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Does the Entry Mode of Foreign Banks Matter for Bank Efficiency? Evidence from the Czech Republic, Hungary, and Poland

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Abstract

This paper investigates the impact of specific modes of entry of foreign banks, i.e. *greenfield investment* versus *merger and acquisition*, on bank performance in three transition economies – the Czech Republic, Hungary, and Poland. We use stochastic frontier analysis to model and measure the cost efficiency of banks. We adopt a maximum likelihood approach to estimation in which the variance of the one-sided error term is modeled jointly with the cost frontier, thus enabling us to retrieve efficiency scores, as well as estimating the various determinants of X-inefficiency. We first find that foreign banks are generally more cost efficient than their domestic counterparts, a result that confirms those of the existing empirical literature. We then turn our focus to comparative performance of greenfield banks versus merger and acquisition banks (M&As), and of M&As versus domestic banks. The results show that on average, M&As are surpassed in terms of efficiency by greenfields banks, but no cost efficiency difference is apparent between M&As and domestic banks. However, we find a strong age effect with respect to M&As which suggests that the evolution of M&As' efficiency follows an inverse U-shape, that means M&As tend to get more inefficient following the acquisition, but approximately 4 years and a haft later, their efficiency starts to improve.

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1. Introduction

The second half of the 1990s witnessed a dramatic increase of foreign participation in emerging markets' banking systems. Central and Eastern European countries, especially the Czech Republic, Hungary, and Poland, witnessed the most striking changes, with foreign presence rising from around 10% at the end of 1994 to around 60% at the end of 1999 (Mathieson & Roldos, 2001). The transformation of the communist mono-bank system into a two-tier one has led the authorities to open up the banking system to new entries and foreign banks have taken this opportunity to make their presence felt through greenfield investments. The banking crises that resulted from state-owned banks holding huge amounts of non-performing loans forced the governments of these countries to undertake vast programs of bank privatization that eventually drew in foreign banks through mergers and acquisitions of domestic banks. The need to comply with the requirements of membership in the OECD and for European Union accession has led the Czech, Hungary, and Poland to further removal of barriers to entry.

Given the main objectives of these countries in liberalizing their banking systems are to promote banking efficiency and stability, it is useful to assess whether this policy has been effective. In this paper, we attempt to do so by looking at the comparative performance between the two modes of entry of foreign banks – greenfield investment (hereafter Greenfields) versus entry by merging with or acquiring a domestic bank[2] (hereafter M&As), and between the M&As and domestic banks.

To this end, we use stochastic frontier analysis to model and measure the cost efficiency of banks in three transition economies: the Czech Republic, Hungary, and Poland. We adopt a maximum likelihood approach to estimation in which the variance of the one-sided error term is modeled jointly with the cost frontier, thus enabling us to retrieve efficiency scores, as well as estimating the various determinants of X-inefficiency. This one-stage approach gets round the recurrent criticisms inherent in the two-stage approach commonly adopted so far. Our preferred framework in the one-stage setting is the conditional mean model. We first compare the performance of foreign banks versus domestic banks to see whether our result confirms those of the existing empirical literature. We then turn our focus to the comparative cost performances of greenfield banks versus M&As, and of M&As versus domestic banks. Moreover, we try to identify whether an age effect on performance exists with respect to M&As.

The results obtained are as follow. First, we confirm that foreign banks outperform their domestic peers, a common finding in the literature on emerging and transition economies. Second, we find that on average, M&As are surpassed in terms of efficiency by greenfields banks, but no cost efficiency difference is apparent between M&As and

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[2] We define foreign banks as those in which foreign owners (Companies + Individuals) hold at least 50% of total share capital. A greenfield investment involves the establishment of an institution from scratch, whereas a merger and acquisition implies the purchase of a firm's (here a bank's) shares or other form of capital. In this paper, we are exclusively interested in a control acquisition, i.e. the purchase of equal to or more than 50% of a bank's capital.

domestic banks. Moreover, we find a strong age effect with respect to M&As which suggests that the evolution of M&As' efficiency follows an inverse U-shape, that means M&As tend to get more inefficient following the acquisition, but approximately 4 years and a haft later, their efficiency starts to improve.

Our paper is most closely related to the empirical literature on the role of foreign ownership on bank performance. A large number of studies have attempted to answer this question for both developed and developing economies. The results obtained point to a sharp contrast between mature and emerging markets. For instance, in an empirical study of developed economies, Berger et al. (2000) find that foreign banks are less efficient than domestic banks in terms of cost and profit efficiency. However, some banking organizations, particularly from the United States, are found to consistently operate at or above the efficiency levels of domestic banks. In contrast, empirical evidence on developing economies point out that foreign banks are more efficient than domestic banks. The contrasting results may reflect differences in initial conditions, particularly in the levels of economic and financial developments (Lensink & Hermes, 2004; Hermes & Lensink, 2004). This may also be explained by significant differences in the reasons for entry as well as in the competitive and regulatory conditions between mature and emerging economies (Claessens et al., 2001), (Mathieson & Roldos, 2001)[3].

The line of literature that addresses the impact of foreign bank entry on bank performance in the context of transition economies has done so mainly by comparing the performances of foreign and domestic banks. Common findings generally point to a positive relationship between foreign involvement, foreign ownership, as denoted by different levels of participation of foreign banks in domestic banks, and bank performance (Bonin et al., 2005).

There are some studies that have focused on the countries of interest to our paper. For instance, Sabi (1996) compares the performance of domestic and foreign banks in Hungary for the period 1992-1993. At this time, the foreign banks present in Hungary are mostly greenfield investments. The author constructs accounting measures of bank performance that reflect profitability, liquidity and credit risk, and commitment to the market economy of both types of banks. He then uses the t- test and Kruskal–Wallis test, and finds that there are significant differences in these indicators generally in favor of foreign banks.

Weill (2003) studies bank efficiency in the Czech Republic and Poland in 1997. He estimates cost efficiency scores using Stochastic Frontier Analysis. The results show that, on average, foreign banks are more cost efficient than domestic banks. In a second-stage regression, he confirms that this finding was not due to the smaller size of foreign banks nor their structure of activities.

Hasan & Marton (2003) study bank efficiency in Hungary over the period from 1993 to 1998. They compute cost and profit efficiencies using Stochastic Frontier Analysis. The

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[3] (Mathieson & Roldos, 2001, p. 37) nicely explains the differences in initial conditions between mature and emerging markets.

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results suggest that domestic banks are less cost- and profit-efficient than those with foreign participation, which confirms those obtained by Weill (2003) for the Czech Republic and Poland. Moreover, they divide foreign banks into four groups based on the extent of foreign involvement, and find that the higher the foreign participation, so is the efficiency. Finally, the average inefficiency scores of all banks exhibit a significant improvement over the sample years both in cost and profits.

Havrylchyk (2006) studies bank efficiency in Poland from 1997 to 2001. She computes cost, allocative, technical, pure technical, and scale efficiency scores for foreign and domestic banks using Data Envelopment Analysis. The results show that foreign banks are significantly more cost-efficient than domestic banks, confirming the findings of Weill (2003). Nevertheless, over the period studied, the efficiency of both foreign and domestic banks appear to have deteriorated on average, which are in contrast with the findings of Hasan & Marton (2003) for the case of Hungary.

This literature suffers from a main drawback. Indeed, although taking into account various discriminating criteria amongst foreign banks such as levels of foreign involvement in bank ownership, types of foreign owners (strategic partners, institutional investors…) or countries of origin of foreign banks, few studies have taken into account their modes of entry. A likely reason for this deficit is the difficulty in tracking evolution in bank ownership over time.

Recent studies (Haas & Lelyveld (2006) and Claeys & Hainz (2006)) have attempted to bridge this gap but have not focused on bank efficiency per se. Indeed, (Claeys & Hainz, 2006) investigates the impact of entry modes of foreign banks on the degree of competition in the local banking markets, and consequently on banks' lending rates. It shows that competition is stronger when market entry occurs through greenfield investments, which will cut down domestic banks' interest rates. (Haas & Lelyveld, 2006) studies credit behavior of foreign and domestic banks in Central and Eastern Europe from 1993-2000, and finds that during crisis periods, domestic banks contracted their credit base, whereas greenfield banks did not. Moreover, the credit behavior of greenfield institutions depends on their home countries' economic growth and the health of their parent banks. Thus, the focus of these studies is not on bank performance.

(Majnoni et al., 2003) is one of the first studies that take into account the implications of foreign banks' modes of entry on bank performance in the context of Hungary from 1995 to 2000. Using accounting measures of banks' costs and profits, they find that in terms of operating, employment costs as well as profitability, Greenfields outperform M&As. (Havrylchyk, 2006) studies the efficiency of the Polish banking industry, and also compares the performance of Greenfields, M&As, and domestic banks between 1997 and 2001. Her results are consistent with (Majnoni et al., 2003)'s, that is Greenfields outperform both M&As and domestic banks. (Havrylchyk & Jurzyk, 2006) considers the profitability of foreign banks in ten Central and Eastern European countries from 1995 to 2003. They also take into account the two modes of entry of foreign banks, and find that greenfield institutions are more efficient than domestic banks. However, this is not the case of takeover banks.

Although taking into account the comparative performances of banks entering the host countries by different modes, this question is not the unique focus of the papers cited above. We contribute to this literature by focusing on the differential implications of entry modes of foreign banks on their performance. Moreover, we try to indentify factors that may affect the performances of M&As after their privatization, with an emphasis on the age effect. In terms of methodology, we approach the issue through a one-stage approach to estimation that jointly models the cost frontier and the determinants of inefficiency. This one-stage approach gets round the recurrent criticisms inherent in the two-stage estimation approach commonly adopted so far.

Our paper is also closely related to the empirical literature on the effects of cross-border bank mergers and acquisitions on bank performance. This literature is considerable but focuses mainly on the United States and to a lesser extent on developed countries in Europe. A larger part of these studies found no beneficial effects of M&A on target bank's performance. Only a few studies show positive changes in performance after a deal, for instance, Cornett and Tehranian (1992) find an increase in the post-acquisition Return on Equity and operating cash flow. Studies on emerging and transition countries are handful, and results are ambiguous. Indeed, Correa (2007) studies changes in performance for target banks by focusing on the first two years after a cross-border acquisition, and find that acquired banks perform worse, or at the same level of the country-specific indices after a takeover. Findings by Bonin et al. (2005a) indicate that privatized banks have succeeded in improving their efficiency, especially those privatized early and those with a strategic foreign investor. Havrylchyk (2004) found increased profitability in the case of mergers, but when it turned to acquisitions, the acquired banks have not only not improved their efficiency, but have even experienced deteriorating performance.We contribute to this literature by carrying out a comparative analysis of performance between M&As and domestic banks.

Our work also relates to the theoretical literature on international M&As which, in contrast to the traditional trade literature, emphasizes that FDI through greenfield investments and through cross-border acquisitions are not "perfect substitutes" as entry modes [e.g. Blonigen (1997), Mattoo, Olerreaga and Saggi (2004), Nocke and Yeaple (2006a,b) and Norbäck and Persson (2006)]. The new theory shows that systematic differences in affiliate performance can emerge between entry modes due to synergies and market power effects from acquisitions (Bertrand et al., 2007). By finding significant differences in the performance of Greenfield investments and M&As, we provide some evidence for this hypothesis.

This paper is of some links to the empirical literature pertaining to foreign direct investment, which has so far mainly focused on determinants of entry mode. Very few papers have directly examined the performance of affiliates given the entry mode[4], which we did.

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[4] See the business literature, e.g. Shaver (1998) who analyzes the exit behavior of acquired and greenfield affiliates; Woodcock et al. (1994) and Slangen and Hennart (2005) who compare the overall performance of affiliates (*See Bertrand et al., 2007, ref. cited therein*).

Our paper is organized as follows. The following section provides an account of strategies of foreign banks in emerging and transition economies. Section 3 discusses the research hypotheses tested in this paper. Section 4 presents the estimation methodology and a description of the data is provided in section 5. Section 6 presents and discusses the results. A concluding section follows.

2. Strategies of Foreign Banks: Motives, Modes of Entry, and Activities

2.1 The General Case

Motives for Entry

Traditional theories of multinational banking have pointed out a number of factors that could explain the motivations for the entry of a bank into a foreign market. Two main factors are the follow-the-client behavior and the search for profitable opportunities in the host country. Indeed, a number of foreign banks are believed to enter emerging markets to serve multinational firms that are headquartered in the banks' home market. These foreign banks are of two types. First are those who limit their activities to services of their multinational clients, and offer little or no service to other multinational corporations or local customers in the country. They have therefore little effect on the domestic economy. Examples are Japanese and Korean banks that have usually entered emerging markets on the heels of a home-based customer they serve. Second are those such as ABN AMRO and Deutsche Bank who have entered emerging markets to follow major multinational corporations with which they have global relationships, and then extend their services to other multinationals, and large domestic corporations (Pomerleano & Vojta, 2001).

Other foreign banks, who may face a mature or an intensely competitive domestic banking and financial services sector, have chosen to expand abroad to look for growth and profit opportunities. They may choose to go to two types of foreign markets: those of large size and with comparatively high rates of growth (*the foreign market size and foreign market relative growth hypotheses*), and those which are not intensely competitive and of low entry barriers irrespective of market size or relative growth (*the foreign market competitiveness hypothesis*). Citibank and HSBC are banks in this category. Risk management, regulation, exchange rate movements, cultural connections, and distance from the home market are also miscellaneous factors that motive the entry of foreign banks (Curry et al., 2003).

The main weakness of the above framework is that it has little to say about the motives of those banks that enter a foreign market by acquiring domestic institutions. Another framework by Tschoegl (2003) offers more complete explanations on the motives of foreign banks. Indeed, the author classifies these into two categories: the *traditionals* and the *innovators*. "The traditionals consist of those many foreign banks, especially those operating via a branch or a small, wholly-owned subsidiary in a national financial center,

that are essentially engaging in normal international banking", that is, servicing trade and multinational firms and usually big local corporations. These banks do not seek to engage in retail banking.

The innovators are those who come to emerging markets in response to the new opportunities created by deregulation, transition, and crisis. Usually, they become part of the solutions needed by these economies in trouble. They can be divided into three sub-categories. The b*ettors* are those whose implications are essentially financial, through portfolio investments into institutions which they thought are promising in order to wrap up the bulk of the value to themselves. Their investments often don't attain the controlling threshold. They do not therefore actually manage the banks in which they invest, but cooperate with a strategic partner. Examples are the International Finance Corporation or the European Bank for Reconstruction and Development. The *prospectors* and the *restructurers* are those who sense a possible opportunity in the unsettled situation following opening, crisis or deregulation. They therefore invest in these markets by establishing small subsidiaries or joint ventures, or taking large equity positions in local banks. Nonetheless, the prospectors' engagement is exploratory rather than part of a broader strategy as in the case of the restructurers. In case of bad profitability outlook, they will walk away. One example is the case of Allied Irish Banks in Poland and Singapore. The investments of the restructurers, in contrast, are not a trial but rather a large scale commitment. Examples of banks in this category abound as banks such as Unicredito (Italy), Erste Bank (Austria), KBC (Belgium), Société Générale (France), and others have acquired banks throughout the transition economies.

Several factors may motivate the choice of an entry strategy by acquiring a domestic institution. Indeed, a foreign bank may choose to acquire a domestic bank that performs poorly because poor performers provide a relatively low-cost entry vehicle. New management would then attempt to improve the long-run performance of the bank by upgrading standards or through changes in business strategies. Alternatively, the target bank may provide a mechanism to exploit expertise and/or cost advantages of the new foreign owner, whether or not the target bank has been a poor performer. Another factor is the strategic orientation of servicing in the retail market because engaging in retail activities requires a significant branch network, which is too costly to set up from scratch than compared to acquiring a local bank which already has such network.

Modes of Entry

There is some confusion in the literature with respect to the categorization of modes of entry. We should distinguish between the institutional forms of entry represented by different organizational structures such as representative offices, branches, affiliates, and subsidiaries, and the modes of entry by foreign banks, i.e. greenfield investment versus merger or acquisition of an incumbent bank.

Forms of Entry. A branch is not an independent legal entity, but an integral part of the parent. It may provide a full range of banking services and operates on the basis of the parent's full capital base. In contrast, an affiliate is an independent legal entity in which

the foreign bank has less than majority ownership. A subsidiary, like an affiliate, is a separate legal entity incorporated in the host country, but one in which the foreign parent has majority ownership.

Each of the above organizational forms has its own advantages and disadvantages. A branch is less costly to establish than a subsidiary, because there is no costs of incorporation, no need to report annually to local registrar of companies, no need for a board of directors, and so forth. It is more appropriate for conducting wholesale and corporate banking activities in host countries, including foreign exchange and money market trading. Nevertheless, as it is part of the parent bank, a branch requires careful supervision because unauthorized trading could make the parent bankrupt. A subsidiary, in contrast, may fail even though the parent is solvent and vice versa, because it is an independent entity. However, a major constraint for a subsidiary is that it can only make loans on the basis of its own capitalization. Thus, it is hardly appropriate for conducting corporate lending and trading activities. In the case of an affiliate, the foreign bank doesn't have full control over it, so its role is limited to that of a prospector rather than of a long term commitment.

Representative office is the least constrained and least costly form of organization. It is like an embassy or a consulate of a company in a foreign market. However, it cannot conduct any type of business. Therefore, it is suitable with an aim of exploring business opportunities in a foreign country.

Modes of Entry. A greenfield investment involves the establishment of an institution from scratch, whereas a merger and acquisition implies the purchase of a firm's (here a bank's) shares or other form of capital. In this paper, we are exclusively interested in a Control Acquisition, i.e. the purchase of equal to or more than 50% of a bank's capital.

Entering via a greenfield investment allows the foreign bank to take advantage of its international reputation, particularly in less developed or less stable economies where depositors may feel more secure banking with well known foreign banks. It also allows foreign banks to target market segments, which would not be possible with the acquisition of a local entity, because it would leave the foreign bank with customer profiles of the old domestic bank which are incompatible or at least inconsistent with the overall market positioning of the parent bank and of which it is costly to make adjustment. However, entering via Merger and Acquisition of a local bank also has its own advantage. Indeed, it gives the foreign bank access to local knowledge. Moreover, where the strategy calls for a comprehensive retail network, acquisition may be the more feasible alternative, particularly if moving quickly is important. In addition, it also hands the foreign bank with immediate access to core deposits, which allows them to engage in local lending more rapidly. Finally, foreign acquisition may be advantageous for multinational banks about which little is known in potential host markets.

Areas of Activities

Foreign banks are better positioned to deliver products and services that require a global platform, a considerable amount of capital, have a strong technological content, and demand sophisticated skills and experience. Domestic banks have greater strengths in delivering products and services that require local capabilities, i.e. local knowledge, access to local currency, possession of a local branch network… Foreign-acquired banks are better able to capture these capabilities compared to their greenfield counterparts.

As a result, foreign banks tend to focus on corporate banking while domestic banks are more inclined to service the local retail and SME markets. Corporate banking products offered by foreign banks range from trade finance, project finance, syndicated loans, foreign exchange services, risk management products, cash management services to financial advisory services, while domestic banks' presence is more pervasive for the delivery of working capital and term loans (Pomerleano & Vojta, 2001)..

2.2 The Case of Central and Eastern European Countries, in Particular the Czech Republic, Hungary, and Poland

Motives for Entry

As in the general case, follow-the-client behavior and the drive towards new business opportunities remain two most important reasons behind the entry of foreign banks into CEE countries. Examples are the expansion of banks from Austria, Germany, US, and the Netherlands. Austrian and German banks were among the first to enter CEE countries, and currently are represented in the largest numbers. In Hungary, Austrian banks tend to acquire low-risk customers with large volume transactions such as multinationals and Hungarian monopolies (Majnoni et al., 2003). Citibank, ING, and ABN AMRO first follow their clients into these countries, then after the setting-up phase, they tend to develop their services using a local customer base and compete directly with domestic banks (Konopielko, 1999).

Another motive was simply to secure presence in view of possible future expansion. This "wait-and-see" approach is followed, for instance, by Deutsche Bank in Hungary (Majnoni et al., 2003).

We also note that some reasons specific to CEE countries may explain the entry of M&A banks. For instance, in Poland, a number of foreign banks may have accepted to take over certain Polish banks in trouble simply to "buy" a license to operate in this market. They were not really interested in these banks, and therefore did not effectively engage in their restructuring and management. As an example, in December 1994, Westdeutsche Landesbank agreed to buy 29% of the new issue of shares in Bank Morski in exchange for a license granted by the National Bank of Poland in February 1995. A similar procedure was subsequently applied to other German banks as in return for a license, they were forced either to support banks in trouble or to take over the `remainder' of almost

bankrupt Polish banks (Konopielko, 1999). Nevertheless, in some cases, the reasons for entry of M&As may not be clear, as (Abarbanell & Bonin, 1997, p. 48) noted for the case of ING acquiring Bank Slaski in Poland "*Whether ING's decision to take a majority stake in the bank was motivated by a desire to exercise tighter control over policy and strategy is not known…*".

Modes of Entry

All of the two modes of entry discussed above, i.e. Greenfield investment versus Merger and Acquisition, are so far present in CEE markets. Their introduction follows two separate waves. Indeed, the transformation of the mono-bank system into a two-tier one has led to the first wave of entry by greenfield banks. Then, the privatization process in these countries has created the opportunities for foreign banks to acquire domestic banks. This is the second wave of entry by M&A banks.

With respect to the forms of entry, according to Konopielko (1999), the most appealing vehicle of entry is through setting up a subsidiary, either from scratch or through the acquisition of existing banks. However, in the specific case of the Czech Republic, the prevalent strategy is entry by setting up a branch, which mirrors the Czech Republic's very liberal strategy towards foreign branches. Indeed, as soon as 1992, the Act on Banks already opened the door to foreign branches by permitting assessments of foreign branch license applications on less restrictive terms than the assessment of full banking license applications by Czech nationals (Simonson, 2001).

Affiliates come up when medium-term portfolio investors acquire a minority of shares in banks, which will be sold later. And in order to follow the "wait-and-see" approach, a number of investment banks as well as some specialized banks adopt the representative office form of organization. However, as Konopielko (1999) reports:

> "…there are a number of exceptions to these rules, mostly prompted by risk perception or regulatory barriers. For example, a number of foreign banks kept their representative offices in Poland throughout the period of license moratorium …. and later established subsidiaries based on these offices when it became legally possible. Investment in minority shares might on the other hand be caused by a strategy of gradual increase of commitment in case of good financial results".

Areas of Activities

As in the general case of emerging countries, the most important areas of activity of foreign banks in CEE are corporate banking and trade services (foreign exchange trading, and trade finance). Interbank operations weigh also heavily in their balance sheet, both on the asset and liabilities sides.

Retail activities are perceived as being the least important. This means entering banks do not adopt a retail strategy in these markets. The main reasons may be the low level of individual wealth as well as high set-up costs. However, since the second half of the 1990s, some foreign banks started to realize the potential of the retail market, and began

to actively participate in this market. As an example, some foreign greenfield banks in Hungary and Poland offer car financing and lending for investing in mutual funds. As Bonin & Abel (2000) noted, throughout the 1990s, foreign banks in Hungary have steadily increased their market share in household deposits from 1.1% in 1993 to 41.5% in 1999, and in household credits from 0.7% in 1993 to 34.8% in 1999.

Other activities which complement core corporate services are non-financial services such as consulting, security trading and leasing. These allow banks to use their know-how and liquid resources to earn some extra income. However, as there are a number of specialized non-bank institutions in these areas of activity, they are treated as `windows of opportunity' rather than directions in which banks should concentrate their resources and efforts (Konopielko, 1999).

In the Czech Republic, in terms of asset structure, the shares of credits and of tradable securities in foreign banks' balance sheet are generally lower than in large domestic banks. On the liabilities side, foreign banks depend heavily on interbank markets, having a much lower level of clients' deposits in their portfolios. This underlines the corporate-oriented approach of foreign banks.

In Poland, foreign banks engage around 40% of their assets in interbank operations and trade finance. However, most of the foreign banks also depend heavily on the interbank market. Deposits in financial institutions averaged 10.6% of assets, while for 100% owned foreign banks the corresponding ratio amounted to 32.8%. Most of the foreign banks have already established or are due to establish their own brokerage firms. Another notable distinction of foreign banks is their low level of fixed assets in total asset volume. This is caused by the low number of branches of these banks outside Warsaw. In most cases, banks' premises are rented and therefore contribute to operating costs. Some banks (Creditanstalt, ING and LG Petrobank) recently engaged in the development of headquarters buildings which in future might lead to an increase of fixed assets/total assets ratio and a decrease in operating costs (Konopielko, 1999).

3. Research Hypotheses

So far, most of the literature on the role of foreign ownership on bank performance has arrived at the following main conclusion: foreign banks outperform their domestic peers. Based on this result, we formulate the following hypothesis 1.

Hypothesis 1: Comparative Performance of Foreign Banks versus Domestic Banks
Foreign banks are more efficient than domestic banks.

Two institutional modes of entry have corresponded to the two waves of foreign bank entry as described in section 2. Findings by (Majnoni et al., 2003), (Havrylchyk, 2006), and (Havrylchyk & Jurzyk, 2006) indicate a superior performance of Greenfields over M&As. Consequently, we formulate the following hypothesis 2.

Hypothesis 2: Comparative Performance of Greenfields versus M&As
Greenfields outperform M&As.

From hypotheses 1 & 2, we can assume that greenfields banks are more efficient than their domestic counterparts. What interests us here is the comparative performance between M&As and domestic banks. This comparison is of bigger interest to us because of the following reasons. First, transition countries had, for a long time, hesitated to completely liberalize the entry of M&As, that is they had been very reluctant to sell a majority part of their banks to foreigners because of fears of foreign dominance of the banking sector. Once they did, their primary objective is to help improve the efficiency of these banks, which otherwise could difficultly be achieved. Therefore, the comparison would help shed light on whether this objective is attained or not. Moreover, the scope of activities of M&As and domestic banks being similar, their comparison would be more correct.

Findings by the literature on the effect of cross-border bank mergers and acquisitions on bank performance (cf. the introduction section) show ambiguous results. Therefore, we formulate the following hypothesis.

Hypothesis 3: Comparative Performance of M&As versus Domestic Banks
M&As may or may not outperform their domestic peers.

Which factors may affect the performance of M&As after their privatization? As our study is carried out on the Czech Republic, Hungary, and Poland, we discuss here factors relevant for these countries.

The first factor may be the corporate governance of the bank after the privatization which is determined by its ownership structure, which, in turn, results from the method of transfer of ownership during the privatization process. The literature so far seems to agree on the importance of attracting a strategic foreign investor on condition that it takes an active role in the development of bank strategy, and brings about new technology and its expertise to the bank. It appears to emerge from the literature that the presence of a strategic investor is not a panacea. Indeed, as far as its investment does not reach a controlling threshold, the presence of two large shareholders - the government and the strategic investor, none with a majority part giving it the control of the bank (a common pattern in the early privatization period) - may not help improving the bank's performance, since conflicts of interest between the shareholders may adversely affect the development of the bank's strategy and will give the bank management the effective influence on the bank[5]. On the other hand, pure Initial Public Offerings and voucher programs, which leads to diffuse ownership, is also of little benefits because it may also leave incumbent managers with a stronger hold on the bank than its shareholder. However, since our definition of foreign ownership requires that from 50% of the bank capital is foreign-owned, a majority of M&As in our sample don't face these problems as they have a controlling strategic investor.

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[5] See, for example, (Abarbanell & Bonin, 1997) on the case of Bank Slaski in Poland.

The second factor may be the nature of the inherited problems from former state-owned banks faced by M&As. Indeed, there may be two major problems: an asset of uncertain quality with some proportion of problem loans, and an overly large staff with a non negligible fraction of those with outdated skills (Abarbanell & Bonin, 1997). The inherited problems could also stem from the bad legacy represented by counter-commercial attitudes left over from the communist era, high operating costs and above-average reserves, inefficient branch network, underdeveloped IT, and low quality clientele… (Majnoni et al., 2003, p. 14). It takes time for M&As to resolve the asset quality problem by restructuring bad loans and introducing new lending practices and procedures. In some cases, these domestic banks acquired have had long term relationships with traditional financially troubled industries, or the merger and acquisition operations may have been facilitated by local authorities on condition that the new M&As maintain a certain level of financial support to these unattractive sectors. Therefore, it also takes time to reorient the loan portfolio away from these sectors into healthier industries, especially in the presence of local pressure. It takes time, too, to reduce the workforce because of fear of labor action or of confrontation with the political bodies which have themselves employment objectives (Abarbanell & Bonin, 1997). We call this adjustment process the *age effect*. Thus, the time it takes to get rid of the inherited problems (measured by the age of the bank) serves to measure the extent of these problems.

The third factor may be the ongoing government intervention which could have a detrimental effect on the performance of privatized banks. Indeed, direct or indirect financial support to poorly performing banks may create moral hazard problems. The use of banks for policy goals such as channeling credits based on non-market criteria delays the transformation of the banks into effective financial intermediaries (Meyendorff & Snyder, 1997). Nevertheless, as our definition of foreign banks fixes the threshold to be considered foreign at 50% of the bank capital, this is less likely to happen with M&As in our sample. Anyway, this factor is difficult to document and quantify.

We may expect factors affecting the performance of M&As after privatization may also contribute to explaining discrepancies in performance between M&As and other banks.

With respect to the comparison with greenfield banks, differences in the nature of activities may be another explanatory factor. Indeed, it is widely believed that the portfolio of greenfield banks is more selective than those of other banks, which could be conducive to their better performance. They choose mostly lower-risk activities, and serve mainly lower-risk customers. This is not the case of M&As as their portfolios reflect, at least in the early years after privatization, those of the former state-owned banks.

Bank size may also play a role, as stylized facts often indicate that Greenfields are of smaller size while M&As may suffer from diseconomies of scale due to the fact that they acquire large institutions (Havrylchyk & Jurzyk, 2006).

Market share may be a factor too as M&As often evolve from former state-owned banks with a significant share of the market. Indeed, according to the theoretical literature on M&As, systematic differences in affiliate performance can emerge between entry modes due to synergies and market power effects from acquisitions.

In contrast, technology and banking know-how would not be the discriminating factors, as both Greenfields and M&As are supposed to possess these skills and technologies.

We also include the factors discussed above into the comparison between M&As and domestic banks.

These arguments lead to the formulation of hypothesis 4.

Hypothesis 4: Factors Affecting the Differential Performance between M&As and Other Banks
The nature of the inherited problems faced by M&A bank as captured by the age effect, the structure of activities, bank size and market share may be the factors affecting the differential performance between M&As and other banks.

4. Estimation Methodology

4.1 Efficiency Estimation Method: Stochastic Frontier Analysis

A number of techniques are available for the estimation of efficiency, which can be categorized into parametric and non-parametric ones. Weill (2003) gives a concise discussion on the advantages and disadvantages of each technique, and on the choice of an appropriate technique. Here in this paper, we choose a popular parametric technique, i.e. Stochastic Frontier Analysis (henceforth SFA).

Aigner, Lovell and Schmidt (1977) and Meeusen and Van Den Broeck (1977) independently proposed the stochastic frontier production model of the form
$$\ln q_i = \mathbf{x}_i' \beta + v_i - u_i \qquad i = 1, \dots \text{I}$$
where q_i represents the output of the i-th firm; $\mathbf{x}_i$ is a $K \ x \ 1$ vector containing the logarithms of inputs; β is a vector of unknown parameters; v_i is a symmetric random error accounting for statistical noise; and u_i is a non-negative random variable associated with technical efficiency.

Explicit assumptions about the distribution of the measurement errors v_i and the X-inefficiency terms u_i allow the frontiers to be estimated using the method of maximum likelihood. The measurement errors are typically assumed to be random errors independently and normally distributed with mean zero and constant variance. These are therefore often referred to as the "two-sided" error terms as they are symmetrically distributed around the "true" frontier. By contrast the inefficiency terms are assumed to have an independent distribution which is truncated below by the frontier itself. For this reason, these inefficiency terms are often referred to as the "one-sided" error terms. A

number of distributions have been suggested for them: half normal, truncated normal, exponential, and gamma.

4.2 Accounting for Environmental Variables

The ability of managers to convert inputs into outputs is often influenced by exogenous variables that characterize the environment in which production takes place. The question then is how to account for these environmental factors?

There are three competing approaches regarding the way the issue of environment is addressed.

Environmental factors in the production frontier

The first approach assumes that the environmental factors influence the shape of the technology. Therefore, these factors should be included directly into the non-stochastic component of the production frontier (e.g., Good et al. (1993)). This leads to a model of the form

$$\ln q_i = \mathbf{x}_i^{'}\beta + \mathbf{z}_i^{'}\gamma + v_i - u_i$$

where $\mathbf{z}_i$ is a vector of (transformations of) environmental variables and γ is a vector of unknown parameters. In this case, it is assumed that each firm faces a different production frontier.

Environmental factors in the inefficiency term

The second approach assumes the environmental factors influence the degree of technical inefficiency (and not the shape of technology) and hence that these factors should be modeled so that they directly influence the inefficiency term[6]. The underlying hypotheses is that all firms share the same technology represented by the production frontier and that the environmental factors have an influence only on the distance that separates each firm from the best practice function.

Early empirical papers (e.g. Pitt and Lee, 1981 and Kalijaran, 1981) explore the relationship between environmental variables and predicted technical efficiencies using a two-stage approach. In the first stage, the firm-specific inefficiency effects assumed to be identically distributed are retrieved from the estimated stochastic frontier. In the second stage, the predicted inefficiencies are used as a dependent variable in a regression model in which explanatory exogenous variables seek to explain differences in these effects (e.g. Mester, 1993). This approach is subject to two main weaknesses. One is that, in the first stage, when the production or cost relationship is estimated, the efficiency terms are assumed to be independently and *identically* distributed, but in the second stage they are assumed to be a function of these firm-specific factors, implying that they are not identically distributed[7]. The other problem is that failure to include environmental

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[6] For a comparison of these two approaches, see Coelli et al. (1999).
[7] Unless all the coefficients of the factors are simultaneously equal to zero.

variables in the first stage leads to biased estimators of the parameters of the deterministic part of the production frontier, and also to biased predictors of technical efficiency[8].

These criticisms have given rise to a substantial empirical literature on the modeling of the inefficiency effects, leading to the emergence of a one-stage approach, whereby these inefficiency effects are modeled jointly with the frontier[9].

One approach to estimating the effect of systematic influences on X-inefficiency is to assume that the truncation point of the one-sided distribution shifts depending on the exogenous factors assumed to determine efficiency. This leads to a model of the form:

$$\ln q_i = \mathbf{x}_i^{'}\beta + v_i - u_i$$

where $u_i \sim N^+(\mathbf{z}_i^{'}\gamma, \delta_u^2)$, z_i is a vector of systematic influences on mean efficiency. This is known as the conditional mean approach ((Kumbhakar, Ghosh, & McGuckin, 1991), (Huang and Liu, 1994), (Battese and Coelli, 1995)). In this type of model, the two-sided error is typically assumed to be $N(0, \sigma_v^2)$. The main weakness of this model is that it doesn't take into account the possibility of heteroskedasticity in the variances of both types of error.

In a second approach, (Caudill & Ford, 1993), (Caudill, Ford, & Gropper, 1995), and (Hadri, 1999) seek to address the problem of heteroscedasticity by parameterizing the *variance* of the inefficiency term. That is, δ_{ui} is assumed to be $\delta_{ui} = g(\mathbf{z}_i, \gamma)$. However, this model cannot incorporate the features of the conditional mean model by assuming the truncation point of the one-sided distribution to be constant.

In a third approach, (Wang, 2002, 2003) combine the two models above by parameterizing both the mean and the variance of the inefficiency term. That means, u_i is assumed to be $u_i \sim N^+(\mu_i, \delta_{ui}^2)$, where $\mu_i = \mathbf{z}_i^{'}\gamma$ and $\delta_{u_i}^2 = \exp(\mathbf{z}_i^{'}\gamma)$. This model affords the non-monotonic efficiency effect as discussed in details in (Wang, 2002). However, as a result, it restricts the functional form of the variance of the inefficiency term to be exponential.

Environmental factors in both
Some researchers incorporate the environmental factors both in the production frontier and the inefficiency term[10]. Note that no theoretical argument has been used to justify these approaches. Their use is rather justified in the statistical ground.

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[8] For more details, see Caudill, Ford, and Gropper (1995), and Wang & Schmidt (2002).
[9] Contributions to the development of the one-stage approach include Khumbhakar, Ghosh and McGuckin (1991); Reichsneider and Stevenson (1991); Yuengert (1993); Simar, Lovell and Vanden Eeckaut (1994); Huang and Liu (1994); Caudill, Ford and Gropper (1995) and Battese and Coelli (1995), Wang and Schmidt (2002) and Wang (2003) amongst others. For a discussion and review of this literature, see Kumbhakar and Lovell (2000), Ch 7.
[10] See e.g. Fries et al. (2005).

4.3 The Cost Efficiency Model

The measure of bank efficiency we focus on in this paper is cost efficiency, i.e. the distance of the firm relative to the best practice frontier. It denotes the quality of the bank management.

As far as the modeling of the inefficiency term is concerned, our preferred framework is the conditional mean model. However, bearing in mind the weaknesses of each approach as presented above, we also estimate the heteroskedasticity model in a check of robustness.

Functional form

The analysis of efficiency in the services industry using SFA has led researchers to estimate a wide range of functional forms for the associated frontiers[11]. Generally, the more parameters in the estimated function, the more flexible it is, such that it is possible to estimate a frontier which is as close as possible to the "true" (non-parametric) frontier. The translog function is generally considered a flexible functional form and has been used extensively in the literature on banking efficiency. In this study, we use the same specification, given as:

$$\ln(\frac{C}{p_3}) = \alpha_0 + \sum_{k=1}^{2} \beta_k \ln y_k + \frac{1}{2} \sum_{k=1}^{2} \sum_{j=1}^{2} \beta_{kj} \ln y_k \ln y_j + \sum_{m=1}^{2} \gamma_m \ln(\frac{p_m}{p_3}) +$$

$$+ \frac{1}{2} \sum_{m=1}^{2} \sum_{h=1}^{2} \gamma_{mh} \ln(\frac{p_m}{p_3}) \ln(\frac{p_h}{p_3}) + \sum_{k=1}^{2} \sum_{m=1}^{2} \phi_{km} \ln y_k \ln(\frac{p_m}{p_3}) + \ln equity + country + time + \varepsilon$$

where C represents total costs, y represents the outputs of the bank and the *p* variables are the prices of the inputs. Total costs and input prices are normalized with respect to p_3 (price of one of the inputs) to ensure linear homogeneity. The equity variable is included in the cost function to control for risk preferences. All the variables are in natural logarithm. Although we choose three relatively homogenous countries for our study, structural conditions in banking and general macroeconomic conditions may still generate differences in bank efficiency from country to country. We therefore include both country and time effects in the estimation of the frontier to control for these factors. For the sake of simplicity, we do not include the index for bank in the equation.

ε is the composed error equal to the sum of the measurement error (*v*) and the X-inefficiency term (*u*). Because the inefficiency term is expected to increase costs, the sign on *u* is positive. Consistent maximum likelihood estimation of the above function for each bank will reveal both the structure of the cost function and the firm-specific X-inefficiency effects. Our definition of inputs and outputs follows the intermediation approach, whereby banks are seen as accepting deposits from customers and transforming

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[11] These include Cobb-Douglas, Box-Cox, quadratic, the composite function, translog and the flexible Fourier form.

these into loans to clients and other investments. We therefore include two outputs in the cost function: y_1=loans and y_2=investment assets[12]. We would have liked to take into account off-balance-sheet items as a third output. However, due to a large number of missing observations of this item (almost one third of the total number of observations), we are unable to do so. We use the prices of labor, physical capital and borrowed funds as the inputs in the estimation of the cost function. The price of borrowed funds is used to normalize each variable to ensure linear homogeneity. Following the literature, the price of labor is the ratio of personnel expenses to total assets, given the unavailability of data on the number of employees. The price of physical capital is constructed as the ratio of other non-interest expenses to fixed assets and the price of borrowed funds is the ratio of interest paid to all funding. Total costs are the sum of personnel expenses, interest paid and other non-interest expenses.

In terms of the modeling of the inefficiency term, the inclusion of variables capturing exogenous factors will help to identify whether discrepancies in performance through each type of bank could be influenced by these factors as opposed to simply better management. We construct three binary dummy variables in the data: foreign, merger and greenfield. These represent, respectively, whether the bank is foreign-owned or domestic-owned, whether it has merged with or acquired a domestic bank or not and whether it has entered through greenfield investment or not. Along with these dummy variables, our inefficiency model controls for the impact of the following factors on bank inefficiency.

Size. To account for bank size, we use the natural log of total assets.

Structure of activities. To account for the nature of activities of banks, we construct two variables. To reflect differences in the structure of assets, we take into account the ratios of investment assets over loans. On the liabilities side, we include the share of deposits in total funding in the regressions.

Age effect. We capture the adjustment process of M&As over time with an age variable. We also take into account the square of the age or the natural logarithm of the age to allow for the possibility that the way cost efficiency adjusts over time may be following a non-linear path.

We calculate the age of a bank by the number of full years since its incorporation. In case a domestic bank is acquired and becomes majority foreign-owned, we classify the former bank as domestic until the acquisition date, and the new merged bank as foreign from the first full year following the acquisition date. The date of incorporation for the new merged bank is therefore this first full year. For those domestic banks whose dates of incorporation are before the transition, we take the date of creation of the two-tier banking system which marked the beginning of a commercial banking system as that of incorporation as only from this date that these banks started to operate on a commercial basis.

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[12] This item is denoted as "other earning assets" in BankScope, which are all the earning assets other than loans.

Market share. We calculate a bank's market share as its share of assets over total banking sector's assets.

5. Data

We obtained data from Bureau van Dijk's BankScope database, version 2006. For our sample, we select three most advanced countries in Central Europe: the Czech Republic, Hungary, and Poland. We choose these countries for a number of reasons. Indeed, we are first motivated by their very high levels of foreign bank penetration in comparison with other transition countries, and even with other developing countries. Consequently, greenfield and merger and acquisition entries take place most extensively in these countries. This therefore facilitates the analysis of different modes of entry on banks' cost performance. Second, the activities of foreign banks there are better documented than in other transition economies. Finally, the levels of economic development between the three countries are relatively homogeneous, which facilitates the cross-country comparison.

As it is commonly known by academic researchers and professionals, the data for banks from less developed and transition countries require substantial editing before a reliable sample can be constructed. We therefore carefully review our data to avoid double counting of institutions, to exclude non-bank financial institutions from the sample. We also exclude banks that are not commercial, cooperative and savings banks to ensure that we are estimating performance based on a relatively homogeneous group of banks. With respect to the type of account, we prefer unconsolidated accounts to consolidated ones wherever available. Once the type of account chosen, we take the one following the international financial reporting standards (IFRS) wherever available. If not, we take the account with local accounting standards. Nevertheless, sometimes IFRS data are available for only one or two years while longer time series are available in local standards. In such cases we use local standards. Thus, our final sample consists of 153 banks from the Czech Republic, Hungary, and Poland over the period 1994 to 2004. The distribution of banks by ownership and mode of entry is given in table 2.

While BankScope has a very large coverage of banks over the world, this database provides information on bank ownership only for the current calendar year. Thus, we have had to track the evolution in the ownership of each bank over time through several sources, including banks' official publications and Zephyr (Bureau Van Dijk)[13]. This enabled us to differentiate between foreign and domestic banks, and, among foreign banks, between greenfield investments and merger and acquisition entries.

Table 3 displays summary statistics of the sample. We observe the existence of differences between the categories of banks. In terms of size, the mean M&A bank is approximately six times bigger than a greenfield bank and two times bigger than a domestic bank. In terms of the structure of activities, the volumes of investment assets hold by M&As and domestic banks are much higher than that of greenfield banks. In fact,

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[13] We are grateful to R.d. Haas and I.v. Lelyveld from de Nederlandsche Bank for kindly sharing data on bank ownership for the years 1994 to 2001.

the former tend to invest massively on government securities with higher returns and lower risk, rather than make loans in a context of difficulties in identifying high-quality new clients, of the nascent stage of institutional infrastructure supporting property and creditors' rights, and information asymmetries. As an example, in Poland, government securities comprised over 25% of Bank Slaski's total assets at the end of 1995 (Abarbanell & Bonin, 1997, p. 53). This feature is also confirmed by Havrylchyk (2006, p. 10). M&As and domestic banks also possess much higher volumes of loans than Greenfields. Therefore, the difference in the relative ratio of investment assets over loans becomes much narrower.

6. Results

We report our results by first comparing foreign banks against domestic banks to see if our results are in line with the existing empirical evidence. We then turn our focus to the comparative efficiency of Greenfields versus M&As, and of M&As versus domestic banks. The parameter estimates from the translog cost functions[14] by themselves have little informational value; they are simply means to the end of producing a frontier with which to estimate bank-specific cost efficiency scores. Of more interest are the coefficient estimates from the inefficiency models, which show the impact of the particular variables on bank cost inefficiency.

6.1 Foreign Banks versus Domestic Banks

In this section, we present results for hypothesis 1 on the comparative performance of foreign banks versus domestic banks. Weill (2003) includes bank size and structure of activities variables in his second-stage regressions of determinants of cost efficiency to control for the influence of exogenous factors other than managerial performance. We follow him here but in a one-stage setting. The results are shown in table 4(1).

First, the negative and highly significant coefficient on *foreign* suggests that foreign banks are on average more cost efficient than their domestic peers. This again confirms the results obtained so far in the literature on emerging and transition economies. Because we control for bank size and structure of assets, we conclude that the better efficiency of foreign banks does result from better management.

The negative and highly significant coefficient on *lnassets* indicates that the size of the bank tends to increase its efficiency. This may be explained by the fact that the average size of banks in the three countries does not reach the critical size to achieve efficiency. With regards to the structure of assets, the positive and significant coefficient on *shareinv* suggests that banks with a higher proportion of investment assets over loans are more inefficient. The coefficient on *sharedep* is negative but insignificant. This suggests that deposits are not more or less costly than other funding as a source of bank financing.

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[14] Results are available from the authors upon request.

We also report the efficiency scores across ownership types. Consistent with the results above, average efficiency scores of foreign banks surpass those of domestic banks.

Our results thus differ from those obtained by Weill (2003) in that bank size and structure of assets do exert an impact on bank efficiency. The divergence might result from the fact that we have a larger sample over a much longer period.

How to explain the superior performance of foreign banks over domestic banks? Apart from better management, size, and structure of activities as indicated by our results, foreign banks have a comparative advantage in banking technology and know-how provided by their mother companies. (Weill, 2003) conjectures that foreign-owned banks' advantages may be the result of better control by private shareholders. Indeed, shareholders of foreign banks in transition countries are mostly from Western countries. Therefore, they are more used to monitoring bank managers, since they are less inclined to enter into friendly relationships with managers, which is a key problem in transition banking. For the specific case of Hungary, according to (Majnoni et al., 2003), foreign banks are pursuing a lending policy not dissimilar from that of domestic banks, but at the same time they are able to achieve a higher profitability. This can be explained by the fact that foreign bank success is related to a product innovation, which could be tied to their ability to supply a broader array of financial services than their domestic competitors, and to a better screening and monitoring of their loan applicants.

6.2 Greenfield Banks versus M&As

We run regressions for a separate sample composed solely of Greenfields and M&As. The regressions results are shown in table 5 (1) and (2).

We first include only the mode of entry dummy, i.e. *merger* in the modeling of the inefficiency term (specification (1)). The results show a positive although not significant coefficient on *merger*, which might be an indication that M&As are less efficient than Greenfields.

Therefore, in a next step, we include variables that reflect size, structure of activities, market share, and the age effect in the modeling of the inefficiency term (specification (2)). As the results show, the coefficient on *merger* remains positive but becomes significant. This therefore indicates that M&As are significantly less efficient than Greenfields. These results are obtained after controlling for other exogenous factors likely to influence X-efficiency. This therefore indicates better management efficiency in Greenfields than in M&As.

Regarding the other determinants of inefficiency, we find the same relationship as discussed earlier, between size and inefficiency: bigger banks tend to be more cost efficient. On the other hand, the positive and significant coefficient on *shareinv* suggests that banks with a higher proportion of investment assets over loans are more cost inefficient. The negative and significant coefficient on *sharedep* indicates that the larger the share of deposits over total funding, the less inefficient the bank is. The coefficient on

sharemar is positive but insignificant, suggesting that market share does not play a significant role in explaining differences in efficiency of banks. These results are perhaps not surprising since the operations and areas of activities of Greenfield banks are somewhat different from M&As and these two categories of banks are not trying to compete away market shares.

The adjustment process of M&As through time shows in the age-related variables. We calculate the natural logarithm of a bank's age in order to take into account an eventual nonlinear effect of age on bank efficiency[15]. We interact *merger* with *lnage* in an attempt to understand the evolution in the efficiency of M&As. The significantly negative coefficient on *merglnage* suggests that older M&As tend to be more cost efficient. Indeed, the older the M&As get, the more likely it is they will have got rid of many of the problems inherited from the acquired domestic banks. In contrast, the positive coefficient on *lnage* suggests that as Greenfields grow older, they tend to become less cost-efficient.

We also report the efficiency scores averaged across the two modes of entry. As is evident, average efficiency scores of Greenfields surpass those of M&As.

The superior performance of Greenfields is documented by Majnoni et al (2003) for Hungary. According to these authors, Greenfields achieve higher profitability than restructured ones, and that this is due to the introduction of new financial products. Clark et al (2003b) note that in Hungary, empirical evidence suggests that fully privatized banks perform better than state owned banks. The evidence also supports the argument in the broader privatization literature that privatized enterprises often do not perform as well as de novo private firms. De novo foreign banks in Hungary are much smaller but perform better than acquired banks and the lesson for policy makers is that it can be more difficult to try to improve an acquired public bank than setting up a good performer from scratch.

Our findings on the superior cost performance of Greenfields also lends some support to the theoretical literature on international M&As, which suggests that systematic differences in affiliate performance can emerge between entry modes (Bertrand et al, 2007).

6.3 M&As versus Domestic Banks

As is the case with Greenfields versus M&As, we run regressions for a separate sample composed solely of Greenfields and M&As. The regressions results are shown in table 6 (1) and (2).

The same reasoning applies as in the case of Greenfields versus M&As. We first include only the mode of entry dummy, i.e. *merger* in the modeling of the inefficiency term (specification (1)). The result shows a negative although not significant coefficient on

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[15] At first, we controlled for nonlinear effect of the age on bank efficiency by including the *age* variable and its square value in the inefficiency model. However, such model doesn't converge. Therefore, we have changed the modeling of the age effect to ensure the translog cost function converges.

merger, which might be an indication that M&A banks are more efficient than domestic banks.

In a next step, we include variables that reflect size, structure of activities, market share, and the age effect in the modeling of the inefficiency term (specification (2)). Again, we obtain a coefficient on *merger* that is negative and insignificant. We therefore conclude that no cost efficiency difference is apparent between these two types of banks.

The size variable still suggests that bigger banks tend to be more cost efficient. The market share variable is significant and suggests that higher market share tends to lead to higher cost inefficiency.

We are particularly interested in the age variables, and the result shows a strong age effect with respect to M&As. Indeed, the evolution of M&As' efficiency follows an inverse U-shape, which means that M&As tend to get more inefficient following the acquisition, but approximately 4 years and a haft later, their efficiency levels start to improve.

6.4 Checks of Robustness

As we have made clear in section 4, each approach in modeling inefficiency in the one-stage setting has its own weaknesses. To make sure our results are not affected by the type of model adopted, in this section, we estimate the heteroskedasticity model for a check of robustness.

Results for foreign versus domestic banks are reported in table 4(2). A comparison of the two models shows that, in essence, the way we model the inefficiency term only affect the magnitude of the differences in the inefficiency between the two types of banks, but not their signs and significances.

Results for greenfield banks versus M&As are shown in table 5 (3) and (4). As we can observe, most results are similar to those of the conditional mean model, except the coefficient on *sharedep*.

Results for greenfield banks versus M&As are shown in table 6 (3) and (4). The results differ between the two types of model on the signs of *merger*, but in all the two cases, the coefficients are not significant. This therefore reinforces our conclusion that not cost efficiency discrepancy is apparent between M&As and domestic banks.

7. Conclusions

Previous studies on foreign bank entry often fail to provide evidence on the impact of entry modes on efficiency levels. This is often due to the unavailability of adequate data to track the ownership of banks. This paper bridges this gap and uses stochastic frontier analysis to do this exercise for foreign-owned banks in three transition economies that have seen a dramatic rise in participation of foreign banks in their economies. In a one-

stage setting, we estimate a conditional mean model along the lines of Battese and Coelli (1995) to model inefficiency. First, we confirm the findings of the empirical literature to date on transition and emerging countries, namely that foreign banks display a superior performance to their domestic peers. In a comparison of the performance of foreign banks that entered through two modes of entry - greenfield investment and mergers and acquisitions - we find that Greenfields are in fact more cost efficient than M&As.

In an attempt to explore age effects to allow for the M&As to adjust and restructure its operations after acquisition, we find evidence of a strong age effect with respect to M&As which suggests that the evolution of M&As' efficiency follows an inverse U-shape. In other words, M&As tend to become more inefficient following the acquisition, but approximately 4 years and a half later, their efficiency begins to improve.

An area that is under-researched in this literature is the ability to take into account different types of customers of banks to reflect the different customer focus of foreign and domestic banks, especially by separating banks into wholesale and retail banking. As Nikiel & Opiela (2002) have shown, this may have an important impact on bank efficiency and needs to be accounted for.

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Table 1: Definitions of variables

Symbol	Description	Source of data
Ownership and modes of entry		
foreign	A dummy variable equal to 1 if the bank is a foreign-owned bank, and 0 otherwise.	R.d. Haas, I.v. Lelyveld & authors' own research.
merger	A dummy variable equal to 1 if the bank is a foreign-owned bank that enters through a merger and/or an acquisition of a domestic bank, and 0 otherwise.	R.d. Haas, I.v. Lelyveld & authors' own research.
greenfield	A dummy variable equal to 1 if the bank enters a domestic market through a greenfield investment.	R.d. Haas, I.v. Lelyveld & authors' own research.
Variables related to the cost function		
C	Total costs; sum of personnel expenses, interest paid, and other non-interest expenses.	BankScope.
y	Outputs; sum of y_1 and y_2.	
y_1	Loans.	BankScope.
y_2	Investment assets.	BankScope.
p_1	Price of labor; equal to personnel expenses divided by total assets.	BankScope.
p_2	Price of physical capital; equal to other non-interest expenses divided by fixed assets.	BankScope.
p_3	Price of borrowed funds; equal to interest paid divided by all funding.	BankScope.
equity	Equity of the bank; reflects its risk preferences.	BankScope.
country	Country dummies.	
time	Time dummies.	
Determinants of inefficiency		
lnassets	Natural logarithm of total assets; denotes the size of the bank.	BankScope.
shareinv	Ratio of investment assets over loans; denotes the structure of assets of the bank.	BankScope.
sharedep	Ratio of deposits and short term funding to total funding; denotes the structure of liabilities of the bank.	BankScope.
sharemar	Share of a bank's assets over total banking system's assets; denotes a bank's market share	BankScope.
age	Number of years since the incorporation of the bank, except first year; denotes the age of the bank.	BankScope.
lnage	Natural logarithm of *age*.	BankScope.
agesq	Square of *age*.	BankScope.

Table 2: Number of Banks by Ownership and Mode of Entry

	1994				1995				1996			
	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total
Czech	6	5		11	6	5		11	8	5		13
Hungary	5	3		8	6	3		9	6	5	1	12
Poland	12	2		14	13	3		16	18	3		21
Total	23	10		33	25	11		36	32	13	1	46

	1997				1998				1999			
	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total
Czech	8	9		17	10	10	2	22	10	10	4	24
Hungary	6	6	2	14	4	9	9	22	4	11	9	24
Poland	24	6	3	33	22	13	4	39	22	14	4	40
Total	38	21	5	64	36	32	15	83	36	35	17	88

	2000				2001				2002			
	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total
Czech	10	10	5	25	8	9	7	24	6	9	9	24
Hungary	3	12	9	24	3	10	8	21	3	11	8	22
Poland	18	14	8	40	13	16	8	37	10	17	10	37
Total	31	36	22	89	24	35	23	82	19	37	27	83

	2003				2004							
	domestic	greenfield	mergers	Total	domestic	greenfield	mergers	Total				
Czech	6	9	9	24	6	9	8	23				
Hungary	2	11	7	20	1	13	7	21				
Poland	11	17	12	40	11	16	11	38				
Total	19	37	28	84	18	38	26	82				

Table 3: Summary Statistics

	Domestic		Greenfield		M&As		Foreign	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Outputs[a]								
Loans	947.26	1693.97	356.89	507.33	1721.15	2103.16	833.94	1460.11
Investment Assets	1063.46	1989.18	303.05	348.23	1953.01	3081.52	880.01	2001.61
Inputs[a]								
Personnel Expenses	35.13	77.34	6.38	9.11	50.49	72.62	21.65	48.10
Other non-Interest Expenses	57.55	130.03	13.14	21.37	75.45	101.02	34.85	68.71
Interest Paid	149.45	256.24	38.19	46.90	156.68	164.41	79.12	117.98
Prices of Inputs[b]								
Price of Labor	1.58	1.23	1.19	1.30	1.20	0.87	1.19	1.16
Price of Capital	153.14	457.47	378.23	611.72	175.53	346.80	307.28	542.43
Price of Borrowed Funds	13.36	80.60	7.91	8.88	6.15	4.11	7.3	7.6

Notes:[a]In millions dollars; [b] In percentage.

- Summary Statistics of Variables Related to the Cost Function -

	Domestic		Greenfield		M&As		Foreign	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Total Assets[a]	2301.07	4062.54	719.27	859.45	4093.75	5506.63	1899.25	3692.7
Investment Assets/ Loans[b]	2.46	6.92	1.57	3.09	1.52	1.89	1.55	2.72
Deposits/ Total Funding[b]	0.94	0.19	0.96	0.08	0.97	0.04	0.96	0.06
Market Share of Assets[b]	0.06	0.09	0.02	0.03	0.06	0.06	0.03	0.04
Age[c]	8.01	3.20	7.09	3.90	4.37	3.25	6.14	3.90

Notes:[a] In millions dollars; [b] In proportion; [c] In years.

- Summary Statistics of the Determinants of Inefficiency -

Table 4: Determinants of Cost Inefficiency – Foreign versus Domestic Banks

Dependent variable: *cost inefficiency*	(1) **Conditional Mean Model**	(2) **Heteroskedasticity Model**
lnassets	-.652	-1.131
	(.132)***	(.149)***
shareinv	.025	.076
	(.008)***	(.023)***
sharedep	-.179	.574
	(.404)	(.752)
foreign	-.306	-.429
	(.135)***	(.183)***
constant	3.44	3.683
	(.668)***	(.927)***
Observations	732	732
Log likelihood	79.845	56.024
Mean efficiency scores		
Foreign banks	0.78	0.84
Domestic banks	0.74	0.80

Table 5: Determinants of Cost Inefficiency – Greenfield versus M&A Banks

	(1)	(2)	(3)	(4)
Dependent variable: *cost inefficiency*	**Conditional Mean Model (1)**	**Conditional Mean Model (2)**	**Heteroskedasticity Model (1)[b]**	**Heteroskedasticity Model (2)[b]**
merger	53.981[a]	.699	.026	17.060
	(38.367)	(.169)***	(.179)	(2.678)***
lnassets		-.383		.336
		(.073)***		(.241)
shareinv		.043		.142
		(.010)***		(.065)**
sharedep		-1.090		6.918
		(.340)***		(2.358)***
sharemar		2.002		-4.675
		(1.678)		(4.469)
lnage		.105		6.440
		(.053)**		(1.058)***
merglnage		-.241		-6.650
		(.089)**		(.994)***
Constant	-266.209	3.038	-1.879	-28.759[c]
	(115.307)***	(.497)***	(.124)***	
Observations	441	438	441	438
Log likelihood	58.874	138.595	16.779	178.253
Greenfield	0.84	0.81	0.77	0.96
M&As	0.79	0.78	0.72	0.80

*Notes:

a. This model doesn't converge. We take the result after 108 iterations, that is after the log likelihood stabilizes.

b. We also control for heteroskedasticity in the random error by incorporating *lnassets* in the modeling of *v*.

c. Missing standard errors are due to Stata not reporting them.

Table 6: Determinants of Cost Inefficiency –M&A versus Domestic Banks

Dependent variable: *cost inefficiency*	(1) **Conditional Mean Model (1)**	(2) **Conditional Mean Model (2)**	(3) **Heteroskedasticity Model (1)[b]**	(4) **Heteroskedasticity Model (2)[b]**
merger	-3.334[a] (36.408)	-.797 (.521)	.076 (.151)	3.697 (2.209)*
lnassets		-.414 (.127)***		-.400 (.157)***
shareinv		.004 (.009)		.087 (.031)***
sharedep		.325 (.514)		10.429[c]
sharemar		3.235 (1.451)**		6.961 (2.040)***
age		-.229 (.096)***		.579 (.413)
agesq		.016 (.006)***		-.008 (.019)
mergage		.587 (.298)**		.593 (.488)
mergagesq		-.066 (.034)**		-.119 (.035)***
Constant	-299.304 (201.359)***	2.443 (.763)***	-2.309 (.102)***	-16.331 (2.464)***
Observations	441	441	441	441
Log likelihood	82.877	110.951	141.005	196.018
Mean efficiency scores				
Domestic	0.82		0.79	
M&As	0.81		0.77	

*Notes:
a. This model doesn't converge. We take the result after 242 iterations, that is after the log likelihood stabilizes.
b. We also control for heteroskedasticity in the random error by incorporating lnassets in the modeling of v.
c. Missing standard errors are due to Stata not reporting them.

Table 7: Cost Efficiency Parameters Estimates – Foreign versus Domestic Banks

	(1) Conditional Mean Model	(2) Heteroskedasticity Model
Y1	0.888	0.825
	(0.049)***	(0.058)***
Y2	0.491	0.375
	(0.060)***	(0.063)***
P1	0.741	0.818
	(0.192)***	(0.214)***
P2	0.335	0.265
	(0.018)***	(0.025)***
Y1Q	0.096	0.096
	(0.012)***	(0.016)***
Y2Q	0.135	0.137
	(0.005)***	(0.006)***
Y1Y2	-0.133	-0.118
	(0.009)***	(0.011)***
P1Q	0.058	0.489
	(0.145)	(0.162)***
P2Q	-0.036	-0.028
	(0.005)***	(0.005)***
P1P2	0.004	-0.041
	(0.033)	(0.034)
Y1P1	-0.025	-0.091
	(0.038)	(0.046)*
Y1P2	-0.031	-0.024
	(0.007)***	(0.007)***
Y2P1	0.094	0.118
	(0.040)**	(0.045)***
Y2P2	0.006	0.009
	(0.007)	(0.007)
LnEQUITY	-0.122	-0.240
	(0.045)***	(0.029)***
COUNTRY_2	0.158	0.167
	(0.020)***	(0.025)***
COUNTRY_3	0.094	0.080
	(0.018)***	(0.022)***
YEAR_2	-0.035	-0.034
	(0.046)	(0.058)
YEAR_3	-0.048	-0.041
	(0.043)	(0.056)
YEAR_4	-0.132	-0.138
	(0.042)***	(0.052)***
YEAR_5	-0.100	-0.078
	(0.039)**	(0.050)
YEAR_6	-0.097	-0.072
	(0.040)**	(0.051)
YEAR_7	-0.136	-0.122
	(0.040)***	(0.051)**
YEAR_8	-0.128	-0.115
	(0.040)***	(0.052)**
YEAR_9	-0.124	-0.084
	(0.042)***	(0.053)

YEAR_10	-0.134	-0.071
	(0.044)***	(0.054)
YEAR_11	-0.124	-0.059
	(0.043)***	(0.055)
Constant	-0.442	0.907
	(0.391)	(0.293)***
Observations	732	732

*Notes:
1. Y1 = (Ln(Loans))
2. Y2 = (Ln(Other Earning Assets))
3. P1 = (Ln(Labor Price/Borrowed Fund Price))
4. P2 = (Ln(Capital Price/Borrowed Fund Price))
5. Standard errors are in parentheses.
6. *, **, *** denote significances at 10%, 5%, and 1% levels respectively.

Table 8: Cost Efficiency Parameters Estimates - Greenfield Banks versus M&A Banks

	(1)	(2)	(3)	(4)
	Conditional Mean Model (1)	Conditional Mean Model (2)	Heteroskedasticity Model (1)	Heteroskedasticity Model (2)
Y1	0.753	0.991	0.753	0.419
	(0.056)***	(0.111)***	(0.053)***	(0.068)***
Y2	0.166	0.245	0.155	0.364
	(0.052)***	(0.079)***	(0.062)**	(0.073)***
P1	0.751	0.691	0.679	0.660
	(0.231)***	(0.243)***	(0.266)**	(0.272)**
P2	0.074	-0.014	0.124	0.038
	(0.045)*	(0.046)	(0.051)**	(0.045)
Y1Q	0.066	0.037	0.085	0.123
	(0.014)***	(0.022)*	(0.015)***	(0.016)***
Y2Q	0.117	0.121	0.120	0.119
	(0.006)***	(0.006)***	(0.006)***	(0.006)***
Y1Y2	-0.081	-0.093	-0.088	-0.104
	(0.009)***	(0.013)***	(0.009)***	(0.010)***
P1Q	0.229	0.638	0.225	0.455
	(0.189)	(0.208)***	(0.213)	(0.211)**
P2Q	0.005	0.003	0.006	0.007
	(0.007)	(0.007)	(0.008)	(0.005)
P1P2	-0.023	-0.067	0.003	-0.067
	(0.035)	(0.042)	(0.036)	(0.039)*
Y1P1	-0.023	-0.019	-0.087	0.014
	(0.049)	(0.050)	(0.050)*	(0.054)
Y1P2	-0.025	-0.006	-0.043	0.004
	(0.009)***	(0.009)	(0.009)***	(0.007)
Y2P1	0.062	0.055	0.123	0.058
	(0.048)	(0.043)	(0.047)***	(0.040)
Y2P2	0.023	0.020	0.031	-0.004
	(0.007)***	(0.008)***	(0.008)***	(0.008)
lnEQUITY	-0.125	-0.073	-0.162	-0.212
	(0.112)	(0.078)	(0.133)	(0.093)**
COUNTRY_2	0.111	0.116	0.097	0.118
	(0.028)***	(0.025)***	(0.032)***	(0.020)***
COUNTRY_3	0.013	0.110	-0.017	0.131
	(0.030)	(0.028)***	(0.035)	(0.024)***
YEAR_2	-0.011	-0.057	-0.004	0.003
	(0.082)	(0.081)	(0.091)	(0.077)
YEAR_3	-0.030	-0.071	-0.022	-0.000
	(0.081)	(0.076)	(0.089)	(0.075)
YEAR_4	-0.034	-0.078	-0.036	-0.053
	(0.073)	(0.072)	(0.082)	(0.072)
YEAR_5	-0.013	-0.081	0.009	-0.040
	(0.069)	(0.070)	(0.075)	(0.070)
YEAR_6	0.017	-0.035	0.021	-0.010
	(0.068)	(0.069)	(0.075)	(0.069)
YEAR_7	-0.039	-0.091	-0.045	-0.052
	(0.068)	(0.069)	(0.076)	(0.070)
YEAR_8	-0.033	-0.073	-0.049	-0.061
	(0.069)	(0.071)	(0.077)	(0.070)

YEAR_9	-0.004	-0.030	-0.029	-0.027
	(0.071)	(0.073)	(0.080)	(0.070)
YEAR_10	0.001	-0.001	-0.015	-0.047
	(0.072)	(0.073)	(0.080)	(0.071)
YEAR_11	-0.002	-0.010	-0.023	-0.060
	(0.071)	(0.072)	(0.079)	(0.071)
Constant	1.469	0.130	1.557	2.665
	(0.810)*	(0.690)	(0.964)	(0.696)***
Observations	441	438	441	438

*Notes:
1. Y1 = (Ln(Loans))
2. Y2 = (Ln(Other Earning Assets))
3. P1 = (Ln(Labor Price/Borrowed Fund Price))
4. P2 = (Ln(Capital Price/Borrowed Fund Price))
5. Standard errors are in parentheses.
6. *, **, *** denote significances at 10%, 5%, and 1% levels respectively.

Table 9: Cost Efficiency Parameters Estimates - M&A versus Domestic Banks

	(1) Conditional Mean Model (1)	(2) Conditional Mean Model (2)	(3) Heteroskedasticity Model (1)	(4) Heteroskedasticity Model (2)
Y1	0.696	0.797	0.473	0.459
	(0.054)***	(0.079)***	(0.045)***	(0.050)***
Y2	0.287	0.422	0.294	0.325
	(0.048)***	(0.078)***	(0.036)***	(0.043)***
P1	0.705	1.213	0.804	1.127
	(0.262)***	(0.293)***	(0.231)***	(0.234)***
P2	0.421	0.385	-0.053	-0.046
	(0.023)***	(0.025)***	(0.023)**	(0.042)
Y1Q	0.161	0.162	0.186	0.172
	(0.010)***	(0.018)***	(0.009)***	(0.010)***
Y2Q	0.207	0.205	0.201	0.192
	(0.011)***	(0.012)***	(0.008)***	(0.010)***
Y1Y2	-0.174	-0.189	-0.172	-0.164
	(0.009)***	(0.012)***	(0.007)***	(0.009)***
P1Q	0.626	0.161	0.038	-0.029
	(0.222)***	(0.270)	(0.288)	(0.183)
P2Q	-0.054	-0.034	0.022	0.028
	(0.008)***	(0.008)***	(0.004)***	(0.007)***
P1P2	-0.097	-0.074	0.015	-0.028
	(0.052)*	(0.055)	(0.028)	(0.035)
Y1P1	-0.079	-0.091	-0.071	0.012
	(0.031)**	(0.043)**	(0.036)**	(0.040)
Y1P2	-0.025	-0.024	-0.001	0.005
	(0.009)***	(0.010)**	(0.005)	(0.009)
Y2P1	0.154	0.123	0.132	0.012
	(0.045)***	(0.054)**	(0.038)***	(0.046)
Y2P2	-0.004	-0.006	0.008	0.004
	(0.009)	(0.009)	(0.004)*	(0.008)
lnEQUITY	-0.184	-0.176	-0.275	-0.214
	(0.064)***	(0.047)***	(0.039)***	(0.027)***
COUNTRY_2	0.171	0.185	0.241	0.139
	(0.032)***	(0.030)***	(0.018)***	(0.024)***
COUNTRY_3	0.143	0.133	0.192	0.092
	(0.029)***	(0.028)***	(0.023)***	(0.023)***
YEAR_2	-0.034	-0.029	-0.060	-0.076
	(0.051)	(0.054)	(0.025)**	(0.036)**
YEAR_3	-0.033	-0.023	-0.034	-0.079
	(0.049)	(0.052)	(0.022)	(0.036)**
YEAR_4	-0.180	-0.141	-0.173	-0.123
	(0.049)***	(0.051)***	(0.038)***	(0.036)***
YEAR_5	-0.142	-0.101	-0.182	-0.102
	(0.046)***	(0.049)**	(0.038)***	(0.034)***
YEAR_6	-0.117	-0.098	-0.114	-0.135
	(0.046)**	(0.050)*	(0.030)***	(0.037)***
YEAR_7	-0.126	-0.103	-0.101	-0.149
	(0.046)***	(0.050)**	(0.034)***	(0.037)***
YEAR_8	-0.117	-0.121	-0.135	-0.153
	(0.048)**	(0.051)**	(0.041)***	(0.041)***

YEAR_9	-0.119	-0.122	-0.065	-0.165
	(0.051)**	(0.052)**	(0.044)	(0.043)***
YEAR_10	-0.119	-0.121	-0.090	-0.173
	(0.052)**	(0.054)**	(0.044)**	(0.044)***
YEAR_11	-0.133	-0.113	-0.110	-0.176
	(0.054)**	(0.054)**	(0.044)**	(0.045)***
Constant	1.270	0.300	2.919	2.716
	(0.473)***	(0.478)	(0.291)***	(0.266)***
Observations	441	441	441	441

*Notes:

1. Y1 = (Ln(Loans))
2. Y2 = (Ln(Other Earning Assets))
3. P1 = (Ln(Labor Price/Borrowed Fund Price))
4. P2 = (Ln(Capital Price/Borrowed Fund Price))
5. Standard errors are in parentheses.
6. *, **, *** denote significances at 10%, 5%, and 1% levels respectively.

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