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Bank governance changes in Pakistan: Is there a performance effect? ☆

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ABSTRACT

This paper investigates the performance effects of bank governance reforms in Pakistan where banking industry has completed two decades of transition from dominance of state-owned banks to a system where foreign and private banks compete freely with state-owned banks. We employ the stochastic frontier and inefficiency effects model on panel data from 1991 to 2005 and control for inter-bank heterogeneity in bank cost structures. We find that private banks demonstrate highest level of cost efficiency, followed by foreign, and then state-owned banks. Privatized and restructured banks suffer from efficiency losses in years following privatization/restructuring, but improve performance once they adjust. Although small and weak banks are selected for M&A, but following ownership change they increase technical efficiency. If present trends continue the reformed banks are likely to hold on to efficiency gains in the near future. The winners from the reforms are privatized banks and private banks selected for M&A who exploit new profit making opportunities.

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1. Introduction

The banking sector in Pakistan has completed two decades of dramatic transition from the pre-dominance of state-owned banks to a system where private and foreign banks have a level playing

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field. Financial sector reforms in Pakistan were initiated in 1989, which continued in the 1990s. The reforms entailed encouragement to private sector ownership, opening of several new private sector banks, easing of branch policy for private and foreign banks, privatization and restructuring of state-owned banks, and bank consolidation (see, *SBP, 2003*). With the removal of regulatory controls and privatization of state-owned banks, the asset share of state-owned banks has declined from 93% in 1990 to 22% in 2004 (*SBP, 2005*).² The resulting ownership changes raise some important questions. The most important question is how these governance reforms have impacted bank performance? However, the investigation of the efficiency effects of these reforms in the context of developing countries is still work-in-progress.

The existing literature on the comparative efficiency of foreign, private and state-owned banks in transition and developing countries is extensive but offers mixed results.³ For example, most studies suggest that state-owned banks in these countries are least efficient in allocation of banking resources, but the evidence on the relative efficiency of foreign versus private banks markedly differs in the available studies. For instance, *Berger, Hasan, and Klapper (2004)* use data of 28 developing countries to show that foreign banks are most profit efficient, followed by private banks while state-owned banks are least efficient. Two studies on the data of Indian and Turkish banks reach similar conclusions (*Bhattacharya, Lovell, & Sahay, 1997; Isik & Hassan, 2002*). However, two recent studies based on the data of Pakistani banks (*Patti & Hardy, 2005; Burki & Niazi, 2009*) present mixed results. Using parametric approach, *Patti and Hardy (2005)* show that foreign banks are more profit efficient, followed by private and then state-owned banks, but the average cost efficiency of these banks is similar. By contrast, *Burki and Niazi (2009)* use data envelopment analysis and data from 1991 to 2000 to determine that foreign banks show superior cost efficiency than private and state-owned banks, but the efficiency of “foreign banks worsens after the consolidation stage of the financial reforms is over”. Similarly, the available literature on the impact of privatization on the performance of banks in developing countries also fails to provide a clear picture. These studies generally conclude that some performance measures improve after privatization while others show no change (*Boubakri, Cosset, Fischer, & Guedhami, 2005; Clarke, Cull, & Shirley, 2005; Williams & Nguyen, 2005*). However, *Patti and Hardy (2005)* find that profit efficiency of privatized banks in Pakistan increases in the beginning, but the gains are not sustained. Few such studies control for inter-bank heterogeneity in production or cost structures, which may partially explain the inconsistent results in banking studies (see also, *Sherlund, Barrett, & Adesina, 2002*).

This leads us to ask whether bank governance changes, as a result of banking sector liberalization and reforms in Pakistan had a positive or negative effect on the performance of these banks. We do so by using the stochastic frontier model, developed by *Battese and Coelli (1995)*, on unbalanced panel data consisting of 46 commercial banks over the 1991–2005 period. Our goal is to analyze the effects of bank governance reforms on the efficiency of domestic and foreign banks.⁴ We explore this relationship by addressing five related questions: (1) how did market liberalization policy affect performance of private and foreign banks vis-à-vis state-owned banks?; (2) how pre-privatization efficiency of selected banks compares with their peers, and to what extent and in which direction has post-privatization efficiency changed in the short- and the long-term?; (3) what role did restructuring of state-owned banks play in their performance?; (4) how did policy reforms in merger and acquisition (M&A) change the post-merger performance of these banks?; (5) who are the winners and losers from these reforms?

To address these questions we adopt an empirical framework proposed by *Berger, Clarke, Cull, Klapper, and Udell (2005)*, which is suitable to study the impact of bank governance reforms on performance when various types of bank governance variables are included in the same model, e.g., static governance variables, selection variables, short-run effects of bank governance change, and long-run effects of bank governance change. Our empirical specification helps to control for inter-bank

² The share of private banks in total assets was 67.5% in 2004, while the same share of foreign banks increased from 6.7% in 1990 to 10.4% in 2004.

³ See, for instance, *Lensink et al. (2008), Hauner and Peiris (2007), Yildirim and Philippatos (2007), and Figueira et al. (2009)*.

⁴ Here bank governance refers to direct observable governance structures, e.g., direct state ownership, direct ownership by private sector, and direct ownership by foreigners.

heterogeneity in cost structures by including a series of bank governance variables. The governance variables considered in this study are (1) state-owned, private and foreign banks (with no-governance change); (2) privatization of state-owned banks; (3) restructuring of state-owned banks; (4) merger and acquisition of private and foreign banks.

This paper is different from the previous studies on Pakistan's banking sector in a few respects. Firstly, unlike the two aforementioned studies (i.e., Patti & Hardy, 2005; Burki & Niazi, 2009⁵) that examine only the static impact of financial reforms on efficiency of domestic versus foreign banks, our empirical work in the present study in addition to the static effects on foreign versus domestic banks also focuses on selection, short-run and long-run effects of bank governance reforms in Pakistan. In this way, our empirical specification helps us control for inter-bank heterogeneity by including all bank governance reforms in the same model, which no other study on Pakistan's data has ever attempted. Secondly, our paper is the first study to investigate the impact of government restructuring and M&A on the performance of banks in Pakistan. Thirdly, like Burki and Niazi (2009) we collect data from balance sheet and income statements of the banks and hence avoid data aggregation issues to which Patti and Hardy (2005) continue to draw our attention. Finally, we include in our sample all banks that were operating in Pakistan during the study period, and use more recent data than all previous studies.

We find that private banks (with no-governance change) demonstrate the highest level of cost efficiency, which is followed by foreign banks, and then state-owned banks. Consistent with evidence reported in some other studies, privatized or restructured banks tend to suffer from efficiency losses in the years following the privatization or restructuring, but improve performance once they adjust and adapt to the new environment. Banks selected for M&A are usually small in size or are poor performers, but following the governance change these banks tend to increase their technical efficiency. The data also make it apparent that if present trends continue these banks are likely to hold on to efficiency gains in the near future.

Before turning to these results, a brief survey of related literature is given in Section 2. Section 3 describes the regulatory framework in Pakistan's banking sector. Section 4 outlines the empirical model while Section 5 describes the data and data sources. Section 6 explains the estimation results, discusses the effects of ownership reforms on X-inefficiency of banks, and presents the results of the sensitivity analysis. Concluding comments are in Section 7.

2. Review of related literature

During the 1990s and 2000s many developing countries introduced bank governance reforms, which provided a laboratory environment to study the relationship between bank ownership structure and its performance. After decades of regulatory controls and complete dominance of state-owned banks in the banking sectors of these countries, foreign-owned and domestic private banks have recently been allowed to compete freely (La Porta, Lopez-de-Silanes, & Shleifer, 2002). At the same time, some of these countries have also initiated policies of privatization and restructuring of state-owned banks, and consolidation of banks through merger and acquisition (M&A).

Vast literature suggests that, on average, state-owned banks in developing countries tend to be inefficient than foreign and domestic private banks (e.g., Hauner & Peiris, 2007; La Porta et al., 2002; Patti & Hardy, 2005).⁶ These conclusions help explain why so many governments have privatized state-owned banks. In support of the view that state-owned banks are inefficient than domestic and foreign banks, several papers appeal to a combination of factors including: (i) lower environmental pressures and incentive problems for the managers of state-owned banks (e.g., Altunbas, Lynne, & Molyneux, 2001), (ii) increased lending to politically motivated firms by state-owned banks (e.g., Faccio, 2006;

⁵ In addition to providing insights on the relative performance of state-owned, private and foreign banks, the paper by Burki and Niazi (2009) also throws light on how asset quality, loan size, non-performing loans and bank branches correlate with bank efficiency indexes, i.e., cost efficiency, allocative efficiency, pure technical efficiency and scale efficiency.

⁶ For bank efficiency studies about the US see, among others, Elyasiani and Mehdiian (1992, 1995), Grabowski et al. (1994), and Berger and Mester (2003). For a survey of this literature see also, Berger and Humphrey (1997).

Khwaja & Mian, 2005; La Porta et al., 2002; Sapienza, 2004), and (iii) problems linked with competition (Shirley & Walsh, 2000).

However, empirical studies on relative efficiency of foreign versus private banks both in developing and transition countries is associated with mixed results (e.g., Berger et al., 2004; Bonin, Hasan, & Wachtel, 2005; Burki & Niazi, 2009; Figueira, Nellis, & Parker, 2009; Hauner & Peiris, 2007; Isik & Hassan, 2002; Lensink, Meesters, & Naaborg, 2008; Patti & Hardy, 2005; Yildirim & Philippatos, 2007).⁷ For example, using data of transition economies Bonin et al. (2005) find that foreign banks are more efficient than private and state-owned banks, but another study (Yildirim & Philippatos, 2007) also on transition countries concludes that profit efficiency of foreign banks is lower and cost efficiency of foreign banks is higher than private and state-owned banks. Similarly, Nikiel and Opiela (2002) find that foreign banks are less profit efficient than domestic private banks. Similarly, two recent studies using cross-country data from transition and developing countries find mixed results on relative profit and cost efficiency of foreign, private and state-owned banks (see, Berger et al., 2004; Lensink et al. 2008). Berger et al. (2005) and Delfino (2003) based on bank data from Argentina show that foreign and private banks are equally efficient, but both are more efficient relative to state-owned banks. Two previous studies on Pakistani data (Burki & Niazi, 2009; Patti & Hardy, 2005) also find that while foreign and private banks are more efficient than state-owned banks, there are mixed results on the relative efficiency of foreign versus private banks. Therefore, from a policy standpoint it is unclear if entry of foreign banks is indeed helpful in increasing the performance of banks.

Research on the impact of privatization on banking sector performance in developing countries is expanding. Although a number of recent studies (e.g., Boubakri et al., 2005b; Boubakri, Cosset, & Guedhami, 2009; Clarke et al., 2005; Lin & Zhang, 2009) have studied post-privatization performance indicators in these countries, the results are at best mixed.⁸ To illustrate, Boubakri, Cosset, and Guedhami (2005) Boubakri, Cosset, Fischer, et al. (2005), Fries and Taci (2005), Clarke et al. (2005), Beck, Cull, & Jerome (2005), and Bonin et al. (2005) provide convincing evidence to support the view that privatization improves performance and increases competition, some other studies (e.g., Berger et al., 2005; Patti & Hardy, 2005) find that post-privatization profit-oriented performance measures generally improve, but cost oriented performance measures improve less often. Some studies conclude that gains from privatization are modest in countries where government retains stakes in the privatized banks (see, Bonin and Watchel, 2000, 2003; Bonin et al., 2005; Boubakri et al., 2009; Otchere, 2005), and that post-privatization performance gains are higher in countries where foreigners are allowed to compete (see, Cull, Matesova, & Shirley, 2002; D'Souza et al., 2001; Frydman et al., 1997; Haber, 2005). In contrast to the literature on privatization, a few empirical papers have also explored the impact of M&A on performance (see, Berger et al., 2005; Crespi, Miguel Garcia-Cestona, & Salas, 2004; Cuesta & Orea, 2002; Kapopoulos & Siokis, 2005; Rezitis, 2008; Williams & Nguyen, 2005). Again, mixed results prevent us to draw a general conclusion about the efficiency effects of M&A from these empirical studies.

In a related line of research, some recent studies take all bank governance reforms together in the same model to investigate their impact on performance. Developed by Berger et al. (2004), this approach was illustrated by Berger et al. (2005) and Williams and Nguyen (2005) in a case study and cross-country settings, respectively. For example, Berger et al. (2005) study the effects of corporate governance on bank performance using data from Argentina in the 1990s; their results suggest that corporate governance changes effects on state-ownership are most robust. While they find dramatic improvement in performance of state-owned banks after their privatization, they do not find similar improvement for banks involved in M&A. Williams and Nguyen (2005) study the impact of bank governance changes on performance of banks across a sample of South East Asian countries during the Asian crisis. Their results favor a policy of bank privatization, but consistent with the findings of Berger et al. (2005) they do not find conclusive evidence on the impact of foreign acquisitions. More

⁷ Advocates of foreign banks in poor countries argue that “these banks can achieve better economies of scale and risk diversification than domestic banks, and that they introduce more advanced technology, import better supervision and regulation, and increase competition” (Detragiache et al., 2008). For few others, success of foreign banks in developing and transition countries is determined by the quality of institutions in host countries (Mian, 2006; Lensink et al., 2008).

⁸ For a review of privatization literature, see Megginson (2005) and Clarke et al. (2005).

recently, following up on Berger et al. (2005), Lin and Zhang (2009) also adopt this approach and “conduct a joint analysis of the static, selection, and dynamic effects of (domestic) private, foreign and state ownership” in order to examine the impact of bank ownership reforms on performance in China. They corroborate the finding that “state-ownership is negatively related to bank performance” and that the banks put up for “foreign acquisition or public listing” show better performance, but they do not find support to the view that short-run and long-run performance changes in these banks also takes place.

3. Regulatory framework in the banking sector of Pakistan

In this section we highlight important historical developments relating to regulatory controls and removals in Pakistan's banking sector that inspire this empirical study. These developments include: (i) level playing field for private, foreign and state-owned banks; (ii) privatization of state-owned banks; (iii) restructuring of state-owned banks; (iv) merger and acquisition of private and foreign banks. Since SBP (2003) and Patti and Hardy (2005) have carefully examined the evolution of Pakistan's banking industry, we will only emphasize the most relevant developments that underlie this empirical study.

Up to the early-1990s, the structure of Pakistan's financial sector largely reflected “the policy initiatives taken in the early-1970s that drastically enlarged the role of government in the process of deposit mobilization and credit allocation” (SBP, 2003).⁹ When it became clear that the pre-1990s system was counterproductive, the policy makers began to work on removing regulatory and bank controls to give rise to financial liberalization, institutional strengthening of nationalized commercial banks, institutional strengthening of the State Bank of Pakistan (the central bank), debt management reforms, monetary management measures, exchange and payment reforms, and capital market reforms. A detailed description of the pre-reform structure, and the nature and assessment of financial sector reforms in 1990s is found in SBP (2003).

The present reforms initiated in the late-1980s, barely affected the functioning of the banking industry up until 1992.¹⁰ More dramatic reforms were introduced in early-1991, and the subsequent rise of domestic private-owned and foreign-owned banks has altogether changed the landscape of the banking industry. In the next 15 years, the impact of these reforms on bank ownership changes can be studied at three distinct levels.

Firstly, in order to liberalize the financial sector a significant development took place in 1990 when the Banks' (Nationalization) Act 1974 was amended to facilitate privatization of state-owned banks and opening-up of new banks (SBP, 2003). In 1991, stage-wise privatization process began with the sale of 26% of Muslim Commercial Bank's (MCB) shares to the private sector; 50% of its shares were divested to the general public in 1992 and 1993, respectively, and finally, the remaining 24% shares were sold in 2001–2002. Similarly, in September 1991, 26% of Allied Bank Limited's (ABL) shares were disinvested and the management control of the bank was handed over to the private sector; and 25% of its share were sold in 1993 (SBP, 2003). In 2002, a large state-owned bank, United Bank Limited (UBL), was privatized. More recently, Habib Bank Limited (HBL), which was one of the largest commercial banks in Pakistan, was also privatized in February 2004. With the nationalization of banks in 1974, a ban had been imposed on setting-up of new private domestic commercial banks. This ban was lifted when in August 1991, 10 new private banks were granted permission to operate, of which eight banks started operations in the latter half of 1992; the other two banks started operations in 1993. Similarly, three new foreign banks were granted permission in 1992 and two provincial government banks were scheduled in September 1994. In 1995, controls on the opening of new bank branches by private and foreign banks were also removed. Removal of these regulatory controls, privatization and M&A led to

⁹ This system was aimed at promoting socioeconomic goals in the aftermath of the banking reforms.

¹⁰ Attempts were made to introduce Islamic banking in 1979, but the procedure adopted to implement the system on the basis of “mark-up” was declared un-Islamic by the Islamic court in 1991, which was endorsed by the Supreme Court of Pakistan in 1999 (SBP, 2005). Since then efforts are afoot to introduce true Islamic-banking instruments. Islamic finance industry has made some progress since 2003. Currently, there are six full-fledged Islamic banks and twelve conventional banks offering Islamic banking branches with a branch network of 336 branches with market share of around 4%. For major products and processes of Islamic finance see, for example, Ayub (2007).

a gradual increase in the share of private banks from none in 1990 to 25.8% in 1995, 30.3% in 2000 to 67.5% in 2004; likewise, the share of state-owned banks in total assets declined from 93.3% in 1990, 59.3% in 1995, 53.2% in 2000 to 22% in 2004 (SBP, 2005).

Secondly, in the aftermath of the nationalization of commercial banks in 1972, considerable distortions were created in the supervisory role of the SBP because monitoring and inspection of state-owned banks was given to the Pakistan Banking Council (PBC), which was formed under the Banks (Nationalization) Act, 1974 to oversee the objectives of nationalization.¹¹ In the 1970s and 1980s, labor unions assumed great significance, especially as collective bargaining agents in seven state-owned banks which enjoyed “absolute public sector ownership”. In 1990 with more than 7000 bank branches all over the country, as compared with only 45 branches of 17 foreign owned banks, state-owned banks were the mainstay for the economy’s banking sector needs. However, politically motivated appointments, directed credit, and swelling of non-performing loans made some of these banks fragile and vulnerable.¹² In February 1993, as part of a self-governance initiative in nationalized commercial banks, some amendments were made in the Banking Companies Ordinance, 1962 aimed at curtailing and making “disruptive union activities” punishable and providing “guidelines for recovery of bad or doubtful loans” (SBP, 2003). The State Bank of Pakistan was awarded partial autonomy in 1994 and complete autonomy in May 1997 when PBC was dissolved. It was at this point that oversized and over-staffed state-owned banks were subjected to restructuring and downsizing, apparently to cut financial intermediation cost and to enhance rate of return on deposits. Under this initiative state-owned banks launched their respective employee separation schemes and eventually 21,996 bank employees (or about 22%), were released under voluntary golden shake-hand schemes between July 1997 and December 1999. To further rationalize the cost structure about 26% of total branches were closed down; some 814 loss making branches were closed down between 1997 and 2000 while 1,122 branches were closed down between 2001 and 2003. Few large banks received major injections to improve their balance sheets while attempting to maintain their financial sustainability.

Finally, the governance of banks was also influenced by merger and acquisitions leading to consolidation of some private and foreign banks. Higher minimum capital requirement set by SBP encouraged merger and acquisition of small and struggling private and foreign banks by their financially superior counterparts. As a result, a total of 12 M&A have occurred between 2000 and 2005, out of which 9 acquisitions were such where foreign banks were merged or acquired mostly by domestic private banks.

The emerging market structure forced rival banks to hire/train highly qualified professional managers and executives who could cope with the new challenges in changing demands of the market. Moreover, fast-track developments in information technology and deployment of customer care services before the rivals gave innovator advantage to forward looking private and foreign banks that gained customer confidence and, in turn, greater market share.

4. The econometric model

We use the cost representation of the stochastic frontier model developed by Battese and Coelli (1995) for the unbalanced panel data that allows time-varying bank effects. We assume that banks are intermediaries of financial services who collect funds from savers/depositors and provide these funds to borrowers. We further assume that banks face exogenously determined factor prices to minimize their total cost. The model may be written as

$$\ln C_{it} = C(y_{it}, w_{it}; \beta) + v_{it} + u_{it} \quad (1)$$

where subscript i indexes a sample bank ($i = 1, \dots, N$), and t indexes time period ($t = 1, \dots, T$)¹³; C_{it} is the observed total cost of production for the i th sample bank in the t th time period; y_{it} is a vector of bank

¹¹ PBC was also responsible for framing recruitment policies, pre- and in-service trainings and modernization schemes of these banks. Some of the PBC functions prescribed in the Act directly conflicted with the role of the SBP.

¹² Burki and Niazi (2009) find that in Pakistan “every 10% increase in share of non-performing to total loans decreases banking efficiency from 6% to 10%”.

¹³ All the banks in our data are not observed for all T time periods in this model.

outputs; w_{it} is a vector of input prices of known functions of cost and other explanatory variables linked with the i th bank at the t th time period; $C(y_{it}, w_{it}; \beta)$ is the assumed functional form; and β is a vector of unknown parameters to be estimated. As usual in frontier literature, the stochastic composite error term in Eq. (1) is decomposed into v_{it} and u_{it} where v_{it} represent the stochastic random error component that captures the effects of exogenous shocks to the cost function due to factors beyond the control of the bank and are assumed to be $iid N(0, \sigma_v^2)$. Moreover, v_{it} is independently distributed of the u_{it} .

The technical inefficiency term, u_{it} , is a non-negative random variable capturing firm- and time-specific cost inefficiency effects reflecting the extent to which the cost of the i th bank at t th time period exceeds the minimum cost defined by the frontier. A higher value of u indicates an increase in technical inefficiency. When u equals zero, the bank is perfectly technically efficient because it is on the cost frontier. We further assume that u_{it} s are independently distributed, such that u_{it} is obtained by truncation at zero. In effect, the technical inefficiency, u_{it} , for each bank in Eq. (1) could be replaced by a linear function of explanatory variables reflecting firm- and time-specific characteristics specified by

$$u_{it} = \delta z_{it} + \varepsilon_{it} \tag{2}$$

where δ is a vector of unknown bank and time-specific parameter estimates associated with technical inefficiency of banks and ε_{it} is an unobservable random variable that is obtained by truncation of the normal distribution with mean zero and variance, σ^2 . The point of truncation occurs at $-\delta z_{it}$ or $\varepsilon_{it} \geq -\delta z_{it}$.

The functional form employed in the empirical analysis is the translog stochastic cost frontier for the panel data written as

$$\begin{aligned} \ln\left(\frac{C_{it}}{w_{Nit}}\right) &= \alpha_0 + \sum_{r=1}^2 \beta_r \ln\left(\frac{w_{rit}}{w_{Nit}}\right) + \sum_{m=1}^2 \alpha_m \ln(y_{mit}) + \sum_{r=1}^2 \sum_{s=1}^2 \beta_{rs} \ln\left(\frac{w_{rit}}{w_{Nit}}\right) \times \ln\left(\frac{w_{sit}}{w_{Nit}}\right) \\ &+ \frac{1}{2} \sum_{m=1}^2 \sum_{n=1}^2 \alpha_{mn} \ln(y_{mit}) \times \ln(y_{nit}) + \sum_{r=1}^2 \sum_{m=1}^2 \gamma_{rm} \ln\left(\frac{w_{rit}}{w_{Nit}}\right) \\ &\times (\ln y_{mit}) + \phi_\tau \tau_{it} + v_{it} + u_{it} \end{aligned} \tag{3}$$

where $\beta_{rs} = \beta_{sr}$ and $\gamma_{rm} = \gamma_{mr}$; m and n denote outputs; r and $s = 1, \dots, N - 1$ denote factor prices; t refers to the time period; τ is a time trend variable for the year of the observation for each bank accounting for the effects of disembodied technological progress. The dependent variable (C) is calculated as the cost of three factors of production, viz., labor, financial capital and operating cost. Linear homogeneity in prices is imposed by dividing price of financial capital (w_3) with total cost (C), price of labor (w_1), and price of operating cost (w_2). The output vector consists of investments (y_1), and loans and advances (y_2).

To test whether bank governance changes have a positive or negative impact on the technical inefficiency of banks, we specify technical inefficiency model given by a linear function of explanatory variables reflecting bank- and time-specific characteristics. To allow the effects of governance change we follow the suggestion of Berger et al. (2005) and include all the relevant effects of different types of governance-change as follows:¹⁴

$$\begin{aligned} u_{it} &= \delta_0 + \sum_{j=1}^2 \delta_j \text{STATIC} + \sum_{k=3}^5 \delta_k \text{SELECTION} + \sum_{l=6}^8 \delta_l \text{SR-DYNAMIC} \\ &+ \sum_{m=9}^{11} \delta_m \text{LR-DYNAMIC} + \delta_{12} \ln(A_{it-1}) + \delta_{13}(\tau_{it}) + \varepsilon_{it} \end{aligned} \tag{4}$$

¹⁴ This approach was developed by Berger et al. (2004) and illustrated by Berger et al. (2005) and Williams and Nguyen (2005).

where STATIC is a vector of three dummy variables for static governance change, e.g., private banks with no-governance change (base category), foreign banks with no-governance change, and state-owned banks with no-governance change; SELECTION is for banks selected for governance change (yes = 1, no = 0), e.g., selected for privatization, selected for restructuring and selected for M&A; SR_DYNAMIC depicts short-run effects of governance change on each bank (yes = 1, no = 0), e.g., underwent privatization, underwent restructuring and underwent M&A; and LR_DYNAMIC is for long-run effects of governance change, e.g., years after privatization, years after restructuring and years after M&A, (see Table 1

for more details). We also include lagged assets, $\ln(A_{it-1})$, to capture the effects of scale of operations on banking inefficiency, while τ specifies time-varying inefficiency effects in the inefficiency effects model.

We simultaneously estimate the stochastic frontier model in Eq. (3), along with technical inefficiency effects model in Eq. (4) by maximizing the likelihood function given by

$$\ln L_{it} = -\frac{1}{2} [\ln(2\pi) + \ln(\sigma^2)] - \frac{1}{2\sigma^2} [c_{it} - f(w_{it}, y_{it}, \tau_{it}; \beta) + Z_{it}\delta]^2 - \ln[\Phi(m_{it})] + \ln[\Phi(m_{it}^*)]$$

where β , δ , γ and σ^2 are the estimated parameters, $f(w_i, y_i, \tau_i; \beta)$ is the stochastic cost frontier, $m_i = Z_i\delta/(\gamma\sigma^2)^{1/2}$, $\Phi(\cdot)$ denotes the cumulative standard normal distribution function, $m_i^* = \{(1 - \gamma)Z_i\delta - \gamma[c_i - f(w_i, y_i, \tau_i; \beta)]\}/[(\gamma(1 - \gamma)\sigma^2)]^{1/2}$, $\gamma = [\sigma_u^2/\sigma_v^2]$.

5. Data description

Some previous studies on Pakistan's banking sector have taken data from the State Bank of Pakistan's annual publication *Banking Statistics of Pakistan*. However, these studies have identified several drawbacks in this data including inappropriate aggregation of data on assets, liabilities, costs and revenues (see, for example, Patti & Hardy, 2005). Therefore, for this study, we collected data from balance sheet and income statements of all the commercial banks that operated in Pakistan from 1991 to 2005. We constructed an unbalanced panel data of 46 banks over the sample period yielding 490 observations. Due to opening of new banks, bank closures, and merger and acquisition activity during the sample period, the number of observations vary over time, e.g., 23 banks in 1991; 36 banks in 1992 to 1994; 38 banks in 1995; 39 banks in 1996, 1999 and 2000; 40 banks in 1997 and 1998; 35 banks in 2001; 34 banks in 2002 and 2003; 33 banks in 2005.

Although there is no consensus in the banking literature on the definition and measurement of bank inputs and outputs (Sealey & Lindley, 1977), yet researchers often adopt the intermediation and production approaches to define inputs and outputs. The intermediation approach takes the view that banks are intermediaries of financial services; they collect purchased funds and convert them into loans, investments and other assets. Under this approach, the total cost is determined by including interest cost along with other operating cost. By contrast, the production approach is premised on the assumption that banks produce loans and deposit account services by using labor and capital as key inputs.

We adopt the intermediation approach to define bank inputs and outputs because interest cost accounts for more than 70% of the total cost of banks in our sample.¹⁵ As noted above, we use two output variables, viz., investments (y_1), and loans and advances (y_2), and three prices of variable inputs, viz., price of labor (w_1), price of operating cost (w_2), and price of financial capital (w_3). The definition of variables in the cost function and inefficiency effects equation is given in Table 1 whereas Table 2 provides summary statistics of these variables.

¹⁵ The intermediation approach has been used by several other studies including those on multi-period efficiency of banks (see for instance Berger & Mester, 1997; Isik & Hassan, 2002; Patti & Hardy, 2005; Havrylychuk, 2006; Burki & Niazi, 2009 among many others).

Table 1
Definition of the variables.

Variable name	Definition
Frontier cost function:	
Total cost (C)	Wage bill including directors fee + depreciation on and repair to bank's property + operating cost + interest paid on deposits and borrowing.
Investments (y_1)	The amount of investment made by the bank consisting of government securities, treasury bills, shares fully paid-up, debentures, bonds and other investments, like NIT and gold.
Loans & advances (y_2)	The value of loans and advances, which include loans, cash credits, overdrafts and bills discounted and purchased.
Price of labor (w_1)	Total expenditure on employees' salary including directors' fees divided by the total number of employees.
Price of operating cost (w_2)	Total operating cost divided by total assets. Operating cost includes rent, insurance, law charges, postage, telegrams, stamps, auditor's fee, stationary, printing and advertisement, etc.
Price of financial capital (w_3)	Total interest paid on deposits and borrowing divided by total deposits.
Time trend (τ)	A simple time trend variable indicating the year of observation involved.
Technical inefficiency model:	
<i>Static variables:</i>	
Private bank with no-governance change (z_0)	Dummy equals 1 for all periods for a private bank if it underwent no governance change over the 1991–2005 interval and equals 0 for all periods otherwise.
Foreign bank with no-governance change (z_1)	Dummy equals 1 for all periods for a foreign owned bank if it underwent no governance change over the 1991–2005 interval and equals 0 for all periods otherwise.
State-owned banks with no-governance change (z_2)	Dummy equals 1 for all periods for a state-owned bank if it underwent no governance change over the 1991–2005 interval and equals 0 for all periods otherwise.
<i>Selection variables:</i>	
Selected for privatization (z_3)	Dummy equals 1 for all periods for a bank that was selected for privatization over the 1991–2005 interval and equals 0 for all periods otherwise. (Note: If a bank was privatized after restructuring, it is set to equal 1 because privatization is considered a dominant event)
Selected for restructuring (z_4)	Dummy equals 1 for all periods for a bank that was selected for government restructuring (e.g., downsizing, capital/equity injection, etc.) over the 1991–2005 interval and equals 0 for all periods otherwise. (Note: If a bank was privatized after restructuring, it is set to equal 0 because privatization is considered a dominant event)
Selected for M&A (z_5)	Dummy equals 1 for all periods for a bank that was selected for domestic or foreign acquisition or merger over the 1991–2005 interval and equals 0 for all periods otherwise.
<i>Short-run dynamic variables:</i>	
Underwent privatization (z_6)	Dummy equals 1 for all periods following privatization of a bank starting in the next year after privatization, equals 0 for the year of the privatization and prior to the privatization. Banks that did not undergo privatization are set to equal 0 for all periods.
Underwent restructuring (z_7)	Dummy equals 1 for all periods following restructuring of a bank starting in the next year after restructuring, equals 0 for the year of restructuring and prior to the restructuring. Banks that did not undergo restructuring are set to equal 0 for all periods.
Underwent M&A (z_8)	Dummy equals 1 for all periods following merger or acquisition of a bank starting in the next year after M&A, equals 0 for the year of M&A and prior to M&A. Banks that did not undergo M&A are set to equal 0 for all periods.

Table 1 (Continued)

Variable name	Definition
<i>Long-run dynamic variables:</i>	
Years after privatization (z_9)	Number of years since privatization of the bank took place. Set to equal 0 for the year of and the years prior to privatization and starts with 1 for the first year after privatization, 2 for the second year and so on. Banks that did not undergo privatization are set to equal 0 for all periods.
Years after restructuring (z_{10})	Number of years since restructuring of the bank took place. Set to equal 0 for the year of and the years prior to restructuring, and starts with 1 for the first year after restructuring, 2 for the second year and so on. Banks that did not undergo restructuring are set to equal 0 for all periods.
Years after M&A (z_{11})	Number of years since M&A of the bank took place. Set to equal 0 for the year of and the years prior to M&A, and starts with 1 for the first year after M&A, 2 for the second year and so on. Banks that did not undergo M&A are set to equal 0 for all periods.
<i>Other control variables:</i>	
Log lagged assets ($\ln A_{t-1}$)	Natural log of bank assets after taking one year lag for each bank in constant 1999–2000 Pak rupees.
Time trend (τ)	A simple time trend variable indicating the year of observation involved.

6. Estimation results

The maximum likelihood estimates of the parameters of the translog cost function and the inefficiency model are estimated simultaneously using the procedure in computer program FRONTIER 4.1 (Coelli, 1996). Hypothesis testing regarding functional forms and specifications is conducted on the basis of generalized likelihood ratio tests,¹⁶ which have approximately a χ^2 distribution, except cases where the null hypothesis also involves the restrictions of $\gamma = 0$. In such cases, the asymptotic distribution of the likelihood ratio test statistic is a mixed- χ^2 distribution and therefore the appropriate critical values are drawn from Kodde and Palm (1986). Table 3 reports the results of the hypothesis tests regarding functional forms and model specifications with generalized likelihood ratio tests.

The theoretical restrictions for symmetry and linear homogeneity in input prices are imposed *a priori* on the translog cost frontier. The null hypothesis that the correct functional form for the cost function is Cobb–Douglas is rejected in favor of the translog at the 1% level of significance (Table 3). We do not restrict the cost frontier to be Hicks neutral *a priori*. However, the generalized likelihood ratio test in Table 3 indicates that the model in (3) and (4) is best specified by Hicks-neutral technological change.¹⁷ These results indicate that despite technological change, the shares of labor, financial capital and operating costs remain unchanged over the entire sample. Table 3 also reports the generalized likelihood ratio test that technical inefficiency effects are absent ($\gamma = \delta_0 = \dots = \delta_{13} = 0$), which is rejected at the 1% level of significance indicating that most of the banks in the sample are operating above the cost frontier. If the parameter γ equals zero, then it implies that the variance of u_{it} equals zero and the model reduces to a mean response function. In other words, the traditional average cost representation of banking technology is not adequate because a major portion of cost variability among the banks in the sample is explained by the existing differences in the degree of technical inefficiency. Further, the null hypothesis, $H_0: \delta_1 = \delta_{13} = 0$, entails that all the explanatory variables in the inefficiency model are jointly zero is also rejected. This result indicates that the linear explanatory variables reflecting the

¹⁶ The generalized likelihood-ratio test is defined by $LR = -2\{\ln[LH_0/LH_1]\} = -2\{\ln[L(H_0)] - \ln[L(H_1)]\}$ where $L(H_0)$ and $L(H_1)$ denote the values of the likelihood function under the null and alternative hypothesis, respectively (Coelli et al., 1998). Under the null hypothesis the test statistic has approximately chi-square distribution with parameters equal to difference between the parameters involved in the null and alternative hypothesis.

¹⁷ The hypothesis that square-terms of time trend variable, τ^2 , in the translog and inefficiency equations are jointly zero cannot be rejected at the 1% level of significance.

Table 2

Summary statistics of the variables employed in the cost function and inefficiency model.

Variable	Mean	Std. Dev	(in Pak rupees)	
			Minimum	Maximum
<i>Frontier cost function:</i>				
Total cost (C)	2.95×10^9	5.40×10^9	1.91×10^7	3.63×10^{10}
Investments (y_1)	1.21×10^{10}	2.40×10^{10}	16343	1.66×10^{11}
Loans & advances (y_2)	2.07×10^{10}	3.92×10^{10}	3577888	3.17×10^{11}
Price of labor (w_1)	388649	302286	102160	2198541
Price of operating cost (w_2)	0.091176	0.082175	0.000328	0.88786
Price of financial capital (w_3)	0.006738	0.009904	0.001188	0.12192
<i>Technical inefficiency model:</i>				
Private bank with no-governance change (z_0)	0.26866	0.44368	0	1
Foreign bank with no-governance change (z_1)	0.26767	0.44322	0	1
State-owned banks with no-governance change (z_2)	0.11777	0.32268	0	1
Selected for privatization (z_3)	0.11349	0.31753	0	1
Selected for restructuring (z_4)	0.13993	0.34723	0	1
Selected for M&A (z_5)	0.16045	0.36736	0	1
Underwent privatization (z_6)	0.006424	0.079978	0	1
Underwent restructuring (z_7)	0.029979	0.17071	0	1
Underwent M&A (z_8)	0.036403	0.18749	0	1
Years after privatization (z_9)	0.27409	1.51736	0	14
Years after restructuring (z_{10})	0.18415	0.85186	0	6
Years after M&A (z_{11})	0.077088	0.48414	0	5
Log lagged asset ($\ln A_{t-1}$)	23.2917	1.57819	19.51499	26.87995
Time trend (τ)	7.66809	3.83947	1	14
No. of observations	490	–	–	–

effects of bank-specific characteristics on cost inefficiency is significant even though the individual parameters of some variables may not be significant.

6.1. Cost frontier results

The estimated parameters of the Hicks-neutral translog cost frontier, constrained to satisfy symmetry and homogeneity in prices, and the correlates of X-inefficiency are presented in Table 4, column 1 (full model). In this model, we include all static and dynamic ownership reform variables on the three attributes of bank governance considered in this paper. Most of the estimated parameters in the translog cost frontier are statistically significant at least at the 95% confidence level. Monotonicity in factor prices also holds since all estimated factor shares are positive both at their mean values and at each observation. The signs of all first order parameters are positive as expected and statistically significant, which indicate that the banking costs in our sample increase with increasing factor prices and outputs. The curvature conditions for the estimated factor demand are satisfied at the point of approximation as indicated by the negatively sloped factor demands. The estimated measure of returns to scale ($1/\sum \alpha_m$) at the point of approximation is 0.965 and is statistically significant, which indicates

Table 3

Model specification tests.

Null hypothesis	Critical value ($\alpha = 0.01$)	Test statistics	Decision
H_0 : Cobb–Douglas vs. translog cost	23.21	352.3	Reject H_0
H_0 : Technical change is Hicks neutral	15.08	2.00	Fail to reject H_0
H_0 : $\gamma = \delta_0 = \dots = \delta_{13} = 0$	28.48 ^a	46.03	Reject H_0
H_0 : $\delta_1 = \dots = \delta_{13} = 0$	27.67	36.68	Reject H_0

^a Critical values are taken from Table 1 of Kodde and Palm (1986) using 1% level of significance.

Table 4
 Estimation results of stochastic cost frontier and technical inefficiency model.

Variable	Parameter	Robustness check in full model				
		Full model (1)	With privatization variables ^a (2)	With restructuring variables ^b (3)	With M&A variables ^c (4)	Without LR.DYNAMIC variables ^d (5)
<i>Frontier cost function: (dependent variable is $\ln C$)</i>						
Constant	α_0	0.449*** (13.83)	0.458*** (12.98)	0.459*** (12.88)	0.476*** (15.53)	0.479*** (14.14)
$\ln y_1$	α_1	0.485*** (14.91)	0.484*** (15.05)	0.486*** (15.05)	0.482*** (15.12)	0.487*** (15.58)
$\ln y_2$	α_2	0.551*** (16.74)	0.552*** (16.99)	0.555*** (17.00)	0.556*** (17.37)	0.550*** (17.14)
$\ln w_1$	β_1	0.066** (2.11)	0.059** (2.04)	0.061** (1.99)	0.064** (2.03)	0.057** (1.93)
$\ln w_3$	β_3	0.262*** (8.67)	0.261*** (9.06)	0.268*** (8.99)	0.269*** (8.90)	0.270*** (9.41)
τ	ϕ_τ	0.004 (0.62)	0.003 (0.50)	0.005 (0.81)	0.002 (0.34)	0.002 (0.46)
$\ln y_1^2$	α_{11}	0.137*** (15.75)	0.136*** (15.57)	0.137*** (15.50)	0.136*** (15.51)	0.137*** (16.03)
$\ln y_2^2$	α_{22}	0.140*** (12.57)	0.139*** (12.45)	0.139*** (12.65)	0.141*** (12.90)	0.138*** (12.71)
$\ln y_1 \ln y_2$	α_{12}	-0.115*** (-12.41)	-0.113*** (-12.26)	-0.113*** (-12.20)	-0.114*** (-12.46)	-0.114*** (-12.37)
$\ln w_1^2$	β_{11}	0.020 (1.15)	0.021 (1.26)	0.023 (1.35)	0.014 (0.80)	0.020 (1.28)
$\ln w_3^2$	β_{33}	-0.008 (-0.34)	-0.003 (-0.10)	-0.008 (-0.33)	-0.016 (-0.70)	-0.007 (-0.30)
$\ln w_1 \ln w_3$	β_{13}	-0.052** (-2.50)	-0.055*** (-2.67)	-0.055*** (-2.66)	-0.045** (-2.21)	-0.052*** (-2.64)
$\ln w_1 \ln y_1$	γ_{11}	0.018 (1.36)	0.015 (1.08)	0.015 (1.12)	0.016 (1.17)	0.017 (1.28)
$\ln w_3 \ln y_1$	γ_{31}	0.003 (0.15)	0.006 (0.32)	0.005 (0.31)	0.005 (0.31)	0.004 (0.22)
$\ln w_1 \ln y_2$	γ_{12}	-0.074*** (-4.51)	-0.071*** (-4.53)	-0.071*** (-4.38)	-0.071*** (-4.37)	-0.074*** (-4.70)
$\ln w_3 \ln y_2$	γ_{32}	0.024 (1.55)	0.020 (1.28)	0.024 (1.51)	0.024 (1.51)	0.023 (1.52)
<i>Technical inefficiency model: (dependent variable is u_{it})</i>						
Constant	δ_0	-2.523*** (-2.09)	-1.346 (-1.22)	-2.903** (-2.16)	-3.959* (-1.89)	-2.68*** (-2.90)
Foreign bank with no-governance change	δ_1	0.673*** (3.00)	0.632*** (2.95)	0.442*** (2.58)	1.392** (2.46)	1.304*** (3.16)
State-owned banks with no-governance change	δ_2	0.953*** (3.26)	0.949*** (3.16)	0.798*** (2.84)	1.721** (2.52)	1.782*** (3.35)
Selected for privatization	δ_3	0.395 (1.32)	0.274 (0.95)	- -	- -	0.938** (2.27)
Selected for restructuring	δ_4	-0.403 (-1.39)	- -	-0.568* (-1.78)	- -	-1.011** (-2.54)
Selected for M&A	δ_5	0.673*** (2.78)	- -	- -	1.380** (2.35)	1.259*** (3.06)
Underwent privatization	δ_6	3.826** (2.53)	1.860*** (2.67)	- -	- -	0.937 (1.35)
Underwent restructuring	δ_7	1.255 (1.58)	- -	1.094 (1.52)	- -	0.083 (0.09)
Underwent M&A	δ_8	-0.790 (-0.83)	- -	- -	-2.761* (-1.67)	-2.717* (-1.85)
Years after privatization	δ_9	0.048 (0.59)	-0.256** (-2.21)	- -	- -	- -

Table 4 (Continued)

Variable	Parameter	Robustness check in full model				
		Full model	With privatization variables ^a	With restructuring variables ^b	With M&A variables ^c	Without LR_DYNAMIC variables ^d
		(1)	(2)	(3)	(4)	(5)
Years after restructuring	δ_{10}	-0.669** (-2.23)	-	-0.496* (-1.74)	-	-
Years after M&A	δ_{11}	-0.060 (-0.19)	-	-	-0.022 (-0.09)	-
Log lagged assets	δ_{12}	0.052 (1.15)	0.025 (0.56)	0.066 (1.39)	0.027 (0.60)	0.062 (1.30)
Time trend	δ_{13}	-0.057*** (-2.61)	-0.091*** (-3.57)	-0.097*** (-3.69)	-0.101*** (-3.13)	-0.089*** (-3.59)
$\sigma^2 = \sigma_u^2 + \sigma_v^2$	-	0.402*** (6.06)	0.564*** (4.68)	0.473*** (4.56)	0.735*** (3.22)	0.599*** (4.33)
$\gamma = \sigma_u^2 / (\sigma_u^2 + \sigma_v^2)$	-	0.861*** (28.63)	0.899*** (38.57)	0.880*** (25.47)	0.918*** (32.70)	0.898*** (39.97)
Log-likelihood	-	-153.38	-157.61	-158.00	-154.18	-153.45
Mean efficiency	-	1.361	1.345	1.354	1.330	1.323
No. of observations	<i>N</i>	490	490	490	490	490

All models are estimated with maximum likelihood.

^a Includes only privatization variables; all restructuring and M&A variables in full model are deleted.

^b Includes only restructuring variables; all privatization and M&A variables in full model are deleted.

^c Includes only M&A variables; all privatization and restructuring variables in full model are deleted.

^d Deletes all long-run dynamic variables in full model.

* Indicate statistically significant at the 90% confidence level.

** Indicate statistically significant at the 95% confidence level.

*** Indicate statistically significant at the 99% confidence level.

that a proportionate increase in all banking inputs brings about a proportionate increase in banking output. Statistically insignificant parameter estimate for τ in the frontier cost model indicates that these banks do not experience an annual rate of increase in banking costs.

6.2. Technical inefficiency effects of bank governance reforms

Our primary interest in this paper is to estimate the differential impact of bank governance reforms on X-inefficiency. The estimate for γ in full model (column 1, bottom panel) is 0.861 with *t*-value of 28.63, which indicates that most of the residual variation is explained by the inefficiency effects. The mean cost efficiency of banks is 1.361, which indicates that cost of production exceeds the minimum level frontier by 36% due to X-inefficiency. Since the dependent variable is technical inefficiency, a negative (positive) sign on coefficient indicates decrease (increase) in technical inefficiency, or increase (decrease) in efficiency. The estimate for time trend variable, $\delta_{13} = -0.057$, implies that, holding all else as constant, inefficiency of banks continues to decrease at the rate of 5.7% per annum throughout the 15-year period. In other words, banks move closer to their efficient cost frontier during the study period. We also find that size of a bank is not significantly associated with its X-inefficiency index in our sample.

6.3. Performance effects on domestic and foreign banks

The estimated coefficients δ_1 and δ_2 (static governance variables) indicate long-term effect of constant foreign and state-ownership vis-à-vis private banks. We find that on average private banks (with no-governance change) are significantly more efficient than foreign and state-owned banks (with no-governance change) since both δ_1 and δ_2 are positive. This result is not altogether surprising given the finding (see, Burki & Niazi, 2009) that the relative cost efficiency of foreign banks had already started falling in the post-1997 period vis-à-vis private banks. Further the difference in the estimated delta

($\delta_2 - \delta_1 = 0.28$) shows that state-owned banks are least efficient; this result compares favorably with other studies (e.g., Berger et al., 2005; Isik & Hassan, 2002; Patti & Hardy, 2005, Burki & Niazi, 2009). Hence the regulators in Pakistan may want to continue with their policy of market liberalization aimed at providing a level playing field both to domestic and foreign banks.

6.4. Performance effects due to privatization

We begin by considering pre-governance change difference between selected banks for privatization in relation to private banks (not selected for governance change). We find that the selected state-owned banks are not amongst the least efficient of the banks; technical inefficiency of selected banks is statistically equal to private banks in reference category ($\delta_3 = 0.395, t = 1.32$). This conclusion is also supported by Boubakri et al. (2005b).¹⁸ There may be two reasons for relatively good performance demonstrated by selected state-owned banks. Firstly, the sale and control of worst performing banks cannot be easily shifted to the private sector; hence relatively better performing state-owned banks are the ones that go up for sale first. Secondly, even poorly performing state-owned banks undergo a preparatory and restructuring phase prior to their privatization.

We also examine the dynamic performance effects of privatization. Earlier evidence from developing countries shows mixed results. Some studies find that privatization significantly improves performance of the privatized banks (e.g., Boubakri et al., 2005a) while others show that gains from privatization are not immediate, or performance may even fall temporarily (e.g., Berger et al., 2005; Boubakri et al., 2005b; Clarke et al., 2005). In this study, our data supports the results consistent with the latter, but unlike Berger et al. (2005) we support the conclusion that cost-oriented performance of banks indeed improves in our sample.

This raises the possibility that the privatized banks may experience different efficiency trends in the short- and the long-term. Therefore, we estimate these effects separately. The short-term performance effects are represented by δ_6 and the long-term effects are distinguished by δ_9 . The main finding here is that privatization leads to substantial short-term performance loss, but this performance deterioration reverses in the long-term.¹⁹ For example, the large and significantly positive parameter value, $\delta_6 = 3.83, t = 2.53$, implies that the privatized banks experience a major and significant increase in X-inefficiency in the years after privatization as compared with their own performance over the 1991–2005 period ($\delta_1 = 0.395, t = 1.32$). Because the difference in estimated delta ($\delta_6 - \delta_3$) is 3.435 in the same direction, it suggests a major increase in relative inefficiency. The evidence that short-term efficiency loss to the privatized banks reverses in the long-term is illustrated by a much smaller and statistically positively insignificant delta coefficient ($\delta_9 = 0.048, t = 0.59$). Since the difference in estimated delta $\delta_9 - \delta_6$ is -3.782 in the opposite direction, it suggests that if the current trend continues the efficiency gains to the privatized banks are likely to accrue even in the near future. Furthermore, the post- and pre-privatization level performance is measured by the difference in the estimated delta of -0.347 (i.e., $-3.782 + 3.435 = -0.347$) moving in the opposite direction, which indicates that post-privatization efficiency improvement is even more than the pre-privatization level performance. A priori expectation of improvement in efficiency of the privatized banks perhaps is also due to efficient management and recapitalization of these banks before their sale.

In sum, these results suggest that government policy makers in Pakistan have considerable options to continue with the policy of privatization without much worry about the short-term and long-term performance effects on these banks.

6.5. Performance effects of restructuring of state-owned banks

Equivalent to variables in the performance effects of privatization, we consider the coefficients δ_4, δ_7 and δ_{10} , representing pre- and post-governance change effects of bank restructuring. Turning to

¹⁸ Patti and Hardy (2005) show that the banks selected for privatization in Pakistan depicted the lowest cost and profit efficiency prior to privatization, but their sample includes only two banks that were privatized in 1991–1992.

¹⁹ By contrast, Otchere (2005) and Clarke et al. (2005) find negligible efficiency gains after divestiture of state-owned banks.

pre-governance change differentials in performance of selected banks, we find that their performance is statistically not differentiable from the private banks ($\delta_4 = -0.403$, $t = -1.39$). These results tend to reveal that X-inefficiency performance of the selected banks generally corresponds to the performance of private banks over the 1991–2005 periods, except for the years when they were subject to government restructuring on account of temporary financial difficulties.

Then we ask how government restructuring influences the short-term and the long-term performance of these banks? Our results suggest that technical inefficiency of these banks increases in the short-run (since the estimated coefficient $\delta_7 = 1.255$ is positive and large), but inefficiency substantially decreases (since the estimated coefficient $\delta_{10} = -0.669$, $t = -2.23$ is negative and statistically significant) after the restructuring of these banks. Somewhat contrasting conclusions were drawn by Williams and Nguyen (2005) for the restructured banks in East Asian countries because they were unable to find short run or long run improvement in efficiency in these banks.

In sum, these results suggest that government restructuring brings about increase in X-inefficiency in the short-term; however, any short-term efficiency loss due to restructuring, not only, reverses in the long-term, but also the gain in efficiency that accrues in the long-term is substantial. In a dynamic setting, these results reveal that if the current trend continues the long-term efficiency gain is likely to accrue even in the future.

6.6. Performance effects of policy reforms in M&A

In this sub-section, we ask how governance change due to M&A affects performance of the selected banks. To characterize the efficiency effects due to M&A, we first consider the coefficient δ_5 , which gives the pre-governance change performance picture of the banks selected for M&A. Table 4 shows that the coefficient δ_5 is significantly positively correlated with X-inefficiency index ($\delta_{10} = 0.673$, $t = 2.78$), indicating that banks selected for M&A are technically more inefficient than private banks. This result corroborates the general hypothesis that poorly performing banks are more likely to go through M&A; a finding consistent with the results of Crespi et al. (2004), who also find that pre-merger efficiency of merged or acquired banks is relatively low. The fact that banks selected for M&A were generally small domestic or foreign banks suggests that these banks were either uninformed about the state of the market or they possessed weak asset base due to which they failed to withstand the onslaught of rising competition in the banking industry. For example, foreign banks selected for M&A were those who were in trouble after the freezing of foreign currency accounts in 1998, leading to a sharp fall in their currency deposits and, in turn, contraction in their assets.²⁰

The short-term effect of M&A ($\delta_8 = -0.79$, $t = -0.83$) entails that following governance change, a decrease in X-inefficiency overwhelms the increase in X-inefficiency witnessed in pre-governance change era; although no statistical significance could be attached to these results. Continuing on this, the coefficient on the long-run effect ($\delta_{11} = -0.06$, $t = -0.19$) further suggests that if the trend continues, this group of banks is expected to hold on to most of the improvement in X-inefficiency and not return to their previous levels of X-inefficiency for a long time. These results also provide some contrast to the effects of M&A on cost efficiency in other countries.²¹

6.7. Robustness check of the results

As discussed above, our full model includes all bank governance reform variables. However, to separate the effect of each factor it is important to test alternative empirical specifications to explore how robust the results are to these specifications. Therefore, we present four different scenarios in the sensitivity analysis where we test each type of governance change in a separate model as shown in Table 4, columns 2–5. In column 2, we consider a specification where only privatization variables are included in the technical inefficiency effects model; all other attributes of bank governance reforms

²⁰ Pakistan's nuclear detonation in May 1998 was followed by international economic sanctions forcing the government to freeze foreign currency accounts in all Pakistani banks.

²¹ See Amel et al. (2004) for a review of the international evidence on mergers and acquisitions.

are excluded. In column 3, we explore the performance effects of restructuring variables by excluding all other controls. In column 4, we allow only static and dynamic M&A variables by excluding all other governance attributes. Finally, in column 5 we include all effects of bank governance reforms, except long-term effects.

Empirical results of the sensitivity analysis show that while the coefficients of most ownership reform variables are highly robust across alternative specifications, there is one important instance where there is a sign change. We note that Years after Privatization variable (δ_9) is sensitive to the inclusion of selected for M&A variable (δ_5) in the full model. This is so because one of the privatized banks was also selected for M&A in the latter period due to which the true effect of δ_9 appears suppressed in the full model. If true, this result signals that in the long-run, privatization triggers a major decrease in technical inefficiency of these banks. In other words, the magnitude of improvement in performance in the long run is much bigger than suggested by the results of the full model.

7. Conclusions

In this paper, we study the performance effects of bank governance reforms in Pakistan. We use the stochastic frontier and technical inefficiency effects model on unbalanced panel data of 46 banks from 1991 to 2005. Unlike many previous studies, we adopt an empirical framework proposed by Berger et al. (2005) that allows us to control for inter-bank heterogeneity in the cost structures of the banks. Our objective in this paper was to evaluate the effects of bank governance reforms on efficiency of domestic and foreign banks by considering static, selection, short-term dynamic and long-run dynamic effects of privatization, restructuring and M&A which took place over the last 20 years in the wake of financial sector reforms in Pakistan. We find that the cost of production of banks exceeds their minimum level frontier, as indicated by the mean cost inefficiency of 36%. X-inefficiency of banks decreases overtime at the rate of 5.7% per annum, which assures, in general, that banks continue to improve their performance over the reform period.

Our results indicate that, on average, private banks demonstrate highest level of cost efficiency, followed by foreign, and then state-owned banks. These results support the perceived wisdom that the policy of bank privatization adopted in the country is duly justified. Like most papers that use the data of transitional and developing countries, spread over a number of years, this paper also shows that the performance effects due to bank governance reforms do not happen uniformly. That is, the static and dynamic governance changes lead to different short-term and long-term efficiency trends. In other words, the short-term efficiency gains (losses) do not preclude the possibility of a reversal in the observed trend in the long-term.

We then show that privatization of state-owned banks was consistently concentrated among banks that were already good performers while worst performing state-owned banks were subject to a preparatory and restructuring phase prior to their privatization. While privatization and government restructuring of these banks led to substantial short-term efficiency losses for the selected banks, a dramatic reversal in this trend took place in the long-term when the privatized banks experienced large efficiency gains. Our results further suggest that after a time lag of a few years, post-privatization performance of these banks even exceeds their pre-privatization level performance. These results reinforce our earlier conclusion that the policy of bank privatization in Pakistan is justified on economic grounds. Continuation of the privatization policy in Pakistan has merit. This should mean that, *ceteris paribus*, more efficiency gains are likely to accrue to the privatized banks. The scope of reforms in Pakistan corresponds with many other developing countries with prevalence of government-owned, domestic private and foreign banks. The reforms in Pakistan are quite representative of the structural change other developing countries may be compelled to carry out in order to liberalize their banking sectors to cope with the challenges of globalization.

We also investigate whether M&A in a developing country setting allows performance gains to the banks that are subject to this form of governance change. Our results suggest that banks selected for M&A are small in size or poor performing, but following ownership change they increase their technical efficiency. Moreover, M&A efficiency gains of selected banks overwhelm increasing inefficiency levels of pre-governance change period. The results predict that the banks subjected to M&A are expected to hold on to improvements in their X-inefficiency levels for a long time. The paper shares the premise

of Berger et al. (2005) that all the relevant governance change variables must be included in the same empirical model because the extent of this bias is nontrivial to be ignored in this literature.

In short, the findings of this paper suggest that while banking reforms in Pakistan have generally improved banking sector performance, the winners from the reforms are the privatized banks, and private banks selected for M&A, whose post-governance-change efficiency levels have enabled them to exploit new profit making opportunities. An eventual decrease in profits should be expected with further consolidation of the banking industry, but this is likely to happen much more slowly than the present gains in efficiency.

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