Applying Data Envelopment Analysis in Measuring the Efficiency...

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Abstract: China is a bank-dominated country; therefore, the sustainability of the Chinese banking industry is important for economic development. In this paper, data envelopment analysis (DEA) was combined with the Malmquist index, and we statically and dynamically analyzed the efficiency of listed banks during the period 2012–2017. The results showed that 12 of the 17 banks improved their technical efficiency. The technical efficiency of three banks remained the same, whilst that of two banks had dropped slightly by less than 1.0%. The Chinese government has learned from the lessons of past financial crises to find a way to forestall financial crisis, and implemented macroprudential policy, therefore the banking industry has actively served the real economy and promoted economic development while paying attention to the prevention of financial risks. According to the report of The Banker in 2018, for the first time, the four biggest banks in China topped the list of the Top 1000 World Banks. The research showed that, the Chinese government applied macroprudential framework in the banking supervision, and the listed banks effectively resisted financial risks and realized steady growth. We believe that the macroprudential framework plays a positive role in the economic development and financial stability in China.

Introduction

Finance is the core element of the modern economy. As a bank-dominated country, it is important for the national economy to achieve sustainable and healthy development of the Chinese banking industry. Therefore, the Chinese government has been paying significant attention to policy making and planning of the banking industry. In 2012, the former Chinese president Hu Jingtai pointed out that the Chinese government was going to enhance financial supervision and improve the competitiveness of financial institutions, including banks [1]. In the following year, the report on the work of the government also underlined the importance of improving the competitiveness of banks [2]. Recently, the five-year plan (2016–2020) stressed that the government should accelerate financial reform, enhance the efficiency of finance in serving the real economy, and improve the service quality and management levels of financial institutions [3]. In 2017, Chinese president Xi Jinping pointed out that the Chinese economy has been transitioning from a stage of rapid growth to an era of high-quality growth, which means that China will pursue an economy with better quality, higher efficiency, and an increased total factor of productivity. In addition, the reform of the financial system should be strengthened in order to serve the real economy better, and the financial supervision framework should be enhanced to forestall financial risks [4].

In 2008, the global financial crisis caused by the subprime mortgage crisis in the United States severely damaged the global financial system. At the annual meeting of the World Economic Forum held in January 2017, Chinese president Xi Jinping emphasized that the extravagant profit-seeking behaviours of the financial capital, as well as the serious lack of financial supervision, caused the global financial crisis. Therefore, we need to strengthen the ability of financial markets to resist risks [5]. Researchers found that the lack of effective macroprudential concept was an important reason for the crisis [6,7]. Over the years, international organizations, regulatory authorities of various countries, and academics have begun to pay more attention to the development of the theory and practice of constructing a macroprudential framework, and there is an international consensus on strengthening financial supervision and preventing risks [7,8].

The idea of macroprudential policy is that the rational behavior of individual financial institutions may be irrational from the perspective of the financial system. In boom times, the credit expansion of banks may result in financial crises; however, people find it hard to get a loan from banks during a credit crunch, which may contribute to worsening financial instability. Therefore, the aim of macroprudential policy is to reduce the probability and the huge costs of systemic financial risks. Furthermore, the proximate objective of macroprudential policy is to decrease stress on the financial system and its ultimate objective is to reduce the loss of output resulting from financial instability [9,10]. Macroprudential policy has played an important role in mitigating systemic risk and creating a suitable financial environment [7,11]. Additionally, Xu
Zhong, the director of the research bureau of the People's Bank of China, pointed out that during the process of opening China's financial industry to the outside world, it is necessary to open up steadily and orderly on the premise of improving macroprudential management, strengthening financial supervision, and improving the transparency of the financial markets. Thus, international competitiveness of the financial system can be improved, and the reform and development of the financial sector can be pushed to a new level in the new era. Moreover, the reinforcement of macroprudential management concentrates on the interaction between finance and the economy, which is conducive to the better financial support for development of the real economy [12–14].

At present, the direction of financial supervision is shifting from microprudential policy to a combination of microprudential and macroprudential policies. For instance, Basel III emphasizes the concept of macroprudential supervision. According to the development and changes of the economic and financial situation, the People's Bank of China, being the central bank of China, has continuously improved the macroprudential policy framework and constructed the Macro Prudential Assessment (MPA) system in 2016. The MPA system supervises the financial institutions in terms of capital and leverage, assets and liabilities, liquidity, pricing behavior, asset quality, cross-border financing risk, and the implementation of credit policy. Since the first quarter of 2017, the central bank incorporated off-balance-sheet financing into broad credit indicators for MPA. Moreover, in the report of the 19th National Congress of the Communist Party of China (CPC) in October 2017, it was formally put forward that macroprudential policy and monetary policy should be the two pillars of the regulatory framework of the financial system [4].

Benefiting from the deepening of reforms and the improvement of policy frameworks, China's banking industry has achieved steady growth, even in the post-crisis period. According to the statistics disclosed by the China Banking Regulatory Commission (CBRC), the total assets of China’s Banking Financial Institutions (BFC) increased from 128.5455 trillion yuan to 252.4040 trillion yuan during the period from 2012–2017, with an average growth rate of 11.90%. Additionally, the number of employees who work in the BFC grew from 3,362,000 in 2012 to 4,090,000 in 2016. However, whether the efficiency of the banking industry is growing along with the rapid growth of the industry has become a focus of public attention. Moreover, whether a bank operates efficiently is associated with the sustainability of the bank. Additionally, as mentioned above, the sustainable development of the banking industry, especially in China, is important for economic growth as the banking industry could affect many other industries. In addition, according to Reference [15], most research focuses on the efficiency of banks in developed countries. However, development of the banking industry is not the same in developed countries and in developing countries. Therefore, research on the banking industry in developing countries will be quite interesting. Moreover, the studies will be of importance as China plays a more important role in the development of the global economy [16–18]. In all, our study concerning Chinese banks will fill the gap in previous studies. Furthermore, the DEA-based efficiency evaluation based on the latest data can depict the status quo of the banking industry in China well.

**Keywords**

data envelopment analysis (DEA); efficiency; total factor productivity; listed banks; finance; macroprudential framework; financial supervision; financial risks; financial stability; economic development

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