Efficiency Amongst China's Banks:
A DEA Analysis Five Years after WTO Entry

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Abstract

WTO entry in 2001 heralded a new stage in the reform of China's banking sector. With the reality that foreign banks would be extended national treatment by the end of 2006, China's banks faced the imperative to reform in earnest. They began reforms from a variety of different starting points and have pursued a variety of different reform approaches. Five years on, this paper assesses efficiency levels in 11 of China's most prominent banks. The results, obtained using Data Envelopment Analysis (DEA), suggest that differences in efficiency levels are actually quite small. On the one hand, this finding is encouraging because it suggests that few of China's major banks lag behind the pack. On the other hand, it also implies that efficiency levels almost certainly do lag in China's less prominent banks, which together still account for more than 40 per cent of total banking system assets.

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1. Introduction

The reform of China's banking sector has lagged behind that of other sectors of the economy. In contrast to the manufacturing sector, during the 1980s and 1990s foreign investment in China's banking sector was barred and domestic banks were protected from competition with foreign entrants. China's largest banks were also wholly state-owned and operated as quasi-fiscal entities that made loans according to government policy directives rather than commercial considerations. These stylized facts contributed to a highly inefficient banking sector (Lardy 1998) that was described by *The Economist* (1998, 65) as being "the worst in Asia". WTO entry in 2001 heralded a new stage of reform in China's banking sector. Most significantly, as part of its WTO accession agreement the Chinese government committed to extending national treatment to foreign banks by the end of 2006. At the time this commitment was made, there was considerable concern expressed within China regarding whether domestic banks would be able to transform themselves into viable competitors within the five-year transitional period. Xu and Li (2007, 885) offered the dire prediction that, "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, such as Bonin and Huang (2002) and Leung and Chan (2006), reached more sanguine conclusions, emphasizing, for example, the competitive advantages that accrue to domestic banks from having an established customer base and a comprehensive branch network. Whether foreign bank entry undermines the solvency of domestic banks or not, there can be no doubt that their presence has greatly increased the pressure on China's banks to become more efficient. Incumbents have also faced increased competition from new domestic banks. In the mid-1980s, China's banking sector consisted of a simple two-tiered structure with the People's Bank of China (PBC) as the central bank, and four large, wholly state-owned banks that each focused on a specific sector the economy – the Industrial and Commercial Bank of China (ICBC), Bank of China (BOC), China Construction Bank (CCB) and Agricultural Bank of China (ABC). Together, the "big four" held more than 90 per cent of total banking sector assets (Laurenceson and Chai 2003).

Since this time the big four have been joined by more than 10 nation and region-wide joint stock commercial banks (JSCBs) and more than 100 City Commercial Banks (CCBs). As shown in Table 1, at the end of 2007 the big four, plus the Bank of Communications (BOCOM), China's fifth largest bank, accounted for only 53.2 per cent of total banking sector assets. In 2007, 31 of China's banks were included in *The Banker*'s annual listing of the world's 1000 largest commercial banks.

Table 1. Institutional Structure of China's Banking Sector, 2007

	Total (RMB millions)	Big 4 + BOCOM	JSCBs	CCBs	Other banks[1]
Assets	525982.5 (100%)	280070.9 (53.2%)	72494 (13.8%)	33404.8 (6.4%)	140012.7 (26.6)

Notes
1. Other banks include policy banks, rural commercial banks, urban and rural credit cooperatives, and postal savings, amongst others.
Source – China Banking Regulatory Commission

China's banks have begun to reform from a variety of different starting points and have pursued a variety of different reform approaches. For example, in terms of starting points, on the one hand, the big four have suffered from a legacy of being wholly state-owned and operated as quasi-fiscal institutions. On the other hand, relative to China's other banks, they had the advantage of having a large and established customer base and extensive branch networks. The ICBC, BOC and CCB have also been the recipients of large central government-sponsored injections of fresh capital and have had large chunks of their non-performing assets transferred to Asset Management Companies (AMCs) created specifically for that purpose (Fung and Ma 2006; Ma 2007). Meanwhile, the reform program of the ABC has yet to be defined or instigated. While China's other banks have faced less historical government interference in their operations, and some such as China Minsheng Bank (CMSB) have even been majority non-state owned, they have also benefited less from scale economies and have received less direct government support. In terms of reform approaches, some, starting with the Bank of Shanghai in 2001, have sought to become more efficient by taking on foreign investment (Leigh and Podpiera 2006). As part of its WTO accession agreement, the Chinese government also agreed to permit minority foreign investment in China's banks. Current regulations permit a single foreign investor to hold up to a 20 per cent stake in a Chinese bank, and total foreign investment can reach a maximum of 25 per cent. Other domestic banks, such as Shenzhen Commercial Bank in 2006, have raised fresh capital by selling equity to other domestic institutions. Others still, such as China Merchants Bank (CMB) in 2002, have raised capital through a public listing on either the Shanghai and / or Hong Kong Stock Exchange.

This paper analyses efficiency levels in 11 of China's most prominent banks five years after WTO entry and the imperative to reform began in earnest. Unfortunately, the efficiency of China's major banks cannot be benchmarked against foreign banks operating in China, which might be taken to represent best international efficiency practice, because foreign banks only began incorporating in China at the end of 2006 and so separate data for their Chinese operations are not yet available. Nonetheless, benchmarking China's major banks against one another still serves to answer a number of important questions. In particular, have the different starting points and different approaches to reform led to large differences in efficiency amongst these banks today? If yes, which banks are the least efficient and most vulnerable to rising levels of competition? Also, if there are large differences in efficiency levels, are common characteristics observable amongst the more efficient banks, such as the presence of foreign investors? Alternatively, has the common imperative that all banks have faced to reform led to a convergence in their relative efficiency levels, despite the variation in starting points and reform paths taken?

Section two of this paper reviews the existing literature that discusses efficiency levels of amongst China's banks and highlights the knowledge gaps that remain. Section three describes the methodology we use in this paper to analyze efficiency levels, as well as the data we use to perform our empirical investigation. Section four presents the empirical findings. Section five makes concluding comments.

2. Literature review

This study is not the first to consider efficiency levels in China's banks. Existing studies can be divided into three basic categories.

The first category uses interviews with industry participants to arrive at perceptions of efficiency. For example, PWC (2007, 15) asked CEOs and Senior Executives at 40 foreign banks operating in China to rank the competitiveness, a proxy for efficiency, of various domestic banks according to their own perceptions. The top three domestic banks nominated were BOC, ICBC and CMB. The report acknowledges, “These views are recognized as being very subjective but they nevertheless reflect a degree of differentiation in the minds of the foreign bankers interviewed.

The second category tries to take a less subjective approach by using common accounting ratios to infer efficiency levels. For example, Shimuzu (2005) uses a variety of accounting ratios such as 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 stated preferred measure of efficiency is the cost-income ratio. According to this measure, ICBC was China’s most efficient bank at the end of 2006 with a cost-income ratio of 36.3 per cent. Bank of Ningbo (BON) and CMB closely followed. The least efficient amongst the 31 Chinese banks included in the list was CMSB, which had a cost-income ratio of 58.74 per cent. The problem with accounting ratios, as observed by O’Donnell and van der Westhuizen (2002), is that they are only partial productivity measures. That is, they fail to comprehensively relate a banking 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. The case of CMSB is illustrative. While it ranked last according to the cost-income ratio, it ranked near the top according the non-performing loan (NPL) and in the middle of the pack according to the return on assets. Based on a large sample of Chinese banks over the years 2001-2006, Laurenceson and Qin (2008) showed that the correlation coefficient amongst such partial efficiency measures was close to zero and this made them of little practical use for deriving overall efficiency rankings.

The third category uses frontier analysis, such as Data Envelopment Analysis (DEA) and

Stochastic Frontier Analysis (SFA), to generate more complete efficiency measures. These techniques begin with the specification of a model that defines the banking firm's major inputs and outputs. Observed data for these inputs and outputs are then collected for a sample of firms. DEA, the technique we use in this paper, then uses linear programming to generate a frontier of best practice, or efficiency, from amongst these firms (discussed in more detail below). Where a particular firm lies relative to this frontier then determines its own efficiency score. 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) and Berger et al (2007). By seeking to comprehensively relate a bank's inputs and outputs all of these studies adopt a theoretically more rigorous approach to efficiency measurement than those that have used simple accounting ratios. Nonetheless, a number of shortcomings remain. Chief amongst these is that the above studies use relatively old data sets and thus shed little light on current efficiency levels. This is significant when it is recalled that reforms in China's banking sector only began in earnest in 2001. For example, Chen et al. (2005) considered the period from 1993-2000, Fu and Heffernan (2007) the period from 1985-2002, Kumbhakar and Wang (2007) from 1993-2002 and Berger et al. (2007) from 1994-2003. Secondly, all of the above studies present their results in terms of groups of banks, such as the big four or JSCBs, rather than in terms of individual banks. This approach might mask important variations in efficiency within a particular group. Finally, data for China's banks in popular databases such as *Bankscope* have previously only been available in highly aggregated form and this necessitated the use of relatively coarse frontier analysis models. For example, Chen et al. (2005) acknowledge the DEA model they use is less than ideal by including just two inputs - interest expenses, reflecting the input of leveraged funds, and non-interest expenses, reflecting the use of all other inputs. In 2008, this data constraint has been relaxed somewhat and for most of China's major banks it is now possible to assemble data for their three most significant inputs - leveraged funds, capital and labour.

3. Methodology

DEA, the analytical technique we use in this paper, can generate efficiency scores pertaining to different types of efficiency, including scale efficiency (SE), technical efficiency, allocative efficiency (AE) and cost efficiency (CE). It is worthwhile briefly explaining each of these on a conceptual level and how DEA arrives at an efficiency score for each. The following discussion is taken from O'Donnell and van der Westhuizen (2002). Figure 1 shows a variable returns to scale (VRS) production frontier, OX, that relates a single input, *x*, and a single output, *y*. It is described as a VRS frontier because the slope, or average product, $\frac{y}{x}$, changes along the frontier. The increasing returns to scale section (i.e., where average product is increasing) and the decreasing returns to scale section (i.e., where average product is decreasing) are denoted by OE and EX, respectively. In special cases, a production frontier may exhibit constant returns to scale (CRS) and an example of this is the frontier OM. Since average product does not change along a CRS frontier, all points along it can be considered equally scale efficient. However, with respect to the VRS frontier, it can be seen that the point of highest productivity is to be found at point E. While firms operating at points D and G are also on the frontier, only the firm operating at point E can be considered as operating at the optimal scale. This leads to scale efficiency for the firm operating at point G, for example, being defined as –

$$SE_G = \frac{\text{slope at G}}{\text{slope at E}} = \frac{\text{slope at G}}{\text{slope at F}} = \frac{\mathrm{O}A/\mathrm{O}L}{\mathrm{O}A/\mathrm{O}K} = \frac{\mathrm{O}K}{\mathrm{O}L} \qquad (1)$$

While only the firm operating at point E is scale efficient, firms operating at points D, E and G can all be considered technically efficient in that it is impossible for any of them to reduce their input usage and maintain their current level of output. The firm operating at point H, however, cannot be considered technically efficient because, theoretically, it could reduce its input usage by IL without reducing its output. This observation leads to the technical efficiency of this firm in percentage terms being defined as –

$$TE_H = 1 - \frac{IL}{\mathrm{O}L} = \frac{\mathrm{O}I}{\mathrm{O}L} \qquad (2)$$

Note that technical efficiency is measured relative to the production frontier. The firm operating at point G is considered technically efficient because it lies on the VRS frontier.

However, if the production frontier was in fact the CRS frontier, OM, the technical efficiency of the firm operating at point G would be measured relative to point F and it would be considered technically inefficient because O*K*/O*L* < 1. Note that O*K*/O*L* is also the scale efficiency of the firm operating at point G by (1). This means that scale efficiency can also be calculated by dividing a CRS measure of technical efficiency by a corresponding VRS measure.

Technical efficiency can also be discussed in a multiple-output, multiple-input framework, and presenting it in this manner better facilitates a discussion of allocative efficiency. Figure 2 shows a two-input, single output production technology. The isoquant SS' shows the different input combinations that can produce a given output level, *y*. Any point on this isoquant is technically efficient because it is not possible to reduce the two inputs proportionately and maintain the same level of output. In contrast, a firm operating at point *A* cannot be considered technically efficient because, theoretically, both inputs could be reduced proportionately by the distance *AB* without any reduction in output. This leads to the technically inefficiency of this firm in percentage terms being defined as the ratio *AB* / O*A*. Alternatively, the technical efficiency of this firm can be defined as -

$$TE_A = 1 - \frac{AB}{\mathrm{O}A} = \frac{\mathrm{O}B}{\mathrm{O}A} \tag{3}$$

Allocative efficiency deals with the challenge that firms face in selecting an input mix that minimizes the cost of producing a given level of output. In Figure 2, the isocost line WW' shows all the combinations of inputs x_1 and x_2 that yield the same cost. Thus, on the isoquant SS', the firm operating at point R is not only technically efficient but is also minimizing cost. The cost of inputs at R is the same as at point C and this is less than at points B and A. This leads to the allocative inefficiency of the firm operating at point A in percentage terms being defined as BC/OB. Alternatively, the allocative efficiency of this firm could be defined as –

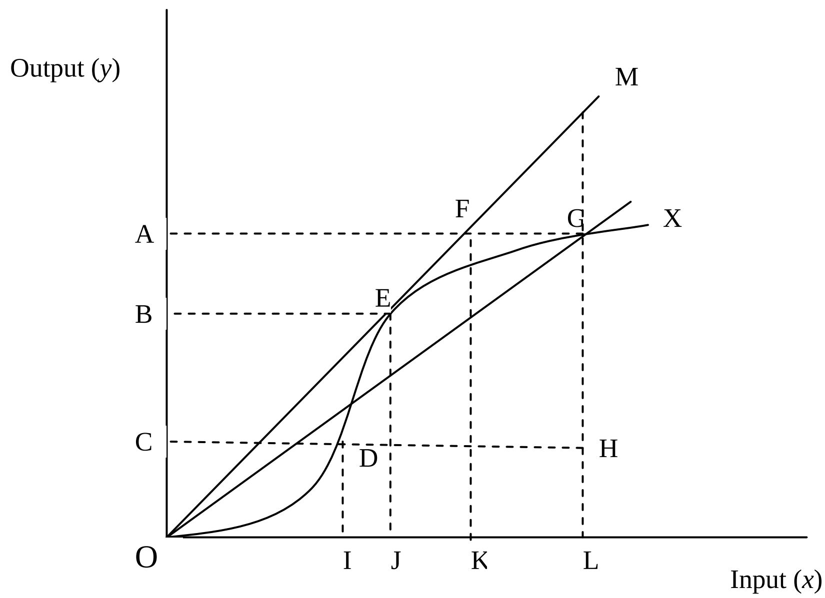
$$AE_A = 1 - \frac{BC}{\mathrm{O}B} = \frac{\mathrm{O}C}{\mathrm{O}B} \tag{4}$$

The final efficiency concept, cost efficiency, can simply be defined as the product of a firm's technical and allcoative efficiency scores.

In short, as summarized by O'donnell and van der Westhuizen (2002, 4), "A firm is said to be scale efficient if it operates on a scale that maximizes productivity, technically efficient if it produces a given set of outputs using the smallest possible amount of inputs, allocatively efficient if it selects an input mix that minimizes the cost of producing this given set of outputs, and cost efficient if it is both technically and allocatively efficient.

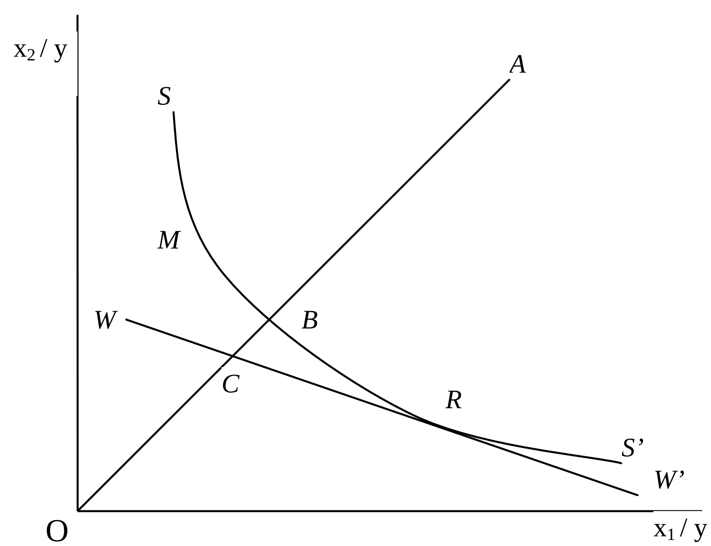
The objective of frontier analysis is essentially to estimate production frontiers such as isoquant SS'. This then permits the calculation of scores pertaining to SE, TE, AE and CE. The way DEA does this is by using linear programming to find a set of linear segments that bound, or envelop, the observed data. For example, Figure 3 takes the observed data for the firms operating at points M, R and A in Figure 2 and depicts the frontier VV' that would be estimated by DEA frontier. We leave our discussion of the different types of efficiency and DEA at this conceptual level. Those readers seeking more technical detail, such as the specifics of the linear programs that DEA uses to generate the frontier, we refer to excellent sources such as Coelli et al. (2005).

Figure 1. Single-input, single-output production technology



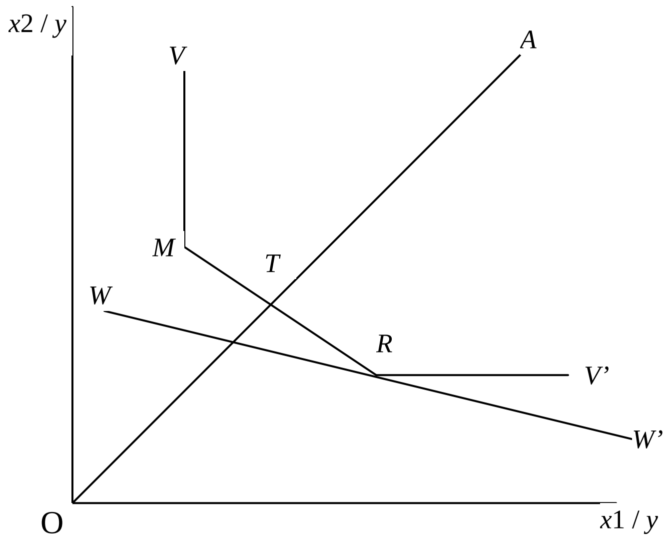
Source - O'Donnell and van der Westhuizen (2002)

Figure 2 Two-input, single-output production technology



Source - O'Donnell and van der Westhuizen (2002)

Figure 3. Two-input, Single-output DEA Frontier



Source - O'Donnell and van der Westhuizen (2002)

In defining the inputs and outputs of the banking firm we take inspiration from the intermediaton approach (see Sealey and Lindley 1977), which views a bank principally as an intermediary that facilitates the transfer of funds from surplus agents to deficit agents. Banks accumulate leveraged funds, such as deposits and money marketing borrowings, and in combination with other inputs, such as capital and labour, transform these into outputs such as loans, securities investments and other outputs that earn non-interest income, such as transactions. Consistent with this approach, the outputs, inputs and input prices used in our model are presented in Table 2.

Table 2. DEA Model

Output quantities	Input quantities	Input prices
y_1 – Loans (net) and other earning assets y_2 – Loans plus deposits	x_1 – Deposits	w_1 – interest expenses / x_1
	x_2 – Number of employees	w_2 - personnel expenses / x_2
	x_3 - Fixed assets value / w_3	w_3 – fixed asset price index

While most outputs, inputs and input prices are self-explanatory, a few warrant additional comment. The first output variable, y_1, expresses loan volume in net rather than gross terms.

Loans (net) is equal to total customer loans minus loan loss reserves. For example, in 2007 ICBC had total customer loans of RMB4073 billion and loan loss reserves of RMB116 billion that were being set aside to offset RMB112 billion of problem loans. Thus, its loans (net) was RMB3957 billion. Using loans (net) follows Grigorian and Manole (2006) who undertook a similar study to ours in the context of Eastern and Central European transitional economies. These authors make the point that it is important to recognize output quality as an important objective of the reforming banks in these countries. The second output variable, y_2, loans plus deposits, follows O'Donnell and van der Westhuizen (2002). This output aims to measure the production of outputs that banks produce that earn non-interest income such as transactions and guarantees. Thus, an assumption is being made that the quantity of these outputs is proportional to bank size, a proxy of which is loans plus deposits. The first input, x_1, deposits, is assumed to be the bank's only source of leveraged funds. While this may not be appropriate in the case of banks operating in OECD countries that have ready access to money markets of various types, it is reasonable in the case of China. For example, in 2007 deposits accounted for 93.2 per cent of ICBC's total liabilities. In contrast, money market funding only accounted for 2.6 per cent. The third input, x_3, which seeks to account for the capital input, must be inferred. The only data series we have available to us is the value of fixed assets and a fixed asset price index. The indirect approach to index number construction is based on the premise that a value change can be decomposed into the product of a price change (i.e., a price index) and a quantity change (i.e., a quantity index). Thus, a quantity index for capital can then be inferred by dividing the value of fixed assets by the price index.

To estimate the above DEA model, we use pooled data for 2005, 2006 and 2007 taken from 11 of China's most prominent banks (see below). Using DEA terminology, pooling data permits us a total of 33 decision-making units (DMUs). Pedraja-Chaparro et al. (1999) note that a common rule of thumb used by DEA practioners is that the number of DMUs should be at least three times the number of outputs plus inputs. Others are more cautious preferring five times. Ours is more than six times. The banks in our sample were selected on the basis that they had published data for each of the above years at the level of disaggregation required by our model. The sample is representative of the institutional structure of China's banking sector in that it includes three of the big four (ICBC, BOC and CCB), six JSCBs (BOCOM, CMB, CMSB, China CITIC Bank (CCITICB), Huaxia Bank (HX) and Shenzhen Development Bank (SDB)) and two CCBs (Bank of Beijing (BOB) and BON). In 2007, these 11 banks accounted for 53 per cent of the total assets of the banking system. If China's three policy banks – China Development Bank (CDB), Agricultural Development Bank (ADB) and China Exim Bank (CEB) - are excluded from the total, and this seems reasonable given that these banks largely do not compete in the retail market[1], the share of the 11 banks in our sample rises to nearly 60 per cent. The banks included in the sample also allow strong inferences to be made regarding the efficiency of those not included. For example, amongst the big four, ICBC, BOC and CCB have all undergone extensive reform programs. If these banks do not lie on or near the efficiency frontier, the other member of the big four, the ABC, for which data is not available and which has yet to undergo a comprehensive reform program, almost certainly will not. Similarly, BOB is China's largest CCB, operating in one of the country's most prosperous localities, and it has embarked on an extensive reform program that sees foreign investors holding the maximum equity stake that current regulations permit. Thus, if BOB is found to be relatively inefficient, it can safely be concluded that most of China's other 100-plus CCBs will be even less so. All data are taken from the *Bankscope* database with the exception of the fixed asset price index, which comes from China's National Bureau of Statistics. Descriptive data for the variables in our model pertaining to the banks in the sample are presented in Table 3.

Table 3. Descriptive Data

	Loans (net) and other earning assets[1]	Loans plus deposits	Deposits	Interest expenses	Personnel expenses	Fixed assets	Employees
Mean	2096583	2964242	1893548	32477	12183	25810	93154
Std. Dev.	2524553	3517641	2304329	39032	15936	32729	131204
Maximum	8466672	11671687	7714145	132822	54899	94421	381713
Minimum	41206	51940	32648	491	264	753	1183
Observations	33	33	33	33	33	33	33

Notes –

[1] This is likely to change in the future. In February 2008, CDB, the largest policy bank, received government approval to begin reforms that aim to transform it into a commercial bank.

1. All data is in units of RMB millions with the exception of Employees

The DEA software package, *DEAP Version 2.1* (Coelli 1996), is used to generate measures of SE, TE, AE and CE for each DMU, i.e., for each bank in each year. The average efficiency score in 2005, 2006 and 2007 for each bank is then taken as that bank's overall efficiency score. We estimate the model assuming variable returns to scale because there can be no presumption that the banks in our sample are already operating at an optimal scale.

4. Results

The DEA results are presented in Table 4.

Table 4. DEA Results

SE[1]		TE		AE		CE	
HXB	1.000	BON	1.000	BON	1.000	BON	1.000
SDB	1.000	SDB	1.000	SDB	1.000	SDB	1.000
BOC	0.994 (drs)	ICBC	0.999	CCB	0.999	ICBC	0.998
CCITICB	0.989 (drs)	CMSB	0.998	ICBC	0.999	CCB	0.996
BOB	0.982 (irs)	BOC	0.997	CMSB	0.992	CMSB	0.990
CMSB	0.981 (drs)	HXB	0.997	BOC	0.992	BOC	0.989
BOCOM	0.972 (drs)	CCB	0.996	HXB	0.987	HXB	0.984
CCB	0.957 (drs)	CMB	0.991	BOCOM	0.986	BOCOM	0.965
ICBC	0.945 (drs)	BOCOM	0.979	CCITICB	0.981	CMB	0.960
CMB	0.943 (drs)	CCITICB	0.978	CMB	0.969	CCITICB	0.959
BON	0.942 (irs)	BOB	0.953	BOB	0.843	BOB	0.803

Note –
1. Aside from presenting the scale efficiency score, we also indicate whether the bank was operating in increasing returns to scale (IRS) or decreasing returns to scale (DRTS) section of the production frontier.

The SE scores show that mid-size banks in our sample, HX and SDB, were found to be the most scale efficient. It is not surprising that the smallest bank, BON, was found to be lying in the IRS section of the production frontier and receives the lowest SE score. We caution against interpreting this finding as evidence that BON has been mismanaged. Current regulations permit CCBs to only open branches in their city's boundaries and this will have an obvious impact on the scale economies they are able to achieve. It is also important to note that while BON is small by the standards of our sample, it is not small by the standards of China's CCBs more generally. Thus, this result implies that the scale at which most of China's CCBs are operating is even more inefficient. The results also suggest that being big is not necessarily better. The largest bank in our sample, ICBC, is found to be lying in the DRS section of the production frontier and exhibits an SE score only marginally higher than BON. Overall, however, differences in SE scores are quite modest. This means that the banks in our sample display close to constant returns to scale.

With respect to TE scores, all banks are found to be operating at or close to the frontier. BOB has the lowest TE score at 0.953. This score implies that BOB could reduce the quantity of inputs it uses by 4.9 per cent without reducing its outputs. Thus, there is scope for BOB to improve its technically efficiency, but not by a lot. With BON lying on the frontier, there is no suggestion that being a CCB necessarily negatively impacts on the ability to achieve technical efficiency.

With respect to AE scores, again, all banks are found to be operating at close to the frontier, with the exception of BOB. An AE score of 0.843 implies that BOB could produce the same level of output at 15.7 per cent less cost through changing its input mix. The product of its TE and AE scores generate a CE score of 0.803, the lowest in our sample, implying that it could, theoretically, produce the same level of output at 19.7 percent less cost by becoming both technically and allocatively efficient. This finding suggests that BOB has the potential to become significantly more cost efficient, a key determinant of competitiveness. The second lowest ranked bank, CCITICB, has a CE score of 0.959. This implies that it only has the scope to produce its current level of output at 4.1 percent less cost.

To be sure, in an increasingly competitive environment all potential cost savings are important. Nonetheless, the general conclusion from our results is that despite beginning from different starting points and taking different reform paths, the common imperative that all banks have had to reform and improve their efficiency has seemingly led to a convergence in their efficiency levels. We caution that this finding should not be taken as evidence that there has been a convergence in efficiency levels amongst China's banks more generally. The banks that formed our sample were chosen for reasons of data availability, and the mere fact that they have published data on their operations in a relatively disaggregated manner likely says much about their sophistication vis-à-vis other domestic banks. If we were able to include other banks such as the ABC and some of the smaller CCBs in our analysis, the variation in SE, TE, AE and CE scores would almost certainly be much greater. Still, amongst the banks in our sample, the variation in efficiency levels is quite small. DEA studies conducted in the context of the banking sectors of other countries (e.g., Berger and Humphrey 1997) typically show average efficiency scores in the order of 0.7-0.9.

5. Conclusion

WTO entry was a watershed event in the evolution of China's banking sector. By committing to extend national treatment to foreign banks after a five-year transitional period, the Chinese government greatly increased the imperative for China's banks to reform and become more efficient. China's banks are a heterogeneous mix that began to reform from a variety of different starting points and they have taken a variety of different paths. This paper assessed efficiency levels amongst 11 of China's most prominent banks five years after WTO entry. In particular, it sought to determine whether the variety of starting points and reform path approaches taken has led to large variations in efficiency levels, or alternatively, whether the common imperative that all banks have faced to improve their efficiency levels has promoted a relative convergence in efficiency levels? The empirical results lend strong support to the second hypothesis. With the exception of BOB, none of the banks in our sample appeared significantly less efficient than any of the others. This is an encouraging finding in the sense that our sample comprised nearly all of China's most prominent banks that together account for more than half of total banking sector assets. However, by way of conclusion, two caveats are in order. Firstly, our findings cannot be taken to mean that China's most prominent banks are efficient relative to other banks not included in the sample, such as foreign banks. No foreign banks operating in China were included in the sample because data for these banks was unavailable. Now that foreign banks have begun incorporating in China, separate data for their Chinese operations might soon be made publicly available and incorporating this into the analysis would add further value to the present paper. Theoretically, various competitive advantages and disadvantages can be cited for both domestic and foreign banks and whether one group is relatively more efficient awaits future empirical investigation. Secondly, our results are based on a sample of China's banks that are almost certainly a better performing group than the population of China's banks as a whole. If data were available for China's other banks, which are many in number and together still account for more than 40 per cent of total banking sector assets, a much wider dispersion in efficiency levels would be expected. The fact that the findings indicate that BOB, China's largest CCB and one of its most dynamic, has the scope to become substantially more efficient strongly suggests that many of China's other banks lag even further behind and could well struggle to compete in the future. Thus, the Chinese Government and CBRC would be well advised to prepare contingency plans in order to manage such potential sources of banking sector instability in the future.

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