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Productivity, efficiency, and non-performing loans in the Chinese banking industry

Ning Zhu [a,*], Bing Wang [a], Yanrui Wu [b]

[a] School of Economics, Jinan University, No. 601, West of Huangpu Avenue, Tianhe District, Guangzhou, Guangdong 510632, China
[b] Business School, University of Western Australia, 35 Stirling Highway, Crawley, Perth, Western Australia 6009, Australia

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ABSTRACT

In this paper, the directional distance function and the metafrontier-Luenberger productivity indicator are used to measure the efficiency and the total factor productivity in 25 Chinese commercial banks over the period between 2004 and 2010. It is found that the pure technical efficiency of the state-owned commercial banks is better than that of the joint-stock commercial banks and the city commercial banks, while non-interest income is the major source of inefficiency. In total, the Chinese banking industry performs well in terms of overall productivity. The technological scale change indicating the change of return to scale in technology is the driving force for overall productivity growth. However, the pure technical efficiency change and the pure technologic change are not significant, and the scale efficiency change has a negative effect to productivity. The potential technological relative change for the three groups is greater than zero.

1. Introduction

The rapid growth of the Chinese economy, particularly since 2001, has led a number of scholars, both within China and overseas, to study the performance of the Chinese banking industry (Ariff & Luc, 2008; Barros, Chen, Liang, & Peypoch, 2011; Chen, Skully, & Brown, 2005; Kumbhakar & Wang, 2007). However, these earlier studies have not taken non-performing loans into account, although non-performing loans are a critical component to impact the development of the Chinese banking industry. Later studies, such as Drake and Hall (2003), have included non-performing loans as a fixed input, and measured banking efficiency. However, Fukuyama and Weber (2008) find that the non-performing loans as a byproduct of performing loans should be treated as an undesirable output. Guarda, Rouabah, and Vardanyan (2012) strongly evidence that non-performing loans are an important undesirable output.

Chung, Färe, and Grosskopf (1997) introduce the directional distance function, expanding desirable outputs and constricting undesirable outputs simultaneously, to evaluate the performance of Swedish pulp mills. Many scholars (Banker, Chang, & Lee, 2010; Park & Weber, 2006) have employed the directional distance function to measure banking efficiency with non-performing loans because of its ability to solve the oriented problem successfully. Although the directional distance function solves the oriented problem, the radial problem still exists. Therefore, this paper employs a generalized non-radial and non-oriented data envelopment analysis to

* Corresponding authors. Tel.: +86 20 85220173.
E-mail addresses: znzy1986@163.com (N. Zhu), twangb@jnu.edu.cn (B. Wang), yanrui.wu@uwa.edu.au (Y. Wu).

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solve both problems. This model is described as the slack-based measurement directional distance function (Fukuyama & Weber, 2009). Departing from the Wei, Ni, and Sheng (2011) method to measure inefficiency, one of the benefits of using the slack-based measurement directional distance function is that it can be decomposed easily to explore the sources of inefficiency.

In addition to the radial and oriented problems, another limitation is the assumption that all firms have homogeneous technology. In other words, it is assumed that only one technology frontier exists; however, this assumption ignores heterogeneous technology derived from different environments. A number of different group frontiers are caused by different technology frontiers. To measure the efficiency of multi-groups, Hayami (1969) proposes the concept of the meta-production function, and the metafrontier model improves following intensive studies in the field. Ruttan and Binswanger (1978) define the meta-production function as a production function that is determined by large numbers of firms with optimum efficiency. More recently, Sharma and Leung (2000) introduce the concept of stochastic frontier analysis into the meta-production function. Battese and Rao (2002) apply a stochastic metafrontier model to measure the technical efficiency of multi-groups with different technologies. They find there are two types of data generation processes in a stochastic frontier and a metafrontier analysis. However, Battese, Rao, and O'Donnell (2004) modify the hypothesis and find there is only one data generation process, which is the given technology. They also find that the technology gap ratio can measure the potential efficiency ratio between actual and potential groups. Furthermore, Rambaldi, Rao, and Dolan (2007) use a distance function to define the metafrontier. They also propose a metafrontier-Malmquist productivity index, whose decomposition is based on data envelopment analysis. In particular, the metafrontier-Malmquist productivity index has introduced the concept of the metafrontier function to the field of total factor productivity measurement. Furthermore, Zhang and Choi (2013b) incorporate Zhang and Choi (2013a) and Zhang, Zhou, and Choi (2013) to develop a metafrontier non-radial Malmquist–Luenberger productivity index.

Some scholars have applied the metafrontier method to measure the efficiency of foreign and regional banks, particularly due to the technology gap ratio (Bos & Schmiedel, 2007; Chiu, 2006; Huang & Chiang, 2010; Kontolaimou & Tsekouras, 2010), but very few papers focus on total factor productivity of the Chinese banking industry.

To overcome the problems mentioned above, this study widens the research in a number of aspects. First, when non-performing loans are treated as an undesirable output, the slack-based measurement directional distance function is used to solve radial and oriented problems to measure banking inefficiency. Meanwhile, inefficiency is decomposed to explore its sources. Second, to match the additive slack-based measurement directional distance function, a non-radial and non-oriented metafrontier-Luenberger productivity indicator is used to deal with the heterogeneity problem to evaluate the banking total factor productivity.[1]

2. Background

2.1. Three types of banks in the Chinese banking industry

Dramatic industrial structure change since the 1978 opening up of the Chinese economy has influenced the nation's economic growth and the development of its banking industry (Dong, Song, & Zhu, 2011). During the 1979–1984 period, the Agriculture Bank of China, the Bank of China, the China Construction Bank, and the Industrial and Commercial Bank of China, commonly known as the Big Four, were separated from the People's Bank of China. As the state-owned specialized banks for different sectors, the Big Four provided credit to various state-owned enterprises. However, due to the Big Four's political obligation to support state-owned enterprises during China's 1979 moving toward economic reform, large amounts of non-performing loans were accumulated, which seriously slowed the growth of the banking industry (Zhang & Wang, 2011). Barseghyan (2010) finds that non-performing loans reduce social output and drop the rate of production. Furthermore, Zhu, Wang, and Yu (2014) use shadow price to measure the opportunity cost of non-performing loans and find that non-performing loans reduce banking efficiency.

In order to break the monopoly of the Big Four in the Chinese banking industry, and explore the reform for the Big Four, the first joint stock commercial bank (JSCB), the Bank of Communication, was established in 1986. Later, other JSCBs, like the China CITIC Bank, and the China Merchants Bank, appeared sequentially. Meanwhile, three state-owned policy banks were specially established in 1994, and the Big Four transformed specialized banks to state-owned commercial banks (SOCBs), but many non-performing loans still seriously burden the SOCBs.

In addition, with the exception of the SOCBs and the JSCBs, there were more than 5200 urban credit cooperatives in Chinese financial market in the 1979–1995 period. Due to the large accumulation of non-performing loans and bank mergers among local urban credit cooperatives since 1995, the 138 city commercial banks (CCBs) that have formed is another important group promoting reform in the Chinese banking industry.

In contrast to the SOCBs and JSCBs, the CCBs mainly serve small and medium-sized enterprises, and further subdivide the market to transform the transaction-oriented bank into the service-oriented bank. However, unlike the experienced and adequately funded SOCBs and JSCBs, CCBs are more susceptible to risk because of an unstable operating situation (Ouyang, 2010).

In sum, the SOCBs, JSCBs, and CCBs are the collective driving force of the Chinese banking industry, and they

[1] Boussemart, Briec, Kertens, and Poutineau (2003) compare the Malmquist productivity index and the Luenberger productivity indicator in theory and practice, and present that the Luenberger productivity indicator based on differential form is likely to play a more important role in further research.