



The sources of bank productivity growth in China during 2002–2009: A disaggregation view

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ABSTRACT

This study investigates the sources of bank productivity growth in China over the period 2002–2009. In order to perform this research, we propose an advanced index – input slack-based productivity index (ISP) – a model that disaggregates total factor productivity growth into each input productivity change. Funds, capital, and employees are chosen as the inputs, whereas loans and other earning assets are outputs in this study. Our results show that technological gains transcend the efficiency regressions and result in total factor productivity growth. More specifically, technical progress in capital productivity reveals the dominant force behind the total factor technical change and productivity improvement. In addition, this paper uses these disaggregation terms to find out the competitive advantages and disadvantages of input usages for each Chinese bank. These findings indicate that the ISP index provides more insights than traditional total factor productivity indices.

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1. Introduction

In the past three decades, China's banking system has reformed gradually and gained remarkable successes in many respects. The total assets of the banking industry are over RMB 60 trillion, or 300 times that in 1978.¹ In November 2009 the capital adequacy ratio and the provision coverage of the banking industry were over 10% and 150%, respectively. Chinese banks in recent years have raised their importance in the world banking system. For example, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, and Bank of China are four of the largest 10 banks in the world. Moreover, financial reforms have made efficiency and productivity improvements in the banking sector (Chen et al., 2005; Matthews et al., 2009).

This paper investigates the total factor productivity (TFP) changes and disaggregates the sources of productivity change in China's banking industry from 2002 to 2009. This research period

is meaningful for Chinese banks, because China has entered the World Trade Organization (WTO) in December 2001. In addition, China's 'Big Four' state-owned banks (SOBs) have been partially privatized to take on minority foreign ownership since 2005. However, the academic literature related to bank productivity mainly focuses on US and European banks, using the Malmquist productivity index and Luenberger productivity index approaches.

One of the first studies to investigate productivity change in the banking industry is Berg et al. (1992), who employ the Malmquist index for productivity growth and find that the source of productivity growth is efficiency improvement in Norway's banks during 1980–1989. Other evidence indicates that productivity growth is mainly driven by technical change for the American (Alam, 2001; Mukherjee et al., 2001), European, and Japanese banks (e.g., Casu et al., 2004; Koutsomanoli-Filippaki et al., 2009; Barros et al., 2010; Assaf et al., 2011) by applying the Malmquist index or Luenberger index. However, only a few research studies have taken a look at the productivity growth of Chinese banks, such as Kumbhakar and Wang (2007), Matthews et al. (2009) and Matthews and Zhang (2010). These studies generally conclude that a positive TFP growth is dominantly driven by technical progress in China's banking industry and the TFP growth rate of joint-stock banks (JSBs) is higher than SOBs.

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¹ RMB stands for Renminbi, the Chinese currency.

In summary, prior literature adopts the Malmquist productivity index (MPI) or Luenberger productivity index (LPI) to investigate the change of TFP, efficiency change, and technical change. Unfortunately, these two indices are aggregative and do not simultaneously deal with the TFP growth and the productivity change of a single factor under a total factor framework, meaning insights may be lacking if we want to investigate the productivity change of one particular factor among all input factors (such as labor, capital, and fund inputs). This paper tries to overcome the disadvantage of the total factor productivity index and introduces an index to measure the productivity change of an individual factor under a total factor framework.

The proposed index herein, the so-called input slack-based productivity index (ISP), uses a Färe–Lovell efficiency measure to extend the traditional Luenberger productivity index and finds the strongly efficient vector for each input. This index then can be decomposed into particular input efficiency change and input technical change, meaning that we can discuss the sources of individual input productivity. Furthermore, we show that the TFP change is the average of the productivity change of an individual input. It is meaningful that we can explore the sources of each bank's TFP growth, efficiency change, and technical progress.

The remainder of this paper is organized as follows. Section 2 reviews financial reform in China's banking industry and the literature on efficiency and productivity improvements of Chinese banks. Section 3 illustrates our proposed total factor input productivity index. Section 4 interprets the data sources and variables' descriptions. Section 5 provides the empirical results and Section 6 concludes this paper.

2. Literature review

2.1. Financial reform in China's banking industry

China is both a developing country and a transitional market economy. Financial reform and development there reflect the influence of both these contexts. Referring to the environment with different regulations and competition, the China Banking Regulatory Commission (CBRC) divides the financial reform of the banking industry into three stages. We briefly introduce these three stages of financial reform process since 1978 (for more details, see Kumbhakar and Wang, 2007; Berger et al., 2009, 2010; Lin and Zhang, 2009).

2.1.1. First stage of financial reform (1978–1993)

Before financial reform, China's financial system took on a mono-bank model (i.e. People's Bank of China, PBOC). During 1978–1993, the financial system began the first round of financial reform aimed at restructuring the operations of its banking system. To expand the banking system, four wholly state-owned specialized banks, commonly called the 'Big Four', were founded and provided loans to state-owned enterprises (SOEs) in specific sectors. Bank of China, Agricultural Bank of China, and China Construction Bank were founded in 1979, and Industrial and Commercial Bank of China was established in 1984. Sequentially, the Big Four were allowed to enter and compete in all sectors in 1985.

2.1.2. Second stage of financial reform (1994–2002)

During the 1990s, the asset quality of the Big Four worsened significantly as they accumulated a great amount of non-performing loans (NPLs). This difficulty was attributed to these banks making large volume policy loans to the SOEs, which only played a social role rather than for profit maximization. To alleviate this problem, the Chinese government launched the second round of financial reform in 1994. Accordingly, the government set up three major instruments for strengthening the balance sheets and the competitiveness of SOBs as follows.

First, to decrease the massive NPLs in China's financial system, the government established three policy banks to take over the policy-lending activities from the SOBs in 1994. The government also initiated four asset management companies (AMCs) to absorb the existing pool of NPLs in 1998. These AMCs bought the NPLs of the SOBs with a sum of 1.4 trillion RMB at face values (roughly 20% of their outstanding loans).

Second, in May 1995 the government enacted the 'Commercial Banks Law of the People's Republic of China' to construct a legal commercial banking system. The SOBs now could move more toward being a commercial business and profit-driven. Additionally, the government encouraged the entry of both new domestic commercial banks and foreign banks by relaxing the entry barriers. In the mid-1990s, 10 joint-stock banks (JSBs) and over 100 city commercial banks (CCBs) were established in the banking system.

Third, new accounting principles, which are consistent with the basic ideas of the International Accounting Standards, were adopted in July 1993. After the Asian financial crisis, China's central bank recognized the importance of risk management in the banking sector and adopted a new risk management system with five-tier classifications of loans in 1998.

2.1.3. Third stage of financial reform (2003–present)

In 2003, three important policies were implemented in line with the third stage of financial reform. First, the China Banking Regulatory Commission (CBRC) was established to realize better governing of Chinese banking institutions. Second, CBRC promoted foreign share purchases, regulating that foreigners could own up to 25% of any domestic bank and ownership from any one single foreign investor was allowed at between 5% and 20%. Third, the State Council provided US\$45 billion of foreign exchange reserves to Bank of China and China Construction Bank in order to reinforce their capital structures.

Up until now, many state-owned banks, joint-stock banks, and city commercial banks have brought in foreign strategic investors after 2003. For example, in October 2005, Royal Bank of Scotland announced a US\$3.1 billion investment which gave the British bank control of just under a 10% in Bank of China. Further investments were made by Swiss bank UBS and Singapore government-led Temasek, which also promised to subscribe to an additional US\$500 million worth of shares during Bank of China's initial public offering (IPO).

Aside from financial restructuring and foreign strategic investments, China's government encouraged banks to list on stock exchanges in order to improve their governance and external monitoring. For instance, to date, all of the Big Four banks have successfully issued IPOs inside and outside China. Table 1 summarizes some information on the IPOs of the Big Four. It shows that China Construction Bank was the first to issue an IPO among the Big Four, whereas Bank of China was the first to take this route on the local market – the Shanghai Stock Exchange. Moreover, the Agricultural Bank of China completed the world's largest IPO at a total of US\$22.1 billion.

The step of China's financial reforms is ongoing. The capital adequacy ratios of all Chinese banking institutions were for the first time over 8% on average in 2007 and over 10% in 2009. Furthermore, China Development Bank Corporation was established in 2008, indicating that reform in policy banks had also made significant progress.

2.2. Evolution of efficiency and productivity improvements of Chinese banks

After an introduction on China's financial reform, this subsection further reviews existing research studies that investigate efficiency and productivity issues to see whether the reform would

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