Gauging the Efficiency of China's Bank Using a Cost Efficiency Model

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Most studies on data envelopment analysis arrive at efficiency values that are too similar to be compared. Using a "cost efficiency model", we gauge the efficiency of China's banks by analyzing 25 listed banks from 2001 to 2016 to resolve this issue. The results show that the efficiency value of each bank has been clearly differentiated. Moreover, we determine that the banks' efficiency would only improve by lowering the number of employees, reducing payroll, or increasing loans and making investments to generate higher revenues. Additionally, owing to policies in favor of the development of rural areas, certain rural commercial banks increased their efficiency and gradually displaced urban counterparts in terms of operation efficiency in 2016.

Keywords: listed banks; cost efficiency; data envelopment analysis

Foreword

Prior literature has attempted to identify the key to improving operational outcomes using diverse methods. Operational efficiency will affect a firm's profitability, which is in turn reflected in current profit, asset return, and return on equity (ROE). Therefore, scholastic studies on accounting and finance usually evaluate a business's operational efficiency by looking at its current yield, rate of return on assets, and ROE. However, although financial measures on operational efficiency are capable of rendering an objective appraisal, they often fail to provide a comprehensive comparison of the differences among different business units.

As an analysis of non-financial indices, stochastic frontier approach adopts parametric analysis; it is not uncommon, however, that functions constructed during the process turn out to be less cogent. One method of analysis wherein no function paradigms are established is data envelopment analysis (DEA). Moreover, DEA is not subjected to a large sample or affected by subjective ideas and is suitable for the analysis of cases involving multiple items of input and output. Therefore, this method can provide a mine of information on the resource use and efficiency improvement of business units. For example, DEA has been adopted in the evaluation of bank operational efficiency in the studies of Sturm and Williams [1], Defung et al. [2], and Apergis and Polemis [3].

Prior accounting and finance literature has identified a significantly positive correlation between the banking industry's efficiency value under DEA and asset

return (e.g., Penny [4]; Avkiran [5]; Dewi et al. [6]) and generally acknowledged the existence of earnings management in the banking industry.

Therefore, it would be more meaningful to directly investigate operational efficiency by looking into an operational efficiency value less susceptible to manipulation. As banks' assets are derived mainly from credit loans, bad loans are likely to arise, thereby reducing operation revenue and lowering production efficiency. For disbursed loans, provisions for bad debts need to be withdrawn in advance for potential losses. This increases the cost of financial operations and exacerbates input efficiency. Thus, operational efficiency suffers directly whether observed from the perspective of input or output.

In the evaluation of the banking industry's operational efficiency, the intermediation approach in the literature on DEA application has particularly come into focus. This approach entails that banks are intermediaries for the transfer of funds between fund suppliers and the demand side He et al. [7]. This is in accordance with Kamau's view [8], who noted banks' important role as financial intermediaries. However, the efficiency values in most DEA literature are too close to be compared. Therefore, we adopt views from the intermediation approach of DEA and reference Nguyen et al. 's [9] cost efficiency model to resolve the aforementioned weakness in DEA. We evaluate the operational efficiency of China's banks by looking into both their inputs and outputs.

To the best of our knowledge, the cost efficiency model has yet to be applied for the evaluation of the operational efficiency of China's listed banks. The research period selected for our work coincides with the European debt crisis and the global financial crisis triggered by sub-prime loans in the United States in 2007–2008. According to Dendramis et al. [10], in a financial environment fraught with economic recession and political instability, the credit risks of mortgage loans tend to increase and thus harm banks' operational performance. We analyze and assess the viability of its research results using annual analysis to control the impact of different economic environments and political elements on bank operating efficiency. The findings reveal that China's listed banks behave significantly different in terms of efficiency. Moreover, rural commercial banks are more efficient already.

The remainder of this paper is arranged as follows. Section 2 reviews past literature, Section 3 introduces the research design, Section 4 presents the results of the empirical analysis including a descriptive analysis of the sample and an analysis of the banks' operational efficiency, and Section 5 presents the conclusion.

Literature review

Edwards and Mishkin [11] and Qin [12] consider the banking industry to be important financial intermediaries. Under the intermediation approach, banks provide intermediary financial services with loan disbursement, earnings, and investments as outputs and funding costs—including interest expenses, labor, and operational costs—as inputs (Chen and Fang [13]). Theoretically speaking, the intermediation approach is more in line with banks' practical operation.

During operation, banks' operational processes exhibit a control mechanism with close internal linkages; therefore, the overall operational process merits special attention in gauging a bank's operational efficiency. By adopting a model wherein the surveyed company produces outputs with its inputs and additional information on the input price is available, we can gauge cost efficiency. As an evaluation of cost performance from the perspective of cost–benefit analysis, cost efficiency determines the performance by measuring the efficiency of production at a relatively low cost for a certain amount of output. Given the same market environment and amount of output, those closer to the effective frontier or the optimum unit cost of operation are more cost efficient. We therefore adopted Nguyen et al.'s [9] cost efficiency model as a criterion for the evaluation of banks' operational efficiency.

Research design

To simplify the diversity of banks, we used China's listed banks as samples and studied the data spanning 16 years—from 2001 to 2016. Excluding those with incomplete variables in the analysis of a given year, we studied 25 banks[1] with a total of 193 samples. We sourced all data from the China Stock Market & Accounting Research Database.

We chose a moderate sample size for the course of the research because Thompson et al. [14] and Bowlin and Rozeff's [15] empirical rule dictates that the number of examined institutions should be at least double of the total number of input and output items. In addition, the total number of input and output variables should not exceed one-third of the number of surveyed institutions [16]. When performing DEA on the data, the addition of each pair of input and output items diminishes the

[1] 25 banks included Wujiang Rural Commercial Bank; Bank of Guiyang; Industrial and Commercial Bank of China; Bank of Nanjing; China Merchants Bank; Bank of Ningbo; China Construction Bank; Bank of China; Bank of Beijing; China Citic Bank; Bank of Communications; Shanghai Pudong Development Bank; Agricultural Bank of China; China Minsheng Bank; Huaxia Bank; Ping An Bank; Wuxi Rural Commercial Bank; Zhangjiagang Bank; Bank of Hangzhou; Bank of Shanghai; Changshu Rural Commercial Bank; Jiangyin Bank; Industrial Bank; China Everbright Bank; Bank of Jiangsu.

distinguishability of the evaluated institution within the analysis. Thus, we limited the number of input and output items.

By consulting relevant literature for China [17] and in compliance with the aforementioned rules, the analysis variables selected for DEA include output items (loan disbursement, earnings per share, and investment), input items (staff number, size of deposits, and interbank placements), and input cost (employee pay, interest expenses, etc.).

Then, we supposed C to be a bank's real cost given a certain input and output item, and C* to be the minimum cost at the margin of effective cost. The bank's cost efficiency is therefore represented as CE = C*/C. That is, with the same amount of production, the cost that should be saved by the bank is represented as $(1 - CE) \times 100\%$. The value range of CE —the bank's cost efficiency—is [0, 1]. We then performed further analysis on CE by further classifying the banks into groups in accordance with the industry classification of the China Securities Regulatory Commission. This classification was conducted to observe the sample classification's operating efficiency.

Empirical findings and analysis

The skewness of each index is greater than 0, indicating that the positive deviation value in the distribution is large. This implies a higher number of sample banks with higher input–output index values. Moreover, the kurtosis is almost greater than 0, indicating that the peak of the input–output indicator is steep and is a spike.

An analysis of relevant factors reveals that an evident correlation exists between the variables selected in this study, which is in compliance with the condition of the DEA approach that there should be a correlation between the input and output items.

Judging from the banks' average efficiency, with a maximum value of 1 and a minimum of 0.586, we found that there is a significant difference in efficiency among banks. The cost efficiency model can clearly distinguish the operational efficiency of different banks. Less efficient banks are advised to make improvements by starting from input and output items (for example, by reducing staff numbers) to cut back total payroll and save costs; or by increasing employee productivity to disburse more loans, increase investments, and generate more revenue, thereby improving cost efficiency.

It is also possible to save costs by absorbing low-interest deposits and decreasing interest expenses, or generate more revenue and become more cost efficient by sufficiently and effectively lending out deposits as loans or making investments, all while complying with the legal provisions of bank reserve funds. Meanwhile, attention should also be paid to the quality of loan disbursement and investment.

Rural commercial banks are often less efficient compared with other banks, as shown in Table 1. Among all the banks sampled in the duration of the study, rural commercial banks show the largest gap between classified efficiency and frontier cost efficiency, a sign indicating that they saved the least amount of cost and defrayed the most significant amount of superfluous outlay. Closer to the frontier efficiency are joint equity commercial banks, followed by urban commercial banks and city banks; large state-owned commercial banks stood nearest to the frontier.

Table 1. Average efficiency ranking based on sample classification for the sample period 2001–2016.

Banks sampled	Average efficiency	Ranking
Large state-owned commercial banks	0.931	1
Urban commercial banks	0.927	2
Joint equity commercial banks	0.834	3
Rural commercial banks	0.812	4

Generally speaking, rural commercial banks have been making progress in operational efficiency in recent years. As Aziz [18] notes, in an economic system, financial institutions drive economic growth through effective allocation of resources. Since the implementation of reform policies in rural China in 2014, rural economies have exhibited momentum in their growth. Given the extensive influence of the banking industry's operational efficiency, the dynamism in the banking industry has given impetus to economic growth; economic growth enables banks to provide better services, the better they provide financial service, the better they can drive the growth of the local economy.

Therefore, the efficiency values from 2014 to 2016 are further observed as shown in Table 2. Rural commercial banks became listed for the first time in 2016 and achieved higher efficiency than urban commercial banks, the second most efficient banks. The rural commercial banks are Wuxi Rural Commercial Bank, Jiangsu Jiangyin Rural Commercial Bank, Jiangsu Wujiang Rural Commercial Bank, Jiangsu Changshu Rural Commercial Bank, and Rural Commercial Bank of Zhangjiagang. Apart from Jiangsu Wujiang Rural Commercial Bank and Wuxi Rural Commercial Bank, which started their operation in 2004 and 2005, all these banks long-term engage local finance since 2001.

Table 2. Efficiency ranking based on sample classification for the sample period 2014–2016.

	2014		2015		2016	
Banks sampled	Average efficiency	Ranking	Average efficiency	Ranking	Average efficiency	Ranking
Joint equity commercial banks	0.739	3	0.849	3	0.787	3
Urban commercial banks	0.930	2	0.942	2	0.770	4

Large state-owned commercial banks	0.945	1	0.949	1	0.913	1
Rural commercial banks					0.812	2

Conclusion

By adopting the views of the intermediation approach and evaluating banks' operational efficiency using the cost efficiency model, we addressed the similarity in efficiency values observed in most literature on DEA analysis.

If banks could enhance their cost efficiency and generate more revenue by reducing staff numbers, lowering the payroll, or increasing loan disbursement and investments, we could expect an overall improvement in the efficiency of China's banks. This would improve the operational efficiency of the banking industry and give momentum to China's economic growth. Employees are the backbone of the company; hence, improving the value of employees is a major concern for the company.

Further, we found that rural commercial banks have registered progress in operational efficiency in recent years due to the implementation of rural reform policies. The banking industry's operational efficiency is a powerful driving force for economic growth; hence, banks should continue providing excellent financial service to stimulate the local economy.

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