIT we use the summation of the quantified answers as in Fernandez and Gonzalez (2005), Barth et al. (2001b, 2004b, 2007b), Pasiouras et al. (2006), Pasiouras (2008), among others. An alternative would be to use the principal components approach as in Beck et al. (2006) and Barth et al. (2007a). Barth et al. (2004a) have followed both approaches. They mention that on the one hand the drawback of using the summation for the construction of the index is that it assigns equal weight to each of the questions, whereas on the other hand the disadvantage of the first principal component is that it is less transparent how a change in the response to a question changes the index. While they only report the empirical reports using the principal component indexes, they mention that "*we have confirmed all this paper's conclusions using both methods*" (p. 218), implying that there are no differences in the results. Consequently, in the present study, we rely on the summation of the individual zero/one answers as we do not expect significantly different results.

supervisory authorities force a bank to change its internal organizational structure? (5) Are off-balance sheet items disclosed to supervisors? (6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (7) Can the supervisory agency suspend director's decision to distribute dividends? (8) Can the supervisory agency suspend director's decision to distribute bonuses? (9) Can the supervisory agency suspend director's decision to distribute management fees? (10) Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? (11) Does banking law allow supervisory agency or any other government agency (other than court) to suspend some or all ownership rights of a problem bank? (12) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than court) supersede shareholder rights? (13) Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace management? (14) Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace directors? Thus, this index can take values between 0 and 14 with higher values indicating higher supervisory power.

PRMONIT is an index of private monitoring that measures the degree to which banks are forced to disclose accurate information to the public and whether there are incentives to increase private monitoring. It is calculated by adding 1 if the answer is yes to questions (1)-(6) and 0 otherwise, while the opposite occurs in the case of questions (7) and (8) (i.e. yes=0, no =1). The eight questions that are considered are: (1) Is subordinated debt allowable (or required) as part of capital? (2) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? (3) Are off-balance sheet items disclosed to public? (4) Must banks disclose their risk management procedures to public? (5) Are directors legally liable for erroneous/misleading information? (6) Do regulations require credit ratings for commercial banks? (7) Does accrued, though unpaid interest/principal enter the income statement while loan is non-performing[14]? (8) Is there an explicit deposit insurance protection system? Hence, PRMONIT can take values between 0 and 8 with higher values indicating higher private monitoring.

Finally, ACTRS is a proxy for the level of restrictions on banks' activities in each country. It is determined by considering whether participation in securities, insurance, real estate activities, and ownership of non-financial firms are unrestricted, permitted, restricted

[14] In cases that accrued but unpaid interest for a non-performing loan is allowed to enter the income statement it might be more difficult for market participants to assess the financial condition of a bank (Barth et al., 2007b).

or prohibited. Depending on the answer, the level of restrictions in each activity is quantified as 1 (unrestricted), 2 (permitted), 3 (restricted), or 4 (prohibited). We then construct an overall index by calculating the average value over all four activities. Consequently, ACTRS can take values between 1 and 4, with higher values indicating higher restrictions.

4.3. Control variables

To control for other potential determinants of bank productivity, we use three bank-specific and seven country-specific variables. The first bank-specific variable is the equity to assets ratio (EQAS) that is used as a proxy of capital strength. To control for size we use the natural logarithm of real total assets (LNAS). However, as there might be a non-linear relationship between size and productivity we also use the logarithm of the squared term of real total assets (LNAS2). Similar bank-specific control variables have been used in the studies of Isik (2007) and Aysan and Ceyhan (2008).

Following previous studies that focus on banks' performance (Barth et al., 2004a; Demirguc-Kunt et al., 2004; Fries and Taci, 2005; Pasiouras et al., 2006; Pasiouras, 2008), we control for cross-country differences in the national structure and competitive conditions of the banking sector, using the following measures: (i) concentration in terms of assets of the three largest banks (CONC3), (ii) percentage of assets held by foreign banks (FOREIGN), and (iii) percentage of assets held by government-owned banks (GOVERN). As in Kasman and Yildirim (2006) and Pasiouras (2008) (among others) we control for the macroeconomic environment using the real GDP growth (GDPGR) and the inflation rate (INFL). Finally, we control for the financial development and the overall economic development in each country by using the credit to the private sector expressed as a percentage of GDP (CREDIT) (e.g. Barth et al., 2003a; Pasiouras, 2008), and the GDP per capita (GDPCAP) (e.g. Barth et al., 2003a; Dermiguc-Kunt et al., 2004).

4.4. Data

Our panel is unbalanced and consists of 3,047 observations from 533 commercial banks operating in 22 transition countries between 1999 and 2006.[15] We focus on commercial

[15] The geographical coverage of the study is as follows: Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, FYROM, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Moldova, Poland, Romania, Serbia, Slovakia, Slovenia, and Ukraine.

banks for two main reasons. First, because this provides a more homogenous sample in terms of services and consequently inputs and outputs, which in turn enhances the comparability of the banking systems examined. Second, as mentioned in Demirguc-Kunt et al. (2004), since the regulatory data of the World Bank (WB) database are for commercial banks, it is more appropriate to use bank-level data only for this type of banks.

We collect information from five sources. All bank-level data were obtained from the BankScope database of Bureau van Dijk and were converted to US dollars and in real 1995 terms (using country-specific GDP deflators). Information on bank regulations and supervision is obtained from the World Bank database developed by Barth et al. (2001b) and updated by Barth et al. (2006, 2007b). Since this database is available at only three points in time we used information from Version I for bank observations for 2000, from Version II for bank observations for the period 2001-2003, and from Version III for bank observations for 2004-2006.[16,17] Data for concentration are collected from the 2007 version of the WB database on financial development and structure, which was initially constructed by Beck et al. (2000). Data for the percentage of assets held by foreign and government-owned banks, and the credit to the private sector (%GDP) are from the European Bank for Reconstruction and Development. Macroeconomic data are collected from Global Market Information Database.

Descriptive statistics for the inputs and outputs used in the first stage of our analysis and the explanatory variables used in the second stage are available in Tables 1 and 2, respectively.

[Insert Tables 1 and 2 Around Here]

5. Results

Table 3 reports geometric means for the total factor productivity change estimates by country and over time (obtained from the first stage of our empirical analysis). As already mentioned, an index greater than one indicates a positive TFP growth while an index lower than one

[16] Version I was released in 2001 and contain information for 117 countries (Barth et al., 2001b). For most of the countries, information corresponds to 1999, while for others information is either from 1998 or 2000. Version II describes the regulatory environment at the end of 2002 in 152 countries (Barth et al., 2006) and Version III describes the regulatory environment in 142 countries in 2005/06 (Barth et al., 2007b).

[17] While acknowledging this shortcoming, we do not believe that it has an impact on our results. Many other studies that have used this database across a number of years worked under a similar assumption (e.g. Demirguc-Kunt and Detragiache, 2002; Demirguck-Kunt et al., 2004; Fernandez and Gonzalez, 2005).

indicates a decrease in TFP growth. The results suggest that during the sample period most countries present significant TFP growth on average, which is representative of banking systems under immense reform. In particular, average TFP growth has been quite large in Czech Republic, Estonia, Kazakhstan, Latvia and Lithuania, while it has been declining in Armenia. Large fluctuations are observed in Serbia, which are probably due to the hostility in the beginning of the period, while a noticeable upward trend in the value of the index is observed for Slovenia and Hungary. Overall, the banking systems examined exhibit relatively high TFP growth scores compared with those reported by other studies for developed banking systems (e.g. Casu et al., 2004).

[Insert Tables 3 and 4 Around Here]

As suggested above, Eq. (2) is estimated using the bootstrap procedure described in Brissimis et al. (2008), which accounts for the potential endogeneity of some of the right-hand side variables, in our case the EQAS variable.[18] The results of the second-stage analysis are reported in Table 4. We estimate various models, where we control for alternative country-specific factors. In all cases, we control for the bank-specific characteristics and for country effects using dummy variables.[19] In particular, Model 1 is our base model where we examine the impact of regulations on productivity, while controlling for bank-specific characteristics. In Model 2, we additionally control for market structure by including CONC3, FOREIGN and STATE in the regression equation. In Model 3, we control for the macroeconomic conditions using INFL and GDPGR. In Model 4, we control for the financial and overall economic development through the inclusion of CREDIT and GDPCAP. As a robustness test, we also present two re-estimations of Model 1, in which we examine the potential impact of outliers and the effect of time, respectively.[20]

PRMONIT has a positive and statistically significant coefficient, and this finding holds across all of our specifications. Thus, our results strongly support the view that

[18] The underlying theory of the potential endogeneity of bank capital in models of bank performance is outlined in detail in Berger (1995).

[19] The country dummies were found to be jointly statistically significant (using a simple F-test). For expositional brevity, we do not report the coefficients on these variables; however the results are available upon request.

[20] We examine the sensitivity of our results to outliers, by re-estimating our benchmark model, this time excluding all observations with an error term in the upper or lower 5th percentile (therefore, we drop 10% of our sample). The results remain practically unchanged at conventional levels of statistical significance. Also, to control for potential time effects we re-estimate our benchmark model while including year dummies. The inclusion of these dummies in the analysis does not alter the baseline results, while the joint significance of the year dummies (tested using an F-test) is quite low (p-value=0.17).

empowering private monitoring, through disclosure requirements and other incentives, increases the productivity of banks. On the other hand, CAPRQ and SPOWER are insignificant in all cases, indicating that higher capital requirements and more powerful supervisors do not influence the productivity of banks. Taken together, these results imply that transition, as well as developing countries aiming to enter in a transition stage, should place particular emphasis on enhancing private monitoring over the other pillars of Basel II, while upgrading their supervision and regulatory framework. This in turn will allow banks to increase productivity.[21]

Our results indicate that ACTRS has a positive and significant impact on productivity, with the relationship being robust across all the specifications. Barth et al. (2003a) point out that on the one hand, fewer restrictions could provide greater profit opportunities; yet, on the other hand, banks may systematically fail to manage a diverse set of financial activities beyond traditional banking, and hence experience a lower profitability. Obviously, by interpolation, we can argue that those banks that fail to manage a diverse set of financial activities will also experience a decline in productivity. In other words, our results imply that banks may be forced to offer a limited number of services, so as to acquire expertise and specialization in specific market segments that will allow them to be more productive. This may be particularly true within banking systems of transition countries, as banks in these countries only recently gained access to modern technologies and improved the quality and training of their staff, which are necessary ingredients for an efficient expansion of intermediation services.[22]

Turning to the country-specific control variables, we find that only FOREIGN and CREDIT have a significant impact on productivity growth. Consistent with our expectations, FOREIGN has a positive sign, a result in line with the literature that suggests a number of benefits from the entry of foreign banks in emerging markets.[23] For example, Levine (1996) mentions three major benefits from foreign banks presence: (i) improvement of quality and availability of financial services in the domestic market due to increased bank competition as well as adoption of modern banking skills and technology; (ii) development of the domestic

[21] Note, that this finding is in line with the recommendations of studies that examine soundness (Demirguc-Kunt et al., 2008), efficiency (Pasiouras, 2008), corruption in lending (Beck et al., 2006) and other aspects of performance and development (Barth et al., 2004a).

[22] As Bonin et al. (2005) suggest, until recently the information technology in transition countries was only basic, while the human capital necessary to make even prudent lending decisions and to price risk properly was sparse or non-existent. Kazandjieva (2007) also points out that in the past, private banks in Bulgaria were lacking knowledge and experience to develop new products.

[23] See various articles in Altzinger and Petkova (2007) that discuss the benefits form the entry of foreign banks in South East European countries.

bank supervisory and legal framework; and (iii) enhancement of the country's access to international markets. Furthermore, the presence of foreign banks may encourage non-financial foreign firms to invest in the host country in the same way that foreign banks follow their customers abroad (Brealey and Kaplanis, 1996). Finally, Lensink and Hermes (2004) argue that foreign banks may also increase the quality of human capital in the banking system, either by importing high skilled bank managers to work in their branches or by training the local employees. CREDIT also carries a positive sign, indicating that financial development increases the productivity of banks, which is consistent with findings in the efficiency literature (e.g. Pasiouras, 2008).

6. Conclusions

Despite the efforts of international organisations and policy makers to promote a regulatory framework with more stringent capital requirements, higher supervisory involvement and empowerment of private monitoring, there is an ongoing debate as for which of these regulations really work and whether policies that have proved successful in one country will also be successful in another. Theoretical answers to these questions have in general provided conflicting views, while researchers have only recently used cross-country data to investigate aspects of banking regulation that were traditionally explored in individual-country studies.

The present study, examines the relationship between bank-level productivity and country-level capital requirements, official supervisory power, market discipline and restriction on bank activities. We first use the Malmquist index to estimate the total factor productivity growth of 533 banks operating in 22 transition countries between 1999 and 2006. Then, we use a robust bootstrap procedure to regress the first-stage TFP growth scores on our regulatory variables, while controlling for country- and bank-specific characteristics.

Our results suggest that from the three pillars of Basel II, only market discipline has an impact on productivity growth. This is consistent with the majority of studies that have explored other issues of bank performance, soundness, and risk taking. Therefore, our findings suggest that policy makers should direct their efforts towards ensuring adequate and timely disclosure of information and promote a framework that provides incentives for private monitoring. Certainly, this may not imply that the other two pillars of Basel II should be abandoned. There exist prominent theoretical arguments and a limited number of empirical studies that reveal a close relationship between regulations related to the first two

Pillars and mitigation of bank risk-taking, while policy makers report that such regulations are useful in ensuring the enforcement of private monitoring.

Furthermore, we found that restrictions on bank activities had also a positive impact on productivity growth. While this contradicts the results of some studies on financial stability, it perhaps suggests that banks in transition countries that focus on core banking areas acquire knowledge and specialization in these services, enhancing their productivity. It may be the case that potential productivity gains are dissipated if banks are afforded greater opportunities to diversify.[24] Finally, we found that the percentage of assets held by foreign banks and the credit to the private sector as a percentage of GDP influenced positively the total factor productivity of banks.

We contend that future research regarding the impact of regulations on bank performance in general and on productivity growth in particular may benefit from focusing on the structure and risks facing the banking industry or individual banks.

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[24] Stiroh (2004) finds that for US banking diversification is associated with lower risk-adjusted profits and higher risk, and he suggests that there are "*few obvious diversification benefits from the ongoing shift toward non-interest income*" (p.853).

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Table 1
Descriptive statistics of bank inputs and outputs (country averages)

Country	ta	dep	fa	over	loans	oea	nintinc
Albania	1669.8	100321.4	1851.8	3224.9	26127.0	74930.9	1312.5
Armenia	263.1	13349.5	901.8	982.3	6056.6	6770.0	692.0
Azerbaijan	431.8	21873.7	1796.0	1284.2	14932.0	5092.0	1369.9
Belarus	24.9	1433.1	141.9	153.9	1194.7	286.6	103.3
Bosnia	1907.6	103124.7	4943.4	5643.8	74060.9	33477.0	4030.7
Bulgaria	111.3	7685.5	319.1	355.8	5018.9	3634.0	193.0
Croatia	6763.2	378610.8	9560.7	13738.5	283114.2	176647.6	8530.5
Czech	28144.7	1872211.0	43274.1	60033.3	932382.2	1309705.0	38405.0
Estonia	11922.6	784478.6	12740.9	23931.4	717090.5	174867.1	16500.0
FYROM	1255.9	68438.2	3842.9	3651.0	37593.4	35934.3	3305.5
Georgia	401.7	18129.5	2070.6	2040.5	19262.9	4063.2	1344.1
Hungary	9340.2	566448.3	12937.1	29064.2	403552.9	238327.2	20961.6
Kazakhstan	2732.7	103727.4	2929.2	4849.1	134671.3	57398.2	3954.9
Latvia	3425.0	250032.0	5464.8	8491.6	176240.0	106992.0	6357.6
Lithuania	6641.4	488250.6	14816.8	17851.8	372559.8	188491.4	11136.2
Moldova	166.4	9137.8	777.0	725.1	6709.4	3384.9	677.8
Poland	13599.4	754397.0	19024.4	34765.9	472637.9	395066.8	27229.5
Romania	374.2	24001.6	2228.8	1697.7	14620.7	9208.8	909.6
Serbia	621.4	29584.6	2223.4	2828.2	22013.1	15987.2	3681.1
Slovakia	11091.8	849096.5	26441.7	32071.7	405928.9	525442.0	17626.3
Slovenia	12752.2	732174.0	20239.1	26154.8	561781.6	391392.9	16012.2
Ukraine	811.8	42338.4	3197.5	2757.4	36204.7	8703.9	1897.3
Total	5625.5	327033.0	8865.6	13220.2	209538.9	176080.6	9243.9

Notes: ta: total assets, dep: deposits, fa: fixed assets, over : overheads, loans : loans, oea: other earning assets, nintinc: non-interest income

Table 2
Descriptive statistics of determinants of TFP change

Country	LNAS	LNAS2	CAPRQ	SPOWER	PRMONIT	ACTRS	CONC3	STATE	FOREIGN	INFL	GDPGR	GDPCAP	CREDIT
Albania	6.549	0.130	4.000	11.701	4.026	2.321	73.439	34.122	63.719	2.645	5.597	1425.8	10.126
Armenia	5.190	0.227	3.448	10.724	4.857	2.462	62.034	1.082	51.080	2.683	11.530	940.6	7.776
Azerbaijan	4.863	0.259	5.137	9.975	5.124	2.933	82.111	57.092	5.257	6.050	13.812	1073.9	7.661
Belarus	2.060	0.221	5.000	7.349	4.294	2.808	76.420	66.644	13.166	46.702	7.581	2031.4	12.529
Bosnia	6.829	0.201	4.995	13.133	4.005	2.576	56.401	13.396	72.993	2.511	4.958	1542.1	14.658
Bulgaria	3.950	0.168	6.566	11.143	5.000	2.389	51.255	8.794	77.491	6.302	5.172	1933.6	28.551
Croatia	7.489	0.150	3.861	11.147	4.992	1.965	57.517	4.197	88.944	3.109	4.417	5480.0	52.539
Czech	9.194	0.104	4.875	9.560	5.155	2.857	64.720	6.520	83.133	2.515	4.043	6694.5	34.777
Estonia	7.497	0.191	4.408	13.184	5.408	1.704	97.625	0.022	97.173	3.782	9.229	5928.7	39.831
FYROM	6.367	0.306	3.830	12.125	4.857	2.170	78.333	1.604	49.285	2.749	21.729	1926.4	2.266
Georgia	5.450	0.242	3.039	11.039	4.000	2.250	67.317	0.100	43.490	6.103	6.857	759.3	11.304
Hungary	8.108	0.127	5.986	14.000	5.281	2.675	62.484	7.958	75.616	6.188	4.408	5828.9	40.554
Kazakhstan	6.742	0.202	5.994	10.976	3.869	2.896	67.184	3.506	21.525	8.066	10.311	2055.7	25.463
Latvia	7.286	0.120	5.012	11.280	5.857	1.894	55.160	4.057	57.711	4.218	8.455	4484.0	39.896
Lithuania	7.866	0.121	3.587	12.016	4.984	2.349	81.450	6.838	85.321	1.781	7.154	4120.7	23.621
Moldova	4.691	0.256	6.286	12.152	4.438	2.828	69.090	14.569	32.107	13.425	5.947	383.3	19.798
Poland	8.424	0.147	4.569	9.280	4.995	1.966	56.462	23.642	72.344	3.682	3.580	4795.1	28.861
Romania	4.783	0.180	4.862	9.841	3.862	2.922	66.641	28.716	58.527	20.914	5.487	2184.3	14.562
Serbia	5.692	0.261	5.000	6.020	3.996	2.001	51.811	41.377	37.525	32.727	5.069	2381.8	17.305
Slovakia	8.567	0.098	5.018	13.170	4.304	2.571	78.204	8.641	84.384	6.529	4.573	4202.7	34.729
Slovenia	8.842	0.104	6.558	12.701	5.857	2.568	64.828	21.892	19.757	5.703	3.812	10346.8	47.095
Ukraine	5.884	0.161	5.000	12.000	5.000	1.750	49.094	10.253	16.585	11.073	7.404	952.6	24.088
Total	6.589	0.174	4.975	10.880	4.763	2.340	62.297	17.450	52.992	9.622	6.702	3284.4	26.068

Notes: LNAS: ln (real total assets); LNAS2: [ln (real total assets)]^2; EQAS: equity/total assets; CAPRQ: capital requirements; SPOWER: official supervisory power, PRMONIT: private monitoring; ACTRS: restrictions on bank activities; CONC3: 3-bank concentration; STATE: the market share of government-owned banks; FOREIGN: the market share of foreign-owned banks; INFL: Inflation rate; GDPGR: Real GDP growth; GDPCAP: real gdp per capita; CREDIT: domestic credit to the private sector/GDP.

Table 3
Estimates of TFP change (country geometric means)

Country	2000	2001	2002	2003	2004	2005	2006
Albania	0.936	0.841	1.037	1.160	0.863	0.968	1.030
Armenia	1.120	1.114	1.061	0.980	0.993	0.967	0.885
Azerbaijan	1.113	0.780	1.039	1.174	0.905	0.962	1.033
Belarus	1.021	0.807	1.098	1.015	0.946	1.061	1.003
Bosnia	0.998	1.181	1.200	1.014	1.016	1.012	0.977
Bulgaria	1.083	1.095	0.955	1.011	1.053	1.127	1.006
Croatia	1.020	0.977	1.175	1.027	0.975	1.051	1.043
Czech	1.096	1.374	1.149	1.312	0.911	1.218	1.080
Estonia	1.073	1.114	0.954	1.196	1.002	1.089	1.375
FYROM	1.275	0.935	0.993	1.003	1.025	1.160	1.039
Georgia	1.143	0.912	0.886	1.039	0.966	1.255	1.014
Hungary	0.960	1.092	1.006	1.044	1.070	1.083	1.169
Kazakhstan	1.092	0.976	1.031	1.041	1.177	1.013	1.186
Latvia	1.036	1.310	0.956	1.078	1.087	1.129	1.049
Lithuania	1.154	1.226	1.145	1.286	0.834	1.011	1.137
Moldova	1.003	0.985	1.138	1.061	1.046	1.028	0.968
Poland	1.051	1.066	1.038	1.003	1.072	0.992	1.019
Romania	0.984	1.056	1.006	0.988	1.054	0.919	0.963
Serbia	1.502	0.787	0.707	0.770	1.264	0.954	1.036
Slovakia	1.019	1.079	0.909	0.998	0.984	1.098	0.962
Slovenia	0.984	0.992	1.081	1.039	1.126	1.156	1.103
Ukraine	0.938	0.956	1.134	1.067	0.994	0.994	1.064

Table 4
Determinants of TFP change

	Basic model		Market structure		Macroeconomic conditions		Economic & financial development		Basic model without Outliers		Basic model with Year dummies	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
LNAS	0.029	1.94	0.030	1.98	0.015	1.94	0.015	1.89	0.015	1.97	0.030	2.01
LNAS2	-0.002	-1.56	-0.002	-1.63	-0.001	-1.43	-0.001	-1.37	-0.001	-1.39	-0.002	-1.62
EQAS	0.107	1.82	0.107	1.82	0.102	1.63	0.102	1.83	0.038	1.11	0.107	1.82
CAPRQ	0.000	0.08	0.002	0.41	0.001	0.18	-0.002	-0.84	-0.001	-0.45	0.001	0.22
SPOWER	-0.002	-0.57	-0.002	-0.78	-0.003	-0.91	-0.002	-0.89	-0.001	-0.72	-0.003	-0.88
PRMONIT	0.042	4.56	0.041	4.45	0.039	4.07	0.032	6.15	0.033	7.07	0.047	4.98
ACTRS	0.035	2.33	0.033	2.19	0.035	2.34	0.027	3.38	0.023	3.03	0.039	2.62
CONC3			0.011	0.26								
FOREIGN			0.049	2.31								
GOVERN			-0.014	-0.53								
INFL					-0.001	-1.19						
GDPGR					0.003	1.20						
GDPCAP							-0.021	-0.88				
CREDIT							0.066	2.08				
Constant	0.657	7.83	0.631	7.25	0.698	7.70	0.767	6.96	0.768	7.61	0.619	7.11
year dum.											6.12	0.410
sigma	0.329		0.329		0.329		0.160		0.160		0.328	
obs.	2514		2514		2514		2514		2270		2514	
wald	32.63		41.02		34.16		93.38		88.79		38.83	

Notes: LNAS: ln (real total assets); LNAS2: [ln (real total assets)]^2; EQAS: equity/total assets; CAPRQ: capital requirements; SPOWER: official supervisory power, PRMONIT: private monitoring; ACTRS: restrictions on bank activities; CONC3: 3-bank concentration; STATE: the market share of government-owned banks; FOREIGN: the market share of foreign-owned banks; INFL: Inflation rate; GDPGR: Real GDP growth; GDPCAP: real gdp per capita; CREDIT: domestic credit to the private sector/GDP.; year dum.: a Wald test of the joint significance of year dummies and the associated p-value; sigma: the variance of the estimated equation; obs.: the number of observations; wald: the Wald test of the estimated equation; The Basic model without Outliers corresponds to a re-estimation of the basic model while excluding all observations with an error term in the upper or lower 5th percentile (therefore, we drop 10% of our sample). The Basic model with Year dummies corresponds to a re-estimation of the basic model with year dummies to control for potential time effects.