BANKING SECTOR EFFICIENCY IN INDIA: AN EMPIRICAL STUDY OF PUBLIC AND PRIVATE SECTOR

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ABSTRACT

This study delves into the Total Factor Productivity (TFP) growth of major Indian private and public sector banks from 2012 to 2022, employing the Malmquist Productivity Index and Data Envelopment Analysis (DEA). It scrutinizes TFP change, technical change, and efficiency change within the banking sector. Among public sector banks, approximately 58% exhibit positive productivity changes, contrasting with the increased productivity of private banks displaying 31.5%. Significant differences in TFP become evident, with Canara Bank ranking highest among public sector banks, achieving a TFP score of 1.059, while Punjab National Bank exhibits the lowest TFP, averaging at 0.948. In the private sector, Axis Bank emerges as the frontrunner with an average TFP of 1.145, whereas Tamil Nadu Mercantile Bank lags behind with an average TFP of 0.381. These findings furnish policymakers and stakeholders with crucial insights to formulate strategies aimed at bolstering the technical efficiency of both private and public sector banks in India, significant for the sector's sustained growth and stability.

Executive Summary

This study presents a comprehensive analysis of the Total Factor Productivity (TFP) growth in major Indian private and public sector banks over the period 2012 to 2022. Utilizing the Malmquist Productivity Index and Data Envelopment Analysis (DEA), it examines the dynamics of TFP change, technical change, and efficiency change within the banking sector.

The findings reveal noteworthy disparities between public and private sector banks in terms of productivity growth. Approximately 58% of public sector banks exhibit positive productivity changes, while private banks demonstrate a higher proportion, with 31.5% displaying increased productivity. This disparity highlights differing performance trajectories and underlying factors influencing productivity within the two segments of the banking sector.

A key highlight of the study is the identification of significant variations in TFP scores among the sampled banks. Within the public sector, Canara Bank emerges as the top performer, achieving a commendable TFP score of 1.059, indicating substantial productivity gains over the analyzed period. In contrast, Punjab National Bank exhibits the lowest TFP among public sector banks, with an average score of 0.948, signaling areas for improvement and potential challenges faced by the institution.

Similarly, in the private sector, Axis Bank emerges as the frontrunner, boasting an average TFP of 1.145, reflecting robust performance and efficiency gains. Conversely, Tamil Nadu Mercantile Bank lags behind with an average TFP of 0.381, indicating areas requiring attention and strategic interventions to enhance productivity and competitiveness.

These findings underscore the importance of targeted strategies to bolster the technical efficiency of both private and public sector banks in India. Policymakers and stakeholders can leverage these insights to formulate evidence-based policies and interventions aimed at addressing underlying constraints and fostering a conducive environment for sustainable growth and stability within the banking sector.

By understanding the factors driving productivity disparities and benchmarking performance against industry peers, banks can identify areas for improvement, optimize resource allocation, and enhance operational efficiency. Moreover, fostering a culture of innovation and continuous improvement will be crucial for navigating evolving market dynamics and maintaining competitiveness in an increasingly complex and dynamic banking landscape.

In conclusion, this study serves as a valuable resource for policymakers, regulators, and industry stakeholders, providing actionable insights to drive strategic decision-making and promote the long-term viability and resilience of the Indian banking sector. By addressing productivity challenges and leveraging opportunities for innovation and efficiency enhancement, banks can play a pivotal role in supporting economic growth and financial stability in India.

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Introduction

The economy relies heavily on the banking sector, which facilitates savings mobilization, efficient capital management, aids investment decision-making, and enhances risk management strategies. Strengthening the financial structure is imperative for overall economic development. India's banking system is predominantly bank-based, where banks play a crucial role in the financial framework, thus significantly impacting the country's economic development. India, with its vast population, diverse cultures, income disparities, urban-rural gaps, widespread illiteracy, and diverse economic, social, and geographical landscapes, possesses a banking system distinct from other Asian nations. In India, banks operate within the regulatory framework of the Reserve Bank of India (RBI). The banking sector

in India is divided into two categories: Scheduled banks and Non-scheduled banks. Scheduled banks are further classified into commercial or cooperative banks. Scheduled banks are those listed under schedule two of the RBI Act 1934. The RBI functions as the banker to all banks. Figure 1 illustrates the organizational structure of the Indian banking system.

Bank is termed a Scheduled bank that fulfills the following conditions laid under section 42(6) of the RBI Act, 1934:

1. Those banks whose reserve capital and the paid-up capital is as mentioned in the Act during that time.

2. Those who could assure RBI that their act is not detrimental to the interest of their depositors.

Categorically, the banking system is divided into public banks, private banks, and foreign banks based on ownership. Public banks are those where the government holds the majority stake (51%), private banks are owned predominantly by private entities, and foreign banks are owned by entities outside India. The overall well-being of the country's financial system hinges on its health. Efficiency and productivity serve as key indicators of financial health and performance.
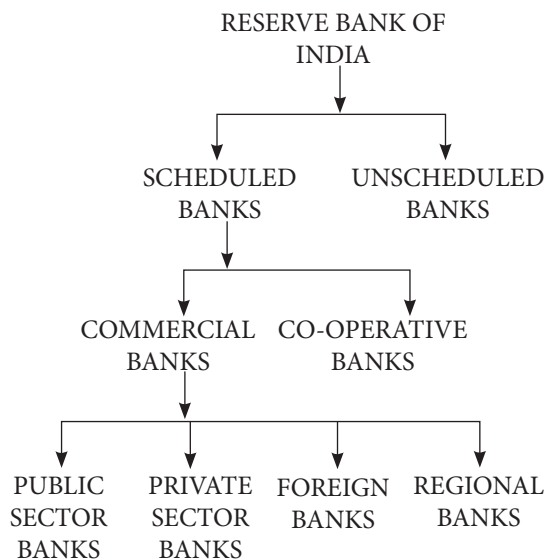
RESERVE BANK OF INDIA

SCHEDULED BANKS   UNSCHEDULED BANKS

COMMERCIAL BANKS   CO-OPERATIVE BANKS

PUBLIC SECTOR BANKS   PRIVATE SECTOR BANKS   FOREIGN BANKS   REGIONAL BANKS

Fig. 1. Structure of Banking System in India

Indian banks vary following size, structure, and ownership. Due to this, the measurement of efficiency needs to be different for different banks. There are various methods of measuring the efficiency of banks. These measurement techniques include traditional ratio methods, regression methods, and new non-parametric frontier methods. Financial ratios are the most simplest and easiest method of measuring efficiency. However, these ratios prove to be less reliable in the presence of more robust parametric and non-parametric methods. The primary methods commonly employed are regression-driven Stochastic Frontier Analysis (SFA) and nonparametric Data Envelopment Analysis (DEA). On the basis of assumptions of the random error, distribution of inefficiencies, and specification of frontier, the methods are selected. The basic assumption of Stochastic frontier Analysis is that it assumes a functional form, while this requirement of functional form is not present in DEA. DEA method is more flexible than SFA, wherein it allows multiple inputs and output for decision-making units instead of single output or intput required in SFA. Moreover, DEA helps in accounting for the undesirable form of output (input), which is not accounted for in SFA.

Productivity is the measurement of the ratio of output produced to the inputs consumedThis indicates the connection between inputs and outputs, aiding in the assessment of bank productivity and identifying areas where the banking sector can enhance its productivity. Productivity can also be measured using technical changes and the improvement in efficiency. To measure the productivity of the banks , the most appropriate method used is the MPI using the DEA technique.

Literature Review

Muharrami, (2008) determined the efficiency using DEA of public sector banks of India that operated for the period 2004-2005. The technical efficiency of public sector banks were found to be 88.5%. Hence, the research revealed that public sector banks exhibit decreasing returns to scale efficiency. Akeem and Moses, (2014) used Data Envelopment Analysis to study the banking efficiency of ten Nigeran banks during the period 2002-2012. The study reveals that the allocative efficiency of the Nigerian Banks does not depict the global perspective. Certain banks were efficient and consistent in their performance. However,

GT bank showed remarkable consistency among all the sample banks, certain banks showed an efficiency level below satisfactory. This low level of performance could be due to the competitive level of managerial services in the banks. The study revealed that the banks of Nigeria needed managerial attention for achieving the recapitalization of banking reforms, and their merger and acquisition level so that the global level of efficiency could be achieved. Sathye and Sathye, (2017) used the bootstrap data envelopment analysis to compute the performance efficiency of the banks of India. The authors found that the correlation of Indian banks between ATM intensity and the technical efficiency is negative.

Goyal *et al.*, (2019) assessed the intra-bank efficiency of a sample of 66 Indian banks during 2015-2016. Their findings indicated that Indian banks operated efficiently at a rate of only 73.44%, suggesting significant room for enhancing the efficiency of the banking sector in India. Furthermore, they noted that both foreign and private banking sectors exhibited superior performance compared to the public sector. Kamarudin *et al.*, (2019) investigated the potential effects of macroeconomic and bank-specific factors on the revenue efficiency domestic banks of Malaysia. The authors found that foreign banks' revenue efficiency is higher than that banks owned by governement of Malaysia. It was found that the management quality, liquidity, and bank market power significantly influence the revenue efficiencies of Malaysian banks. Wasiaturrahma *et al.*, (2020)specifically, Bank Perkreditan Rakyat (BPR determined the efficiency of two rural Indonesian banks and found that those banks are efficient in production yet inefficient in their role of intermediation. Moreover, it was reported that these results were affected by the Capital adequacy ratio (CAR) and the location of those banks. Himmawan and Firdausi, (2021) studied the efficiency and stability of commercial banks of Islam during 2017-2020. The operational expenses, total financing and third-party funds are positive and significant in the long run. While, in the short run, operational earnings are impacted by the operational expenses and total assets are impacted by the total financing. Cho and Chen, (2021) utilized Data Envelopment Analysis (DEA) to employ the meta-frontier cost Malmquist productivity index in assessing scale-to-return variables and the economic

implications and cost-side productivity in China. Their analysis unveiled a 6.26% enhancement in Malmquist productivity between 2011 and 2017.

Ullah, Majeed and Popp, (2023)number of branches, administration expenses, non-interest expenses, and loan loss provisions. In contrast, the output variable consists of net interest income, net commissions, and total other income. This study considers the internal determinants of the bank's Efficiency as corporate governance, enterprise risk management, ownership structure (state, foreign, and domestic ultimate owned banks determined the efficiency of seventeen banking sectors of Pakistan during the period 2011-2020. The study revealed that global ownership, corporate governance and return on equity positively and significantly impact the efficiency of Pakistan banks. However, there is a negative of financial leverage and enterprise risk management on banking efficiency. Patra, Padhan and Padhi, (2023) namely, business, profit, and Z-Score efficiencies for private and publicly owned Indian banks. It uses the data envelopment analysis (DEA estimated various efficiencies such as *z-score efficiency,* profit efficiency, and business efficiency of public and private banks using the DEA. The research found that the mean score of banks owned by government is more than that of privately owned banks. The level of ccapitalization and return on assets are related to the efficiencies of the private sector banks. Veluthedan and Kiran, (2023) measured the influence of digital financial services on the banking sector productivity in India using the MPI for the period 2012-2020. A sample of forty-four commercial banks was considered for the study. The authors found that impact of digital financial services variables on the productivity of Indian banks is positive. Krejnus *et al.*, (2023)we focus on identifying different indices that are aimed at measuring digitalization or e-Government. The results of the analysis showed that there are several indices that focus on this area within the EU, such as EGDI, EPI, LOSI, DGI, e-Government benchmark, Eurostat—Internet use, GII, DSGI, Going Digital toolkit, and DESI. Subsequently, the index areas to be used in the DEA method to measure the efficiency of e-Government-related inputs and outputs within the EU were identified. Inputs and outputs were selected logically and then verified using correlation analysis. Among the input and

output indices chosen were Internet usage, DSGI, GII, e-Government benchmark, and interaction with public administration online. From the analysis, three inputs and three outputs were used and the models were output oriented. After implementing the correlation, it can be said that the values between the selected sub-variables are suitable for DEA analysis. Two models were chosen for the calculation, namely the CCR and BCC models. The CCR model found 10 states to be efficient and BCC model found 13 states to be efficient. In addition, in the close analysis, we took a closer look at the CCR model's inference. Countries such as Denmark, Finland, Estonia, Malta, and Portugal were efficient outliers. When comparing the regions within the EU, we can conclude that the countries of Northern Europe are the most efficient in the field of digitalization (e-Government measured the efficiency level of digitization or e-government using the DEA technique in European Union. The efficiency using CCR and BCC models was found to be efficient for 10 and 13 states respectively. The researchers found that the efficiency in the field of e-government is high for the Northern European countries.

Research Methodology

Total factor productivity (TFP) of public banks and private banks is determined in this study. This study considers the19 private banks and 12 public banks from the period 2012-2022. The data for this research is purely secondary in nature. The data is obtained from the "*Statistical tables relating to banks in India*" available on the website of the apex bank i.e. RBI. The banks that were throughout the duration studied was considered in this research.

Selection of variable selection

Certainly! In the realm of variable selection for analyzing productivity in the banking sector, there are three primary methods: the production approach, the intermediation approach, and the value-added approach.

1. Production Approach: This method focuses on how banks convert capital and labor into deposits and loans. Essentially, it examines the banking efficiency in utilizing their resources to generate financial products and services.

2. Intermediation Approach: Here, banks are viewed as intermediaries that facilitate the flow of funds from surplus units (those with excess funds) to deficit units (those in need of funds). This approach emphasizes the role of banks in channeling resources within the economy.

3. Value-Added Approach: This approach considers the value creation aspect of assets and liabilities within banks. It evaluates how these assets and liabilities contribute to the overall value generated by the bank's operations, treating them as inputs or outputs for decision-making units.

In the current study, the intermediation approach is adopted for variable selection. This means that the focus is on understanding how banks mediate the flow of funds between surplus and deficit units. For the variables selected, output variables include interest and non-interest income. These are key indicators of the revenue generated by the bank's operations. On the other hand, input variables encompass fixed assets, employees, and loanable funds including deposits and borrowings from other banks. These inputs represent the resources utilized by banks in their operations.To assess productivity, the study employs the output-based Malmquist productivity index. This index allows for the measurement of changes in productivity over time by comparing the banking efficiency in converting inputs into outputs. More precisely, it assesses the productivity of 12 public sector banks and 19 private sector banks in India from 2012 to 2022. By employing the approach that assumes bank as intermediary i.e. intermediation approach and utilizing these specific variables and productivity index, the study aims to provide insights into the performance and efficiency of Indian banks for the specified timeframe.

Malmiquist Productivity Index

The current study uses the Malmquist Productivity Index. Malmquist productivity index is the Data envelopment analysis method that is used to measure the changes in productivity over a period of years. Thus, this method requires the panel dataset for measuring

the productivity in the form of TFP. This Total factor of productivity is seggregated into technological change and efficiency change. According to Fare et., (1994), output-oriented productivity is measured in the form of:

$$m_o\left(y_{t+1}, x_{t+1}, y_t, x_t\right) = \left[\frac{d_o^t\left(x_{t+1}, y_{t+1}\right)}{d_o^t\left(x_t, y_t\right)} \times \frac{d_o^{t+1}\left(x_{t+1}, y_{t+1}\right)}{d_o^{t+1}\left(x_t, y_t\right)}\right]^{1/2}$$

The index mentioned above represents The geometric average of two out-based productivity indices for the technology of period t and for the subsequent period t+1. It signifies the improvement in productivity from period (x, y) to period (xt+1, yt+1). The MPI can be approached either from an input-based perspective, focusing on reducing inputs without altering output quantities, or from an output-based perspective, concentrating on increasing output while maintaining input quantities.

Studies by Jaffry et al. (2007), Isik and Hassan (2003), and Isik (2008) suggest that the output-oriented Malmquist productivity index is deemed most appropriate for evaluating productivity in developing nations such as India. Therefore, this study chooses the output-oriented Malmquist productivity index to assess the productivity of public sector banks in India from 2012 to 2022. A value exceeding 1 indicates a positive Total Factor Productivity (TFP), whereas a value below 1 indicates a negative TFP.

Results And Discussions

In this section, the results of technical efficiency, total factor productivity, and efficiency change, for the selected private banks and public banks have been determined.

Table 1 presents an overview of the technical change, efficiency change, and total factor productivity observed in sample public sector banks from 2012 to 2022. Total factor productivity is further broken down into efficiency change and technical change to explain variations in productivity.

On average, the technical efficiency change for public banks stands at 1.012, with efficiency change contributing 1.007. The total factor productivity of public banks averages at 1.019, indicating a positive shift in the technical progress of India's public banks. Notably, the lowest total factor productivity among Indian public sector banks was recorded by Punjab National Bank, averaging at 0.948, while the highest was achieved by Canara Bank, reaching 1.059.

The analysis indicates that Bank of Baroda's productivity remained unchanged throughout the study period, as evidenced by a Malmquist index of 1. Among the 12 Indian public sector banks, seven demonstrated productivity improvements, with values

Table 1: Table showing the Efficiency change, TFP change and technical change of public sector banks.

BANKS	EFFCH	TECHCH	TFPCH
BANK OF BARODA	1	1	1
BANK OF INDIA	0.978	1.041	1.018
BANK OF MAHARASHTRA	1	0.982	0.982
CANARA BANK	1.088	0.973	1.059
CENTRAL BANK OF INDIA	1	1.01	1.01
INDIAN BANK	1	1.056	1.056
INDIAN OVERSEAS BANK	1	0.995	0.995
PUNJAB AND SIND BANK	1.122	0.997	1.118
PUNJAB NATIONAL BANK	0.908	1.043	0.948
STATE BANK OF INDIA	0.965	1.024	0.988
UCO BANK	1.035	0.971	1.005
UNION BANK OF INDIA	1	1.058	1.058
Geometric mean	1.007	1.012	1.019

exceeding 1. These banks include Bank of India, UCO Bank, United Bank of India, Canara Bank, Indian Bank, Punjab & Sind Bank, and Central Bank of India. Conversely, Bank of Maharashtra, Indian Overseas Bank, Punjab National Bank, and State Bank of India exhibited productivity indices below 1, indicating lower productivity levels.

Table 2 illustrates that the average total factor productivity (TFP) of private banks of India stood at 0.857, indicating a decrease in productivity during the period from 2012 to 2022. The average efficiency change and technical efficiency change were recorded at 0.985 and 0.871, respectively. Among these banks, Tamil Nadu Mercantile Bank exhibited the lowest

average TFP at 0.381, while Axis Bank displayed the highest TFP with an average score of 1.145.

Moreover, six out of the 19 private sector banks—Axis Bank, IDBI Bank, CSB Bank, HDFC Bank Ltd, RBL Bank Limited, and Nainital Bank Limited—achieved average productivity scores exceeding 1, indicating an improvement in their average technical productivity over the period. Conversely, City Union Bank, DCB Bank, Federal Bank Limited, ICICI Bank Limited, IndusInd Bank Limited, Jammu & Kashmir Bank Limited, Karnataka Bank, Karur Vyas Bank Limited, Kotak Mahindra Bank, South Indian Bank, Tamil Nadu Mercantile Bank, The Dhanalakshmi Bank, and Yes Bank Limited experienced a decline in technical productivity from 2012 to 2022.

Table 2: Table showing the efficiency change, total factor productivity, and technical change of Private sector banks.

BANKS	EFFCH	TECHCH	TFPCH
AXIS BANK LIMITED	1.19	0.962	1.145
CITY UNION BANK LIMITED	0.863	0.902	0.779
CSB BANK LIMITED	1.072	1.021	1.095
DCB BANK LIMITED	0.912	0.995	0.907
FEDERAL BANK LTD	0.977	0.836	0.817
HDFC BANK LTD.	1	1.056	1.056
ICICI BANK LIMITED	1	0.883	0.883
IDBI BANK LIMITED	1	1.089	1.089
INDUSIND BANK LTD	1	0.992	0.992
JAMMU & KASHMIR BANK LTD	1	0.739	0.739
KARNATAKA BANK LTD	1	0.582	0.582
KARUR VYSYA BANK LTD	1.212	0.815	0.988
KOTAK MAHINDRA BANK LTD.	1	0.881	0.881
NAINITAL BANK LTD	0.995	1.046	1.041
RBL BANK LIMITED	1	1.084	1.084
SOUTH INDIAN BANK LTD	0.838	0.881	0.738
TAMILNAD MERCANTILE BANK LTD	1	0.381	0.381
THE DHANALAKSHMI BANK LTD	1.009	0.852	0.86
YES BANK LTD.	0.744	0.969	0.721
Geometric mean	0.985	0.871	0.857

Conclusion

In conclusion, this study employs the MPI approach within the framework of DEA to evaluate the productivity of Indian banks, both in the public and private sectors. Assessing the total factor productivity of 12 public sector and 19 private sector Indian banks over the period 2012-2022, our analysis reveals significant findings.

Among private banks, six out of nineteen demonstrated higher levels of total factor productivity, while seven out of twelve public sector banks exhibited greater productivity levels. Notably, the average efficiency change, technical change, and total factor productivity change for public sector banks were recorded at 1.007, 1.012, and 1.019, respectively, indicating a constructive shift in productivity.

Conversely, private sector banks experienced a technological regression, with average scores of 0.985, 0.871, and 0.857 for efficiency change, technical change, and total factor productivity change, respectively.

This study underscores a notable disparity in total factor productivity between public and private sector banks, with only 31.5% of private banks showing positive productivity compared to 58% of public-owned banks achieving higher productivity indices. These findings emphasize the urgency for government and policymakers to redirect attention towards enhancing the productivity of private sector Indian banks.

However, it's important to acknowledge the limitations of this study, particularly in terms of mathematical methods employed. Future research could explore alternative methodologies to provide a more comprehensive understanding of productivity dynamics within the Indian banking sector.

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