The Differential Impact of Bank Liberalization *

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ABSTRACT

In this paper, we investigate the effects of liberalization on banking markets. While some previous studies find a positive impact of liberalization on banking efficiency, other studies point out several adverse effects for domestic banks. In this paper, we explain these diverse findings by showing that the way liberalization affects markets depends on the banks' inherent distance relative to a technology frontier set by foreign owned banks. Banks that operate close to the frontier, generally improve on their efficiency following liberalization. Banks that operate in further distance do not manage to compete with foreign market entrants, therefore, losing from liberalization. Interestingly, we also find that highly efficient banks forfeit some of their competitiveness if their market is not liberalized. These findings suggest that there is no one size fits all policy concerning banking market liberalization.

Keywords: financial market liberalization, foreign banks, integration of banking markets

JEL Classification: G16, G14, G21, F36, O16

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1. Introduction

According to the classical Shaw (1973) - McKinnion (1973) framework banking liberalization should enhance the efficiency of domestic banks. As argued, foreign entry helps to establish market discipline, imports of foreign know-how and expertise, as well as capital. This framework serves as a justification for the Washington consensus that fosters the elimination of all entrance barriers and state involvement. In this paper, we suggest that this argumentation might be of the opposite if the technological distance between incumbent banks and the foreign entrants is large.

The main idea of this paper is that liberalization has a differential impact on banking efficiency. The way liberalization affects banking markets depends on the inherent abilities of banks prevailing in a market (relative to the entering banks). Incumbent banks that operate close to the frontier have the ability to adapt to the entrance threat and successfully compete with the new entrants. In this case, competition should have its well-known positive effects on the efficiency of the market participants. If, on the other side, the technological distance is too wide, the incumbent banks will have no ability to respond to the entrance threat. As a consequence, these banks would fall further behind and might be driven out of the market by foreign banks.

In order to test for our hypotheses, we collect data for banks in eleven Eastern European transition economies over the years of 1995 to 2002. These countries constitute a relatively homogeneous group, but chose different dates and methods to open up their markets (shock liberalization versus gradual opening). By estimating a stochastic frontier analysis, we obtain efficiency scores for each bank in our sample. Each bank's distance from the efficiency frontier serves as a measure for the distance from the world technology frontier. Next, we group our banks based on their initial efficiency scores and run a differences-in-differences (DID) analysis for banks with a different inherent efficiency level. Since our sample countries chose to open up their markets at different points in time, this estimation strategy allows us to control for bank, country and year heterogeneity.

Results strongly support our hypotheses. We find a significant improvement of banking efficiency for the most efficient banks. For banks operating further form the frontier we find a clearly negative impact of liberalization on banking efficiency. A rolling window estimation shows how the DID coefficient of interest decreases when the initial efficiency level of banks declines. We can also reject endogeneity concerns by including lags and leads of our event dummies into our specification.

In summary, we find that liberalization has a differential impact on local banking markets. Thus, there is no one size fits all policy concerning banking liberalization. For highly efficient banks, competition improves their efficiency standard, while less efficient banks cannot compete with foreign banks and further decrease in efficiency or are driven out of the market. Overall, the average efficiency level of local banking markets should be an important variable in deciding to open up their banking market.

The remainder of this paper is structured as follows. Section 2 reviews related literature. In section 3, we derive our hypotheses. Section 4 introduces our experiment and is followed by the empirical analysis in Section 5. Section 6 concludes.

2. Literature review

In the current literature, the effect of equity market liberalization has been well explained. Henry (2003, 2000a,b) and Bekaert, Harvey, and Lundblad (2001, 2005) show that equity market liberalization is related to capital inflows. As a consequence, the cost of capital for listed firms decrease which itself results in higher aggregate economic growth. Nevertheless, these benefits are only obvious for listed firms which tend to be large in size.

The effects of banking market liberalization has been, however, much less explained. Banking liberalization generally evokes the entrance of foreign banks, and, as a consequence, the level of competition increases. Theoretically, this should enhance the efficiency of domestic banks (Lehner and Schnitzer 2006), but might have adverse effects on banking market stability (Vives 2001). Demirguc-Kunt, Laeven, and Levine (2004) provide evidence that tighter regulations on bank entry boost the cost of financial intermediation. Barth, Caprio, and Levine (2004) find that tighter entry requirements are negatively associated with banking efficiency. Unite and Sullivan (2003) analyze the effect of foreign banks' entrance on domestic banking markets in the Philippines. They observe a reduction in interest spreads and bank profitability following foreign bank entrance. But not all studies agree on a clear-cut improvement of incumbent banking efficiency following liberalization. Stiglitz (1993) discusses potential costs for domestic banks and local entrepreneurs as a consequence for opening a market. For emerging markets, Schnitzer (1999) shows theoretically that banking competition might result in higher levels of bad debts. Bayraktar and Wang (2004) argue that the effect of banking liberalization on domestic banks depends on the sequencing of financial liberalization. If stock markets are liberalized first, domestic bank competitiveness improves after bank liberalization. This result vanishes for countries that liberalized their capital account first. For a sample of 7900 bank observations from 80 countries Claessens, Demirgüc-Kunt, and Huizinga (2001) find that foreign banks have higher profits than domestic banks in developing countries. The opposite is true for developed countries. A high presence of foreign banks reduces the profitability of domestic banks. That might be interpreted as an improvement of banking efficiency as a consequence of foreign entry. However, this might also contribute to market instabilities since lower bank profitability might be associated with higher default risk. According to Keeley (1990), an increase in competition results in a higher default probability of banks through asset risk and capital reduction. Morgan and Strahan (2004) suggest that banking integration has a stabilizing effect within the US, but a destabilizing effect internationally (in terms of a higher business volatility). In a recent paper, Daniel and Jones (forthcoming) show that incumbent banks are likely to default following liberalization even if a banking system is well designed.[1]

Literature points out differences between emerging and developed markets. Vives (2001) argues that costs of bank failures are considerably higher in emerging markets. Therefore, these markets should foster a lower level of competition. Cetorelli (1997) pro-

[1] Since information asymmetries are especially high for foreign market entrants after liberalization, they set high interest rates. This behavior drives up overall market rates and domestic banks enjoy high profits. Once foreign banks gain information and rates fall, domestic banks have already increased their capital stock to a risky level.

vides theoretical foundation for the latter argument and finds that especially for developing markets monopoly power can be superior in terms of financial stability.

Theoretically, competition in the banking sector has an ambiguous effect on firms' access to external finance (Cetorelli and Strahan 2006). On the one hand, more competitive banking systems may channel less financing to firms because they have less of an incentive to invest in close relationship with the firms (Petersen and Rajan 1995). On the other hand, hold-up problems can arise under close relationships because borrowers cannot easily break-away from the lending relationship without providing an adverse signal about its quality. Such hold-up problems occur less in more competitive banking systems (Boot and Thakor 2000). Thus, the effect on external finance is not clear.

Empirically, Cetorelli and Gambera (2001) show that banking sector concentration exerts a depressing effect on economic growth even if it promotes growth of industries that heavily depends on external finances. Claessens and Laeven (2005) apply an industrial organization indicator to measure the degree of bank competitiveness in a certain market. In their study greater competition in the countries' banking systems allows financially-dependent industries to grow faster. According to Cetorelli and Strahan (2006) a more competitive banking system fosters access to credit for firm entrants in the US.

Our paper relates to current findings in the industrial organization literature. Aghion, Burgess, Redding, and Zilibotti (2005, 2006b) suggest a heterogeneous firm response to liberalization threads. They argue that technologically advanced firms benefit from liberalization since they are more likely to respond to the threat of entry by investing in new technologies. Firms that are far from the frontier will be disincentivized. As a consequence, liberalization magnifies initial differences in productivity between foreign and domestic firms. This theoretical argument is supported by empirical findings. Aghion, Blundell, Griffith, Howitt, and Prantl (2006a) (for the UK), Aghion et al. (2006b) (for India) and Aghion and Bessonova (2006) (for Russia) find that a reduction to foreign firm entry has a more positive effect on the economic performance for domestic firms and industries that are initially closer to the technology frontier. In a related paper, Sabirianova, Svejnar, and Terrell (2005) show that the more foreign firms enter a market, the higher the productivity gap between foreign and domestic firms.

3. Motivation and hypothesis

The main idea of this paper is that the way liberalization affects banking markets depends on the inherent abilities of the banks prevailing in a market. This point can be illustrated by an example. In Figure 1, Panel A, we assume that there are two banks operating in an initially closed market that differ in their inherent abilities. Bank A is operating relatively close to the world frontier, while Bank B is a less efficient bank (operating relatively far from the frontier). What would we expect to happen to these banks once markets are liberalized? The incumbent bank that is sufficiently close to the technological frontier can most likely survive and will deter entry by introducing new technologies and cutting costs. Thus, an increased entry threat should increase efficiency. But what would we expect to happen for the other bank far from the frontier? Such banks are in a weaker position to fight external entry. For these firms, an increase in the entry threat reduces expected payoff from introducing new technologies or cost-cutting, since possible bankruptcy or take-over decreased their expected life horizon. As a consequence, we expect this bank will further lose in its efficiency level. Thus, liberalization would magnify the initial efficiency differences between the two banks. This reasoning provides our first hypotheses:

H1: Banks that operate close to the efficiency frontier should improve their efficiency after bank liberalization.

H1a: Banks that are distant from the efficiency frontier should worsen in their efficiency after bank liberalization.

In Figure 1, Panel B, we consider the same two banks as before, but assume that their market remains closed. How would we expect that the banks' efficiency evolves over time in this scenario? The initially efficient bank operates most likely very profitable. Over time, however, the lack of competition is likely to result in managerial slack (Hart 1983) and the bank's management misses incentives to innovate and further improve its efficiency. Therefore, we expect the initially efficient bank to forfeit some of its efficiency advantage relative to the other incumbent bank. The bank operating initially distance from the frontier is, however, likely to benefit from the closed market environment. Knowledge spill-overs or switching employees from more efficient institutions are likely to help most of these banks to catch-up with its more efficient competitors. In this way, imitating and 'learning-by-doing' could help the initially inefficient bank to improve on its efficiency. If our argumentation holds true, we expect the efficiency distance between banks to vanish. Therefore, our second hypotheses states:

H2: Banks that operate close to the efficiency frontier should worsen in their efficiency if they operate in a less competitive environment.

H2a: Banks that are distant from the efficiency frontier should improve their efficiency in a less competitive environment.

4. Experiment

We chose eleven CEE transition countries that had different approaches to liberalization in order to test for our hypotheses.[2] For these countries, we obtain bank-level data based on the Bankscope database.[3] Time series information was gathered by consulting Central Banks' reports, annual reports of the relevant banks and the banks' Internet presence.[4] Furthermore, details about the merger and acquisition activities of all banks were hand-collected. Overall we have 1728 bank-year observations of 295 different banks for the years of 1995 to 2002.[5] Our sample excludes bank-observations during crises periods.[6]

All countries inherited similar financial structures from the regime they succeeded. During the nineties, these countries followed different strategies to liberalize their banking

[2]Namely the eight CEE countries that joined the EU in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia), the two countries that joined the EU 2007 (Bulgaria, Romania) and Croatia.

[3]We decided to eliminate all unconsolidated statements whenever both consolidated and unconsolidated statements were reported by Bankscope. Furthermore, we only report commercial banks, since the behavior of non-commercial banks might not reflect profit-maximizing behavior.

[4]A bank is defined as foreign owned if foreigners or foreign entities own 50 percent or more of its assets.

[5]Out of the 295 banks 188 are domestic banks.

[6]Crises periods were identified according to Caprio and Klingebiel (2003). Since our sample period starts in 1995, the second stage of transition, most banking markets have been stabilized by then.

markets at different points of time. Some countries opted for shock liberalization as suggested by Sachs and Warner (1996).[7] In Hungary, for example, the majority of the banking markets was basically sold overnight to foreign-owned banks (Kiraly et al. 2000). Other countries were considerably more reluctant to open their markets and only allowed foreign banks to enter gradually.[8] The choice of the liberalization strategy led to different market structures in our sample countries. Figure 2 illustrates the market share of foreign banks in the Slovak Republic and Slovenia during our sample period, for which, until 1999, the share of foreign banks in both markets were below 20 percent. Then, the Slovak Republic suddenly opened up its banking market to foreign entrants. By 2000 foreign banks have taken-over more than 90 percent of market share, whereas in Slovenia, the market share of foreign banks remained below 20 percent.

Since financial market liberalization was generally the result of several different acts, it is difficult to define an exact liberalization date for each country. In some countries, whereas liberalization was officially allowed, foreign entry was prevented by red-tape restrictions. Actual liberalization often went along with changes of the political parties or external pressures from the EU. Therefore, we define banking liberalization with a data driven method, based on three alternative definitions:

Measure 1: Number of foreign banks that entered a market: After more than 20 percent of new (foreign) banks entered we code one (and zero before the event).

Measure 2: Market share shocks by foreign banks: After foreign banks gain more than 30 percent within 2 years we code one (and zero before the event).

Measure 3: Market majority by foreign banks: After foreign banks gain more than 50 percent of market share we code one (and zero before the event).

The liberalization dates we obtain under these three measures are very similar and hardly change when threshold values for our definitions are changed. Furthermore, our event dates correspond with the banking liberalization events identified in the Bekaert and

[7]Sachs and Warner (1996) argue that high product market competition through liberalization fosters allocative efficiency which in turn is an important factor to gain high growth rates.

[8]For a review about the banking liberalization experiences of the CEE countries see Barros et al. (2005) and Coricelli (2001).

Harvey (2004) database.

Table 1 reports the coding of our event according to Measure 1. Seven out of our eleven countries liberalized during our sample period. There seems to be no clustering of the timing of liberalization across countries and liberalization is independent of the economic development of the countries.

5. Empirical analysis

In this section, we measure bank efficiency by estimating a stochastic frontier analysis. Based on these estimates we report descriptive statistics. Next, we present our specification and provide our results.

5.1. Stochastic Frontier Analysis

Bank efficiency is measured by applying a stochastic frontier analysis (SFA). The basic idea of this concept is to determine the maximum amount a bank can reduce its costs while still producing the same or a combination of financial services in a given market at a given year. We apply the standard procedure initially developed by Aigner, Lovell, and Schmidt (1977) and use the panel estimator derived from Greene (2005). This methodology has been applied in a similar way for banks by Berger and Mester (1997) and Bonin, Hasan, and Wachtel (2005). In order to capture a world technology frontier we include domestic, as well as foreign banks, operating in our sample countries in the subsequent estimation.

The cost function of a bank depends on the quantity of its outputs, the prices of its inputs, environmental factors, random error and inefficiency:

$$C = C(y, w, f, u, e) \tag{1}$$

Total costs of the bank, C, are the sum of interest expenses and total operational costs. There are three outputs *y*, total loans, total deposits and the sum of investments plus liquid assets. The two input prices *w* are the price of capital, defined as the ratio of total operating costs to total fixed assets and the price of funds, measured by the ratio of interest expenses to total deposits. We choose the well known translog form to specify the cost function C:

$$\begin{aligned}
\ln\left(\frac{C}{w_2 y_3}\right) \quad = \quad & \delta_0 + \delta_1 \ln\left(\frac{w_1}{w_2}\right) + \frac{1}{2}\delta_2 \ln\left(\frac{w_1}{w_2}\right)\ln\left(\frac{w_1}{w_2}\right) + \sum_{k=1}^{2}\gamma_k \ln\left(\frac{y_k}{y_3}\right) + \\
& + \frac{1}{2}\sum_{k=1}^{2}\sum_{j=1}^{2}\gamma_{kj}\ln\left(\frac{y_k}{y_3}\right)\ln\left(\frac{y_j}{y_3}\right) + \sum_{k=1}^{2}\eta_k \ln\left(\frac{w_1}{w_2}\right)\ln\left(\frac{y_k}{y_3}\right) + \qquad (2) \\
& + \sum_{k=1}^{11}\theta_k COUNTRY + \sum_{k=1}^{8}\omega_k YEAR + \quad \ln e + \quad \ln u
\end{aligned}$$

Outputs are scaled by the sum of investments and liquid assets, the input price by the costs of funds and total cost by both. The scaling of the output prices is necessary to reduce heteroskedasticity and make banks of different sizes comparable. Input prices are scaled to ensure price homogeneity following Berger and Mester (1997). The first error term e represents the inefficiency of each bank, while the second error term u is a random error that incorporates measurement error and luck. Furthermore, the symmetry condition that $\gamma_{kj} = \gamma_{jk}$ is imposed. For a detailed discussion of the chosen specification refer to Berger and Mester (1997).

For the estimation of equation (2) the following distributional assumptions are made:

(i) $u \sim$ iid $N(0, \sigma_u^2)$;

(ii) $e \sim$ iid $N^-(0, \sigma_e^2)$, thus negative half normal distributed;

(iii) u and e are distributed independently of the regressors and of each other.

In order to obtain our efficiency ranks, a two step estimation is necessary. In the first step, we obtain the composite error term $\ln\varepsilon = \ln e + \ln u$ by estimating equation (2) with a log likelihood estimation. In a second step, we extract u_{it} out of ε_{it} by applying the Jondrow et al. (1982) method. Once point estimators for e_{it} are obtained, we define our efficiency ranks relative to the most efficient bank of our sample:

$$COSTEFF_{it} = \frac{e_{min}}{e_{it}} \qquad (3)$$

where e_{min} is the minimum e_{it} across all banks in the sample. Thus, we obtain a efficiency measure that is bound between zero and one with the most efficient bank in our sample taking a value of one.

In our subsequent analysis we apply two alternative measures of cost efficiency. For our original measure, we exclude country and year fixed effects from specification (2) since we control for year and country heterogeneity in our subsequent analysis. As a robustness test, we also apply efficiency scores based on fixed effects estimation. Table 2 reports means of our cost efficiency scores (excluding country and year fixed effects in the estimation) grouped by countries and years. On average, banks in our sample could reduce their costs by 27 percent and still produce the same output bundle, if they would operate as efficient as the most efficient banks of the sample. Surprisingly, we hardly see improvement in the overall cost efficiency between 1995 and 2002, even-though many foreign banks have entered the market during this time period. This surprising observation might be explained by the framework we offer in this paper.

5.2. Descriptive Statistics

Having obtained our efficiency measures we can look at descriptive statistics. For this task, we rank all the banks in our sample by their inherent efficiency (the average efficiency rank that the bank had at the outset of our sample period in the years of 1995/1996). In Figure 3 we compare banks of different inherent efficiency ranks that had a liberalization event. The dashed line plots the average efficiency of the initially most efficient banks (top 15 percent) before and after the event. The solid line plots efficiency for banks whose initial efficiency is among the lowest three quartiles. All observations are aligned in the way that period 0 constitutes the actual event date. For the most efficient banks, we observe a gradual reduction in efficiency before the event. After opening up their markets, the efficiency of these banks clearly improves. When observing the solid line (the banks with an inherent low efficiency ranks), we can see that the efficiency of these banks slightly improved before the liberalization and then considerably dropped after the event. This graph suggests a differential impact of liberalization on banking efficiency as suggested in H1.

Figure 4 replicates the previous figure for banks operating in countries that had no liberalization event. Since there is no event date for these markets, banking efficiency for these banks is simply plotted over time. As before, banks are split according to their initial efficiency scores with the top line representing the top 15 percent of banks the bottom line the lowest 75 percent of banks. The efficiency of the initially most efficient banks gradually declines over time if the market remains protected. The opposite is true for the initially inefficient banks. For this group of banks operating in a non-competitive environment (closed market) leads to a gradual improvement in efficiency. At the end of the sample period the gap between the initially most efficient and less efficient banks has considerably narrowed. Thus, the graphs suggests a convergence of these two different groups of banks.

To summarize, both graphs provide clear support for our suggested framework. Once banks have reached a certain level of efficiency, liberalization and competition have a positive effect on the banks' efficiency. Interestingly, we observe a decrease in efficiency if these banks are not liberalized. The mechanism works the other way around for banks with a low initial level of efficiency. Banks in this category cannot weather competitions with foreign banks, therefore, liberalization would further dampen their level of efficiency. These banks are, however, able to improve their efficiency if their market remains closed. Overall, both graphs support H1a/b and H2a/b.

5.3. Methodology

In this section, we apply a differences-in-differences (DID) methodology in order to see whether our previous findings also hold statistically. This allows us to exploit the fact that different countries liberalized their banking markets at a different point of time. Therefore, we group our sample according to banks' initial efficiency level and estimate the following equation for each group of the banks:

$$y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk} \tag{4}$$

where i indexes for domestic banks that have not been taken over by a foreign bank throughout our sample period; j indexes for countries; t for time and k for the initial level of each bank's efficiency. Our variable of interest, y, corresponds to each bank's efficiency score over time. Time and bank fixed effects are denoted as α_t and α_i. The liberalization event described earlier is denoted as $Event$ and X comprises a vector of controls from the literature.[9] Our coefficient of interest is δ that measures for each segment of banks with the same initial efficiency scores the impact of banking liberalization on efficiency.

The multiple pre-intervention and post-intervention time periods take care of many threats concerning validity. This methodology is best illustrated by the following example. Suppose we have two countries, A and B, undergoing liberalization at times t=1 and t=2, respectively. Consider t=0 to be the starting period in our sample. From t=1 to t=2, country B initially serves as a control group. Following that, country B serves as a treated group for subsequent years. Therefore, most countries belong to both treated and control groups at different points of time. This specification is robust to the fact that some groups might not be treated at all or were treated prior to 1995, which is our sample's beginning date.

For our methodology to be meaningful the liberalization effect has to be exogenous to banking efficiency. All of our sample countries (except Croatia) joined the EU. One condition for joining this economic union was to open up financial markets. Thus, liberalization was mostly pursued by exogenous pressures of the EU commission. A close look at the Bekaert and Harvey (2004) database also shows that in some countries, the actual liberalization followed shifts in the ruling party. Therefore, we think that we do not have to worry about endogeneity for our sample countries.

Further, Meyer (1995) has emphasized the importance of group similarity in research while suggesting that "for a given degree of similarity within the treatment group, however, greater differences across comparison groups are desirable if they are likely to lead to different biases." Since our sample countries share a similar history and are geographically very close we believe that this condition is fulfilled for our sample. Finally, in the subsequent analysis, we use robust clustered standard errors as suggested by Bertrand, Duflo, and

[9] The exact control variables included for each specification are listed in each regression table.

Mullainathan (2004).[10]

5.4. Results

In Table 3, we present our coefficient of interest for different segments of our sample according to inherent bank efficiency. In column (1), we run the DID estimation for all banks whose initial ability was among the highest 10 percent. For these banks, liberalization had a highly significant positive impact on their efficiency level. On average they improved their efficiency score by around 0.14. If we extend the sample size to banks that show an initial inherent ability of 15 percent (column 2), the effect is also highly significant but decreases somewhat in magnitude. Considering the banks with an inherent efficiency in the top 25 quartile, the coefficient of interest is insignificant and close to zero (column 4). These results support our first hypotheses underlying the positive effects of competition for banks that have reached a certain level of efficiency prior to market liberalization.

Next, we look at banks with low initial ability. For banks with an initial inherent efficiency score in the three lowest quartiles (column 4), the liberalization effect is negative. In column (5) we exclude banks with an inherent ability in the lowest quartile since these banks might be characterized by considerable mismanagement. In column (6), we even exclude the lowest two quartiles from the sample. Interestingly, the negative effect remains highly significant. Thus, even banks with an inherent efficiency above average have lost in efficiency following liberalization (column 6).

According to our estimates, the majority of the incumbent banks loses from liberalization. For the sample countries, market failures are likely to be huge, due to information asymmetries. In most of the countries we looked at, banking markets were still fragile and there were considerable inefficiencies present. Thus, the technological distance between the average domestic bank in a transition economy and the foreign banks that originated from developed countries was considerable. These conditions can explain why we find losses in efficiency for the majority of incumbent banks following liberalization.

[10]We cluster our standard errors by country.

Previous cut-off points for our sample segments were self-chosen. Next we estimate specification (4) with a rolling sample. We start with a sample of all banks with an inherent efficiency rank in the range of 0.9 and 1. We then decrease both bounds in 0.01 steps until we reach the initially most inefficient banks. For each estimation, we plot the resulting value of our coefficient of interest, δ, in Figure 5. As previously shown, the liberalization impact is positive for initially efficient banks. This impact decreases almost linearly for less efficient banks until a certain point.

For the remainder of this section we want to deal with possible caveats. First, we explore how sensitive our findings are with the chosen definition of our liberalization measure. Therefore, we repeat the same estimation as reported in Table 3, replacing Measure 1 with the alternative measures. These results for Measure 2 are shown in Table 4, and for Measure 3, in Table 5. Both tables support previous findings.

As argued before, we believe that bank liberalization in transition countries was exogenous. To further address this issue we study the dynamic effects of the liberalization shocks on changes in bank efficiency. Therefore, we include leads and lags of our event dummy in specification (4). Including leads of our event variable allows us to assess whether any change in efficiency can be observed prior to the market opening and might have triggered this event. The left hand side of Table 6 provides these estimates. None of the leads is statistically significant. The same holds true for including lags (see the right hand side of Table 6).

Next, we observe whether our results are driven by certain bank or country specific characteristics. Therefore, we include a number of control variables in our specification. As reported in Table 7, bank characteristics, such as the size (measured by total assets), the solvency ratio (equity to assets) or the liquidity ratio (liquid assets to total assets) do not affect our conclusions. Similarly, macro controls, such as GDP growth or market structure controls for, leave previous results unchanged. Nevertheless, the banks' characteristics included in this specification might be endogenous to banking efficiency. Therefore, we do not include these variables in our other specifications.

Our results might be blurred by government owned banks. In many of the observed countries, it is likely that these banks could expect considerable subsidies from the government. Therefore, the behavior of these banks might not be influenced by changes in competition. To address this issue, we exclude all government banks from our estimation in Table 8. Since our coefficients remain largely unchanged, we conclude that our findings are not driven by the state banks. Finally, we apply an alternative definition of our efficiency estimates as a dependent variable in Table 9. Now, country and year fixed effects are included in the translog cost function (2). Findings based on this alternative definition of efficiency estimates are very similar to previously reported results.

6. Conclusions and Implications

Our main finding is that liberalization has a differential impact on the efficiency of domestic banks. Banks that operate close to the frontier, generally improve on their efficiency following liberalization. Banks that operate in further distance do not manage to compete with foreign market entrants, therefore, losing from liberalization. Interestingly, we also find that highly efficient banks forfeit some of their competitiveness if their market is not liberalized since these banks lack incentives to innovate in such an environment. Banks with an initially lower efficiency level benefit from a closed market.

While a welfare analysis of this effect would go beyond the scope of our paper, we want to briefly discuss possible implications of our findings. These implications are not straight forward. Is it always beneficial if less efficient domestic banks are driven out of the market by more efficient foreign banks? Recent findings of the banking literature suggest that their is a social benefit of having domestic banks. Through building up relationships with their borrowers, banks are able to obtain 'soft' information about their borrowers (Petersen and Rajan 1995). These information play an important role in overcoming information asymmetries. If foreign banks enter a market and drive out domestic banks, these 'soft' information about the borrower get lost and especially information opaque may no longer receive external finance. This argumentation also holds true, if foreign banks enter a market by taking over a domestic bank since the domestic bank will become part in a multinational bank with a different organizational structure. Multinational banks generally have a centralized structure, hence, rely on hard information for their loan decisions (Stein 2002).[11] Furthermore, Giannetti and Ongena (2005) argue that foreign banks might be hesitant to decentralize because the local bank personnel may be considered lacking experience or even untrustworthy. As a consequence, information opaque borrowers are likely to experience credit rationing after domestic banks have been driven out of the market.[12]

The previous argumentation implies that liberalization might have negative welfare effects if the technology distance between the domestic and foreign banks is too large. These findings set a question mark behind one of the most important implications of the so-called 'Washington consensus': Liberalization is unambiguously good for economic performance and government intervention should always be minimized. While our paper also shows the benefits of liberalization once banks have a reached a certain technology level, we also suggest that certain policies that discourage competition may be beneficial for less developed countries. If market failures are severe and where imitation and learning by doing externalities may sometimes justify 'infant-industry' type of policy (Stiglitz 2006). Thus, as argued by Aghion (2003), non-competitive policies may have limited costs, or even benefits, when countries are far from the world technology frontier, but become much more costly near the frontier.

[11] Liberti (2004) argues that soft information can only be used for a loan decision if the bank has a decentralized structure

[12] Several empirical studies have shown that foreign bank are less willing to lend to information opaque borrowers. E.g. Theoretically, Sengupta (forthcoming) shows that foreign banks lend more to large firms thereby neglecting SMEs. Empirically, Mian (2006) argues that due to distance constraints foreign banks avoid lending to informationally difficult yet fundamentally sound firms requiring relational contracting. Similarly, Berger et al. (2001) find that foreign owned banks have problems supplying credit to information opaque SMEs.

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Table 1: Coding of Measure 1

Notes: This table reports the underlying values of Measure 1 for each country and each year. This measure takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before the event).

event 1	1995	1996	1997	1998	1999	2000	2001	2002
BUL	0	0	0	0	0	1	1	1
CRO	0	0	0	0	0	0	0	0
CZECH	0	0	0	0	0	1	1	1
EST	0	0	0	1	1	1	1	1
HUN	0	0	1	1	1	1	1	1
LAT	0	0	0	0	0	0	0	0
LIT	0	0	0	0	0	1	1	1
POL	0	0	0	0	0	0	0	0
ROM	0	0	0	1	1	1	1	1
SLK	0	0	0	0	0	1	1	1
SLO	0	0	0	0	0	0	0	0

Table 2: Means of efficiency scores obtained by stochastic frontier analysis

Notes: This table reports means of the average efficiency scores of all banks operating in each country and each year. These means are based on an estimation of the cost function (2) excluding country and year fixed effects.

	1995	1996	1997	1998	1999	2000	2001	2002	**total**
BUL	0.89	0.67	0.78	0.60	0.56	0.57	0.59	0.62	**0.65**
CRO	0.69	0.71	0.68	0.68	0.72	0.74	0.77	0.80	**0.72**
CZECH	0.75	0.74	0.78	0.72	0.73	0.73	0.69	0.72	**0.73**
EST	0.61	0.69	0.81	0.82	0.88	0.89	0.90	0.85	**0.78**
HUN	0.81	0.83	0.75	0.81	0.76	0.72	0.72	0.70	**0.75**
LAT	0.57	0.57	0.63	0.65	0.66	0.75	0.78	0.75	**0.66**
LIT	0.77	0.78	0.70	0.67	0.72	0.79	0.70	0.63	**0.73**
POL	0.74	0.76	0.77	0.79	0.79	0.78	0.77	0.74	**0.77**
ROM	0.63	0.64	0.72	0.79	0.78	0.75	0.72	0.69	**0.74**
SLK	0.75	0.75	0.75	0.75	0.75	0.74	0.74	0.75	**0.74**
SLO	0.75	0.75	0.75	0.76	0.75	0.77	0.78	0.81	**0.75**
total	**0.71**	**0.72**	**0.73**	**0.73**	**0.73**	**0.73**	**0.73**	**0.73**	0.73

Table 3: Regression results for Measure 1 - Testing for H1 and H2

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before this event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks for the years 1995 to 2002. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 1	0.136	0.096	0.003	-0.059	-0.070	-0.080
	(0.04)***	(0.01)***	(0.04)	(0.02)***	(0.03)**	(0.01)***
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	30.52%	31.95%	39.06%	66.86%	59.93%	73.27%

Table 4: Regression results for Measure 2 - Testing for H1 and H2

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after foreign banks gain more than 30 percent market share within 2 years (and zero before the event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 2	0.093	0.073	0.004	-0.119	-0.103	-0.063
	(0.05)*	(0.03)**	(0.04)	(0.05)**	(0.04)**	(0.03)*
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	30.09%	33.53%	39.06%	52.10%	46.05%	52.69%

Table 5: Regression results for Measure 3 - Testing for H1 and H2

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after foreign banks gain more than 50 percent of market share (and zero before the event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 3	0.082	0.065	0.006	-0.127	-0.126	-0.074
	(0.04)*	(0.02)*	(0.02)	(0.03)***	(0.04)***	(0.02)**
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	30.02%	30.02%	39.07%	53.00%	48.08%	53.67%

Table 6: Testing for dynamics in the relationship between liberalization and banking efficiency

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. Furthermore we include leads and lags of $Event_{jt}$ in this specification. In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before this event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks for the years 1995 to 2002. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 15%	2nd/3rd/4th percentile		Top 15%	2nd/3rd/4th percentile
Measure 1	0.066	-0.086	Measure 1	0.066	-0.101
	(0.02)***	(0.03)**		(0.03)*	(0.05)*
Before (-1)	0.017	-0.012	After (+1)	0.039	0.013
	(0.03)	(0.04)		(0.04)	(0.05)
Before (-2)	0.001	-0.044	After (+2)	-0.021	-0.052
	(0.06)	(0.06)		(0.03)	(0.04)
bank fixed effects ?	yes	yes	bank fixed effects ?	yes	yes
year fixed effects ?	yes	yes	year fixed effects ?	yes	yes
st. errors clustered by country ?	yes	yes	st. errors clustered by country ?	yes	yes
adj. R-squared	30.97%	51.95%	adj. R-squared	31.14%	51.62%

Table 7: Regression results for Measure 1 - Controlling for bank and country characteristics

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before this event). Furthermore, we include bank characteristics such as log of banks' total assets, banks' solvency and liquidity ratio (for banks that do not report liquid assets we include a dummy referred to as $Dummy - Liquidity$). In order to account for specific country characteristics we include GDP growth of the market each bank operates in as well the as the market share of each bank (as a measure for market power). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks for the years 1995 to 2002. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 1	0.157	0.153	0.104	-0.048	-0.061	-0.077
	(0.07)**	(0.04)***	(0.05)*	(0.02)**	(0.03)*	(0.03)**
Assets	-3.976	-1.350	0.054	-0.217	-0.194	-0.032
	(1.27)***	(1.12)	(0.07)	(0.21)	(0.18)	(0.20)
Solvency	-0.455	-0.580	-0.268	-0.199	-0.086	-0.226
	(0.26)	(0.26)**	(0.32)**	(0.17)	(0.17)	(0.16)
Liquidity	0.133	0.070	0.080	0.055	-0.041	-0.082
	(0.13)	(0.07)	(0.05)	(0.06)	(0.06)	(0.04)*
Dummy-Liquidity	0.044	0.038	0.057	0.005	-0.011	-0.006
	(0.09)	(0.05)	(0.02)***	(0.03)	(0.03)	(0.05)
GDP	0.007	0.004	0.006	-0.005	-0.008	-0.002
	(0.01)	(0.01)	(0.01)	(0.003)	(0.003)**	(0.01)
Market	14.909	9.795	2.465	-0.013	-0.302	-0.762
share	(6.35)**	(4.93)*	(1.90)	(0.23)	(0.28)	(0.97)
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	42.76%	44.37%	44.53%	67.60%	60.84%	73.82%

Table 8: Regression results for Measure 1 - Excluding government owned banks

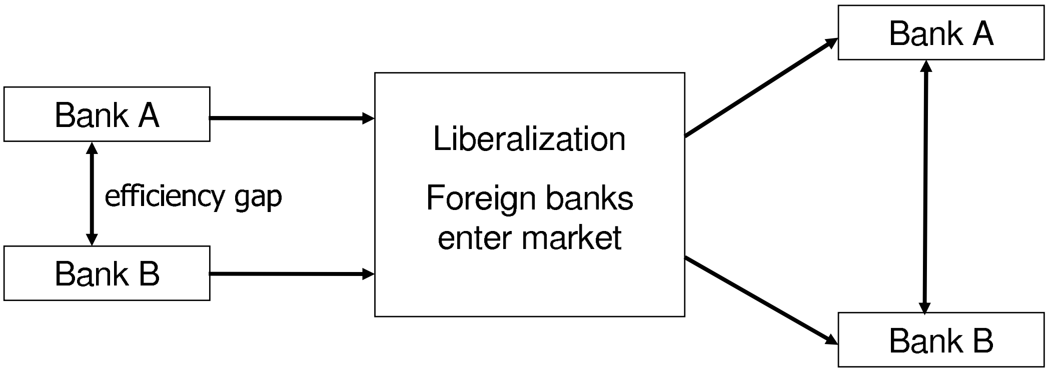
Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency (excluding government owned banks). In all regressions the dependent variable is banking efficiency excluding country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before this event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 133 different private owned banks for the years 1995 to 2002. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 1	0.168	0.112	0.022	-0.142	-0.134	-0.090
	(0.06)**	(0.05)**	(0.05)	(0.04)***	(0.05)**	(0.05)*
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	41.26%	43.64%	46.78%	51.31%	43.83%	61.04%

Table 9: Regression results for Measure 1 - Applying an alternative efficiency measure

Notes: Regression results from estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. In all regressions the dependent variable is banking efficiency including country and year fixed effects in the translog cost function. The $Event_{jt}$ dummy takes the value of one after more than 20 percent of new (foreign) banks entered a certain banking market (and zero before this event). Definitions of the other variables are provided in Section 5.3. Standard errors are reported in parentheses. The regressions were run for 188 different banks for the years 1995 to 2002. Standard errors are clusters of their country of operation. The bottom line of the table states the adjusted R-squared of each estimation. ***Significantly different from 0 at the 1-percent level.

	Top 10%	Top 15%	Top quartile	2nd/3rd/4th quartile	2nd/3rd quartile	3rd quartile
Measure 1	0.191	0.117	0.010	-0.168	-0.152	-0.154
	(0.08)**	(0.06)*	(0.06)***	(0.06)***	(0.08)*	(0.08)*
bank fixed effects ?	yes	yes	yes	yes	yes	yes
year fixed effects ?	yes	yes	yes	yes	yes	yes
st. errors clustered by country ?	yes	yes	yes	yes	yes	yes
adj. R-squared	25.36%	28.82%	34.83%	51.58%	44.76%	52.13%



Panel A: Expected change in efficiency following liberalization of two banks that differ in their inherent efficiency

Panel B: Expected change in efficiency of two banks that differ in their inherent efficiency and operate in a closed market

Figure 1: Illustration of the differential impact of liberalization on banking efficiency

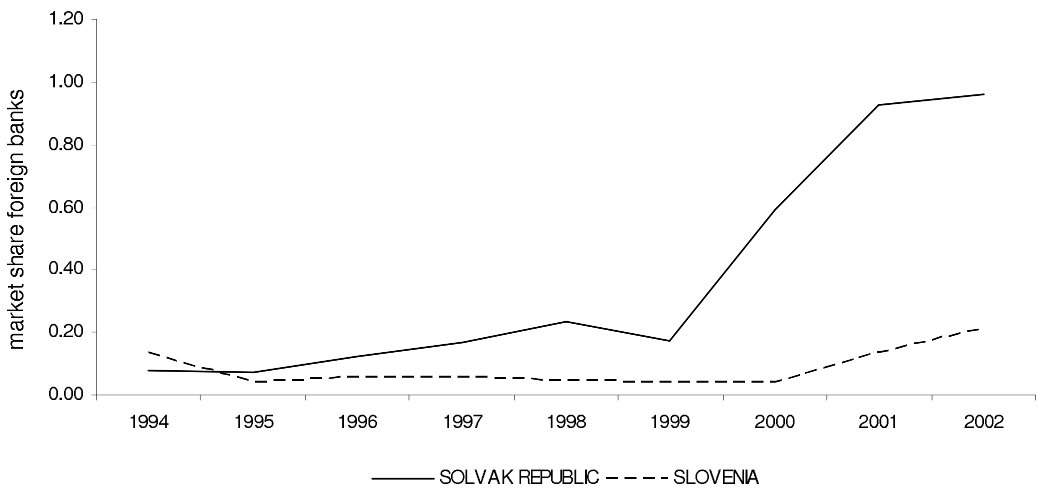


Figure 2: Market share of foreign banks in the Slovak Republic and Slovenia over time

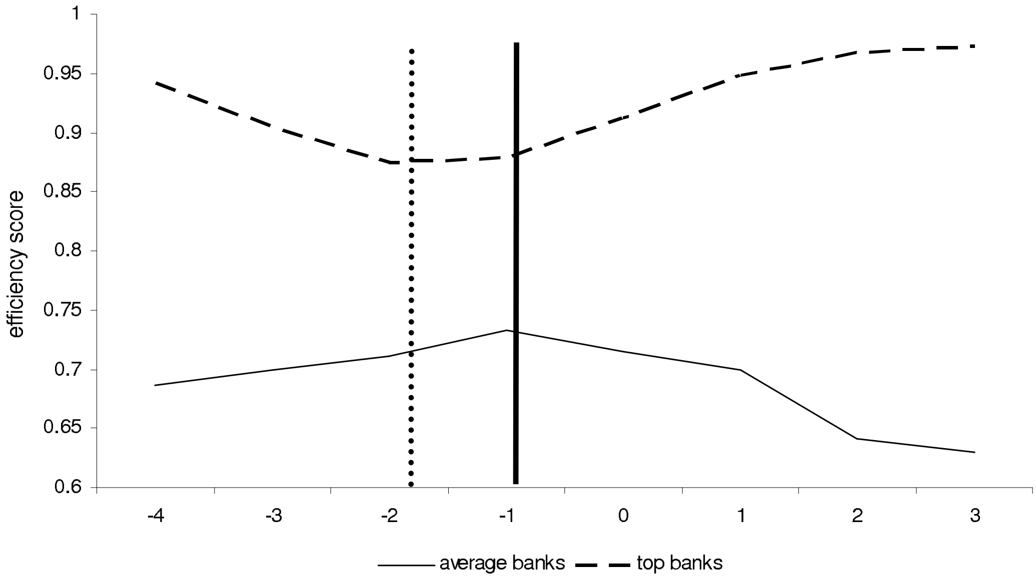


Figure 3: Bank efficiency before and after liberalization of initially efficient and inefficient banks

Notes: This figure compares average efficiency of banks operating in markets that have been liberalized during our sample period. The dashed line plots the average efficiency of banks that were among the initially 15 percent most efficient banks. The full line does the same for banks with an inherent efficiency rank among the lowest 75 percent. All observations were aligned around the date of liberalization of each country according to our Measure 1. Both lines have been smoothed applying a MA(1) process.

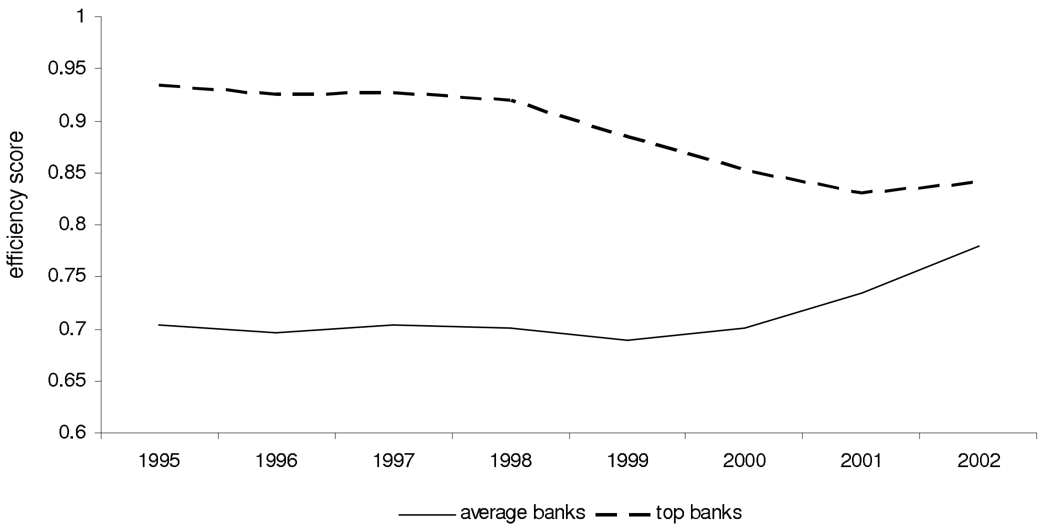


Figure 4: Bank efficiency of initially efficient and inefficient banks operating in closed markets

Notes: This figure compares average efficiency of banks operating in markets that remained closed during our sample period. The dashed line plots the average efficiency of banks that were among the initially 15 percent most efficient banks over time. The full line does the same for banks with an inherent efficiency rank among the lowest 75 percent. All observations were aligned around the date of liberalization of each country according to our Measure 1. Both lines have been smoothed applying a MA(1) process.

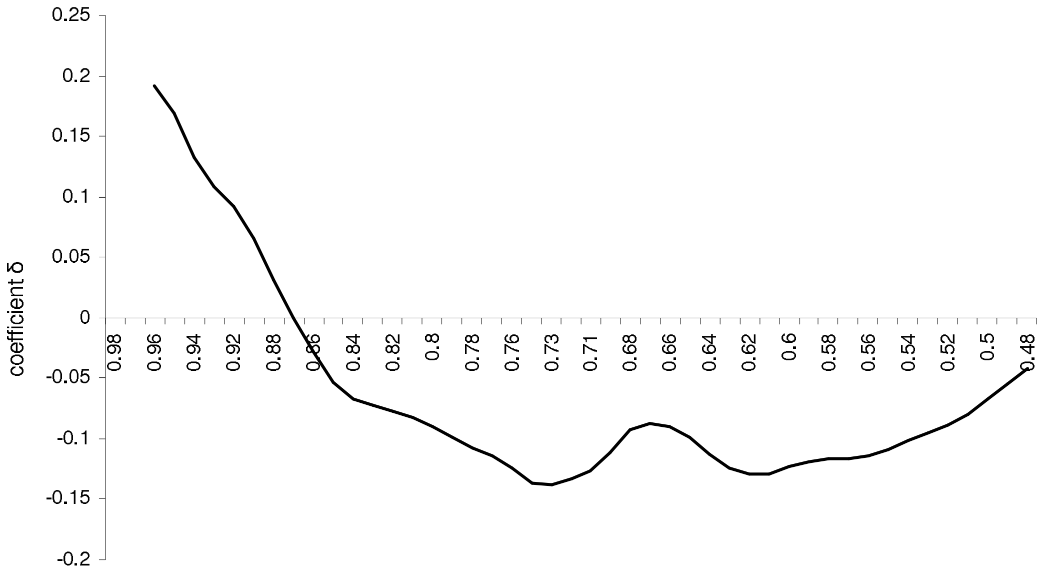


Figure 5: Values of the coefficient δ for different sample segments sorted according to inherent banking efficiency

Notes: The coefficient δ is obtained by estimating specification $y_{itk} = \alpha_t + \alpha_i + \gamma_k \cdot X_{ijt} + \delta_k \cdot Event_{jt} + \varepsilon_{itk}$ for different sample segments sorted by banks' inherent efficiency. The left hand side of the graph shows the coefficient for all banks with an inherent efficiency of 0.9 and 1. In the subsequent, both bounds of this range are stepwise reduced by 0.01. The graph plots the resulting values of δ from this exercise.