

Are foreign banks the efficiency benchmark in China's banking sector?

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Abstract

Since the end of 2006, wholly foreign-owned banks (WFOBs) in China have been extended national treatment. Divergent perspectives have been offered regarding the likely outcome that direct competition between WFOBs and domestic banks (DBs) will have. This paper seeks to shed light on the impact of market entry by WFOBs by using data envelopment analysis (DEA) to compare the technical, allocative and cost efficiency of 17 leading WFOBs and DBs at year-end 2007. The results indicate that while both groups have similar levels of technical efficiency, WFOBs lag behind DBs with respect to cost efficiency because they use a less than optimal fixed asset / employee ratio. These findings suggest that the solvency fears sometimes expressed for DBs as a result of direct competition with WFOBs should not be overstated.

JEL classifications – F23,G21, G28

Keywords: China, domestic banks, wholly foreign-owned banks, efficiency

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1. Introduction

The reform of China's banking sector has lagged behind that of other sectors of the economy. In marked contrast to the manufacturing sector, during the 1980s and 1990s government involvement in the banking sector, in terms of ownership and regulation, was ubiquitous and it was off limits to foreign participation. Foreign investors were barred from taking equity stakes in domestic banks (DBs) and while wholly foreign owned banks (WFOBs) existed, their operations were highly circumscribed. They were not, for example, permitted to accept deposits or make loans denominated in RMB. Such a state of affairs was hardly conducive to bank efficiency and led to *The Economist* (1998) contending that China had "The worst banking system in Asia". Against this background, WTO entry in 2001 was a watershed event. As part of its accession agreement, China agreed to allow foreign investors the right to purchase minority equity stakes in DBs. China also agreed to extend national treatment to WFOBs after a five year phase in period. Enabling legislation was subsequently issued at the end of 2006. The main requirement that this legislation imposed on WFOBs was that in order to operate with national treatment, they needed to incorporate locally (China Daily, 2006). These policy changes have dramatically changed the landscape of China's banking sector. Many of China's DBs, large and small, now have foreign equity partners (see Leigh and Podpiera, 2006). Several WFOBs, energised by the extension of national treatment, have also been busy rolling out their own branch networks. HSBC (2008) reported that at the end of the first quarter 2008, there was a total of 21 locally incorporated WFOBs that together owned 276 branch outlets. However, nearly 70% of these were owned by just five banks – HSBC (24%), Bank of East Asia (17%), Standard Chartered (11%), Hang Seng Bank (8%) and Citibank (8%). In a recent survey of 42 WFOBs in China in early 2008, which included some banks not yet locally incorporated, respondents reported to employing more than 27,000 people, an increase of more than 10,000 over the preceding year (PWC, 2008). Although such numbers point to WFOBs expanding rapidly, they are growing from a small base. The latest data from the China Banking Regulatory Commission (CBRC) show that at the end of the third quarter 2008 WFOBs accounted for just 2.34% of total banking sector assets.

Divergent perspectives have been offered regarding the likely impact that direct competition between WFOBs and DBs will have now that the former has been extended national treatment. One sees WFOBs rapidly acquiring market share at the expense of DBs, and in so doing, potentially even undermining their solvency. According to this view, the competitive advantage of WFOBs is driven by having better technology, less historical baggage¹ and superior global connections. A recent paper that espouses this view is Xu and Lin (2007). They conclude (Xu and Lin, 2007, p.885),

“...it is unlikely that Chinese banks can compete against their foreign counterparts in the short run. The increase in competition from foreign banks will therefore exert further pressure on the losses that Chinese banks have experienced in recent years. Since domestic banks are already in poor financial health due to large bad debts, low efficiency, and poor management, the losses of low-cost deposits and quality loans to the foreign competitors will require even larger regular capital injections from central government. The only way to avoid a banking crisis in the short run it seems is more government bailouts in the name of financial stability and social harmony”.

Others, however, have pointed out that while WFOBs may well have a technological advantage over DBs, they are at a disadvantage in other areas. Bonin and Huang (2002) considered the impact that foreign bank entry had in the transitional economies of Central Europe in order to shed light on what might be expected in China. They report that WFOBs were not able to attain a sizeable market share until there was large scale privatization of DBs in these countries. China has no plans to undertake large scale privatisation in the banking sector, nor do its WTO commitments require it to. The limited market share of WFOBs prior to the privatization of DBs in these countries chiefly reflected the fact that as new entrants WFOBs suffered from not having comprehensive branch networks. Bonin and Huang (2002, p.1082) conclude,

“Most importantly, the experiences of the Central European countries demonstrate that competitive pressure from foreign entry evolves only gradually and depends on the foreign banks’ share of credit markets becoming significantly large. Hence, domestic banks have a window of opportunity to adjust to competition. In a large, relatively closed economy such as China, the adjustment period is likely to be even longer as the competitive pressure will evolve even more gradually and be managed by the authorities. Furthermore, the eventual outcome need not involve market

¹ For example, some DBs have accumulated non-performing assets as a result of past policy lending.

dominance of the banking sector by foreign banks as the situation in many large countries with open capital markets demonstrates.”

Leung and Chan (2006) also note the disadvantage that WFOBs suffer with respect to not having comprehensive branch networks. They further add that while DBs may once have been highly inefficient, they have improved considerably. In particular, they emphasize the role that Hong Kong SAR, a world class international financial center, has played, and will continue to play, in bringing best international practices to DBs on the mainland. They also contend that WFOBs are at a disadvantage to DBs with respect to local knowledge and connections with government ministries and regulators. Leung and Chan (2006, p.233) conclude,

“...it is likely that only a handful of resourceful and committed multinational bank will be able to emerge in the near future as major market players in RMB market segments. In any event, it seems unlikely that the future Chinese banking market will be as profitable as many originally anticipated. In fact, it well may prove to be a tough battlefield, where only the fittest will survive.”

This paper seeks to shed light on the likely impact of market entry by WFOBs by investigating the relative efficiency of WFOBs and DBs. A bank's efficiency level is a key determinant of its competitiveness. As the above discussion highlights, it cannot simply be assumed that WFOBs are more efficient than DBs because various advantages and disadvantages can be cited for both groups. If WFOBs do indeed possess a strong technological advantage over DBs, then one would expect to find evidence of them being relatively more efficient because they could combine production inputs more effectively to produce output. On the other hand, if DBs were using an important production input more intensively than WFOBs, such as fixed assets (e.g., bank branches), then they may well still emerge as being more efficient in spite of any technological deficiencies.

Section 2 of this paper briefly reviews previous studies that deal with bank efficiency in China. Section 3 outlines the methodology and data used in this paper to investigate the research question. Section 4 presents the results. Section 5 makes concluding comments.

2. Literature review

Existing studies that deal with bank efficiency in China can be divided into three basic categories according to the methodological approach they adopt.

The first category uses interviews with industry participants to arrive at perceptions of bank “efficiency”, or “competitiveness” or “success”. An example is PWC (2008), which surveyed CEOs and Senior Executives at 42 WFOBs and asked them to rank the degree of competition that various DBs provided their own operations. The three most competitive DBs nominated were Bank of China, Industrial and Commercial Bank of China and China Merchants Bank. Survey participants were also asked to nominate the most successful WFOBs across a range of banking activities. In the area of retail banking, for example, the top three nominated were HSBC, Citibank and Standard Chartered. This study has two main limitations. Firstly, DBs are ranked against other DBs while WFOBs are ranked against other WFOBs, and thus no comparison between the two groups is made. Secondly, as the report itself acknowledges, given that the findings are based on perceptions, the rankings are very subjective.

The second category tries to take a less subjective approach by using accounting ratios to determine efficiency levels. For example, Shimuzu (2005) uses the cost-income ratio, the non-performing loan ratio, the capital adequacy ratio and the return on assets to devise a list of China’s “best performing” banks for the consideration of potential foreign investors. In its annual rankings of the world’s 1000 largest commercial banks, *The Banker*’s preferred measure of efficiency is the cost-income ratio. The chief problem with accounting ratios, as has been elaborated upon by O’Donnell and van der Westhuizen (2002), is that they are only partial productivity measures. That is, they fail to comprehensively relate a firm’s inputs and outputs and, as a result, while a given bank may appear to be performing poorly based on one measure, it may appear to be doing well based on another. This problem is clearly in evidence when the performance of DBs and WFOBs in our sample (discussed in section 3) is compared using four popular accounting ratios (Table 1). DBs appear to be performing significantly better than WFOBs when one examines the return on assets and / or the cost-income ratio. However, if instead one examines the total capital adequacy ratio and / or the impaired loan ratio, the conclusion is reversed.

Insert Table 1 here.

The third category uses frontier analysis, such as Data Envelopment Analysis (DEA) or Stochastic Frontier Analysis (SFA), to generate more theoretically robust measures of efficiency. These techniques begin with the specification of a model that defines a bank's major inputs and outputs. Data is then collected for these inputs and outputs for a sample of banks. DEA, the technique we use in this paper, then uses linear programming to generate a frontier of best practice, or efficiency, from amongst these banks. Where a particular bank lies relative to the frontier then determines its own efficiency score ($0 \leq \text{efficiency score} \leq 1$). If it lies on the frontier, it receives an efficiency score of 1. Studies to have employed frontier analysis in the case of China's banking sector include Chen, et al. (2005), Fu and Heffernan (2007), Kumbhakar and Wang (2007), Laurenceson and Qin (2008) and Berger et al (2009). However, a limitation in all of these studies is that WFOBs are not included as part of the analysis. The reason is simple - data for WFOBs have not been previously available. In the past, the costs and revenues associated with the China operations of WFOBs were subsumed into the accounts of their parent companies because they were not locally incorporated. However, this changed when the Chinese Government made local incorporation a requirement for the extension of national treatment at the end of 2006. The leading WFOBs in China were quick to comply and this meant that data describing the operations of several WFOBs at year-end 2007 became available during 2008. This data permits for the first time a comparison to be made between the efficiency of DBs and WFOBs.

3. Methodology

In this study we use DEA to estimate three models of the banking firm to compare the efficiency of DBs and WFOBs. Multiple models are used to test the sensitivity of the results to any one particular specification. DEA is already an established efficiency measurement technique in the literature and so we do not elaborate here. Those readers seeking more technical detail, such as the specifics of the linear programs that DEA uses to generate the efficiency frontier, we refer to excellent sources such as Coelli, et al. (2005). If data for output quantities, inputs quantities and input prices is assembled, DEA can generate scores relating to several different efficiency concepts, including technical efficiency (TE), allocative efficiency (AE) and cost efficiency

(CE). O'donnell and van der Westhuizen (2002) summarize that a firm is said to be technically efficient if it produces a given set of outputs using the smallest possible amount of inputs. It is said to be allocatively efficient if it selects an input mix that minimizes the cost of producing this given set of outputs. It is said to be cost efficient if it is both technically and allocatively efficient.

Model 1 is the simplest and depicts the banking firm as producing one output, loans (net) plus other earning assets, using two inputs, fixed assets and employees. Loans (net) is equal to total customer loans minus loan loss reserves. Expressing loans in net form follows Grigorian and Manole (2006) who make the point that it is important to recognize output quality as an important objective of banks, particularly in countries undergoing banking sector reform.

The second model adds an additional output, loans (net) plus deposits. This follows O'Donnell and van der Westhuizen (2002) and aims to account for the fact that banks do not just produce outputs that earn interest income. They also produce fee earning outputs such transactions and guarantees. Thus, an assumption is made that the quantity of these other outputs is proportional to bank size, a proxy of which is loans (net) plus deposits.

The third model adds an additional input – deposits. Some studies, such as Gregorian and Manole (2006), view deposits as the other logical input for a banking firm alongside fixed assets and employees. However, others view deposits as merely being an intermediate product. That is, banks use inputs such as fixed assets and employees to collect deposits and transform these into outputs such as loans. Others, such as Chen, et al. (2005), point out that deposits could even be considered a bank output because they provide liquidity, safekeeping and payments services to savers. Given this debate, we include deposits as an input in model 3 but leave it out of models 1 and 2.

The above three models are estimated using data for 17 banks at year-end 2007. All input and output data is taken from the *Bankscope* database with the exception of employee data for WFOBs, which are taken from various news reports. Our sample consists of 14 DBs and 3 WFOBs and is presented in Table 2 with banks ranked by

total assets. The sample size reflects data availability considerations. While a larger sample would always be preferred, data for 17 banks still satisfies the basic rule of thumb requirement used by DEA practitioners that the number of firm observations should be at least three times the number of outputs plus inputs in the model (Pedraja-Chaparro et al., 1999). In the case of model 1, the sample size is nearly six times the number of inputs plus outputs. The sample is also comprehensive in that it covers most of the major DBs and WFOBs in China. It includes four out of the five so-called State-Owned Commercial Banks, seven out of the twelve Joint Stock Commercial banks, and three City Commercial Banks. According to the CBRC, at the end of 2007, State Owned Commercial Banks, Joint Stock Commercial Banks and City Commercial Banks accounted for 53.2%, 13.8% and 6.4% of total banking sector assets, respectively. The three WFOBs that are included in the analysis – HSBC, Standard Chartered and Bank of East Asia - are currently the three largest WFOBs in China and together account for around 50% of the total branches held by locally incorporated WFOBs (HSBC, 2008).

Insert Table 2 here.

In terms of input prices, conceptually the price of the fixed asset input is equal to depreciation divided by fixed assets, or the rate of depreciation. In the absence of depreciation data appearing in the banks' accounts, a 10% depreciation rate is assumed for all banks². The price of the employee input is taken to be Personnel Expenses divided by the number of employees. It is only recently that some Chinese banks began publishing Personnel Expenses separately from Other Operating Expenses in their accounts. The absence of this data forced previous studies to lump the fixed asset input and the employee input together (e.g., Chen, et al. 2005). Such a conglomerate input is difficult to interpret however, and its price is awkward to specify. Thus, it is desirable for these inputs to enter the model separately. The cost of doing so is that the potential sample size is reduced because many of China's smaller DBs still do not publish separate data for Personnel Expenses. SC is also the only WFOB to separately publish Personnel Expenses. Thus, we estimate this data for the other two WFOBs in our sample by assuming that their Personnel Expenses account

² We also tested the sensitivity of the results to the assumption that WFOBs experienced a higher depreciation rate than DBs because their fixed asset stock is newer. The results were not significantly different and are available from the authors upon request.

for the same proportion of Other Operating Expenses as they do for SC. The price of the deposits input is taken to be Interest Expenses divided by deposits. Descriptive data for all outputs, inputs and input prices used in models 1, 2 and 3 are presented in Table 3.

Insert Table 3 here.

4. Results

The three models described above were estimated using the DEA software package, *DEAP Version 2.1* (see Coelli, 1996). All models were estimated assuming variable returns to scale because there can be no presumption that the banks in our sample are already operating at an optimal scale. The TE, AE and CE scores are presented in Tables 4, 5, and 6, in descending order of CE scores. It should be recalled that CE scores are the product of TE and AE scores.

Insert Table 4 here.

Insert Table 5 here.

Insert Table 6 here.

Before discussing specific results, a general concern that arises with respect to model 3 is that all banks are found to be on the technical efficiency frontier. This may indicate a deficiency with respect to the sample size for this model, which features three inputs and two outputs. That is, in model 3, DEA may be identifying banks as being efficient “by default” because there are insufficient peers with which to compare their performance. Nonetheless, models 1 and 2 do not suffer from this problem, and AE and CE scores in model 3 also show a greater degree of dispersion.

The three models produce similar findings with respect to the relative efficiency of DBs and WFOBs when taken as groups. In the case of TE scores, both groups have similar averages and with few exceptions most banks appear to be operating at close to or on the efficiency frontier. That is, the results suggest that both groups have little scope to reduce input usage and maintain current output levels, or alternatively, maintain current input usage and boost output levels. However, the story is quite different with respect to AE and CE scores. Here WFOBs lag DBs considerably.

Taking AE scores in model 1 as an example, the results suggest that DBs could, on average, reduce their costs by 4% if they produced their current level of output using the optimal mix of inputs (i.e., the cost minimizing input mix). WFOBs, on the other hand, could reduce their costs by a far more substantial 31% by doing likewise.

The two banks in the sample with the lowest CE scores are both WFOBs - HSBC and SC. Given that these two banks actually lie of the technical efficiency frontier in all three models, their cost inefficiency can be attributed entirely to using a sub-optimal input mix. Aside from providing efficiency scores, DEA can also estimate the cost minimizing amount of each input for each bank. By comparing this with the actual amount of each input being used, it is possible to determine which inputs a bank is using in greater or less than optimal quantities. Table 7 presents the ratio of actual input usage to the estimated cost minimizing input usage for all three models in the case of HSBC and SC.

Insert Table 7 here.

All three models suggest that HSBC and SC are using less than the optimal amount of fixed assets and more than the optimal number of employees to produce their current output levels. There are several possible explanations for why this might be the case. The one that we consider most likely is that the regulations that have in the past governed the operations of WFOBs have allowed them to add employees faster than fixed assets, such as bank branches. For example, until 2004, WFOBs were restricted to opening one new branch and two new sub-branches each year. Thus, if WFOBs wished to expand output, increasing their usage of the employee input was close to being their only option. Even though such regulations have now given way to the extension of national treatment, expanding their branch networks is still a costly process. In order to incorporate locally and be extended national treatment, current regulations require that WFOBs must have registered capital of RMB1 billion and then allocate an additional RMB100 million for each new branch they open. Another possibility, less likely in our view, is that the sub-optimal input mix might be the outcome of deliberate choices made by the management teams at WFOBs. For example, it might be speculated the management teams at HSBC and SC have less experience operating in China's banking sector than the management teams at DBs,

and this had led to them selecting a sub-optimal input mix. It is interesting to note that the AE score of the third WFOB in our sample, BOEA, is close to the DB average. BOEA is a Hong Kong SAR-headquartered bank and for this reason its management might be more familiar with the mainland banking market. But it is difficult to make too much of this argument. While HSBC and SC are headquartered in London, both have an extremely long history in Hong Kong SAR (and prior to 1949, on the mainland too) and have been amongst the first WFOBs to take advantage of any loosening of controls on the mainland throughout the reform period.

5. Conclusion

WTO entry in 2001 was a watershed event in the reform of China's banking sector. Amongst other policy changes, China committed to extending national treatment to WFOBs by the end of 2006. Divergent perspectives have been offered regarding the likely impact that direct competition between WFOBs and DBs will have now that WFOBs have been extended national treatment. One foresees WFOBs rapidly taking market share from DBs because of competitive advantages such as having better technology. Another foresees WFOBs finding it difficult to compete against DBs because of competitive disadvantages such as not having comprehensive branch networks. This paper sought to shed some light on the likely impact of market entry by WFOBs by investigating the relative efficiency of WFOBs and DBs. There were two main findings. Firstly, both WFOBs and DBs appear to be operating at similar and high levels of technical efficiency. Note that this does not necessarily imply that any of the banks in our sample are technically efficient in a global sense (i.e., relative to international best practice); only that WFOBs or DB did not emerge as being any more technically efficient than each other. Secondly, WFOBs appear to lag behind DBs with respect to allocative and cost efficiency. Two of the three WFOBs in our sample received the lowest CE scores according to all three models estimated. This implies that there (theoretically) exists considerable scope for these WFOBs to reduce the cost of producing their current output levels by changing their input mix. In particular, the WFOBs that had the lowest CE scores appeared to be operating using a less than optimal fixed asset / employee ratio. Rather than implying poor management decision-making at these banks, we suspect a better explanation is that in the past regulations have curtailed the ability of WFOBs to accumulate fixed assets, such as branches.

The finding that WFOBs do not appear to be any more efficient than DBs is consistent with data that shows WFOBs have not been able to expand their market share during the 2000s. When China joined the WTO in 2001, foreign banks held around 2% of total banking sector assets (People's Daily, 2004). The latest data from the CBRC shows that at the end of the third quarter 2008, six years on from WTO entry and one and half years on from when the first batch of WFOBs was extended national treatment, WFOBs held just 2.34% of total banking sector assets. This was actually down from 2.44% at the end of the March quarter³. Thus, the prediction by some that DBs will not be able to compete with WFOBs with national treatment in the short run appears excessively dire.

There are several caveats in our analysis that should be mentioned. Firstly, several of the DBs in our sample have benefited from large scale, government-funded recapitalisation programs in recent years (see Ma, 2007). Thus, it could be argued that loans (net), an output included in all three of the models estimated, is artificially inflated for these banks because they did not have to set aside loan loss provisions commensurate with the non-performing loans that had been accumulated. However, such recapitalization programs have mainly been limited to the State-Owned Commercial Banks, while other large DBs in our sample were unaffected. Thus, we do not expect this to cause any large bias in our results.

Secondly, while WFOB were found to be less cost efficient than the DBs included in our sample, they may be more efficient than numerous other, typically smaller, DBs not included in the analysis because data was unavailable. Certainly, the DBs in our sample are amongst China's most prominent banks, and more than likely, best performing. However, China also has, for example, more than 100 City Commercial Banks, but only three of these were included in our sample.

Thirdly, while the results lend support to the view that WFOBs are unlikely to take significant market share from DBs in the short run, the situation could be different in the medium and long run. If, as we suspect, the current cost inefficiency of WFOBs

³ Of course, this outcome need not only reflect relative efficiency levels. In particular, the worsening global financial crisis may have led to Chinese savers being reluctant to deal with foreign banks.

such as HSBC and SC can largely be attributed to the impact of past regulations, which have now given way to national treatment, then the sub-optimal input mix used by WFOBs is likely to only be a temporary phenomenon. It would be an interesting exercise to repeat the analysis as new data becomes available (e.g., at year-end 2008) to see if the fixed asset / employee ratio in these banks starts to converge on the optimal mix.

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Table 1. Accounting ratios for DBs and WFOBs at year-end 2007

	Return on assets	Cost-income ratio	Total capital adequacy ratio	Impaired loan ratio
DBs (average)	1.04	37.17	12.65	2.05
WFOBs (average)	0.51	55.13	15.10	0.25

Source – see section 3.

Table 2. Sample banks, by assets (year-end 2007)

Bank	Assets (RMB million)
Industrial and Commercial Bank of China (ICBC)	8683712
China Construction Bank (CCB)	6598177
Bank of China (BOC)	5991217
Bank of Communications (BOCOM)	2110444
China Merchants Bank (CMB)	1310552
China CITIC Bank (CCITIB)	1011186
China Minsheng Bank (CMSB)	919796
Shanghai Pudong Development Bank (SPDB)	914980
Industrial Bank (IB)	851335
Hua Xia Bank (HXB)	592338
Bank of Beijing (BOB)	354223
Shenzhen Development Bank (SDB)	352441
HSBC (HSBC)	141555
Standard Chartered (SC)	104860
Bank of East Asia (BOEA)	99493
Bank of Ningbo (BONB)	75511
Bank of Chongqing (BOCQ)	44631

Table 3. Descriptive data – outputs, inputs and input prices

	Average	Standard Deviation	Minimum	Maximum
Loans (net) plus other earning assets (RMB millions)	1722229	2560908	43608	8466672
Loans (net) plus deposits (RMB millions)	2386109	3530138	60991	11671687
Fixed assets (RMB millions)	18235	29886	494	93791
Employees (no. of persons)	65322	118695	1454	381713
Deposits (RMB millions)	1527162	2314781	37722	7714145
Price of fixed asset input	0.1	0	0.1	0.1
Price of employee input	0.2282	0.0852	0.1272	0.4077
Price of deposits input	0.0203	0.0060	0.0115	0.0351

Table 4. DEA Results – Model 1

Bank	TE	AE	CE
ICBC	1.00	1.00	1.00
CMB	1.00	1.00	1.00
CCITICB	1.00	1.00	1.00
IB	1.00	1.00	1.00
BOB	1.00	1.00	1.00
BOCQ	1.00	1.00	1.00
CCB	1.00	0.95	0.95
BOC	1.00	0.94	0.94
SPDB	0.95	0.98	0.93
BOCOM	0.96	0.90	0.86
HXB	0.88	0.98	0.86
NONB	0.92	0.92	0.85
CMSB	0.79	0.96	0.76
BOEA	0.76	0.93	0.71
SDB	0.78	0.85	0.66
HSBC	1.00	0.58	0.58
SC	1.00	0.55	0.55
<i>Average All</i>	<i>0.94</i>	<i>0.91</i>	<i>0.86</i>
<i>Average DBs</i>	<i>0.95</i>	<i>0.96</i>	<i>0.92</i>
<i>Average WFOBs</i>	<i>0.92</i>	<i>0.69</i>	<i>0.61</i>

Table 5. DEA Results – Model 2

Bank	TE	AE	CE
ICBC	1.00	1.00	1.00
CMB	1.00	1.00	1.00
CCITICB	1.00	1.00	1.00
SPDB	1.00	1.00	1.00
IB	1.00	1.00	1.00
BOB	1.00	1.00	1.00
BOCQ	1.00	1.00	1.00
CCB	1.00	0.98	0.98
BOC	1.00	0.94	0.94
BOCOM	1.00	0.90	0.90
HXB	0.89	0.98	0.87
NONB	0.92	0.92	0.85
BOEA	0.87	0.93	0.81
CMSB	0.85	0.94	0.80
SDB	0.82	0.85	0.69
SC	1.00	0.60	0.60
HSBC	1.00	0.60	0.60
<i>Average All</i>	<i>0.96</i>	<i>0.92</i>	<i>0.88</i>
<i>Average DBs</i>	<i>0.96</i>	<i>0.96</i>	<i>0.93</i>
<i>Average WFOBs</i>	<i>0.96</i>	<i>0.71</i>	<i>0.67</i>

Table 6. DEA Results – Model 3

Bank	TE	AE	CE
ICBC	1.00	1.00	1.00
CCB	1.00	1.00	1.00
BOC	1.00	1.00	1.00
CCITICB	1.00	1.00	1.00
SPDB	1.00	1.00	1.00
IB	1.00	1.00	1.00
SDB	1.00	1.00	1.00
NONB	1.00	1.00	1.00
BOCQ	1.00	1.00	1.00
CMB	1.00	1.00	1.00
HXB	1.00	0.99	0.99
BOEA	1.00	0.99	0.99
BOCOM	1.00	0.98	0.98
CMSB	1.00	0.98	0.98
BOB	1.00	0.97	0.97
SC	1.00	0.86	0.86
HSBC	1.00	0.79	0.79
<i>Average All</i>	<i>1.00</i>	<i>0.97</i>	<i>0.97</i>
<i>Average DBs</i>	<i>1.00</i>	<i>0.99</i>	<i>0.99</i>
<i>Average WFOBs</i>	<i>1.00</i>	<i>0.88</i>	<i>0.88</i>

Table 7. Ratio of Actual Input Usage to Cost Minimizing Input Usage

<u>Model 1</u>	HSBC	SC
Fixed assets	0.74	0.82
Employees	1.90	1.98
<u>Model 2</u>		
Fixed assets	0.72	0.75
Employees	1.85	1.82
<u>Model 3</u>		
Fixed assets	0.63	0.56
Employees	1.44	1.57
Deposits	1.24	1.03