

# **AN INVESTIGATION ON THE BANKING INDUSTRY IN INDIA - A POST LIBERALISATION ANALYSIS**

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**Doctor of Philosophy in Commerce**

Under the Faculty of

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*By*

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*Under the Guidance of*

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**July 2023**

## **DECLARATION**

I, Sreedevi E.S., hereby declare that the thesis entitled **An Investigation on the Banking Industry in India: A Post Liberalisation Analysis** is a bonafide research work done by me under the guidance and supervision of Prof. (Dr.) B. Johnson, Professor (Rtd.), Department of Commerce and Management Studies, University of Calicut. I further declare that no part of the thesis has been presented before for the award of any degree, diploma, fellowship, or other similar title or recognition in any university.

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## **CERTIFICATE**

This is to certify that no modifications or changes are suggested by the examiners in the Ph.D. thesis entitled "An Investigation on the Banking Industry in India: A Post Liberalisation Analysis" submitted by Sreedevi E.S

Place: University of Calicut,

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**Prof. (Dr.) B. Johnson**

(Supervising Teacher)

## **CERTIFICATE**

This is to certify that the thesis entitled “**An Investigation on the Banking Industry in India: A Post Liberalisation Analysis**” is a bonafide record of research work carried out by Sreedevi E.S. under my supervision and guidance for the award of Ph.D Degree of the University of Calicut and no part of the thesis has been presented before the award of any degree, diploma, or other similar title of recognition. She is permitted to submit the thesis.

Both the examiners have not suggested any modifications of suggestions and therefore the original thesis is resubmitted as such. The soft copy attached is the same as that of the resubmitted copy.



**Prof. (Dr.) B. Johnson**  
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# **An Investigation on the Banking Industry in India - A Post Liberalisation Analysis**

Research Scholar: **Sreedevi E.S**

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## **Abstract**

The financial system refers to the whole gamut of institutional arrangements that help to mobilise the financial surplus of an economy and transfer it to areas of financial deficit. India has a well-structured financial system. It has an amazing network of banks, other financial and investment institutions, and different financial instruments that all work in a well-developed capital and money market. The Indian financial system is dominated by banks. Over sixty percent of the entire assets of the financial system are held by commercial banks. Commercial banks are the heart of our financial system. They keep the deposits of millions of individuals, governments, and companies. Through their lending and investing activities, they make funds available to borrowers, such as individuals, businesses, and the government. Hence, the present study analysed the growth, profitability, efficiency, and productivity of commercial banks from 1992–93 to 2020–21. In addition to this, factors determining efficiency and productivity were analysed in the present study. For comparing the performance among the different groups of banks, commercial banks are classified into public sector banks, private sector banks, and foreign banks. Mean, compound annual growth rate, ratios, Data Envelopment Analysis, Malmquist productivity index, Kruskal-Wallis H test, ANOVA, panel tobit regression, and fixed and random effect models were employed for the analysis. The study revealed that none of the groups of banks exhibits consistent performance in the performance indicators selected in the study. In the growth analysis, the growth rate of private sector banks is higher than that of other groups of banks. The share of each bank group for each variable on the total of the variables indicates that public sector banks are still holding the major portion of the business; however, the trend of the percentage share of private sector banks has improved over the study period, while the share of public sector banks has decreased. The profitability and efficiency analysis found that the performance of foreign banks was better than that of domestic banks. Productivity analysis indicates that there is productivity progress among all commercial banks and public sector commercial banks, whereas private sector banks and foreign banks have experienced a decline in productivity. The study concluded that each group of commercial banks is performing better as per one performance indicator or another. None of the bank groups is performing better according to all the selected performance indicators.

**ഇന്ത്യയിലെ ബാങ്കിംഗ് വ്യവസായത്തെക്കുറിച്ചുള്ള ഒരു അന്വേഷണം  
- ലിബറലൈസേഷൻ ശേഷമുള്ള വിശകലന ഗവേഷണം**

റിസർച്ച് സ്റ്റോളർ: ശ്രീദേവി ഇ. എസ്.

ഗൈഡ്: പ്രൊഫ. ബി. ജോൺസൺ

സംഗ്രഹം

ഒരു സമ്പദ്വ്യവസ്ഥയുടെ സാമ്പത്തിക മിച്ഛം സമാഹരിക്കാനും സാമ്പത്തിക കമ്മി ഉള്ള മേഖലകളിലേക്ക് മാറ്റാനും സഹായിക്കുന്ന സ്ഥാപന ക്രമീകരണങ്ങളുടെ മുഴുവൻ ഭാഗത്തെയും സാമ്പത്തിക സംവിധാനം സൂചിപ്പിക്കുന്നു. മികച്ച സാമ്പത്തിക സംവിധാനമാണ് ഇന്ത്യക്കുള്ളത്. ബാങ്കുകൾ, മറ്റ് സാമ്പത്തിക, നിക്ഷേപ സ്ഥാപനങ്ങൾ, വിവിധ സാമ്പത്തിക ഉപകരണങ്ങൾ എന്നിവയുടെ അതിശയകരമായ ഒരു ശൃംഖലയുണ്ട്, അവയെല്ലാം നന്നായി വികസിച്ച മൂലധന, പണവിപണിയിൽ പ്രവർത്തിക്കുന്നു. ഇന്ത്യൻ സാമ്പത്തിക വ്യവസ്ഥയിൽ ആധിപത്യം പുലർത്തുന്നത് ബാങ്കുകളാണ്. സാമ്പത്തിക വ്യവസ്ഥയുടെ മൊത്തം ആസ്തികളുടെ അറുപത് ശതമാനത്തിലധികവും വാണിജ്യ ബാങ്കുകളുടെ കൈവശമാണ്. വാണിജ്യ ബാങ്കുകൾ നമ്മുടെ സാമ്പത്തിക വ്യവസ്ഥയുടെ ഹൃദയമാണ്. ദശലക്ഷക്കണക്കിന് വ്യക്തികളുടെയും സർക്കാരുകളുടെയും കമ്പനികളുടെയും നിക്ഷേപം അവർ സൂക്ഷിക്കുന്നു. അവരുടെ വായ്പ നൽകൽ, നിക്ഷേപ പ്രവർത്തനങ്ങളിലൂടെ, വ്യക്തികൾ, ബിസിനസ്സുകൾ, സർക്കാർ തുടങ്ങിയ വായ്പക്കാർക്ക് അവർ പണം ലഭ്യമാക്കുന്നു. 1992-93 മുതൽ 2020-21 വരെയുള്ള കാലയളവിൽ വാണിജ്യ ബാങ്കുകളുടെ വളർച്ച, ലാഭക്ഷമത, കാര്യക്ഷമത, ഉൽപ്പാദനക്ഷമത എന്നിവ വിശകലനം ചെയ്തു. ഇതിനുപുറമെ, കാര്യക്ഷമതയും ഉൽപ്പാദനക്ഷമതയും നിർണ്ണയിക്കുന്ന ഘടകങ്ങൾ ഈ പഠനത്തിൽ വിശകലനം ചെയ്തു. ബാങ്കുകളുടെ വിവിധ ഗ്രൂപ്പുകൾ തമ്മിലുള്ള പ്രകടനത്തെ താരതമ്യം ചെയ്യുന്നതിന്, വാണിജ്യ ബാങ്കുകളെ പൊതുമേഖലാ ബാങ്കുകൾ, സ്വകാര്യമേഖലയിലെ ബാങ്കുകൾ, വിദേശ ബാങ്കുകൾ എന്നിങ്ങനെ തരംതിരിച്ചിരിക്കുന്നു. ശരാശരി, സംയുക്ത വാർഷിക വളർച്ചാ നിരക്ക്, അനുപാതങ്ങൾ, ഡാറ്റാ എൻവലപ്പ്മെന്റ് അനാലിസിസ്, മാൽകിസ്റ്റ് പ്രൊഡക്ടിവിറ്റി ഇൻഡക്സ്, ക്രൂസ്കൽ-വാലിസ് എച്ച് ടെസ്റ്റ്, അനോവാ, പാനൽ ടോബിറ്റ് റിഗ്രഷൻ, ഫിക്സ്ഡ്, റാൻഡം ഇഫക്ട് മോഡലുകൾ എന്നിവ വിശകലനത്തിനായി ഉപയോഗിച്ചു.



പഠനത്തിൽ തിരഞ്ഞെടുത്ത പ്രകടന സൂചകങ്ങളിൽ ബാങ്കുകളുടെ ഗ്രൂപ്പുകളൊന്നും സ്ഥിരമായ പ്രകടനം കാഴ്ചവയ്ക്കുന്നില്ലെന്ന് പഠനം വെളിപ്പെടുത്തി. വളർച്ചാ വിശകലനത്തിൽ, സ്വകാര്യമേഖലയിലെ ബാങ്കുകളുടെ വളർച്ചാ നിരക്ക് മറ്റ് ബാങ്കുകളുടെ ഗ്രൂപ്പുകളേക്കാൾ കൂടുതലാണ്. മൊത്തം വേരിയബിളുകളിലെ ഓരോ വേരിയബിളിനും ഓരോ ബാങ്ക് ഗ്രൂപ്പിന്റെയും വിഹിതം സൂചിപ്പിക്കുന്നത് പൊതുമേഖലാ ബാങ്കുകൾ ഇപ്പോഴും ബിസിനസിന്റെ പ്രധാന ഭാഗം കൈവശം വയ്ക്കുന്നു എന്നാണ്; എന്നിരുന്നാലും, സ്വകാര്യമേഖലയിലെ ബാങ്കുകളുടെ ശതമാനം വിഹിതത്തിന്റെ പ്രവണത പഠന കാലയളവിൽ മെച്ചപ്പെട്ടു, അതേസമയം പൊതുമേഖലാ ബാങ്കുകളുടെ വിഹിതം കുറഞ്ഞു. വിദേശ ബാങ്കുകളുടെ പ്രകടനം ആഭ്യന്തര ബാങ്കുകളേക്കാൾ മികച്ചതാണെന്ന് ലാഭക്ഷമതയും കാര്യക്ഷമത വിശകലനവും കണ്ടെത്തി. എല്ലാ വാണിജ്യ ബാങ്കുകളിലും പൊതുമേഖലാ വാണിജ്യ ബാങ്കുകളിലും ഉൽപ്പാദനക്ഷമത പുരോഗതി ഉണ്ടെന്ന് ഉൽപ്പാദനക്ഷമത വിശകലനം സൂചിപ്പിക്കുന്നു, അതേസമയം സ്വകാര്യമേഖലയിലെ ബാങ്കുകളും വിദേശ ബാങ്കുകളും ഉൽപ്പാദനക്ഷമതയിൽ ഇടിവ് നേരിട്ടു. വാണിജ്യ ബാങ്കുകളുടെ ഓരോ ഗ്രൂപ്പും ഒരു പ്രകടന സൂചകം അല്ലെങ്കിൽ മറ്റൊന്ന് അനുസരിച്ച് മികച്ച പ്രകടനം കാഴ്ചവയ്ക്കുന്നുണ്ടെന്ന് പഠനം നിഗമനം ചെയ്തു. തിരഞ്ഞെടുത്ത എല്ലാ പ്രകടന സൂചകങ്ങളും അനുസരിച്ച് ഒരു ബാങ്ക് ഗ്രൂപ്പും മികച്ച പ്രകടനം കാഴ്ചവയ്ക്കുന്നില്ല.

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## **List of Abbreviations**

AE	Allocative Efficiency
ALM	Asset Liability Management
ATM	Automated Teller Machines
CAGR	Compound Annual Growth Rate
CE	Cost Efficiency
CRAR	Capital to Risk-Weighted Asset ratio
CRR	Cash Reserve Ratio
DEA	Data Envelopment Analysis
EFFCH	Efficiency Change
IRDA	Insurance Regulatory and Development Authority
LAF	Liquidity Adjustment Facility
NABARD	National Bank for Agriculture and Rural Development
NBFC	Non Banking Finance Companies
PE	Profit Efficiency
PECH	Pure Efficiency Change
PTE	Pure Technical Efficiency
RBI	Reserve Bank of India
RE	Revenue Efficiency
SE	Scale Efficiency
SEBI	Securities and Exchange Board of India
SECH	Scale Efficiency Change
SLR	Statutory Liquidity Ratio
TE	Technical Efficiency
TECHCH	Technology Change
TFPCH	Total Factor Productivity Change

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# CHAPTER I

## **INTRODUCTION**

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## **1.1 Introduction**

A financial system refers to the whole gamut of institutional arrangements, which helps to mobilize financial surplus of an economy and transfer them to the areas of financial deficit (Bhasin, 2006). It plays a vital role in the economic growth of that country. A well-organized, efficient, smoothly functioning financial system is essential for the pursuit of economic growth and stability. The core function of a well-developed financial system is to promote the smooth and efficient transfer of resources from savers to ultimate consumers (Desai, 2019). The financial system consists of a set of institutions, instruments, and markets as well as a legal and regulatory framework that permits transactions to be made by extending credit (World Bank). The primary reason for the existence of the financial sector is to fulfil the requirements of the real economy by directing savings towards productive activities. As the real economy expands and diversifies, the financial sector is expected to grow in size and scope to support the process of economic growth and development (RBI, 2016).

The Reserve Bank of Australia (2014) outlined the four fundamental functions of the financial system as value exchange, intermediation, risk transfer, and liquidity. By exchanging value, the financial sector makes it possible to make payments, and by acting as an intermediary, it makes it easier for savers and borrowers to transfer and receive funds. A financial system that works well makes it easier to price and allocate certain risks, and it also makes it easier to turn assets into cash without losing too much value. According to the World Bank, financial sector development has a significant impact on economic growth. It fosters economic growth through capital accumulation and technical advancement by boosting the

savings rate, mobilizing and pooling funds, creating information on investment, facilitating and encouraging foreign capital inflows, and optimizing capital allocation. In addition, it decreases poverty and inequality by expanding access to finance for the poor and vulnerable groups, facilitating risk management by reducing their vulnerability to shocks, and boosting investment and productivity, which leads to increased revenue production.

India has a well-structured financial system. It has an amazing network of banks, other financial and investment institutions, and different financial instruments that all work in a well-developed capital and money market. The Indian financial system consists of financial institutions, financial instruments and financial markets (Desai, 2019). The financial markets are a crucial part of the Indian financial system. They are not just a source of funds but instead operate as a facilitator by connecting individual and institutional savers and investors. The financial market includes the capital or securities market as well as the money market. The capital or securities market represents institutional sources of long-term capital, whereas the money market component permits the adjustment of liquidity among market participants. The capital or securities market consists of the primary or new issue market and the secondary or stock market (Khan, 2016). Institutions in the financial markets, such as commercial banks and non-bank intermediaries, engage in the process of financial intermediation, in which surplus funds or savings are directed to deficit sectors. The financial institutions distribute surplus economic units' funds to people desiring to invest in real capital. Using their informational advantage in the loan market, financial intermediaries can boost economic growth by combining the funds of small, dispersed savers and allocating them for investment in an efficient manner. They are the primary agents responsible for the mobilization of surplus funds to finance productive activity, and to the extent that they do so, they promote capital accumulation and, consequently promote growth (Machiraju, 2013).

The Indian financial system is dominated by banks. Over sixty per cent of the entire assets of the financial system, which includes banks, insurance firms, non-banking financial companies, cooperatives, mutual funds, and other smaller banking

institutions, are held by commercial banks (Mohanty,2013). Commercial banks are the heart of our financial system. They keep the deposits of millions of individuals, governments, and companies. Through their lending and investing activities, they make funds available to borrowers, such as individuals, businesses, and the government. In doing so, they enable the movement of goods and services from producers to consumers as well as the government's financial operations. They constitute a substantial component of our medium of exchange and are the means by which monetary policy is implemented. These facts naturally lead to the conclusion that the nation's commercial banking system is essential to the running of the economy. Commercial banks play an extremely significant role in our economy; in fact, it is difficult to imagine how our economic system might operate effectively in the absence of many of the services that commercial banks provide. They are the core of our financial structure because, in conjunction with the Reserve Bank of India, they may increase the nation's money supply and create additional purchasing power. The lending, investment, and related activities of banks help the production, distribution, and consumption processes of the economy. The growth of commercial banking activity has occurred in multiple directions and dimensions. Banks have played a catalytic role in area development, backward area development, and rural development assistance, while also significantly assisting agriculture, industry, and international trade. In this manner, commercial banks have emerged as the most important financial institutions for rapid economic growth (Desai, 2019).

The Indian banking sector consist cooperative banks, development finance institutions, non-banking financial companies, insurance companies, provident funds, and mutual funds in addition to commercial banks, which are the primary financial system intermediaries. In accordance with the Banking Regulation Act of 1949 and the Reserve Bank of India Act of 1934, the Reserve Bank exercises its supervisory authority over the whole banking sector, including commercial and cooperative banks. Under the Reserve Bank of India Act of 1934, all financial institutions in India are regulated by the Reserve Bank. Following the 1997 revisions to the RBI Act, a comprehensive regulatory structure for NBFCs was also implemented. While the Reserve Bank regulates state and district central cooperative

banks and regional rural banks, the National Bank for Agriculture and Rural Development (NABARD) is in charge of their supervision. The Insurance Regulatory and Development Authority (IRDA) and the Securities and Exchange Board of India (SEBI) govern insurance funds and mutual funds, respectively (Desai, 2019).

The primary function of banks and other financial institutions is to serve as intermediaries, directing savings into investment and consumption. Through these institutions, the investment needs of savers are reconciled with the credit requirements of investors and consumers. If this transfer process is to be carried out efficiently, it is imperative that the banks be involved. Indeed, they gain significant economies of scale in the performance of their duties: the savings placed at their disposal are used in a vast number of transactions tailored to the specific needs of the borrowers. In this way, both savers and borrowers, who would otherwise have to engage in separate transactions, are able to realize significant cost savings. However, these economies of scale involve more than just cost savings (Desai, 2019).

Commercial banks have been referred to as ‘department shops of finance’ due to the wide variety of financial services they offer. They provide a variety of other services in addition to accepting deposits, lending, and investing, such as fund transfer, collection, foreign exchange, secure custody, safe deposit lockers, traveler's cheques, merchant banking services, credit cards, gift cheques, and so on. They also play a significant role in the growth of entrepreneurship. Commercial bank functions affect economic activity, including agriculture, industry, trade, exports, and consumption. The Indian banking sector is about to undergo a remarkable transformation. With the entry of several new private banks, the facilitation of the expansion of foreign bank branches and the rapid growth of non-banking financial organizations and their activity, banks are in the middle of a fierce competition (Desai, 2019).

After the nationalisation of banks, banking sector reforms led to significant changes to the overall financial system, particularly the Indian banking system. The Narasimham Committee (I) was established to examine all relevant aspects of the

structure, organisation, activities, and procedures of the Indian financial system. The committee examined the system in depth and provided numerous suggestions and recommendations for its enhancement. In response to the committee's suggestions, a number of modifications were implemented. The year 1992-1993 saw the beginning of the implementation of a prudential system of income recognition, asset classification, and provisioning. Several policy changes have been implemented since then in an effort to follow international best practices. In April 1992, the Reserve Bank of India (RBI) introduced a Capital to Risk-Weighted Asset ratio (CRAR) system as the basis for assessing capital for banks (including foreign banks) in India as a capital adequacy measure. In addition, a phased implementation of the transparency and disclosure principles outlined in the International Accounting Standards has taken place. Interest rates have been deregulated, and statutory pre-emption in the form of SLR and CRR have been reduced progressively. The banking system was liberalised by making it possible for new private sector banks and local area banks to enter the market. Under some restrictions, banks have been granted more freedom in areas like branch licensing, credit delivery, recruitment, post creation, etc. A debt recovery tribunal has been established for the rapid adjudication and collection of debts owed to banks and other financial institutions. In November 1994, the Board for Financial Supervision was established as a committee of the Central Board of Directors of the RBI with the aim of exercising integrated supervision. A banking ombudsman scheme has been implemented to investigate complaints against banks and their employees and to quickly resolve complaints from customers. Further, the Reserve Bank of India Act was amended in 1997 to establish a comprehensive regulatory framework for non-bank financial companies (NBFCs) (Shekhar & Shekhar, 2007).

The significant progress made in the reform of the financial sector has inspired confidence to give the banking sector reforms a further push. In light of these circumstances, a committee on banking sector reforms (Narasimham Committee (II)) was formed. In accordance with the committee's recommendations, a number of reforms were also implemented. The mid-term review of Monetary and Credit Policy announced a range of measures to strengthen the banking system,

including the assignment of a risk weight of 2.5% to cover market risk; a risk weight of 100% for foreign exchange and gold open position limits; stringent asset classification, income recognition, and provisioning norms; further enhancing transparency in accounting and disclosure practises; and the reduction of an exposure ceiling with respect to an individual borrower. In accordance with the suggestions, the CRAR was raised from 8% to 9% for the year ending March 31, 2000. From 1<sup>st</sup> April 1999, an Asset Liability Management (ALM) system has been in existence, and the RBI has advised banks to establish internal ALM committees at the senior management level to oversee its implementation. In three sequential stages, the Liquidity Adjustment Facility (LAF) has been implemented, beginning with an interim LAF in April 1999, which was replaced by a full-fledged LAF in June 2000. Banks are advised to establish a review system for larger loans immediately following their approval. Banks are advised to adopt effective measures for the reduction of nonperforming assets and to implement risk management systems and practices to prevent the emergence of new nonperforming assets. In October 1999, detailed guidelines were established for risk management systems in banks, including credit, market, and operational risk (Shekhar & Shekhar, 2007). The first and second reforms were initiated and implemented in a certain sequence to make it easier for banks to overcome external restraints like managed interest rate structures, high levels of pre-emption in the form of reserve requirements, and giving credit to only certain sectors. One of the main goals of reforms in the banking sector has been to boost productivity and efficiency by making the market more competitive (Reddy, 2005).

The present study tries to analyse the growth, profitability, efficiency and productivity of commercial banks from the period of 1992-93 to 2020-21. The following sections describe the statement of the problem, significance of the study, research questions, objectives of the study, hypotheses of the study, conceptual model and chapterization.



## **1.2 Statement of the problem**

The financial system, specifically the banking sector, is an essential component of the economy as a whole. It is necessary for the accomplishment of the goals of the macroeconomic system. It serves as a means of social transformation and a catalyst for economic growth. It is essential for mobilising national savings and channelling them towards core investment priorities, as well as making better use of the available resources. As a result, the financial sector is commonly regarded as a significant contributor to the growth of the economy. Prior to the beginning of the 1990s, the banking industry was characterised by lack of competition, a low capital base, low productivity, and high intermediation costs. Following the nationalisation of major banks in 1969 and 1980, government-owned banks have dominated the banking industry. The role of technology was minimal, and service quality was not given sufficient consideration. Banks also did not follow a proper risk management system, and prudential standards were insufficient. All issues resulted in poor asset quality and low profitability. In this context, financial sector reforms were implemented in the early 1990s to bring about a shift in the structure, efficiency, and stability of financial markets, as well as an integration of the markets. The first generation of banking reforms led to the establishment of new private-sector banks and about 20 new foreign banks after 1993. The emergence of sophisticated, professional private sector banks and foreign banks has strengthened the competition. With the liberalisation of interest rates for both advances and deposits, competition between different bank groups and banks in the same group has become severe. In addition to that, the first phase of reforms comprises a decrease in SLR and CRR, deregulation of interest rates, asset classification and provisioning, revenue recognition, liberalisation of branch licencing policies, and so on. Following the recommendations of the Committees on Banking Sector Reforms in 1998, the second phase of reforms focused more on structural measures and improvements in standards of disclosure and transparency in order to align Indian standards with international best practices. All measures proposed for the first and second phases of financial sector reforms have been implemented in a phased manner. Since the banking sector is considered to be the backbone of the Indian

financial system, not just the financial sector reforms but also the entire liberalisation policies undertaken by the Indian government in other sectors may have an effect on it. In addition to reform, the Indian banking sector has also undergone drastic changes as a result of various regulatory actions and policies introduced periodically by the authorities. Technological progress also made the banking business more vibrant and dynamic. In short, since the implementation of banking sector reforms, the Indian banking sector has undergone significant changes over the time. Therefore, it is expected that there may be variations in the performance of the commercial banks in India. Hence, it is essential to assess whether the performance of India's commercial banks has changed over time. By examining a longer period, it is possible to assess the effect of all the changes that have occurred in the banking industry since the implementation of financial sector reforms on the performance of commercial banks.

### **1.3 Significance of the study**

The Global Financial Crisis (GFC) that occurred in the United States between 2007-2008 showed that a bank's failure affects the nation's economy and the economy of the entire world. This crisis is enough to understand the importance of commercial banks in the country's economic structure. Commercial banks play a vital role in the economic growth of a nation and it maintains a dominant position in the modern financial structure. The operation of commercial banks in India has experienced significant changes due to the implementation of financial sector reforms. Further, the Reserve Bank of India is continuously trying to improve the operational procedures of India's commercial banks in order to make such institutions more effective and profitable. Moreover, several unexpected shocks have affected the banking system's functioning, such as the global financial crisis, the demonetization, COVID-19, etc.

Furthermore, technological advancement made the banking system more efficient and made banking transactions cheaper and more accessible to the public. The widespread availability of Automated Teller Machines (ATMs), internet banking, mobile banking, and various payment applications (such as Google Pay and

Paytm) have made it much simpler and more convenient to conduct financial transactions. Therefore, technology plays a vital part in the day-to-day operations of commercial banks. The Indian banking sector became more differentiated due to the granting of licenses to payment banks and small finance banks; however, this may affect commercial banks because these banks also accept deposits and lend money (only small finance banks). Commercial banks are also adopting technology-based services extensively to attract more clients into their business to attract more customers. In this way, the banking system is very competitive, and commercial banks must be profitable, efficient, and productive to sustain themselves in the market.

The preceding discussion makes it evident that there is a need to regularly evaluate the performance of commercial banks because they operate as the core of the economic system, and the banking sector in India is inherently dynamic. In the current study, four key performance indicators- growth, profitability, efficiency, and productivity are used to analyze the performance of commercial banks. Commercial banks that perform well according to one performance measure may not perform well according to another indicator, even if they perform better overall. Therefore, using those four parameters, the study examines the performance of commercial banks from 1992–1993 to 2020–2021. This period is crucial because substantial changes have occurred in the Indian banking sector due to adopting reforms in the financial sector.

#### **1.4 Scope of the study**

The aim of this study is to investigate the growth, profitability, efficiency, and productivity of the Indian banking industry following liberalization. The study spans the years 1992–1993 and 2020–2021. A comparative analysis of public sector banks, private sector banks, and foreign banks has been conducted. Commercial banks are evaluated based on their growth, profitability, efficiency, and productivity. The growth of commercial banks was determined by analyzing their assets, liabilities, income, and expenses. The spread, burden, and profitability ratios have all been taken into consideration while analyzing the profitability. Productivity is

measured in terms of the change in total factor productivity, whereas efficiency is measured in terms of revenue, cost, and profit efficiencies. The study also examined the factors that influence productivity and efficiency.

### **1.5 Research questions**

This study focuses primarily on answering the following research questions:

1. Which group of banks experienced the highest increase in assets, liabilities, income, and expenses during the research period?
2. During the study period, what was the average profitability of each group of banks?
3. Profitability-wise, which bank group is performing the best?
4. What were the average costs, revenues, and efficiencies of each group of banks during the research period, and how did they fluctuate?
5. Which group of banks demonstrates the greatest cost, revenue, and profit efficiency?
6. Are there significant differences in terms of profitability, efficiency, and productivity between the various groups of banks?
7. What factors affect the efficiency and productivity of commercial banks?
8. Is there any impact of the global financial crisis and demonetisation on the productivity and efficiency of India's commercial banks?

### **1.6 Objectives of the study**

The broad objective of the study is to investigate the changes in the growth, profitability, efficiency, and productivity of the Indian banking industry during the post-liberalization period ranging from 1992–1993 to 2020–21. In particular, the specific objectives of the study are as follows:

1. To study the trend and progress made on the assets, liabilities, income, and expenses of commercial banks as a whole and across different groups of commercial banks.

2. To measure and compare the profitability among different ownership groups of banks during the post-liberalization period.
3. To examine the trends in cost, revenue, and profit efficiencies among the commercial banks as a whole and across distinct ownership groups of banks during the post-liberalization period.
4. To analyze the Total Factor Productivity (TFP) growth of commercial banks in India.
5. To explore the factors affecting the cost, revenue, profit efficiencies, and total factor productivity of commercial banks.

## **1.7 Hypotheses**

To address the above objectives, the study uses the following hypotheses

### **1.7.1 Hypotheses relating to growth analysis**

1. There is no significant difference in the growth rate of advances among public sector banks, private sector banks and foreign banks.
2. There is no significant difference in the growth rate of investment among public sector banks, private sector banks and foreign banks.
3. There is no significant difference in the growth rate of deposits among public sector banks, private sector banks and foreign banks.
4. There is no significant difference in the growth rate of borrowings among public sector banks, private sector banks and foreign banks.
5. There is no significant difference in the growth rate of interest income among public sector banks, private sector banks and foreign banks.
6. There is no significant difference in the growth rate of non-interest income among public sector banks, private sector banks and foreign banks.
7. There is no significant difference in the growth rate of interest expense among public sector banks, private sector banks and foreign banks.
8. There is no significant difference in the growth rate of operating expenses among public sector banks, private sector banks and foreign banks.

### **1.7.2 Hypotheses relating to profitability analysis**

1. There is no significant difference in the ratio of interest income to total assets among public sector banks, private sector banks and foreign banks.
2. There is no significant difference in the ratio of interest expenses to total assets among public sector banks, private sector banks and foreign banks.
3. There is no significant difference in the ratio of spread to total assets among public sector banks, private sector banks and foreign banks.
4. There is no significant difference in the ratio of Non-interest income to total assets among public sector banks, private sector banks and foreign banks.
5. There is no significant difference in the ratio of operating expenses to total assets among public sector banks, private sector banks and foreign banks.
6. There is no significant difference in the ratio of burden to total assets among public sector banks, private sector banks and foreign banks.
7. There is no significant difference in the ratio of interest income to total assets among public sector banks, private sector banks and foreign banks.
8. There is no significant difference in the ratio of interest income to total assets among public sector banks, private sector banks and foreign banks.

### **1.7.3 Hypotheses relating to efficiency analysis**

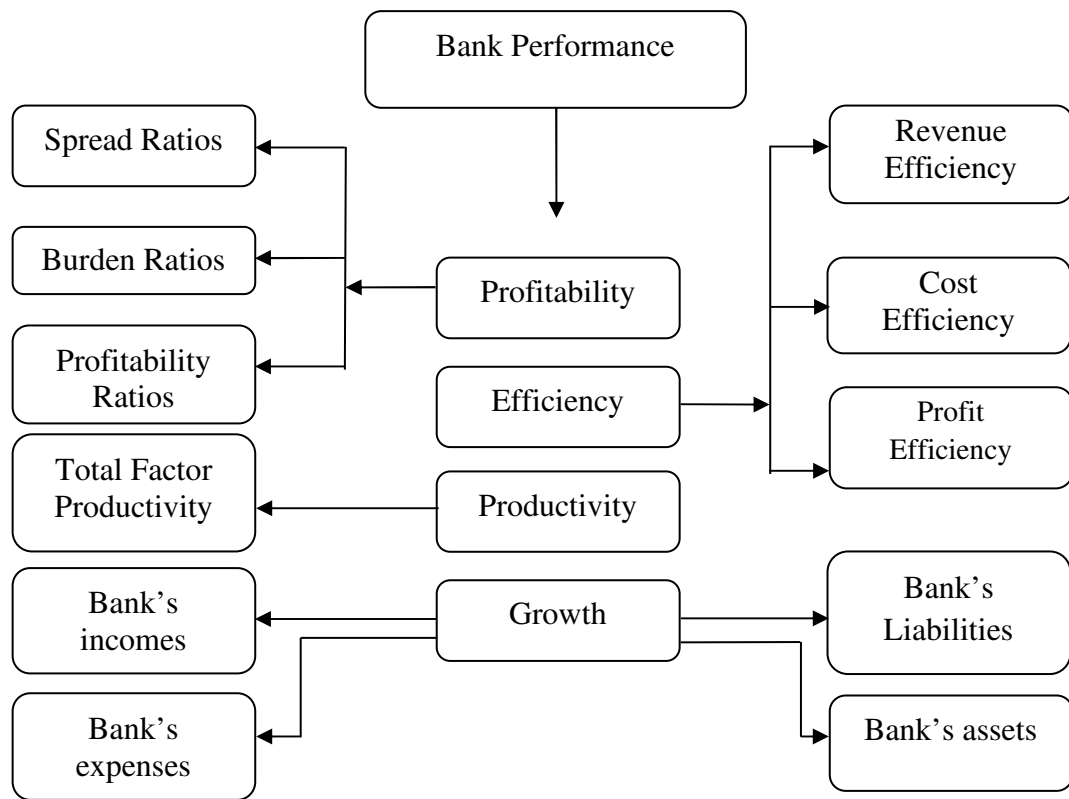
1. There is no significant difference in revenue efficiency among public sector banks, private sector banks and foreign banks.
2. There is no significant difference in output-oriented allocative efficiency among public sector banks, private sector banks, and foreign banks.
3. There is no significant difference in output-oriented technical efficiency among public sector banks, private sector banks, and foreign banks.
4. There is no significant difference in output-oriented pure technical efficiency among public sector banks, private sector banks, and foreign banks.
5. There is no significant difference in output-oriented scale efficiency among public sector banks, private sector banks, and foreign banks.

6. There is no significant difference in cost efficiency among public sector banks, private sector banks and foreign banks.
7. There is no significant difference in input-oriented allocative efficiency among public sector banks, private sector banks, and foreign banks.
8. There is no significant difference in input-oriented technical efficiency among public sector banks, private sector banks, and foreign banks.
9. There is no significant difference in input-oriented pure technical efficiency among public sector banks, private sector banks, and foreign banks.
10. There is no significant difference in input-oriented scale efficiency among public sector banks, private sector banks, and foreign banks.
11. There is no significant difference in profit efficiency among public sector banks, private sector banks, and foreign banks.

#### **1.7.4 Hypotheses relating productivity analysis**

1. There is no significant difference in TFPCH among public sector banks, private sector banks, and foreign banks.
2. There is no significant difference in EFFCH among public sector banks, private sector banks, and foreign banks.
3. There is no significant difference in TECHCH among public sector banks, private sector banks, and foreign banks.
4. There is no significant difference in PECH among public sector banks, private sector banks, and foreign banks.
5. There is no significant difference in SECH among public sector banks, private sector banks, and foreign banks.

### 1.8 Conceptual model of the study



### 1.9 Chapterization

The current study is divided into eight chapters. Chapter I addresses the study's introduction, problem statement, significance, research questions, aims, hypotheses, conceptual model, and chapter structure. Chapter II describes the literature review regarding the growth of the banking industry, the efficiency, profitability, and productivity of commercial banks, as well as the identified research gaps. Chapter III provides an overview of the Indian banking industry and examines its evolution, and major events since independence. The fourth chapter discusses the research methodology used in this study. This chapter describes the research design, period of the study, sample of the study, sources and types of data, and analysis tools, techniques, and variables. Chapter V is an analytical chapter that details the growth and profitability of commercial banks, while Chapter VI depicts the efficiency and productivity of commercial banks by describing an empirical analysis of the latter. Chapter VII describes the study's summary, findings, and conclusion, while Chapter VIII details the study's proposed recommendations.



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## CHAPTER II

# REVIEW OF LITERATURE

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## **2.1 Introduction**

The review of literature is a vital part of the research process. It makes a significant contribution to the remaining portion of the study effort, which is quite important. It is helpful in the first stages of research activity to provide a theoretical foundation for the investigation, to explain any questions or concepts that may exist, and to build a research technique. In the later stages of the research process, literature reviews are used to strengthen and improve the researcher's knowledge base. It is also beneficial to integrate the findings with the existing body of knowledge during the final stage of the research process (Kumar R., 2011).

In the present study, an attempt is made to analyze the performance of commercial banks in India during the post-liberalization period. The performance is evaluated according to growth, profitability, efficiency, and productivity. This chapter provides a review of the previous research that is pertinent to the current topic. The reviews are split up into four categories as follows:

1. Indian studies relating to growth and profitability
2. Foreign studies relating to growth and profitability
3. Indian studies relating to efficiency and productivity, and
4. Foreign studies relating to efficiency and productivity

## 2.2 Indian studies relating to growth and profitability

In this part, studies relating to the growth and profitability of commercial banks in India are included. Studies conducted both before and after the reform using different types of ratios, application of the CAMEL model and CRAMEL approach, and incorporating different groups of commercial banks such as public sector banks, private sector banks, and foreign banks are included here.

**Jayachitra and Geetha (2014)** evaluated the trends in profitability of commercial banks in India from 1980–91 to 2011–12. The study again compared the profitability of different groups of commercial banks, such as all scheduled commercial banks, public sector banks, private sector banks, and foreign banks, and between different periods, namely pre-reform (1980–92) and post-reform (1993–2012). For analyzing the profitability, the study used different indicators such as operating profit margin, net profit margin, operating profit to average working fund, return on capital employed, and credit deposit ratio. The study used an exponential growth function after checking stationarity using the Augmented Dicky-Fuller test. According to the study, when comparing the growth rate of profitability indicators before and after reform, public sector banks showed a declining trend in growth rate for all profitability indicators. It was observed that the major reason for the declining trend in profitability is mainly due to a decline in spread because of increased competition among the commercial banks. Further, not much interbank difference is found in the different profitability indicators selected in the study.

**Bhatia et al. (2012)** investigated the profitability determinants of private sector commercial banks in India from 2006–07 to 2009–10. Twenty-three private sector commercial banks were taken into the study, and backward stepwise regression analysis has been used to study the impact of the determinants. Return on asset (ROA) has been taken as a dependent variable, and spread ratios, provisions and contingencies, non-interest income, credit deposit ratio, operating expenses ratio, profit per employee, business per employee, investment deposit ratio, capital adequacy ratio, non-performing asset ratio, and a dummy variable for type of bank were taken as independent variables for the study. The study found that spread ratio,

provisions and contingencies, non-interest income, operating expense ratio, profit per employee, investment/deposit ratio, and non-performing assets are the variables significantly determining the profitability of private sector commercial banks in India.

**Rakhe (2010)** compared the profitability of foreign banks to that of other Indian bank groups. For this purpose, the study used different profitability ratios such as the net profit to total asset ratio, net interest income as a ratio to total assets, interest income as a percentage of total income, other income as a percentage of operating expense, and so on. From the analysis, the study observed that access to low-cost funds, diversification of income, and adequate other income to meet the operating expenses are the key factors leading to the profitability of foreign banks. The study used panel data regression analysis to find out the determinants of the profitability of commercial banks. For this purpose, net profit to total assets is taken as a dependent variable, and efficiency of fund management, operating expenses to total assets, other income to total assets, credit risk, cyclical output, and inflation are taken as independent variables. The regression analysis found that all the independent variables were significantly affecting the profitability of commercial banks.

**Jindal (2016)** evaluated the profitability growth of commercial banks in India from 2001 to 2015, a span of fifteen years. Utilizing trend analysis, the study employed total income, expenditure, spread, burden, and profit as indicators. For comparison purposes, the banks were put into four groups: SBI groups, nationalized banks, private sector banks, and foreign banks. Private sector banks reported the biggest growth in total income and total expenditures among the four types of banks at the end of the study period. Except for foreign banks, all other banks had an upward trend in total income but a downward trend in expenditures throughout the initial period of the study. Additionally, private sector banks recorded the highest growth index for spread, burden, and profit. SBI Group and foreign banks both showed a downward trend in 2007 and 2010. During the study period, all types of

banks exhibited a varying pattern of burden. Private sector banks, unlike other types of banks, displayed an upward trend in profits during the study period.

**Rani et al. (2013)** examined the performance of commercial banks in India by categorizing them as private sector or public sector and using parameters such as investments, deposits, advances, total assets, gross non-performing assets, net non-performing assets, interest income, other income, interest expended, operating expenses, total expenditure, operating profit, net profit, credit deposit ratio, and investment deposit ratio. Using the compound growth rate, the performance of banks from 2009 to 2012 was evaluated. In the case of the public sector bank, growth was reported in the parameters of deposits, investment, advances, total assets, net NPA, interest income, operating expenses, total expenditure, operating profit, net profit, and credit deposit ratio. For private sector banks, growth was reported in the variables of credit deposit ratio, net profit, operating profit, total expenditure, operating expenses, other income, interest income, total assets, advances, investments, and deposits.

**Vergheese (1983)** attempted to investigate the factors influencing the profitability performance of commercial banks in India, as well as the downward trend in profits and profitability of commercial banks during the 1970s. This study analyzes the trends in the profitability ratios of gross and net profit, operating margin (operation income minus operating expenses), gross yield on assets, and spread for various categories of banks during the period of 1970 to 1979. These categories of banks include all scheduled commercial banks, all Indian scheduled commercial banks, public sector banks, the SBI group, and nationalized banks. The employee productivity of selected banks has also been analyzed based on the average asset per employee, the average deposits and advances per employee, salaries and wages per unit of deposits and advances, the proportion of establishment expenditures in the total current operating expenses, and net income per employee. Further financial implications of cheap funds provided by means of an increase in the SLR and CRR, interest tax proceeds, and priority sector lending have been evaluated in terms of both the method of transfer earnings and their cost.

**Brinda Devi (2013)** examined the profitability of selected private sector banks, namely Axis, ICICI, Karur Vysya Bank, and South Indian Bank. Several ratios, including interest spread percentage, net profit margin, return on long-term fund, return on net worth, and return on assets, were utilized in the study to evaluate the profitability performance of banks from 2002–2003 to 2011–2012. According to the findings of the study, there is a statistically significant difference in the mean values of interest spread, net profit margin, return on net worth, and return on long-term funds of selected private sector banks; however, there was no statistically significant difference in the case of return on assets at these banks. However, the study is silent on the selection criteria for the banks under consideration.

**Mohan (2002)** analyzed the performance of public sector banks following deregulation. From 1991–1992 to 1999–2000, the performance of 19 nationalized banks was measured using five key indicators of performance. The study examined the parameters of nonperforming assets, interest spread, intermediation cost, provision and contingencies, and net profit, and found that the overall efficiency of the banking sector has increased since deregulation. Additionally, the performance of public sector banks was compared to that of private and foreign banks. It was found that public sector banks performed worse than private and foreign banks.

**Chandulal (2016)** carried out a study that compared the financial performance of public and private sector banks in India. Interbank comparisons were made within SBI and its associates, nationalised banks, old private sector banks, and new private sector banks for the purpose of this study. 29 different financial ratios were used to make these comparisons. The financial ratios have been organised into the following categories: capital adequacy ratios, debt coverage parameters, balance sheet parameters, management efficiency parameters, profitability parameters, employee efficiency parameters, and nonperforming assets parameters. The study also examined the financial performance differences between these banks and financial performance based on public and private sector banks. Ten of the selected ratios out of the total of twenty-nine ratios were found to be significant at each of the three levels of analysis.

In his thesis, **Davda (2016)** assessed the financial performance of selected new-generation private sector banks in India. During the time span of 2006–2015, the research looked at how well banks performed financially in terms of their liquidity, asset quality, management efficiency, investment valuation, and profitability. Within the scope of this research, seven new-generation private sector banks were chosen. According to the findings of the ratio analysis conducted over the time period under consideration (2006–2015), both Kotak Bank and Axis Bank had very good performances. Additionally, the study discovered significant differences in almost all of the financial performance ratios. The study's recommendations for enhancing a bank's financial performance may be more creative and tailored to the institution's specific needs, as opposed to the broad recommendations that are well known to everybody.

**Buddha (2015)** also carried out a comparative study of the financial performance of the Dena Bank and the Bank of Baroda by employing conventional ratios such as liquidity ratios, activity ratios, leverage ratios, profitability ratios, and market value ratios for a period of ten years ranging from 2004–2005 to 2013–2014. Even though the study had multiple aims, only the ratios listed above were analyzed. The T test result of the data shows that there is a significant difference between the selected banks with respect to the following ratios: interest earned ratio, non-interest income ratio, spread ratio, net profit margin, return on long-term fund ratio, return on net worth ratio, net profit ratio, other income ratio, operating expense ratio, operating expense to total fund ratio, total assets turnover ratio, assets turnover ratio, capital adequacy ratio, advances and loan ratio, financial charge coverage ratio, total debts to owner fund, and investment deposit ratio.

**Dhaduk (2016)** evaluated the performance of public and private sector banks in India during the time period of 2004–05 to 2013–14 using the CAMEL model. The CAMEL model takes into account nine different ratios, including the return on capital employed ratio, the borrowing to net worth ratio, the return on total assets ratio, the interest earned to total assets ratio, the operating expenses on total fund ratio, the net profit on total fund ratio, the interest income to business ratio, the net

profit to business ratio, and the quick ratio. The analysis discovered significant differences in the CAMEL ratios of selected private and public banks. The study also compared the performance of public and private sector banks and found that there was a statistically significant difference in the CAMEL ratios between public and private sector banks during the study period. This finding was based on the observation that the CAMEL ratios of public sector banks were lower than those of private sector banks.

**Devi (2014)** examined the efficiency, financial soundness, and profitability of commercial banks from 2002–03 to 2011–12 using the CRAMEL and Banko metre models. The CRAMEL model is used to measure the efficiency and profitability of the banks and contains ratios on capital adequacy, resources deployed, asset quality, management efficiency, earnings quality, and liquidity. The research revealed a mixed picture, with different bank groups outperforming each other in each aspect of the CRAMEL model. According to the results of the study, derived from the indexed ratios, the overall financial performance of the banks was rated as excellent, good, fair, or poor for each of the institutions. The study used the Bankometric model to examine the financial soundness of the banks across the study period and determine the solvency ratio. Based on the solvency ratio, the study revealed that all the scheduled commercial banks were exceptionally efficient during the study period. In addition to this, the research discovered the expansion and growth of a number of other factors, including advances, deposits, borrowings, interest income, total income, net worth, total assets, liquid assets, fixed assets, provisions and contingencies, investments, and net profits.

**Bansal (2010)** conducted a study to investigate how the process of liberalisation affected the productivity and profitability achieved by India's public sector banks. In addition to this, it investigated the variables that influence the profitability of public sector banks as well as the contributions of each factor to the profitability and productivity of public sector banks throughout the course of the period 1996–2007. For the purpose of this study, productivity ratios were calculated based on deposits, advances, business, total income, total expenditure, burden, net



profit, and spread on a per branch and per employee basis. Spread, burden, and profitability ratios were utilised for measuring profitability. The ratio analysis of the profitability of the public sector banks revealed a downward trend throughout the course of the study period. The study concluded that strengthening the project assessment capabilities, forming strategic alliances with appropriate banks, changing the organisational structure, and other initiatives will help banks increase their productivity and profitability.

**Bansal et al. (2018)** examined the factors that determined the profitability of 39 BSE-listed Indian banks in the public and private sectors during the years 2012 and 2017. In this work, fixed and random effect panel data estimation methodologies were applied. The quick ratio, capital adequacy ratio, interest income to total fund ratio, interest expended to interest earned ratio, cash deposit ratio, credit deposit ratio, total income to capital employed ratio, total debt to owner fund ratio, and advances to loan funds are the independent variables chosen for the study. The dependent variables are net profit margin and return on assets. When return on asset was employed as the dependent variable, the findings showed that the various financial ratios included in this study had no relationship with the profitability of Indian public sector banks.

In their research work, **Jhamb & Prasad (2012)** attempted to analyse the profitability and efficiency of both private and public sector banks in India during the period of 2000–2001 to 2010–2011. A comparative case study of Oriental Bank of Commerce and HDFC was carried out by making use of a number of selected parameters. These parameters included credit deposit ratio, investment deposit ratio, net interest margin to total assets, return on assets, cost of deposits, cost of funds, burden to asset ratio, return on advances, business per employee, and the ratio of net non-performing assets to net advances. Only three of the ten parameters, including business per employee, return on assets, and net interest margin to total assets, indicated a negative correlation between public and private banks. However, seven of the ten factors showed a positive association.

In her thesis, **Hemachandrika (2003)** made an effort to investigate the productivity and profitability attained by public sector banks in India, as well as the extent to which social objectives are met by these institutions. The study calculated bank productivity using per branch and per staff ratios based on a variety of variables such as deposits, advances, priority sector advances, income, expenditure, profit, spread, burden, and so on. Bank profitability was analysed using spread, burden, and profitability measures from 1970–1980 to 1981–2001. The research found that public sector banks are successful in limiting the concentration of economic power among a few by using loan authorization schemes and differential rate of interest schemes. Following the nationalisation of the banking industry, it was determined that human resource development was of great importance. According to the report, banks should establish an asset reconstruction fund to facilitate the quick takeover of doubtful debt.

**Mahendrasinh (2013)** conducted research on the profitability analysis of a selected group of Indian banks operating in the public and private sectors between the years 2000–01 and 2011–12. The analysis made use of a number of different profitability ratios, including gross profit margin, operating margin, net profit margin, cash profit ratio, return on net worth ratio, return on asset ratio, interest spread ratio, return on long-term fund ratio, and return on capital used ratio. All the selected profitability ratios were found to be significantly different between public and private sector banks. In addition, the research found that the ratios of public and private sector banks are statistically different.

**Kanjana (2007)** performed research on the profitability, efficiency, and growth of scheduled commercial banks that were operating in India from 1995–1996 to 2004–2005. The study conducted an efficiency analysis based on the selected variables of deposits, advances, net profit, spread, establishment expenses, total expenses, business, and burden. The efficiency analysis was performed based on both the branch and the employee. The profitability of the banks are evaluated using three different ratios: the spread ratio, the burden ratio, and the profitability ratio. Herfindhal's index of concentration has also been utilized in research concerning the

relative efficiency of banks. The SBI bank group, as well as nationalized banks and private sector banks, were all included in the study; however, foreign banks were left out of the analysis. The analysis of all four areas provide a comprehensive picture of the profitability of commercial banks in India.

**Thangam and Salini (2016)** made an effort to do research on the profitability analysis of private and public sector banks operating in India during the years 2010–2011 to 2014–2015. It also analyzed the relationship between productivity and profitability in the banking industry by using return on assets and return on equity as the variables for profitability and profit per employee, business per employee, credit deposit ratio, capital adequacy ratio, and wages bills to total expenses ratio as the variables for productivity. The analysis showed that during the period both private and public sector banks are making money.

The performance of Indian banks was analyzed by **Budhedeo (2018)** in terms of productivity, profitability, and liquidity for the time period of 2010–11 to 2016–17. The ratio analysis and the calculation of the compound annual growth rate were utilized in the research project so that the results could be measured. For the purpose of the comparative study, banks in India were divided into three categories: public sector, private sector, and foreign banks. The ratios of deposits per employee, advances per employee, and business per employee were used to gauge productivity. Similarly, the ratios of deposits per office, advances per office, and business per office were also used. Foreign banks had the highest compound annual growth rate compared to other banks in all ratios. Return on equity, return on assets, net interest margin, and profit-loss ratio are the ratios that are utilized for the purpose of analyzing a company's profitability. According to the findings of the analysis, throughout the time period in question, the profitability of private sector banks and foreign banks was significantly higher than that of public sector banks. Liquidity was measured using the liquid asset ratio, liquid asset-deposit ratio, and current ratio. Foreign banks outperformed in the liquid asset and liquid asset deposit ratios, while public sector banks outperformed in the current ratio.

**Mazhumdar (2006)** carried out an investigation into the efficiency of the 27 nationalized commercial banks operating in India during the years 1980–2004. The comparison of the performance of the banks had been measured in terms of three performance indicators: liquidity, business activity, and profitability. The entire study period was divided into two distinct time periods: the pre-reform period, which ranges from 1980 to 1992, and the post-reform period, which ranges from 1992 to 2004. These two time periods were then compared to one another. The private sector banks, which are also a significant part of the Indian banking system, were not included in the study. In addition to the selected performance indicators, examination of bank efficiency can sometimes provide a much more useful picture of bank performance. However, the analysis revealed that the rise in liquidity during the post-reform period relative to the pre-reform period produced a favorable environment for banks to boost investment and advances. The post-reform period also witnessed an increase in business activity and profitability.

**Angadi and Devaraj (1983)** conducted an analysis of the profitability and efficiency of scheduled commercial banks in India during the period of 1969–1980. During the research period, total earnings and expenses of all groups of banks, including all scheduled commercial banks, the state bank group, nationalized banks, foreign scheduled commercial banks, and other scheduled commercial banks, increased. The total working fund was employed as an output variable in the measurement of productivity, whereas establishment expenses were used as an input variable. In comparison to other bank groupings, foreign banks were shown to be more productive over the study period. In this research endeavor, the only ratio that was utilized for the purpose of determining profitability was the profitability per employee.

**Murugan (2010)** analyzed and compared the financial performance of the 19 nationalized banks that are operating in India. The study analyzed the financial performance of commercial banks from 2000 to 2009 using six fundamental parameters, including capital adequacy, asset quality, managerial efficiency, earning assets, liquidity, and profitability. Using 51 ratios in each of the categories, the

analysis discovered that the financial performance of Indian nationalized banks has been moderate and that there is room for improvement. It has been suggested that the banks should enhance their deposit mobilization, credit deposit ratio, investment in non-banking areas, employee productivity, and control their administrative expenses and non-performing assets in order to improve their financial performance.

**Karthi (2013)** examined the financial performance of the State Bank of India and its associates during the period of 2002-03 to 2006-07. CRAMAL ratios were utilized in the study. C refers to capital adequacy, R to resources deployed, A to asset quality, M to management productivity and efficiency, E to earning capacity, and L to liquidity. According to the findings, the State Bank of Patiala performed particularly well among the sample banks in terms of maintaining a good spread, profit per employee, and business per employee, as well as controlling operating expenses and a wage bill that is proportionate to total income. The State Bank of India has the highest NPAs against net advances, followed by the State Bank of Mysore.

**Nagananthi (2007)** discussed the efficiency and profitability of the State Bank of India and its associates from 1995–96 to 2004–05. Based on spread, burden, and profitability ratios, the study found that all the banks improved their profitability during the study period. Branch and employee efficiency based on efficiency analysis indicated that the SBI and its associates have improved efficiency considerably. Regarding nonperforming assets, all the banks have witnessed a reduction in NPAs during the period. Regression analysis conducted to identify the factors contributing to NPA confirms the theoretical relationship that there is an inverse relationship between NPA and profit.

**Parimalam (2011)** investigated the trend and determinants of profitability of SBI and its associates, nationalized banks, and private banks operating in India over a ten-year period from 1999-00 to 2008-09. The study employed the profitability measures of net profit, return on assets, return on equity, and profit per employee. The study observed that the majority of the commercial banks showed an improved trend in profitability during the study period. The economic value addition or

destruction analysis found that there was a one per cent loss of economic value in all the banks during the period of 2007–08. The study concluded that banks needed to improve their profitability by reducing the cost of capital. By using economic value addition as a measure of internal control and a measure of performance, banks can improve their efficiency and enhance profitability. The study used a few profitability ratios, which are not sufficient to get a complete picture of the profitability of the banks.

**Saluja (2012)** tried to analyze the performance of SBI and its associate banks in India. The study also tried to measure the contribution of banks towards the socio-economic development of society by using the parameters of agriculture financing, small enterprise financing, priority sector advances, assistance to weaker sections, and occupation-wise outstanding credit. The study used ratio analysis and took profitability, productivity, efficiency, liquidity, and solvency as the performance indicators. The study found that operating costs are one of the important factors influencing the profitability of commercial banks. It is also recommended that in order to control operating costs and ensure financial viability, the banks should enhance labor productivity, update technology, and employ low-cost funds.

**Kabilavathani (2016)**, in her thesis, measured the operational performance of public sector banks in India based on potency, profitability, and efficiency. The study spans a period of 21 years, from 1992-1993 to 2013-14. Potency is measured in terms of labor, branch, and financial ratios. Profitability is measured with regard to the spread and burden ratios. Finally, efficiency was estimated by using data envelopment analysis, in which technical, pure technical, and scale efficiencies were calculated. The study adopted the CCR and BCC models and an intermediation approach in choosing inputs and outputs. The study used net interest income and non-interest income as outputs and physical capital, loanable funds, and labor as inputs.

**Vadivelraja (2015)** compared the private sector banks in India to the public sector banks in India based on the amounts of deposits the banks were able to collect

during the pre-reform and post-reform time periods. The years 1983–1984 to 2012–2013 make up the scope of the study, which also includes 23 banks from the private sector and 26 banks from the public sector. The research investigated the growth, composition, and trend of total deposits, savings deposits, current deposits, and term deposits. In addition, the study investigated the significant relationship that existed between the number of offices and the number of accounts with various deposits both before and after the reform. The examination of different deposits based on ownership has also been done throughout both the pre-reform and post-reform periods. In addition to this, the effect that deposits have on a wide range of macroeconomic variables has been analyzed, and the results show that there is no significant relationship between deposits and the growth of real GDP, the rate of inflation, the index number of agricultural production, or the index number of industrial production. The remaining macroeconomic variables in the regression study, such as import growth, center fiscal deficit, index number of infrastructure industries, gross domestic savings, annual average of BSE, annual average rate of gold, call notice money rate, and deposit rates, all had high R square values. Analysis of the impact of deposits on profitability, productivity, capital adequacy ratio, cash credit, and investment for scheduled commercial banks showed significant influences.

**De (2013)** investigated the growth and profitability of new-generation private sector banks in India during the period of 2004–05 to 2009–10. Five new-generation private sector banks were purposefully selected for this study. The compound annual growth rate was used to calculate the growth in the total number of branches, total deposits, and total advances of these selected banks. Profitability has been measured in three aspects, such as productivity, operating efficiency, and financial efficiency. Financial efficiency has been calculated based on the credit deposit ratio, the non-performing asset ratio, and the capital adequacy ratio. The interest income, non-interest income, and operating profit of the selected banks have all been expressed as a percentage of average working capital, cost income ratios, and return on assets ratios to measure their operating efficiency. Productivity is measured per branch and per employee. Besides the above analysis, the profitability of private sector banks

has been compared with that of public sector banks. Only five-year period was selected to measure the profitability and growth of banks.

**Krishnan (2014)** examined the operational efficiency of commercial banks in India during the period 1996–97 to 2012–13. Profitability and productivity are factors selected to study the operational efficiency of different categories of banks, such as state bank groups, nationalized banks, and new and old private sector banks. The study used the spread ratio, burden ratio, and profitability ratio to measure the profitability of the selected banks. Business per bank, business per branch, and business per employee are the variables used to measure the productivity of the banks. The study found that the selected profitability ratios were not significantly different among the selected group of commercial banks in India. Aside from operational efficiency, the study looked into customers' perceptions of the quality of service provided by their bankers. The satisfaction level of customers regarding service quality has been found to be moderate for the banking industry.

**Almaqtari et al. (2018)** analyzed the impact of macroeconomic and bank-specific factors on the profitability of commercial banks in India. Econometric panel data analysis has been used to find the determinants of 67 commercial banks in India over the period of 2008–2017. Among the bank-specific factors selected, bank size, operational efficiency, asset management ratio, and number of branches have found a significant positive impact on return on assets. Leverage, on the other hand, had a negative impact on the same. In terms of macroeconomic determinants, inflation, demonetization, exchange rate, and interest rate all have negative effects on asset return.

**Sudhakaran (2009)** attempted to study the impact of financial sector reforms on the banking sector in India. The study found that the performance of the banks has improved after reformation, especially on the selected variables of number of branch offices, number of banks, priority sector advances, investment, deposits, business per employee, net profit per branch, return on assets, net non-performing assets to net advances, and operating profit. The study also compared the performance of banks in Kerala to that of banks nationally, and discovered that the



performance of banks in Kerala is higher on selected variables than that of banks nationally. The study strongly suggested the complete implementation of the recommendations of the Narasimham committee made in 1991 and 1997 and suggested that maximum efforts should be taken to improve the credit deposit ratio and the deployment of credit in the state.

**Joshi et al. (2018)** analyzed the performance of private and public sector banks in India using the CAMEL model during the period of 2005–2016. The capital adequacy ratio and equity to total assets ratio were used as proxies for capital adequacy; the ratio of gross NPA to total assets was used to represent asset quality; the cost to income ratio was used to measure management ability; the return on average assets and return on average equity were used to measure earning capacity; and finally, the ratio of liquid assets to total deposits was used to represent liquidity. The results indicated a statistically significant difference in the performance of public and private banks except in the ratios of capital adequacy and liquid assets to total deposits. The analysis concluded that the biggest source of difference in the performance of both groups of banks was due to the existence of nonperforming assets.

**Verma (2016)** examined the impact of banking sector reforms on the profitability and productivity of public, private, and foreign banks in India during the post-reform period of 2000–01 to 2014–15. Business per employee, profit per employee, business per branch, operating expenses per branch, and profit per branch are ratios used to measure productivity, whereas return on equity, return on assets, credit deposit ratio, intermediation costs ratio, and return on advances are the profitability ratios used by the researcher. This study includes thirty commercial banks, ten from each of the three groups: public, private, and foreign. The study also tested whether there was any statistically significant difference for each ratio in a group of banks by using the Kruskal-Wallis test. Apart from that, a pair-wise comparison of each ratio for each group of banks has been done to find out the exact pair of banks showing a statistically significant difference. In addition, a

comparative analysis of public, private, and foreign banks together has been done on the selected profitability and productivity ratios.

**Sathye (2005)** investigated the effects of bank privatization on the performance and efficiency of Indian commercial banks. The study used the data for the period 1998-2002. Financial performance was measured by using a number of ratios, which include the return on assets, spread to working fund ratio, establishment expenses to total expenses ratio, loan out ratio, and non-performing assets to net advances ratio. Per-employee ratios were also used to measure the efficiency of banks, which include deposits per employee, advances per employee, and net profit per employee. The study found that after privatization, partially privatized banks continued to show improvement in their performance.

**Agrawal (2015)** evaluated the efficacy of 25 scheduled urban cooperative banks in India during the period of 2007–2008 to 2012–13. The study used traditional ratio analysis to measure the profitability and DEA to measure the efficiency, effectiveness, and performance of the banks. Ratios such as ROA, CRAR, profit per employee, spread to working fund ratio, net NPA to net advances, and operating expenses to total assets were calculated, and the study found no significant influence of net NPA to net advances on the ROA of scheduled urban cooperative banks. The DEA result showed that the overall performance of the bank's score is only 76%, while efficiency is 95.8% and effectiveness is 79.6%. The study suggested that, to convert a non-profitable bank into a profitable one, they should control operating costs and use advances and investments effectively to generate sufficient income.

**Hussain (2014)**, in his paper, examined the operational efficiency of selected public and private sector commercial banks in India during 2007–2011 by using the cost-to-income ratio. The study also performed a comparison of the selected banks based on their size and ownership. Significant differences have been found among the small and large banks and the public and private sectors. The average cost-to-income ratio of some public and private banks kept going down until 2010. After that, it went up sharply. Banks were ranked based on cost to income ratio, and it was

discovered that the Federal Reserve Bank and Corporation Bank, both from the private and public sectors, had a low average cost to income ratio when compared to other publicly and privately selected banks.

**Khusro et al. (1971)** established the relation between the annual percentage growth rate and the coefficient of efficiency of 15 nationalized commercial banks in India during the period 1951–68. High R-squared values confirmed the significant relationship between the growth rate and efficiency of banks. Analysis also found that the top four banks in terms of efficiency have stronger positions in terms of assets and growth, which confirms the result of regression analysis. Efficiency has been measured by using the elasticity of the percentage change in deposits in relation to advances. This was accomplished by fitting a regression on the dependent variable of deposits using the independent variables of advances and interest rate. In the study, the coefficients of advances were used to figure out the coefficients of efficiency.

**Saini (2014)** carried out a comparison of the public and private sector banks in India based on the productivity and profitability of the selected banks from each sector. The study used ratio analysis and spread and burden ratios to find out the profitability of the banks for the study period of 2008–09 to 2012–13. In order to find out the productivity ratios, deposit per employee, advance per employee, total business per employee, total expenditure per employee, and total income per employee have been used. The study found a significant difference between the profitability of public and private banks, with the profitability of private sector banks being better than that of public sector banks. No significant difference has been found between the selected public and private sector banks. However, the productivity of public sector banks is higher than that of private sector banks.

**Singla (2013)** also examined the productivity of private sector commercial banks in India. The study selected three banks, such as ICICI, HDFC, and AXIS, without mentioning the criteria for the selection of the samples. Ratio analysis has been used to measure and compare the productivity of the banks during the period of 2007–08 to 2011–12. The research looked at branch and employee productivity.

Deposits, advances, and business are the variables selected in this study. Based on the analysis, it has been found that the per employee productivity of ICICI Bank is better than the other sample banks, and in the case of per branch productivity, ICICI Bank is performing less than the other selected banks.

**Jayarani and Prakash (2018)** assessed the cost and profit efficiency of 27 public sector banks in 2015–16. The study used the DEA BCC model to measure cost, revenue, and technical efficiency under both input and output orientations. For measuring efficiency, the study employed deposits, labor, and fixed assets as inputs and loans, other assets, and investment as outputs. State Bank of India, State Bank of Bikaner & Jaipur, State Bank of Hyderabad, and State Bank of Travancore have been found cost-efficient during the study period, while Corporation Bank, State Bank of India, State Bank of Travancore, IDBI Bank, and Bharatiya Mahila Bank have been found revenue-efficient. The study also revealed that cost- and revenue-efficient DMUs are both technically and allocatively efficient.

**Bhatia & Mahendru (2017)** also examined the cost efficiency of scheduled commercial banks in India from 1991–92 to 2012–13. The study employed an intermediation approach in the selection of inputs and outputs. They used investment, loans, and advances as well as non-interest income as outputs and deposits, borrowings, labor, and fixed assets as inputs, using appropriate input prices for the cost efficiency calculation. It was discovered that cost efficiency and its components were never fully efficient during any of the study periods. The study pointed out that the major reason for the cost inefficiency is the allocative inefficiency, which occurred due to the high variation and unsteadiness in the input prices.

### **2.3 Foreign studies relating to growth and profitability of banks**

Using important profitability parameters such as profit margin, return on assets, return on equity, asset utilization, and equity multiplier, **Rao et al. (2009)** assessed the profitability of public sector, private sector, and international banks over the years 1998 to 2003. The study found a significant improvement in the profit margins of public and foreign banks between 2002 and 2003. Comparing the

selected banks, the consistency with which foreign banks improve their profit margin is slightly greater. The research indicated that foreign banks have a higher return on assets than private and public sector banks. During the research period, both public and private sector banks improved their return on equity. Throughout the whole study period, however, foreign banks had a higher return on equity than domestic banks (both public and private banks). The analysis also revealed that, in terms of profitability, domestic banks were catching up quickly to foreign banks.

**Imtiaj et al. (2014)** analyzed the productivity, profitability, and cost efficiency of the three nationalized banks in Bangladesh. Ratio analysis was primarily used to evaluate performance in terms of productivity, profitability, and cost efficiency. The ratios used to compare the profitability of banks are the interest yield, return on assets, return on equity, return on risk assets, and earnings per share. For understanding the productivity of banks, this study focused on the deposit capital ratio, credit deposit ratio, deposit per employee, credit per employee, net income per branch, net income per employee, deposit per branch, and earning bases in assets. According to the findings, efficiency or improvement was only found to have occurred in the context of deposit mobilization across all three nationalized commercial banks. During the period of the study, banks were found to be inefficient in their utilization of funds.

**Rushdi et al. (2003)** focused on the deregulation impact on the profitability of the Australian banks. The study covers a 15-year period ranging from 1985 to 2001. In this study, profitability was studied based on return on assets, and the components of return on assets, such as interest margin, fee and other income, operating expenses, and provision for doubtful debt, were also analyzed. In addition, efficiency gain and productivity gain have also been examined in terms of operating expenses as a proportion of total assets and labor productivity, respectively. Labor productivity showed an increasing trend, while operating expenses as a proportion of total assets showed a declining trend. This indicates that the productivity and efficiency of Australian banks have improved following the deregulation process. A

thorough examination of efficiency and profitability could provide a clear picture of the impact of deregulation on bank performance.

**Ramlan and Adnan (2015)** studied the profitability of conventional and Islamic banks in Malaysia during 2006–2011. The study used return on asset and return on equity as dependent variables and total equity to total assets, total loans to total assets, and deposits to total assets as independent variables. Independent t tests, regression, and correlation were used to analyze the profitability of banks. The results found that Islamic banks are more profitable than conventional commercial banks. For both conventional banks and Islamic banks, the ratio of total equity to total assets is the only factor that influences the profitability measure of return on equity.

#### **2.4 Indian studies relating to Efficiency and Productivity**

Over the last several decades, a significant amount of research has been undertaken to measure the efficiency of both profit and nonprofit organizations, especially commercial banks. The efficiency analysis of the Indian commercial banks is gaining importance now because India is emerging as one of the fastest growing economies, and commercial banks play an important role in this growing process as they are the linchpin of the economy. This section deals with the efficiency analysis of banks, particularly commercial banks. The present study employed data envelopment analysis for the efficiency measurement; hence, studies using DEA are included more in this section, whether they are from Indian or foreign banks.

The impact of liberalization and deregulation on the efficiency and productivity of the Indian banking industry was examined by **Gulati (2011)**. It also analyzed the cost efficiency and total factor productivity growth across different ownership groups of banks. Analysis showed that public sector banks are more cost efficient than foreign and private banks. Private sector banks were found to be less cost-efficient than public and foreign banks. The study pointed out that the share of income from nontraditional activities in the Indian banking sector has improved considerably from 1992–93 to 2003–04. It was also found that the mean efficiency

of banks is reasonably influenced by non-interest income. The study concluded that the banking sector reforms achieved their desired results to a great extent.

**Rao (2013)** was tired of finding out the cost efficiency, profitability, and productivity performance of scheduled commercial banks operating in India. Banks have been classified as traditional and modern and have used various ratios relating to profitability, cost efficiency, and productivity. The study found that in the case of productivity ratios of net income per employee, business per employee, business per branch, profit per employee, and profit per branch, modern banks have performed better than those of traditional banks. The study used staff cost as a percentage of operating expenses, staff cost as a percentage of net income, and staff cost as a percentage of total business to measure cost efficiency and found that modern banks performed better than traditional banks. During the study period of 2005–2011, traditional banks did better than modern banks in terms of interest income as a share of total income.

**Reddy & Subramanyam (2011)** investigated the input-oriented pure technical efficiency, scale efficiency, and exogenous and endogenous risks of 81 commercial banks in India during 2007–08. The study adopted the production approach by using data envelopment analysis and employed the number of employees and fixed assets as inputs and deposits, advances, investments, and non-interest income as outputs. In terms of overall risk efficiency, none of the public sector banks were found to be efficient, whereas 23 foreign banks and one private sector bank were. The average scale efficiency value of private sector banks is higher than that of foreign and public sector banks. There are nine, five, and fifteen pure technical-efficient public, private, and foreign banks, respectively. The study would be fruitful if it included the analysis of profit and cost efficiency and extended the period of analysis.

**Kaur & Gupta (2015)**, using data envelopment analysis, estimated the productive efficiency of 57 commercial banks in India over the period of 2009 to 2013. For the study, interest costs and operating costs were used as inputs, and interest income, fee-based income, and investment income were used as outputs to

figure out the efficiency of banks. The results found that productive efficiency had improved during the study period. The State Bank of Indore and Jammu and Kashmir has found full efficiency throughout the study period. Asset size, level of NPA, and business per employee have had no significant effect on the productivity of banks. During 2009 and 2013, the capital adequacy ratio was not found to be significant. The study concluded that the profitable banks are productively more efficient. It could be better if the study included other kinds of efficiency measurements along with productive efficiency.

**Shaban and Lazar (2014)** made a comparative study on the profitability and productivity of commercial banks in India during 2000–2009. Using data envelopment analysis, the study examined the profitability efficiency and productivity efficiency of about 70 commercial banks included in the different ownership categories of public, private, and foreign banks. The relative average profitability has been better than the relative average productivity of banks during the period. In terms of productivity and profitability, public banks have found greater efficiencies than private and foreign banks based on ownership. During the study period, in the case of profitability as well as productivity, the majority of the public and private sector banks fell into the category of less efficient and inefficient. It might be better if the study looked at a longer period so that we could learn more about how commercial banks in India are getting more productive and profitable.

**Das & Ghosh (2006)** used an intermediation approach, a value-added approach, and an operating approach to measure the technical efficiency of Indian banks during 1992–2002. The different approaches produced different results, and the efficiency score of the value-added approach was found to be high compared to the other two approaches. During the period of the study, there was no significant change in the number of efficient banks that used the operating approach. The number of efficient banks under CRS estimates and VRS estimates showed a huge difference; the study concluded the existence of scale efficiency among the commercial banks in India. The study also examined the difference in efficiency based on size, ownership, nonperforming assets, and capital adequacy, and a



difference was found in efficiency estimates. The study came to the conclusion that the banks should increase their fee-based activities and open more branches to enhance their efficiency level.

**Megha (2016)** evaluated the revenue, cost, and profit efficiency of private, public, and foreign banks in India during the period 1991–92 to 2012–13. The study split the whole period into two phases: 1991–92 to 2001–02 as the reformatory period, and 2002–03 to 2012–13 as the post-reformatory period. Non-parametric data envelopment analysis has been used to measure the efficiency of the banks by taking deposits, borrowings, fixed assets, and the number of employees as input variables and investment, loans, advances, and non-interest income as output variables. Revenue efficiency and its components for scheduled commercial banks during the reformatory period were found to be higher than those of the post-reformatory period. Cost, revenue, and profit efficiency did not achieve the standard score of one in any of the study periods. However, the Tobit regression analysis showed a statistically significant difference in the cost efficiency of scheduled commercial banks during the reformatory and post-reformatory periods. Analysis also showed a statistically significant difference in profit and revenue efficiency and found that efficiency was superior in the reformatory period. Several bank-specific, industry-specific, and economy-specific variables were selected and regressed on the dependent variables of revenue cost and profit efficiencies.

**Ragupathy (2014)** focused on the efficiency of Indian public and private sector banks over the period of 2002–2011. Ratio analysis and data envelopment analysis were used to estimate and analyze efficiency. Efficiency ratios are divided into operational, financial, and personnel ratios. The study used DEA to estimate scope efficiency, pure technical efficiency, and technical efficiency and classified the banks into four groups: above the third quartile, between the second and third quartiles, between the first and second quartiles, and within the first quartile. Based on data envelopment analysis and ratio analysis, the study observed that public sector banks showed greater consistency in efficiency than private sector banks.

**Jayachitra (2015)** investigated the profitability and efficiency of Indian commercial banks from 1980–1981 to 2012–2013. The study analyzed the bank's performance based on five performance indicators, such as productive efficiency, profitability, operational efficiency, asset quality, and liquidity. The findings pointed out that the private sector banks outperformed public, foreign, and scheduled banks on all performance indicators except asset quality ratios and that all categories of banks showed a declining trend during the study period. Using DEA, the study computed technical efficiency, pure technical efficiency, scale efficiency, cost efficiency, and allocative efficiency. In all the efficiency analyses, public sector banks performed better than other categories of banks, and no statistically significant difference was found in the efficiency values between pre- and post-reform. Regarding the measurement of total factor productivity, the Malmquist productivity index was adopted, and it was observed that, compared to public and private sector banks, foreign banks performed well during the entire study period. While researching the determinants of profitability of Indian commercial banks, it was discovered that the size of the banks was an important factor in determining profitability for all commercial bank categories. The study concluded that the average efficiency of the commercial banks in India had deteriorated in the post-reform period compared to the pre-reform period, and hence the inefficiency should be contained to have sustained economic development.

**Lazar & Shaban (2012)** tried to measure and compare the productivity and efficiency of public, private, and foreign banks in India during 1999–2009. The study used establishment expenses to operating expenses as an input variable and business per branch, business per employee, and operating expenses per employee as output variables. Using the intermediation approach under data envelopment analysis, the study measured the average efficiency of public, private, and foreign banks as 0.496, 0.129, and 0.473, respectively. The study concluded that among public, private, and foreign banks, public banks have been relatively more efficient than private and foreign. It could be better if the study also included the profitability efficiency of the banks in addition to the productivity efficiency.

**Gupta & Garg (2011)** measured the technical efficiency of 49 selected public and private sector commercial banks in India by adopting the intermediation approach under data envelopment analysis. The study used interest spread, noninterest income, deposits, advances, and net profit as outputs and employees, equity fund, and operating expenses as input variables. By adopting the CCR and BCC models, it measured both pure technical efficiency and scale efficiency. Among 49 banks, 12 public and 12 private sector banks had not shown any difference in scale efficiency during the study period. Based on the CRS efficiency, the banks are subsumed into laggards, moderate performers, and leaders during 2007-08 and 2008-09. The number of moderate performers and laggards had increased, and the number of leaders had decreased from 25 to 19 during the study period.

**Raina and Sharma (2013)** attempted to investigate the cost efficiency determinants of commercial banks in India from 2005–06 to 2010–11. By adopting the intermediation approach of data envelopment analysis, the study examined the cost efficiency of 64 commercial banks along with its components of technical and allocative efficiency. The empirical results showed an upward trend in the cost efficiency of selected commercial banks except in 2009–10, in which the cost efficiency declined to 69.8%. During the study period, the average cost, technical, and allocative efficiencies were found to be 72.4%, 94.5%, and 76.7%, respectively. The study also found that cost inefficiencies incurred during the period were mainly due to allocative efficiency rather than cost efficiency. Further Tobit regression analysis found that, among the determinants of cost efficiency, the most significant factor is management size. Along with cost efficiency, it would be great if the study also looked at revenue and profit efficiency. This would give a fuller picture of how well commercial banks in India are doing in terms of their overall efficiency.

**Kumbhakar and Sarkar (2001)** attempted to analyze the relationship between deregulation and total factor productivity in India using a generalized shadow cost function approach. The study used a value-added approach in selecting the input and output variables and thus employed fixed deposits, savings deposits,

current deposits, investments, and advances as outputs, with labor and capital as input variables. Data were collected and analyzed for a 12-year period ranging from 1985 to 1996. During the study period, no significant evidence was found to prove the difference in the performance of banks under various ownership groups. No significant improvement in the productivity growth of public banks has been found after deregulation. However, the productivity growth of private sector banks has improved after deregulation, and its distortions were eliminated by 1996. The study concluded that the expected growth in total factor productivity and reduction in regulatory distortions have not materialized following the deregulation of the Indian banking system.

**Kaur and Kaur (2013)** examined the cost efficiency of public and private sector banks in India from 1989–1990 to 2007–2008. They considered labor, loanable funds, and physical capital as inputs, and non-interest income and net interest income as outputs. During the study period, private sector banks were found to have higher cost efficiency than public sector banks. The study pointed out that the major reason for cost inefficiency is due to allocative inefficiency rather than technical inefficiency. Therefore, the study suggests that the managers should select the optimal mix of inputs at given prices. The study also analyzed the impact of mergers on the cost efficiency of the banks. By fitting an econometric regression model, the study discovered that merger, profitability, and bank size have significant effects on the cost efficiency of commercial banks in India.

**Chandrasekaran and Gopal (2013)** measured the efficiency of 55 Indian commercial banks in 2012 using data envelopment analysis. The study also used principal component analysis to reduce the number of input and output variables for efficiency estimation. The study might be more useful if the data for a number of years had been included. The research included four models: A, B, C, and D. Model A includes the original inputs and outputs, and it found that out of 55 banks, 35 are efficient. Under model B, 7% of banks have been found to be efficient, which includes six original inputs and one principal component output. Model C consists of two principal component inputs and six original outputs. Under this model, 7% of

banks have also found it efficient. Model D is a full PCA-DEA model that demonstrated that nine of 55 selected Indian banks are efficient. From the PCA-DEA model, the study also found that Indian banks are using only 20% of the inputs to produce the given output, and therefore inefficient banks can utilize the unused resources in order to be efficient.

**Roy (2014)** investigated the technical efficiency of 62 Indian commercial banks over three time periods: pre-Basel (1999–2002), Basel I (2003–2008), and Basel II (2009–2012). The study used data envelopment analysis, and for detailed analysis, it decomposed the technical efficiency into pure technical efficiency and scale efficiency. The researcher adopted an intermediation approach and used operating expenses, the number of employees, physical capital, and loanable funds as inputs and net interest income and non-interest income as outputs. Banks have been classified into four groups, such as nationalized banks, private sector banks, foreign banks, and SBI and its associates. The average technical efficiency of private sector banks was found to be higher during the three eras than that of nationalized banks, which have been reported to be the least efficient. The study concluded that the major reason for the inefficiency is the improper size allocation of the Indian commercial banks.

**Singh & Gupta (2013)** examined the technical efficiency of the Indian banking sector during a subprime crisis scenario using non-parametric data envelopment analysis. The study used capital, fixed assets, interest expenses, total borrowings, and total deposits as inputs and advances, investment, net profit, and total revenue as outputs. The result shows that, in line with the Basel accords, the Indian commercial banks are giving importance to capital over the study period. In addition to capital, banks have also given higher preference to fixed assets, advances, and investment as compared to before the crisis. Regarding efficiency, the study found that the selected banks improved their efficiency during the study period.

**Jayaraman and Sreenivasan (2014)** used the Nerlovian profit indicator to measure the profit inefficiencies of public and private sector commercial banks in

India during the period 2005–2012. The input variables selected include equity, borrowed funds, workforce, and the total number of bank branches. Deployed funds and non-interest income are the output variables chosen in this study. The study found that, despite the economic slowdown, the profit inefficiency of Indian commercial banks had declined during the period of 2008–2012 as compared to 2005–2007. No significant difference had been found in the two models of profit inefficiency with a workforce and profit inefficiency without a workforce. Because the workforce had the least impact on profit inefficiency, the study concluded that the workforce plays a significant role in bank productivity. In the case of an asset-wise comparison of the profit inefficiencies, big and large-sized banks were found to be more inefficient as compared to small and medium-sized banks. A decomposition of profit inefficiency into allocative and technical inefficiency also found that the impact of technical inefficiency on profit inefficiency was lower as compared to allocative inefficiency. Therefore, the study suggested that in order to boost profit efficiency, banks need to pay attention to non-performing assets, branch operational costs, and non-interest income.

**Nandy (2008)** tried to analyse the efficiency and profitability of commercial banks and financial sector reforms in India. The study also analysed the role of information technology in the Indian banking sector and discussed various issues of non-performing assets against the backdrop of reforms. From 1998 to 2007, the NPA levels of various bank categories were statistically significant. Therefore, the study suggested that the banks should follow different strategies for managing the NPA in their banks. Efficiency analyses have been made only for the years 2005–2006, and the study found that the majority of the banks were 100% efficient both in the BCC and CCR models. Regarding profitability, interest expenses was the only good predictor of net profit among the other independent variables of interest income, other income, operating expenses, net NPA, and spread.

**Kumar (2014)** compared the technical and scale efficiency of public and private commercial banks in India during the period of 2006–07 to 2012–13. Based on the CAMEL model, the study used various ratios such as the capital adequacy

ratio, net NPA to net advance ratio, business per employee, profit per employee, return on asset, spread as a percentage of assets, credit deposit ratio, etc. In the case of capital adequacy, asset quality, liquidity, and earnings, new private sector banks have found themselves in a better position than that of public sector banks. In addition to the CAMEL analysis, data envelopment analysis has been used by taking interest expenses and operating expenses as inputs and interest income and other income as outputs. For each year, the financial performance of the selected banks was examined, and the scope for potential improvement was determined. Among the selected banks in India, SBI, ICICI, and HDFC were found to be the most efficient.

**Smitha (2012)** made an analysis of the efficiency of commercial banks in India during the post-reform period of 1991–2009. The study used ratio analysis, stochastic frontier analysis, and data envelopment analysis to study the efficiency of public, private, and foreign banks. Bank productivity is measured using a variety of accounting ratios, including operating cost to total assets, cost to income ratio, labour cost per unit of earning asset, non-labor cost, intermediation cost, net interest margin, other operating income to total income, business per employee, business per branch, return on assets, and finally return on equity. The study employed the number of employees, establishment expenses, non-establishment expenses, and non-interest expenditure as DEA inputs and investment, advances, net interest margin, total income, interest earned, and other income as outputs. The study found that public sector banks are more technically efficient than private and foreign banks.

**Wijesiri et al. (2019)** attempted to evaluate the financial and social efficiency of public sector banks in India using Multi-Activity Data Envelopment Analysis (MDEA) over the period of 2011 to 2014. The study used an intermediation approach in selecting inputs and outputs, and the outputs under social efficiency were loans to priority sectors, non-performing loans to priority sectors, and the number of female accounts. The outputs under financial efficiency include loans to non-priority sectors, non-performing loans to non-priority sectors, and other income. The shared inputs include deposits, assets, and labor. The study found a

mean overall efficiency score of 0.8752, a mean social efficiency score of 0.9943, and a mean financial efficiency score of 0.8188 for the 26 public sector banks. The study concluded that the Indian public sector banks have the ability to fulfill their dual objectives both in financial as well as social terms. However, compared with financial efficiency, these banks performed well in the case of social efficiency. The spearman correlation supports the existence of synergy between the financial and social objectives; therefore, the study concluded that social objectives do not conflict with the financial objectives.

**Seshadri (2014)** compared the efficiency of public and private banks in India during the period of 2000 to 2013. The study used the DEA and took interest income to total assets ratio and total income to total assets ratio as output variables and interest expenses to total assets ratio and total expenditure to total assets ratio as input variables. The State Bank of India, Andhra Bank, ICICI Bank, and Kotak Mahindra Bank have been selected to evaluate the efficiency. Analysis of the data revealed that the average efficiency of SBI was 97.54%, that of Andhra Bank was 99.56%, that of ICICI was 97.34%, and that of Kotak Mahindra Bank was 100%. The study concluded that the small banks, such as Andhra Bank and Kotak Mahindra Bank, performed better than the large banks, SBI and ICICI. The study did not describe the basis for selecting the banks.

**Kumar et al. (2010)** evaluated the total factor productivity growth of Indian banks over the period of 1995 to 2006. The banks are classified into four groups: public sector banks, new private sector banks, old private sector banks, and foreign banks. The study used net interest margin and non-interest income as outputs and deposits, borrowings, labour, and fixed assets as inputs. The annual average productivity growth calculated for the study period is 5.1 per cent. The study observed that the major reason for productivity progress is a shift in frontiers rather than the catch-up effect. In addition to measuring productivity change, the study also checked the determinants of productivity change, technical change, and technical efficiency change using a panel regression model. Public sector banks found a significant effect on all dependent variables, whereas old private sector banks found



a significant impact only on TFP growth. No significant impact has been found in the case of foreign banks in any one of the response variables. Time period and size have been found to have a negative impact on TFP growth.

**Tamatam et al. (2019)** evaluated the efficiency of commercial banks in India during 2008–2017. The study included 21 public sector banks and 17 private sector banks and employed two inputs and four outputs: total assets and total deposits as inputs and advance, interest income, total income, and operating profit as outputs. The analysis of productivity change using the Malmquist productivity index noticed that private sector banks outperformed public sector banks in terms of both efficiency progress and technological progress.

## **2.5 Foreign studies relating to Efficiency and Productivity**

**Sufian and Habibullah (2009)** examined the impact of the Asian financial crisis on the efficiency of Korean banks. They measured technical efficiency, pure technical efficiency, and scale efficiency of banks using the CCR and BCC efficiency models and adopted an intermediation approach, a value-added approach, and an operating approach in selecting inputs and outputs. The results produced by these approaches are completely different from each other, not only in terms of efficiency estimates but also in terms of the number of efficient banks in each year. However, the overall results showed the existence of a high degree of inefficiency in the Korean banking sector, which is due to the underutilization of the inputs used. The study also tried to find out the bank- and industry-specific determinants of efficiency using panel data regression. The study found significant impacts from all the factors on the efficiency of the Korean banks. The study concluded that the Asian financial crisis didn't have a significant impact on the efficiency of Korean banks, particularly under an intermediation approach.

**Mzee and Mohamed (2014)** evaluated the cost and profit efficiency of 25 Tanzanian commercial banks over the period 1998–2011. The study adopted the CCR model of efficiency analysis. During the study period, the Tanzanian banks were more profit-efficient than cost-efficient. While comparing the domestic banks with foreign banks, domestic banks are found to be more cost-efficient than foreign

banks, and foreign banks excel more in the case of profit efficiency than domestic banks. A comparison of the efficiency of new and old banks revealed that the new banks are more cost-efficient than the old banks, and the old banks are surpassed in the case of profit efficiency. A comparison of commercial banks based on size revealed that large commercial banks outperformed small banks in both cost and profit efficiency analyses. The cost efficiency of listed commercial banks is found to be higher than that of unlisted commercial banks, and in the case of profit efficiency, unlisted companies do better than listed companies. Moreover, the study tested management behavior by examining the relationship between bank efficiency and loan loss provision. Usually, management behavior is tested by using four hypotheses: bad luck, bad management, skimping, and moral hazard. The study used bad luck and bad management hypotheses and found that inefficiency is not caused by either bad luck or bad management hypotheses.

**Garamu (2016)** examined the relative efficiency and productivity changes of ten Ethiopian commercial banks from 2007 to 2011. The CCR and BCC models are used to measure the technical and pure technical efficiency of selected banks, and the Malmquist Productivity Index is adopted to measure the total factor productivity of the banks. The study used the intermediation approach to select the input and output for measuring the efficiency of banks. The study found that the overall mean technical efficiency of sample banks was 0.820, which indicates banks are technically inefficient on average. The overall mean of pure technical efficiency and scale efficiency was found to be 0.925 and 0.888, concluding that the technical inefficiencies were caused more by scale efficiency than pure technical efficiency. The total factor productivity of banks also showed deterioration during the study period, and it was concluded that this was due to management inefficiency. Therefore, the study suggested that existing managers have to impart adequate training and education programs in order to improve managerial efficiency.

**Tesfay (2016)** tried to find out the determinants of the efficiency of commercial banks in Ethiopia. The study adopted the BCC model to measure the efficiency of commercial banks. By using an intermediation approach, the study

employed deposits and interest expenses as inputs and loans and interest income as outputs. Capitalization, market share, asset quality, management capability, earning strength, bank size, and the bank's diversification strategy are the determinants selected to check their significance on the efficiency of banks. Using Tobit regression analysis, the study found that liquidity and deposits are the factors that are significant in determining the efficiency of Ethiopian commercial banks. The study concluded that, based on the critically analyzed strategies, banks should improve their lending capacity in order to improve their efficiency.

**Kamarudin et al. (2017)** examined the technical efficiency, pure technical efficiency, and scale efficiency of domestic and foreign Islamic banks in Malaysia, Indonesia, and Brunei over the period of 2006–2014. The study used data envelopment analysis to measure efficiency and the t-test, Mann-Whitney test, and Kruskal-Wallis test to check the difference in efficiency between the domestic and foreign banks. Results showed that the technical efficiency, pure technical efficiency, and scale efficiency scores of domestic Islamic banks were higher than those of foreign Islamic banks and showed a significant difference at 1 per cent and 5 per cent in these two banks.

**Stanek (2015)** examined the cost and profit efficiency of 14 Czech commercial banks using stochastic frontier analysis over the period of 2000 to 2012. Loans and investment assets have been taken as outputs and loanable funds, aggregate labor, and physical capital as inputs. The study used alternative profit efficiency instead of standard profit efficiency as it requires output prices, which are rarely available. The average cost and profit efficiency score of selected banks has been found to be 0.74 during the study period. Deposits to asset ratio and mortgages have found a significant relationship with cost efficiency, whereas large banks, mortgage banks, loans to asset ratio, and deposits to asset ratio have found a significant relationship with the profit efficiency of the selected banks. Data envelopment analysis could also be used along with the stochastic frontier analysis to check for any difference in the efficiency scores in these two methods.

**Zreika and Elkanj (2011)** examined the banking efficiencies of 40 banks operating in Lebanon using Data Envelopment Analysis during the sub-periods of 2002–2006 and 2006–2009. For this purpose, they used the DEA production approach and took labor and capital as inputs, whereas deposits and loans were outputs. Accordingly efficiency improved following the 2007 financial crisis. Based on the size of the banks, the study found that even though the technical efficiency of small banks increased rapidly, it was still the lowest compared to other banks. Large banks are efficient in technical and pure technical areas, but not in terms of scale efficiencies. For medium-sized banks, scale efficiency has improved during the study period but has struggled for pure technical efficiency. The study concluded that greater benefits would accrue if consolidation between small and medium banks were encouraged since these banks are operating under increasing returns to scale.

**Percin and Yakici Ayan (2006)** tried to find out the comparative performance of 31 commercial banks operating in Turkey using data envelopment analysis and the Malmquist productivity index. The study adopted the assumptions of constant returns to scale and variable returns to scale for measuring the efficiency of banks. As per the findings, privately owned banks (76.4%) are inefficient than state-owned banks (33.3%) and foreign banks (54.5%), whereas state-owned banks are more efficient than the other two categories of banks. Further, sensitivity analysis was conducted to adjust the input and output in order to eliminate the inefficiencies. The Malmquist Productivity Index shows that for all sample banks, efficiencies improved over the period of 2003–2004. The study only looked at data from 2003 and 2004, which is not enough to get a good picture of the performance of banks.

**Kamau (2011)** studied the intermediation efficiency of commercial banks in Kenya during the post-liberalization period. Data Envelopment Analysis and the Malmquist Productivity Index have been used to analyze the efficiency and efficiency change of the banks selected during the period of 1997–2009. Deposits, capital, and labor were used as inputs in the study, and loans and investments were used as outputs. Analysis shows that the majority of the banks operated at

decreasing returns to scale. Based on the size of banks, analysis shows that large banks are performing more efficiently than medium-sized and small banks. In terms of the ownership structure of banks, foreign banks are found to be more efficient than local public and private banks. Among the local banks, private sector banks outperformed public sector banks. The study estimated the overall average technical efficiency, which is 47%; pure technical efficiency, which is 56%; and scale efficiency 84%. The study concluded that even though the banks are not fully efficient, they performed well during the study period.

**Yadav (2015)** investigated the technical, pure technical, and scale efficiencies of commercial banks in Russian by using the DEA approach. In this study, an intermediation approach was adopted to find out the efficiency scores of banks during the period of 2007–2014. Total deposits and total expenses were used as inputs for the study. Loans and net investment were used as outputs. Analysis shows that the technical efficiency score of banks ranges from 31% to 51%. Therefore, in order to be efficient, banks need to reduce their inputs. Scale inefficiency ranges from 39% to 15%, which is due to inappropriate bank size. Finally, the study concluded that pure technical inefficiency among the selected banks during the period was only due to poor management performance.

**Akeem and Moses (2014)** concentrated only on the allocative efficiency of the commercial banks in Nigeria. The DEA was used in the study to figure out the allocative efficiency of ten Nigerian commercial banks from 2002 to 2011. They adopted deposits, operating expenses, and other assets as inputs and loans and advances, investment, interest income, and noninterest income as outputs. The study found that the banks that are on the allocative efficiency frontier achieved perfect manpower planning. The study concluded that efficient utilization of labor and capital, diversification of investment, enrichment of services, reduction of operating costs, and adoption of a global perspective are the ways in which the banks can improve their efficiency.

**Omar et al. (2006)** measured and compared the productivity change of commercial and Islamic banks in Malaysia that adopted the Malmquist productivity

index during the period 2000–2004. The study employed total deposits, personnel expenses, and capital expenses as inputs and loans and advances, capital market investment, and money market investment as outputs. During the study period, the total factor productivity of the Malaysian banking industry improved slightly, and efficiency change was found to be the most important source of productivity change rather than technical change. Scale efficiency, rather than pure technical efficiency, was the primary source of efficiency change. While comparing Islamic banks and conventional banks, Islamic banks showed less growth in terms of both efficiency and productivity change.

**Qureshi and Shaikh (2012)** made a comparative analysis of the efficiency of Islamic and conventional banks in Pakistan using ratio analysis and non-parametric Data Envelopment Analysis. The study used total deposits and total expenses as inputs and total revenue and earning assets as outputs for efficiency estimation for the period 2003–08. Ratio analysis showed that Islamic banks are more cost-efficient and less revenue-efficient than conventional banks and conventional banks with Islamic divisions. In terms of profit efficiency, conventional banks have been found to be more efficient than Islamic banks and conventional banks with Islamic divisions. Study suggested that the regulators should focus on the pure banking system rather than the clubbing of conventional and Islamic banking. It also concluded that DEA and ratio analysis produce different results, and these two are not substitutes for each other.

**Akhtar (2002)** investigated the efficiency of the commercial banks in Pakistan during the period of 1998–99 using non-parametric data envelopment analysis. The study used deposit and capital as inputs and portfolio investment and advances as outputs to assess the technical and allocative efficiency of 40 major commercial banks, including public, private, and foreign banks. The overall efficiency score of the banking industry was 0.80. By assuming constant returns to scale, the study found that the allocative efficiency is higher than the technical efficiency. That is, the Pakistani banks are utilizing their inputs and outputs in an optimal manner. The study pointed out that the combined effort of the government

and banking sector is essential for bringing the Pakistani banks up to par with best world practices.

**Vinh (2012)** evaluated the efficiency of 20 selected commercial banks in Vietnam during the period of 2007–2010. The study adopted an intermediation approach and used labor, fixed assets, and savings deposits as inputs, whereas interest income and noninterest income were outputs. Using data envelopment analysis, the study found out the cost, allocative, technical, pure technical, and scale efficiencies of banks. These efficiencies showed an upward trend during the study period. However, the effects of the global financial crisis of 2008 hit the efficiency of commercial banks during the period. The Malmquist Productivity Index was administered to find out the productivity change, and the study found positive average annual growth in the Malmquist Index during the study period.

**Jha et al. (2013)** carried out tobit regression analysis to analyze the effect of risk management factors on the technical, pure technical, and scale efficiency scores of 18 commercial banks in Nepal. The study used input-oriented CCR and BCC models for measuring the efficiency scores and applied deposits and interest expenses as inputs, whereas loans and interest income were outputs. With respect to the ownership of banks, public sector banks were found to be less efficient as compared to domestic private sector banks and joint venture banks. Factors like return on asset, return on equity, capital adequacy ratio, and credit-to-deposit ratio showed positive and significant effects on the technical and pure technical efficiency of the banks during the period of 2005–2010. The study suggested that, apart from reducing inputs, banks need to concentrate on the risk management factors as well.

**Raphael (2013)** made an analysis of the relative efficiency of 58 commercial banks operating in East Africa, namely Burundi, Kenya, Uganda, Rwanda, and Tanzania, during the period of 2007–2011. The study used data envelopment analysis and applied both input-oriented BCC and CCR models. The researcher adopted an intermediation approach and employed deposits, interest expenses, and operating expenses as inputs, whereas loan, investment, interest income, and non-interest income were outputs. The results showed a sharp decline in the technical,

pure technical, and scale efficiency of commercial banks from 2008 to 2009. The commercial banks in East Africa have operated in a decreasing returns to scale condition and concluded that inefficient utilization of inputs could be the cause of inefficiency among these banks.

**Maudos et al. (2002)** tried to estimate the profit efficiency and compared it with the cost efficiency of the commercial banks operating in the selected 11 countries of the European Union during the period 1993–1996. The study used the intermediation approach, and the selected outputs include loans, other earning assets, and deposits. The selected inputs include the cost of loanable funds, the cost of labor, and the cost of physical capital. However, the intermediation approach assumes banks act as an intermediary between savers and investors, thus positing deposits as input. However, the analysis found a high level of efficiency in cost and a lower level in profit. In selected countries, a negative correlation has been found between the cost and profit efficiency of the banks, i.e., there is an inverse relationship between the cost and profit efficiency.

**Sufian et al. (2016)** investigated the efficiency of selected domestic and foreign commercial banks in Malaysia during 1999–2008. The study used an intermediation approach to determining the efficiency of commercial banks by taking total deposits, capital, and labour as inputs and total loans, investment, and non-interest income as output variables. A bootstrapping regression procedure had been used to test the influence of bank-specific and environmental variables on the efficiency of the banks. The efficiency of Malaysian commercial banks had improved during the study period. Among the selected bank-specific variables, non-interest income, total assets, size, and total shareholders' equity to total assets showed a positive influence on the technical efficiency of banks during the study period. Loan loss provision to total assets, non-interest income to total assets, and total loans to total income were discovered to have no effect on bank efficiency.

**Ataullah et al. (2004)** compared the technical efficiency of public, private, and foreign banks in India and Pakistan during the period of 1988–98. Data envelopment analysis has been used to measure the technical efficiency, which is



again decomposed into pure technical efficiency and scale efficiency. The study adopted both loan-based and income-based models of inputs and outputs; analysis highlighted that overall technical efficiency has improved after liberalisation in both countries. Pure technical efficiency and scale efficiency jointly contributed to overall technical efficiency in India, whereas in Pakistan technical efficiency improved due to scale efficiency alone. The study concluded that there is scope for improving the technical efficiency in developing countries; however, non-performing assets are the major problem that hinders efficiency improvement.

**Maudos and Pastor (2003)** used non-parametric data envelopment analysis to investigate the cost efficiency, standard profit efficiency, and alternate profit efficiency of Spanish banks from 1985 to 1996. Loans and other earning assets and securities have been taken as output, whereas deposits and other funds, the number of employees, and physical capital have been taken as input. Analysis found that the cost efficiency of commercial banks (90.9%) is higher than that of savings banks (80.2%). In the case of both standard and profit efficiency, commercial banks outperformed the savings banks during the study period. Due to differences in the quality of bank output and the fact that Spanish banks have market power when setting prices, standard profit efficiency has been found to be higher than alternative profit efficiency.

**Kocisova (2014)** applied non-parametric data envelopment analysis to measure the cost, revenue, and profit efficiency of banks in Slovakia and the Czech Republic during the period of 2009 to 2013. The study adopted the intermediation approach of DEA and selected deposits, number of employees, and fixed assets as inputs and total loans and other earning assets as outputs. Based on the analysis, the study pointed out that the banks in Slovakia and the Czech Republic are more revenue-efficient than cost- and profit-efficient. When comparing the banks from two places, Slovakian banks are more revenue-, cost-, and profit-efficient than the Czech banks.

**Lakew (2013)**, in his thesis, attempted to measure the financial performance in terms of efficiency of the Ethiopian commercial banks over the period 1999–2000

to 2010–2011. The study examined the overall technical efficiency, pure technical efficiency, scale efficiency, cost efficiency, and profit efficiency of the banks in Ethiopia by adopting labour and fixed assets as inputs and net loans and deposits as outputs. The study found that Ethiopian banks have a strong positive correlation between cost and profit efficiency. The study found that cost inefficiency is higher than profit inefficiency. The major source of technical inefficiency among banks was due to pure technical inefficiency rather than scale inefficiency. As per this study, public sector banks enjoyed relatively high levels of overall technical efficiency, pure technical efficiency, scale efficiency, and profit efficiency compared to private sector banks.

**Aly et al. (1990)** investigated the overall efficiency, technical efficiency, allocative efficiency, pure technical efficiency, and scale efficiency of 322 US banks in the year 1986. The study adopted an intermediation approach in selecting inputs and outputs. In the study, labour, capital, and loanable funds were used as inputs, and real estate loans, commercial and industrial loans, consumer loans, all other loans, and demand deposits were used as outputs. The study adopted the work of Farrell (1957) and the extended work of Fare, Grosskopf, and Lovell (1985) in measuring efficiency using DEA. The average overall efficiency of the banks is found to be 0.65, and the main source of inefficiency is technical inefficiency rather than allocative inefficiency. No significant difference was found in the efficiency between branching and non-branching banks. Independent factors like the size of banks, product diversity, and degree of urbanisation had no significant influence on the dependent variables of overall efficiency, technical efficiency, and pure technical. The study took only one year for the analysis, and it would have been better if a trend analysis of the efficiency had been done.

Using data envelopment analysis, **Singh and Fida (2015)** looked at the overall technical efficiency, the pure technical efficiency, and the scale efficiency of commercial banks in Oman from 2009 to 2013. The study employed fixed assets and total deposits as inputs and advances and investment as outputs. The results found

that, out of seven banks considered in this study, two are technically efficient in all years. Using Tobit regression analysis, the study tried to find the determinants of the technical efficiency of the banks. Among the factors, capital adequacy, liquidity, and profitability have found significant influence on the efficiency of the Oman banks. However, because bank size is deemed insignificant, banks in Oman do not benefit from economies of scale. The analysis came to the conclusion that by selecting the appropriate scale size and input/output mix, the Oman banking sector still has room for improvement.

**Goiria et al. (2016)** evaluated the social and economic efficiency of microfinancial institutions included in the MIX market database and examined the determinants of these social and economic efficiencies. For measuring economic efficiency, the study considered equity and external funding as inputs and profit and risk as outputs. Inputs for measuring social efficiency included equity and external funding, while output variables included loans, number of clients, number of female borrowers, and economic sustainability. The correlation between the social and economic efficiency of microfinancial institutions has been found to be positively significant in this study. In light of these findings, the study concluded that the social and economic goals of microfinancial institutions are compatible with each other. Interestingly, the social efficiency of nine microfinancial institutions has been found to be higher than that of economic efficiency. The study classified the microfinancial institutions into different categories based on legal status, target market, scale, age, and region, and it found that all these variables are related to social and economic efficiency in the same direction.

During the study period of 2006–2013, **Ally and Patel (2014)** investigated efficiency, particularly technical efficiency, and its components in Tanzanian commercial banks. The study also investigated the determinants of bank efficiency. Adopting input-oriented CCR and BCC models, the study found that large banks are more efficient than small and medium banks. Small banks outperformed medium banks. Using tobit regression, the study found that independent variables like

liquidity, profitability, asset quality, and management capability have a significant relationship with banking efficiency. The study concluded that the main source of inefficiency is managerial inefficiency, so banks should formulate policies in such a way that they enhance the efficiency of the employees. The banks are also advised to follow this kind of benchmarking practise and should pay attention to their efficiency drivers.

**Seelanatha (2012)** used data envelopment analysis to investigate the drivers of technical efficiency among Sri Lankan commercial banks from 1989 to 2009. The study used an input-oriented constant return to scale DEA model and a super efficiency input-oriented constant return to scale DEA model in order to determine the efficiency of Sri Lankan commercial banks and found technical efficiency scores in asset transformation and technical efficiency in intimidation. Results indicate that Sri Lankan banks have a relatively higher level of efficiency, and private banks have been found to be more efficient than state-owned banks. High investment in long-term assets indicates high asset quality and, thus, high productive efficiency. The major determinants of efficiency found in the study are asset quality, amount of purchased funds, degree of operational risk, market risk, ownership type, changes in stock market capitalization, and liquidity.

**Batir et al. (2017)** used data envelopment analysis to investigate the technical, cost, and allocative efficiency of participation and conventional banks in Turkey. The study makes use of labor, capital, and funds as inputs and total loans and off-balance sheet items as outputs. Tobit regression has been used to determine the factors determining the efficiency of banks. Expenses and loan quality have a negative relationship with the efficiency of conventional banks, and these factors have a significantly positive relationship with participation banks. DEA analysis showed that the average efficiency of participation banks is higher than the average efficiency of conventional banks. Technical efficiency for both participation banks and conventional banks was found to be higher than that of allocative efficiency, and

the study concluded that the major source of cost efficiency is technical efficiency rather than allocative efficiency.

**Eriki & Osagie (2014)** used data envelopment analysis to measure the overall technical efficiency, pure technical efficiency, and scale efficiency of selected 19 commercial banks in Nigeria. Interest income and gross earnings are the selected outputs, whereas total assets and equity were used as inputs in this study. According to the study, four of the 19 banks are efficient in terms of both technical and scale efficiency. Eight banks are found to be efficient in terms of pure technical efficiency. According to the study, bank management should implement cost-effective and efficient strategies to improve performance efficiencies.

**Akthar (2010)** evaluated the efficiency and productivity of the 11 Saudi banks using the DEA and Malmquist productivity indexes over the period of 2000 to 2006. By adopting the intermediation approach, the study applied interest and non-interest expenses as inputs and net interest and non-interest income as outputs. MPI results found that productivity grew by 33 per cent during the study period, and this change in productivity was largely attributed to the technological change rather than the efficiency change. The study observed that new technology adoption enabled the banks to improve their productivity, while at the same time, large adjustment outlays in connection with the technology adoption resulted in a decline in efficiency. Analysis of technical efficiency also revealed that both pure technical inefficiency and scale inefficiency result in technical inefficiency, and thus there is substantial room for improving the technical inefficiency. The study also found that smaller banks are more efficient and productive than the other categories of banks.

**Krishnasamy et al. (2003)** evaluated the productivity of ten Malaysian anchor banks using the Malmquist productivity index for the period 2000–2001. The study used labour and total assets as inputs and total deposits, loans, and advances as outputs. During the period, the average efficiency improved by 5.1 per cent. The

study observed that this change in productivity is primarily due to technological progress rather than efficiency improvement.

Using the Malmquist productivity index, **Sathye (2002)** investigated the change in productivity in Australian banks from 1995 to 1999. The study used interest expenses and non-interest expenses as inputs and interest income and non-interest income as outputs. According to the study, banks in Australia have lost 3.1 per cent of their technical efficiency and 3.5 per cent of their total factor productivity. Nine out of 17 Australian banks showed an increase in productivity. In addition to that, the study also checked whether there was any association between size and productivity using simple regression. The study found that the productivity of Australian banks is insignificant by to their size. Hence, the study advocated that arguments in favour of the banks that achieving a larger size would improve productivity were not acceptable.

## **2.6 Research gap**

For many years, banking has been a research topic. By reviewing the relevant literature, it is observed that a large number of studies have been undertaken to analyse the performance of commercial banks over a shorter period of time, say 10 or 15 years. That is, studies covering a large number of years are limited in the existing literature. Similarly, studies incorporating the latest period are very rare in the literature. As a result, there is a period gap in the existing literature for measuring commercial bank performance. In addition, the majority of the research only focused on a single or a couple of indicators of the performance of commercial banks. One group of banks' performance may be good according to one indicator but not according to another. As a result, it is essential to conduct research encompassing more than just two key performance indicators. The studies relating to the growth of the commercial banks in terms of their assets, liabilities, income, and expenses are completely absent in the literature. Further, a significant number of studies have been conducted to evaluate the cost efficiency of commercial banks;

nevertheless, the revenue and profit efficiency of commercial banks has not received significant attention. Similarly, in the existing literature, the productivity of commercial banks is determined primarily using the application of ratio analysis; with this method, it is possible to measure the partial productivity. Studies measuring total factor productivity are very limited in the existing literature. There have been studies conducted to investigate the effect of financial sector reforms on the performance of commercial banks. However, there are only a few studies evaluating the effects of the global financial crisis, and there were no studies that evaluated the effects of demonetization on the performance of commercial banks. Hence, the present study aims to fill the aforementioned research gaps.

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CHAPTER III

**BANKING INDUSTRY IN INDIA  
- AN OVERVIEW**

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### **3.1 Introduction**

Banking is as old as ancient civilizations. The word bank was derived from the Italian word 'banca', which means bench. In Italy, the bankers were called moneychangers, and they carried out their money-changing business by sitting on a bench in the street. It is believed that the rooting of the banking system happened in Italy. In 2000 BC, the Babylonians developed the system of banking by depositing their valuables in temples. The priests were considered financial agents or custodians. However, the system did not last long due to irreligion and disbelief in moral and spiritual values. The practice of granting credit was prevalent in ancient Greece and Rome. Before the system flourished in Greece and Rome, the granting of credit by compensation and orders for transfer was prevalent in Egypt, Assyria, and Phoenicia. In Rome, the bankers were called Argentarii, Callybistoe, and Mensarii, and the banks were called Tabernoe Argentarioe. Initially, the banks preserved the deposits of their customers fully, but later they began to use the money for lending purposes as well as for their own purposes. People used drafts or cheques to settle their accounts with their creditors, and if the creditor had an account with the same bank, the transfer of money was made by order. During that time, payment by draft was known as prescibere and rescribere, and draft was called attribution. In early periods, banking businesses were conducted by private individuals. However, many countries established public banks with the objective of facilitating trade and serving the government, especially for tax collection and financing the government. In 1157, the Bank of Venice was established, and it is supposed to be the most ancient bank in history. Actually, it cannot be called a bank in the modern sense; it was just an office for transferring the public debt (Shekhar and Shekhar, 2010).

In early 1349, the drapers carried out banking businesses in Barcelona. They are not allowed to commence banking business unless they have provided sufficient security. In 1401, a public bank was established in Barcelona, performing banking functions such as receiving deposits, exchanging currency, and discounting foreign and domestic bills of exchange. The Bank of Genoa was established in 1407. The Bank of Venice and the Bank of Genoa continued to function until the end of the 18<sup>th</sup> century. The year 1609 witnessed the establishment of the Bank of Amsterdam, which was aimed at satisfying the needs of merchants in the city. The deposits accepted by the bank were able to be withdrawn on demand and could be transferred from one account to another. Most of the European banks in existence were established on the model of the Bank of Amsterdam. (Shekhar and Shekhar, 2010).

During the period from 1484 to 1560, the banking business in Germany and Poland was carried out by the Fuggers, which are the prominent banking family in southern Germany. In Germany, the oldest private bank, Berenberg Bank, was established in 1590 by the Dutch brothers Hans and Paul Berenberg in Hamburg. The Dutch bankers played a key role in setting up banking businesses in Northern Germany. In 1781, the Bank of North America was established in Philadelphia and became the first national and commercial bank in America. This bank had the monopoly of issuing bills of credit as currency at the national level.

The origin of the banker in modern times can be traced back to the merchant bankers, moneylenders, and goldsmiths who operated in England. According to G. Crowther, these three were called the ancestors of modern banks. During the days of the civil war, people approached the goldsmiths, who had strong rooms and security guards to keep the money and valuables safe. The moneylenders lend surplus money to goldsmiths, who have strong facilities to keep the money and other valuables received from the people safe. Merchants also started to deposit their surplus cash with them. Gradually, goldsmiths began to levy a charge for the safekeeping of the valuables and to lend the money to the needy. Merchants accepted the deposits from the clients to carry out their business. However, these developments did not last long when King Charles II borrowed heavily from them and rejected the debt, so the

public lost confidence in them. Then William III repaid the amount through annuities, confidence was restored, and the Bank of England was established in 1694 (Mago, 1972). In England, the Banking Act was passed in 1833, which accelerated the growth of joint-stock commercial banking. The foundation for the growth of joint-stock commercial banking was laid down during the 19<sup>th</sup> century (Natarajan & Parameswaran, 2001).

### **3.2 Evolution of banking in India**

As in other parts of the world, the system of banking was rooted and developed in India even in the early period. The ancient Hindu scriptures described the existence of money-lending activities during the Vedic period. During the Ramayana and Mahabharata periods, the banking system was widely prevalent in India. Chanakya's *Arthashastra* portrays the existence of powerful guilds of merchant bankers who conducted the banking business by accepting deposits and advancing loans. During the Smrithi period, which was followed by the epic Vedic period, the vaish community conducted banking business widely. The great lawgiver Manu mentioned the terms pledges, deposits, rate of interest, and policy of loan in his books. During this period, the banker performed all the banking functions of modern banking, like lending secured and unsecured loans, receiving deposits, granting loans to the king during the crisis period, issuing and managing the currency, and acting as banker and treasurer to the state.

Even though there was evidence of the existence of banking in the Vedic period, the history of commercial banking in India can be traced back to the 17<sup>th</sup> century with the establishment of trading centres by the East India Company. They did not depend on the indigenous banks; rather, they established agency houses to conduct trading and banking operations. British-style banking operations started with the establishment of the Calcutta agency, which conducted trading and banking business for its own benefit. The system of commercial banking was started with the establishment of the Bank of Hindustan in 1770, which was under the control of Europeans. Its parent company failed in 1832, so it could not survive for long. Later, Sholapur Bank Ltd. also failed due to the faulty combination of trade and banking

operations. The banking activities of the agency houses gradually collapsed due to the acquisitive profit motive, faulty speculation, and the avoidance of safe banking principles (Kunjukunju, 2008). Besides that, their dual functions, i.e., banking in addition to their main trading business and complete dependence on deposits for their capital requirements, also contributed to the failure of agency houses.

In Indian banking history, presidency banks played a crucial role. On June 2, 1806, the Bank of Calcutta commenced its operations. On January 2, 1809, the bank received its royal charter and was renamed the Bank of Bengal. The Bank of Bengal was the first joint stock bank in British India and began with the sponsorship of the Government of Bengal. On April 15, 1840, the Bank of Bombay and, on July 1, 1843, the Bank of Madras were established, and these banks performed some of the functions of a central bank, such as issuing bank notes and managing the treasury business of the government. The Paper Currency Act was passed in 1860; consequently, the rights of note issue of the Presidency banks were abolished, and the act gave the power of note issue to the Government of India from March 1, 1862. No bank had branches until 1862, but then they concentrated on branch expansion. As a result, by 1876, the Bank of Bengal had 18 branches, and the Bank of Bombay and the Bank of Madras had 15 branches each. However, these banks continued to be at the apex of banking in India until the amalgamation and formation of the Imperial Bank of India on January 27, 1921.

Amalgamation made the imperial bank the largest commercial enterprise in the country. In addition to presidency banks, the 19<sup>th</sup> century also witnessed the establishment of a number of well-known banks, like the Bank of Upper India in 1863, Allahabad Bank, which was setup in 1865 under European management, the Bank of Bangalore in 1868, the Oudh Commercial Bank, which was the first commercial bank established under the ownership and management of India in 1881, Ayodhya Bank in 1884, the Punjab National Bank in 1894, and Nedungadi Bank in 1899. In the beginning of the 20<sup>th</sup> century, Peoples Bank and City Union Bank were established in 1901 and 1904, respectively. The Swadeshi movement of 1905 gave rise to 12 more banks, and the most prominent among them were the Bank of India

(1906), Corporation Bank (1906), the Indian Bank (1907), the Bank of Baroda (1908), the Canara Bank (1910), and the Central Bank of India (1911), the South Indian Bank Ltd. (1911), the Karur Vysya Bank Ltd. (1916), the Catholic Bank Ltd. (1920), the Union Bank of India Ltd. (1920), and the Tamil Nadu Mercantile Bank Ltd.

In 1921, the authorities thought to have a state bank operated with all the support and resources of the government with the aim of helping industries and expanding banking facilities in each nook and corner of the country. It was for the accomplishment of this objective that the three Presidency Banks were amalgamated and formed the Imperial Bank of India in 1921 under the Imperial Bank of India Act 1920. The act granted the government the power to exercise control over the currency of the country. The act also allowed for the management of clearinghouses and public debts and permitted the holding of government balances until the establishment of the Reserve Bank of India. However, the act did not allow the bank to issue the currency. Until the establishment of the Reserve Bank of India in 1935, the Imperial Bank played the role of a quasi-central bank.

The need for a central bank was felt in the 18<sup>th</sup> century, but it was established in the 20<sup>th</sup> century. The Reserve Bank of India Act was passed in 1934 based on the recommendations of the Banking Enquiry Committee. As per the RBI Act 1934, the Reserve Bank of India was established in 1935, and it was entrusted with the duty of issuing bank notes, dealing with the currency and credit system of the country, ensuring monetary stability in the country, and acting as a banker to the bank and banker to the government. Even though it was formed under a statute, the Reserve Bank of India in the pre-independence period was a private bank. The bank also performed the functions of facilitation of war finance, repatriation of sterling debt, and management of exchange control. The bank also acted as a banker to the Burmese government (after the separation of Burma, the modern Myanmar) until March 1947 and also provided central banking services until June 1948.

Between the years 1913 and 1948, about 1100 banks failed in India. Unhealthy competition, a high interest rate on deposits, mismanagement, a lack of

funds, a lack of experienced professionals or managers, speculative business, economic depression, excessive lending in industrial sectors, and the absence of a centrally regulated bank were the major reasons for the failure of banks during that period. Even though the Reserve Bank of India was established in 1935 as the central bank of the country, it could not do much to prevent the banks' collapse until the Banking Companies Act came into force in 1948.

### **3.3 Indian banking sector after independence**

After 1947, independent India changed its whole approach to banking, especially commercial banking, and the government recognised banks as a positive instrument for rapid economic growth and development (Nigam, 1988). Independent India witnessed numerous historic events in the Indian banking sector. An important landmark in the history of banks in India was the enactment of the Banking Regulation Act in 1948. With a view to regulating and controlling banking business in India and to foster sound banking in India, the act was passed in February 1949 and came into force on March 16, 1949, as the Banking Companies Act. Later, the act came to be known as the Banking Regulation Act. Initially, the act covered only the banking companies, but in 1956, the act was amended and included cooperative banks in its purview of regulation. The nationalisation of the Reserve Bank of India was also regarded as an important event in Indian banking history. With a view to having close integration between the operations and policies of the RBI and the government, the RBI was nationalised immediately after independence on January 1, 1947, under the Reserve Bank (Transfer to Public Ownership) Act 1948. The Indian government acquired the entire share capital of the RBI, and the bank has continued to function as the state-owned and state-controlled central bank since then (Shekhar & Shekhar, 2010).

#### **3.3.1 Establishment of state bank of India**

Even though the Reserve Bank of India was transferred into public ownership, the core of Indian banking, i.e., commercial banks, was still owned and controlled by private parties. Since independence, there has been a demand for the nationalisation of Imperial Bank. The Indian government was against the

nationalisation of the banks because the banks had branches outside India, which may create political problems, and the government also thought that nationalisation would deviate banks from their commercial operations and functions. The Rural Banking Enquiry Committee (Thakurdas Committee in 1950) also did not recommend nationalisation (Kunjukunju, 2008). The All India Rural Credit Survey Committee was constituted for the purpose of reorganisation and restructuring of rural credit by the Reserve Bank of India in 1951, under the chairmanship of A.D. Gorwala. The committee put forward the idea of setting up one strong state-sponsored and state-partnered commercial banking system with a wide-spread network of branches throughout the country. As a result, the Imperial Bank of India was nationalised and converted into the State Bank of India on July 1, 1955, with the objective of extending banking services to rural and semi-urban areas. As per the provisions of the State Bank of India Act 1959, between October 1959 and May 1960, the bank established its seven subsidiaries (later named associates), viz., State Bank of Bikaner and Jaipur, State Bank of Mysore, State Bank of Patiala, State Bank of Travancore, State Bank of Indore, State Bank of Saurashtra, and State Bank of Hyderabad. The State Bank of India and its associates are collectively known as the State Bank Group. State Bank Group enjoyed preferential treatment by RBI over other banks by way of appointing them as agents of RBI, transacting the business of central and state governments, and setting up currency chests for facilitating efficient cash management.

The banking sector in India during the period of 1948–1968 focused mainly on class banking rather than mass banking, where they gave more importance to security than the purpose for which the banking facilities were accessed. The period also witnessed a decline in the number of banks. As of December 1951, there were 566 banks, including 92 scheduled commercial banks and 474 non-scheduled commercial banks, but at the end of 1968, the number came down to 91. The decline in the number of banks was due to the amalgamation of 217 unviable banks and the adoption of a strong bank licencing policy by the RBI, under which the banks without prescribed norms were delicensed.

### **3.3.2 Policy of social control**

Even though RBI had taken several strong steps to build up a sound banking system after independence and developed the banking system in terms of bank branches and volume of deposits and credits, the Indian banking sector was not equitable and adequate to cater to the needs of all sections and sectors of the country. It was said that commercial banks in India were not contributing to economic development as they were acting as financial agents and not performing their duties in accordance with the objectives of a socialist democratic country. Most of the banks were established by business houses, and their sole objective was to earn maximum profit. These banks were mainly operated in urban and port towns to finance large business houses. Some states were adequately banked, like Tamil Nadu, Maharashtra, etc., while others, like Uttar Pradesh, Madhya Pradesh, Jammu and Kashmir, etc., were totally neglected. It was observed that thirteen districts did not have any bank branches in 1967. Disparities were also persistent in the distribution of credit among the states. In 1967, two-thirds of the total credit was distributed among Maharashtra, West Bengal, and Tamil Nadu. Since banking was security-oriented, several priority sectors like agriculture, cottage industries, small-scale industries, retail trade, exports, etc. were also ignored by the banks as they were not in a position to give security on loans. Since the majority of the banks were owned and operated by big business houses, the board of directors of the bank granted considerable amounts of credit at a concessional rate to those business houses in which the directors were interested. Therefore, the wealth was created and concentrated in a few hands, and thus a monopolistic environment began to emerge in this biggest democratic country. In this scenario, demand for the nationalisation of the banks was raised from all sides, but due to administrative difficulties and adverse effects on the financial resources of the country, the government did not take the decision to nationalize the banks. However, the government formulated and implemented several measures to overcome these limitations and transform the functioning of the commercial banking system in accordance with the national interest. Among them, the most important was the social control of the banks.



The government introduced a bill on the scheme of "social control over commercial banks" in December 1967. In connection with this scheme, on December 22, 1967, the National Credit Council was established to provide a forum to discuss and assess the bank credit requirements of various sectors. The council also intends to ensure the efficient and effective utilisation of the resources through the investment and lending policies of various categories of banks, such as commercial banks, cooperative banks, and other specialised financial agencies. In addition to that, the council is also entrusted with the duty of determining the priorities for the disbursement of credit and for the investment in accordance with the priorities set and based on the availability of the resources.

The Banking Law Amendment Act passed in December 1968 and came into force on February 1, 1969. Then the Deputy Prime Minister, Mr. Morarji Desai, explained the aim of social control as "to regulate our social and economic life so as to attain the optimum growth rate for our economy and prevent at the same time monopolistic trends, concentration of economic power, and misdirection of resources". With the passing of this scheme, banks were prohibited from giving loans and advances to the directors as well as to any companies in which the directors have a substantial interest. In order to professionalise the top management, the law insisted that the bigger banks appoint full-time chairmanships with practical experience and special knowledge in banking operations, business administration, finance, or economics. According to the scheme, the majority of directors (at least 51%) should be persons possessing special knowledge and practical experience in any field of finance, economics, banking, accounting, cooperatives, agriculture, law, small-scale industries, etc. The Government also appointed a Banking Commission under the chairmanship of Shri R.G. Sarariya in February 1969 to undertake a comprehensive inquiry and report on the Indian banking structure, the financial needs, policies, and operations, functional and geographical coverage of the commercial banks, review of existing managerial operations and legislation, modernization of operational methods, recruitment of personnel, cost and capital structure, indigenous banking, and non-banking financial intermediaries.

### **3.3.3 Nationalisation of banks**

The social control scheme initiated and implemented by the government was found inadequate and unsatisfactory because, except for SBI and its associate banks, the rest of the banks were in the private sector, and those banks did not exert much influence to serve social interests. The complaints that were raised against commercial banks have not been solved and have continued even after the implementation of the social control scheme. Therefore, on July 19, 1969, fourteen major private sector commercial banks, each having deposits of more than 50 crores and an aggregate deposit of Rs. 2741.6 crores, with a total of 4130 branches, were nationalised and brought under the ownership and control of the government. Including the deposits of the State Bank of India and its subsidiaries, the aggregate deposits of all state-owned banks constituted 85% of the total deposits of the country.

Again in April 1980, with the aim of attaining national objectives, six more banks were nationalised. Each bank had a deposit of more than Rs. 200 crore at the time of nationalisation. Andhra Bank, Corporation Bank, New Bank of India, Punjab and Sind Bank, Oriental Bank of Commerce, and Vijaya Bank are the banks transferred under the ownership of the central government by way of the second round of nationalisation.

### **3.3.4 Regional Rural Banks**

One of the major milestones in the history of Indian banking is the establishment of Regional Rural Banks (RRB). This was established on October 2, 1975, under the Regional Rural Bank Act of 1976. The major aim of RRBs is to extend credit and other facilities to the weaker sections of the rural community, especially the landless and agriculture labourers, small and marginal farmers, small entrepreneurs, rural artisans, etc. It was established on the recommendation of the Narasimham committee during the period of Smt. Indira Gandhi for the development of agriculture, trade, commerce, industry, and other productive activities in the rural parts of the country. The central government, the concerned state government, and a sponsor bank jointly share the ownership of RRBs, and they

hold equity in the ratios of 50%, 15%, and 35%, respectively. Any public sector bank can act as a sponsor bank that provides assistance in various ways for the smooth functioning of the RRB. As of March 31, 2019, 54 regional rural banks were functioning in India.

### **3.3.5 Financial sector reforms**

Due to the severe balance of payments crisis, deterioration in the foreign exchange reserve, poor performance of the public sector, inflationary pressures, and huge debt on the government, the Government of India introduced the New Economic Reforms in 1991. These fundamental changes were launched with the intention of liberating the economy and improving the economic growth rate. Liberalisation, privatisation, and globalisation (commonly known as LPG) are the important features of this reform. The major policies launched to bring sustained improvements in income, quality of life, and employment were fiscal reforms, monetary and financial sector reforms, reforms in the capital market, industrial policy reforms, trade policy reforms, etc. Among these reforms, a financial sector reform affects commercial banks significantly.

Prior to the introduction of reforms, the Indian banking sector was characterised by a lack of competition, barriers to entry, a low capital base, control over the pricing of financial assets, low productivity, a high reserve requirement under the cash reserve ratio, an increase in NPA, political interference, poor monitoring, the use of inferior technology, and restrictions on the movement of the fund. Because of all these factors, the Indian banking sector suffered from low profitability, productivity, and efficiency. In this backdrop, the Indian government introduced a wide range of banking sector reforms as a part of new economic reforms in 1991. Reforms in the banking sector involve two stages. The first stage of financial sector reform was introduced in the 1992 report of the Committee on Financial Systems, under the chairmanship of M. Narasimham. This report emphasised enabling and strengthening measures. Following are the major recommendations of the committee to improve the efficiency and profitability of financial institutions.

1. A gradual reduction of the Statutory Liquidity Ratio (SLR) and Cash Reserve Ratio (CRR) from 38.5% to 25% and from 15% to 10%, respectively, so that the funds can be invested in more profitable assets.
2. Deregulation of interest rates on deposits and advances by all banks allowed them to set their own interest rates based on market forces.
3. More clear and transparent guidelines for the entry and exit of private sector banks
4. Allow public-sector banks to access capital markets directly.
5. Redefinition of priority sectors in order to include small and marginal farmers, small businesses and transport operators, village and cottage industries, tiny sectors of industries, rural artisans, and other weaker sections of society.
6. Modification of the profit and loss account and balance sheet as per international accounting standard committee norms
7. Abolition of branch licencing policy by giving individual banks freedom to open and close bank branches
8. Allow foreign banks to operate either as branches or as subsidiaries in India, and rationalise the foreign operations of the Indian bank.
9. Speedy computerization of the banking system favours the Rangarajan Committee on computerization.
10. The committee noticed the overcontrol of the banking system both by the RBI and the Ministry of Finance. It advised the removal of double regulation, where the RBI should act as the prime regulator of the banking system.
11. Creation of an asset reconstruction fund with special powers, and it should take over bad and doubtful debts of the bank from the balance sheet at a discount.
12. Prudential norms of asset classification, income recognition, and provisioning for bad and doubtful debts should be followed by banks and financial

institutions, which should follow uniform accounting practises regarding income recognition and provisioning for bad and doubtful debts. In the case of income recognition, with respect to non-performing assets, no income should be recognised in the accounts. The assets should be classified into standard, substandard, doubtful, and loss assets.

13. The criteria recommended for non-performing assets and provisioning requirements should be given due recognition by tax authorities.
14. The public and private sector banks should be treated equally, and foreign banks, if permitted to operate in India, should be subject to the same requirements as applicable to the domestic banks.
15. Individual banks should have the freedom to make their own recruitment decisions instead of having a common recruitment system for officers.
16. There should not be further nationalisation of banks.

The financial sector reforms introduced in 1991 aimed to attain operational flexibility and functional autonomy in order to improve efficiency, productivity, and profitability. Even though substantial improvement has already been attained by the Indian banks as a result of the implementation of the first Narasimham committee, the government of India has appointed a committee again under the chairmanship of M. Narasimham in order to evaluate the first phase of reforms and formulate the programmes for the second round of reforms for strengthening the financial system. The committee submitted the report in April 1998. The first phase of reform gave importance to commercial banks only. The second phase of reforms also considered other financial institutions such as RRBs, cooperative banks, and non-banking financial companies. The following are the major suggestions and recommendations of the committee:

1. The banks should reduce the average level of net NPA to below 5%. Earlier, an asset was classified as doubtful if it was in the substandard category for 18 months; the period was then reduced to 12 months in 2015. Reasons for arising

out of NPA should be differentiated into client-specific, institution-specific, and general factors like agro-environmental and climatic issues.

2. Strong public-sector banks should merge to reap the multiplier effect on the economy.
3. Greater autonomy should be given to the public sector banks in the recruitment of personnel, the general management of staff, and determining the bank's organisational structure.
4. The capital adequacy ratio must be increased to 9% by March 2000 and 10% by 2000 in order to enhance the financial health of the banks. For the capital adequacy requirement, market risk should be considered along with credit risk.
5. Five per cent weight should be given to market risk in the case of government-approved securities, and the risk weight of government-guaranteed advances should be the same as that of other advances.
6. One per cent of the general provision on standard assets is to be introduced.
7. The practise of 'evergreening' should be avoided by banks and other financial institutions.
8. The practise of recapitalizing banks from the government budget should be discontinued immediately.
9. Banks should be encouraged to adopt statistical risk management techniques in respect of balance sheet items, and they should bring out revised operational manuals and update them on a regular basis.
10. Set up an independent loan review mechanism to identify potential NPAs, especially for large borrower accounts.
11. Immediate attention should be given to the recruitment of skilled labour from the open market.

12. Public-sector banks are to be given flexibility in the determination of managerial remuneration levels.
13. The minimum tenure of the chief executive officer of the bank is to be fixed at three years.
14. Information and control systems should be instituted in areas such as risk management, treasury management, asset liability management, accurate and timely information in the areas of profitable products and customers, cost and non-performing assets, and better tackling of spread in order to improve profitability.
15. The minimum shareholding in the equity capital of public sector banks, including the State Bank of India, by the Reserve Bank of India and the government be brought down to 33%.
16. Within the priority sector, the debt securitization concept should be introduced.
17. All supervisory and regulatory functions exercised over rural credit institutions should be vested with the Board for Financial Regulation and Supervision (BFRS), and urban cooperative banks should be brought under the purview of BFRS.
18. BFRS should be separated from RBI by giving it sufficient autonomy and power in order to develop professional experience and expertise.
19. Cooperative banking institutions should be brought under the Banking Regulation Act under the supervision and control of RBI/ NABARD thereby presenting a dual control system over cooperative banks by the state government, and RBI/ NABARD should be removed.
20. Banks should be directed to publish half-yearly disclosure requirements in two parts: (a) general disclosure, describing a summary of performance over a period of time; and (b) brief information on matters such as capital adequacy ratio, profitability, adherence to stipulated norms, comparison with the industry average, and non-performing assets.

21. Introduce an integrated system of supervision and regulation for controlling the activities of banks, NBFCs, and financial institutions under BFRS.

### **3.3.6 Technology adoption in Banking**

Computerization was a positive step towards the growth of Indian banking by providing better service to customers. In 1975, the working group on customer services headed by T.R. Vardachay recommended the implementation of modern technology in specific areas to improve customer service. In 1981, the Goipora committee also repeated the recommendation of the working group of T.R. Vardachay (Uppal, 2006). In addition to these, there were a number of committees formed earlier on computerization under the chairs of Dr. Y.B. Damle in 1982, Dr. C. Rangarajan in 1984, T.N.A. Iyer in 1987, Dr. C. Rangarajan in 1988, and W.S. Saraf in 1994 (RBI, 1988). Even though the need for computerization in banking was felt in late 1980, it gained pace with the implementation of banking sector reforms (India Forbes, 2017).

The Indian banking sector has undergone drastic changes with the application of information technology in banking. Information technology has made banking services faster, easier, more efficient, and more economical. It has an effect on efficiency, productivity, profitability, employment, and the customer's psychology. The major objectives behind the computerization of banking are better customer service, improved housekeeping, improvement in productivity and profitability, and finally faster decision-making (Uppal, 2006). Information technology enabled the banks to use various virtual financial services, some of which are listed below.

1. MICR based cheque processing
2. Electronic clearing services
3. Implementation of RTGS/NEFT
4. Cheque Truncation System Or image based clearing system
5. Introduction of Core Banking Solution
6. Automated teller machines
7. Phone and Tele banking



8. Remote banking services
9. Internet banking
10. Electronic fund transfer
11. Mobile banking
12. Smart cards

### **3.3.7 SARFAESI ACT, 2002**

The Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act was enacted on June 21, 2002, in order to regulate the securitization process and the reconstruction of financial assets for the better control of NPAs in the banking sector. The preamble of the act describes its objective as "an act to regulate securitization and reconstruction of financial assets and enforcement of security interests, and for matters connected therewith or incidental thereto". The act allows the banks and financial institutions to sell the properties pledged (hypothecated or mortgaged) by the borrowers when they fail to repay the loans. In other words, this act enables the secured creditors, which may be banks and other financial institutions, to auction the residential or commercial properties pledged by the borrowers in case of default in the repayment. This helps the banks reduce their non-performing assets by adopting this act, which is an effective debt recovery mechanism. In the event of non-repayment of the financial assistance by the borrower, the secured creditor classifies his account as a nonperforming asset. If the borrower defaults, then the secured creditor is able to intimate the borrower, before the expiry of the period of limitation, in a written notice for the repayment of dues. The notice should clearly state the amount due and the intention for enforcement. If the borrower is unable to discharge the dues within 60 days, the secured creditor is able to take possession of the asset secured, appoint a manager for the secured asset, take over the management of the business of the borrower, proceed against the guarantor, or sell the property pledged without the intervention of any tribunal or court. The act enlists four conditions for enforcing the right against the defaulting borrower:

1. The debt should be secured.

2. The debt should be classified as a nonperforming asset by the bank.
3. The amount outstanding should be one lakh or more and should be more than 20% of the principal amount of the loan and interest thereon.
4. The security to be enforced should not be on agricultural land.

This act is effective only for secured loans where there is an underlying asset, and if the asset is an unsecured one, the banks have to move to court to file a case against the borrower who defaulted. The act enables the establishment of asset reconstruction companies, which are regulated and controlled by the RBI. These companies are established to acquire the assets of the defaulting borrower from banks and other financial institutions. The ARCIL (Asset Reconstruction Company of India Limited), which is the first asset reconstruction company formed under this act,

### **3.3.8 Financial inclusion**

According to S.S. Mundra "financial inclusion is the process of ensuring access to appropriate financial products and services needed by all sections of society in general and vulnerable groups such as weaker sections and low-income groups in particular at an affordable cost in a fair and transparent manner by mainstream institutional players". It is considered a key driver of poverty alleviation and economic growth. The efforts towards financial inclusion can be traced back to the 1960s, when the social control scheme was introduced, which ensures the availability of banking services to the neglected and priority sectors of the economy. In addition to that, nationalisation in 1969 and 1980, the lead bank scheme, the introduction of regional rural banks, the service area approach, the self-help group-bank linkage programme, and the establishment of local area banks are all intended to ensure banking services to the masses. Even though these approaches enhanced the outreach of banking services, the absence of low-cost technology impeded the development of the financial inclusion process. RBI has adopted a planned and structured approach to financial inclusion in 2005-06 by highlighting its significance in its annual report, which insists the banks work to achieve financial inclusion. RBI

implemented several measures to attain the objective of financial inclusion, like a no-frills account, knowing your customer's requirements, business correspondents' model financial technology, financial literacy, unique credit cards, electronic benefit transfers, a self-help group linkage model, etc. In order to boost the financial inclusion process, the Indian Government initiated the national mission for financial inclusion, viz., Pradhan Mantri Jan Dhan Yojana (PMJDY), in August 2014. PMJDY aimed to extend universal banking services to every unbanked household based on the guiding principle of banking the unbanked, funding the unfunded, securing the unsecured, and serving the unserved and underserved areas. According to the Department of Financial Services, the following are the important schemes of financial inclusion implemented by the Government of India: Pradhan Mantri Jan Dhan Yojana, Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), Pradhan Mantri Suraksha Bima Yojana (PMSBY), Atal Pension Yojana (APY), Pradhan Mantri Mudra Yojana (PMMY), Standup India Scheme, and Pradhan Mantri Vaya Vandana Yojana.

### **3.3.9 Differentiated banking**

In order to keep pace with the rapid technological developments and to boost the process of financial inclusion apart from universal banks, the RBI decided to introduce differentiated banks in India. Differentiated banks are banks that are different from universal banks in that they operate in niche segments of society. These banks are different from universal banks in that they provide a limited range of services or products and operate under different regulatory conditions. More clearly, the differentiation could be based on scope of activities, area of operation, or capital requirements. The concept of differentiated banking was first discussed in 2007, but it became a reality only after November 2014, when the RBI issued guidelines on small finance banks and payment banks. RBI received 72 and 41 applications for small finance banks and payment banks, respectively.

**Small finance banks** were established with the objective of promoting the financial inclusion process by offering savings vehicles and loans to small and marginal farmers, small business units, micro and small industries, and other entities in the

unorganised sector by using high technology and low-cost operations. Small finance banks are permitted to operate all over India. The first small finance bank licence was given to Capital Small Finance Banks Limited in March 2016, and in June 2016, the second licence was granted to Equitas Small Finance Bank Limited. Out of 72 applications received for small finance banks, only 10 were granted licences. As of March 31, 2019, Au Small Finance Bank Limited, Capital Small Finance Bank Limited, Equitas Small Finance Bank Limited, ESAF Small Finance Bank Limited, Suryoday Small Finance Bank Limited, Ujjivan Small Finance Bank Limited, and Utkarsh Small Finance Bank Limited are functioning in India. In 2018, small finance banks were allowed to operate in the call money market both as lenders and borrowers.

**Payment banks** were setup in India with the recommendation of the Committee on Comprehensive Financial Services for Small Businesses and Low-Income Households under the chairmanship of Shri Nachiket Mor in 2014. The major objective behind this innovative initiative is the expansion of financial inclusion by opening small savings accounts and payment services using digital mediums for small businesses, low-income households, migrant labour, and other entities in the unorganised sector. These banks are not allowed to accept deposits of more than Rs. 1 lakh from a customer, and they are not allowed to accept deposits from non-resident Indians. These banks are neither able to issue credit cards to their customers nor undertake lending activities. Further, the deposits in these banks are covered by the insurance provided by the Deposits Insurance and Credit Guarantee Corporation. The RBI started issuing licences for payment banks in 2015-16. The first licence was given to Airtel Payment Bank Limited in April 2016. Like small finance banks, payment banks are also permitted to function all over India. As of March 31, 2019, Airtel Payments Bank Limited, India Post Payments Bank Limited, FINO Payments Bank Limited, Paytm Payments Bank Limited, and Aditya Birla Idea Payments Bank Limited are functioning in India. Along with small finance banks, payments banks are also permitted to operate in the call money market as both lenders and borrowers.

### **3.3.10 Mergers and Acquisition among Indian Banks**

The recent consolidation process involving the merger of six public-sector commercial banks is regarded as the largest merger in Indian banking history. On August 30, 2019, Finance Minister Nirmala Sitharaman announced the big bank merger, in which 10 public sector banks amalgamated into four banks, and the amalgamation came into force on April 1, 2020. As per the plan, United Bank of India and Oriental Bank of Commerce were merged with Punjab National Bank. Through this merger, Punjab National Bank will become the second-largest state-owned public-sector commercial bank in India. Syndicate Bank was merged with Canara Bank, thereby becoming the fourth-largest commercial bank with 10324 branches and 15.20 lakh crore in business. Like that, Indian Bank became the seventh largest bank in India with 8.08 lakh crores of business by merging with Allahabad Bank. Andhra Bank and Corporation Bank were merged with Union Bank of India, thus becoming the fifth-biggest commercial bank with 9609 branches and 14.59 lakh crores of business. After this mega merger, the number of public-sector commercial banks will increase to 12, of which six are merged banks and six are independent banks. Independent banks include Indian Overseas Bank, UCO Bank, Bank of India, Punjab and Sind Bank, Bank of Maharashtra, and the Central Bank of India. Merged banks include Canara Bank, Punjab National Bank, Indian Bank, Bank of Baroda, State Bank of India, and Union Bank of India.

The Government of India announced the merger of public sector Dena Bank and Vijaya Bank with Bank of Baroda in September 2017. This move was aimed at making the Bank of Baroda the third-biggest commercial bank after SBI and Punjab National Bank, with 14.08 lakh crores of business and 9489 branches. The merger came into effect on April 1, 2018. Further, with the intention of making State Bank of India one of the biggest commercial banks globally, the government decided to merge the Bharatiya Mahila Bank and five associates of SBI, viz., State Bank of Travancore, State Bank of Bikaner and Jaipur, State Bank of Mysore, State Bank of Patiala, and State Bank of Hyderabad, with SBI. The merger made the SBI one of the top 50 large banks in the world in terms of assets. This merger plan came into

existence on April 1, 2017. In 2008 as well as in 2010, the State Bank of Saurashtra and the State Bank of Indore merged with SBI. All the above merger exercises were conducted to strengthen the financial position of state-owned commercial banks and as a part of creating large banks. The Indian banking sector also witnessed a number of merger practices following bank failures. Some of them are discussed here and occurred after banking sector reforms.

In 1992, Bank of Credit and Commerce International (Overseas) Ltd. was liquidated, and SBI was appointed as its official liquidator. SBI offered to purchase the business of the Mumbai branch for 40 crores, and with the promoter's agreement, SBI Commercial and International Bank Ltd. (SBICI) was incorporated as a wholly owned subsidiary of SBI on October 13, 1993. The Bank of Karad Ltd., which was also liquidated with the Bank of Credit and Commerce International Ltd. in 1992, was amalgamated with the Bank of India in 1994.

Another important merger in the Indian banking industry was the merger of New Bank of India, which was a nationalised bank, with Punjab National Bank in 1993. The New Bank of India incurred losses during the last four years, and with the introduction of banking sector reforms, its financial position worsened again. Hence, in order to protect investors' interests and maintain the strength of the banking system, the New Bank of India was merged. Further, in 1996, Kashinath Seth Bank Ltd., one of the non-scheduled banks, amalgamated with the State Bank of India. Again, in 1997, two private sector small banks, viz., Punjab Co-operative Bank Ltd. and Doab Bank Ltd., were amalgamated into Oriental Bank of Commerce. The 20<sup>th</sup> Century Finance Corporation Ltd. was merged with Centurion Bank in 1998. Sikkim Bank with Union Bank of India and Bareilly Corporation Bank Ltd. with Bank of Baroda were merged in 1999. Times Bank, one of the new-generation private sector banks, was also merged with HDFC in February 2000.

In 2001, Bank of Madura Ltd., one of the Tamil Nadu-based private sector commercial banks, merged with ICICI Bank. The Central Government approved the amalgamation of Benares State Bank Ltd. with the Bank of Baroda in 2002. Following the bank collapse of Nedungadi Bank of Kerala, the RBI proposed a draft

scheme for amalgamation with Punjab National Bank, which was sanctioned by the central government on January 31, 2003. Subsequently, amalgamation came into effect on February 1, 2003. Due to the failure of the South Gujarat Local Area Bank Ltd., the RBI proposed the amalgamation scheme with the Bank of Baroda, and the Indian Government sanctioned the amalgamation scheme with effect from June 25, 2004. One of the new-generation private sector banks, Global Trust Bank Ltd., which was established in 1994, started to report adverse growth in 2002. Then, on August 14, 2004, the bank merged with Oriental Bank of Commerce as per the notification of the Government of India.

In 2005, two new-generation private sector banks, viz., Bank of Punjab Ltd. and Centurion Bank Ltd., submitted a proposal for voluntary amalgamation between banks, and subsequently the RBI approved the scheme. The amalgamation came into effect on October 1, 2005, and Centurion Bank of Punjab Ltd. changed its name to Centurion Bank of Punjab Ltd. Due to the inability of the Ganesh Bank of Kurundwad Ltd. to maintain the capital adequacy requirement for several years, the RBI prepared a draft scheme for the amalgamation of the bank with Kerala-based Federal Bank Ltd. The central government approved the scheme on January 24, 2006. The merger came into effect on September 1<sup>st</sup>, 2006. In the same year, United Western Bank Ltd. merged with Industrial Development Bank of India Ltd. due to the former's inability to maintain the prudential norms of the RBI. The merger came into effect on October 3, 2006. The merger between Lord Krishna Bank Ltd. and Centurion Bank of Punjab Ltd. came into effect on August 29, 2007. During 2007, one of the old private sector banks, Bharat Overseas Bank Ltd., merged with Indian Overseas Bank. Originally, the Indian overseas bank and six private sector banks were jointly owned by Bharat Overseas Bank. By this merger, the number of old private sector banks was reduced to 18 from 19 (Kunjukunju, 2008). As of April 1, 2020, 12 public sector banks and 22 private sector banks were functioning in India.

### **3.4 Indian Banking during Covid-19**

The outbreak of COVID-19 has brought uncertainty to every corner of society. The banking industry is not exempt from this phenomenon. The health

emergency has resulted in an escalation of credit risk for both corporate and retail customers of financial institutions, thereby impacting the global economy. The reduced profitability of core banking in mature markets can be attributed to the low interest rate environment and the substantial impact of the COVID-19 pandemic. Financial institutions are moving towards generating commission-based income through payments and technology enterprises (KPMG, 2020). In response to the pandemic, the Reserve Bank implemented a series of measures, including significant reductions in policy rates and extensive liquidity infusions, both at the system-level and targeted towards distressed sectors, institutions, and instruments. Different measures adopted by RBI are described below;

- RBI has set out various measures aimed to ensure adequate liquidity to all the constituents so that liquidity constraints due to COVID 19 could be eased. Large-scale sell-offs have been sparked in India's local equity, bond, and foreign exchange markets as a result of the outbreak and rapid spread of COVID-19 throughout the country. As the demand for redemption of debt increased, the liquidity premiums that are attached to financial instruments such as corporate bonds, commercial paper, and debentures increased as well. Financial conditions for these instruments, which are used to access operating cash amid the bank credit slowdown, have tightened due to the COVID-19 pandemic and the thinning of trading activity. It has been decided that the Reserve Bank will conduct auctions of targeted term repos of up to three years tenor of appropriate sizes for a total amount of up to Rs. 1,00,000 crore at a floating rate linked to the policy repo rate. This decision was made in order to mitigate the negative effects that these effects have on economic activity, which leads to pressures on cash flows.
- As a one-time measure to help banks deal with the problems caused by COVID-19, the RBI decided to lower the cash reserve ratio (CRR) of all banks by 100 basis points to 3.0 per cent of net demand and time liabilities (NDTL) as of March 28, 2020. This reduction in the CRR would release approximately



1,37,000 crores as primary liquidity across the banking system proportionally to the liabilities of constituents rather than to surplus SLR holdings.

- Under the marginal standing facility (MSF), banks are permitted to borrow overnight at their discretion by tapping up to 2% into the Statutory Liquidity Ratio (SLR). In light of the exceptionally high volatility on domestic financial markets, which causes periods of liquidity stress, and in order to provide comfort to the banking system, it has been determined to immediately increase the limit from 2% to 3%. The above-mentioned measures inject liquidity worth 3.74 lakh crore into the banking system (RBI, 2020).
- All lending institutions, such as commercial banks (including regional rural banks, small finance banks, and local area banks), cooperative banks, all-India financial institutions, and non-bank financial companies (NBFCs) (including housing finance companies and micro-finance institutions), will be able to provide a three-month moratorium on payments for all outstanding term loans as of March 1, 2020. Therefore, the repayment plan, all future due dates, and the length of time for such loans can all be moved by three months.
- Regarding working capital facilities sanctioned in the form of cash credit or overdraft, lending institutions are permitted to allow a three-month deferral on the payment of interest for all outstanding working capital facilities as of March 1, 2020. Following the expiration of the deferment period, the accumulated interest will be paid.
- Working capital facilities granted in the form of cash credit or overdraft, lending institutions may recalculate drawing power by reducing margins and/or reevaluating the borrowers' working capital cycle. Such changes in credit terms granted to borrowers to explicitly mitigate the economic effects of COVID-19 will not be viewed as concessions granted due to the borrower's financial difficulties and thus will not result in a downgrade in asset classification.
- As part of the reforms implemented in the years following the global financial crisis, the Basel Committee on Banking Supervision (BCBS) implemented the

Net Stable Funding Ratio (NSFR), which reduces funding risk by requiring banks to fund their activities with sufficiently stable sources of funding over a one-year time horizon in order to reduce the risk of future funding stress. As per the stipulated schedule, Indian banks were compelled to maintain an NSFR of 100% as of April 1, 2020. The RBI has decided that the implementation of NSFR has been delayed by six months, from April 1, 2020, to October 1, 2020.

- Indian banks are not permitted to participate in the offshore Indian Rupee (INR) derivative market, the Non-Deliverable Forward (NDF) market, despite the widely acknowledged benefits of their participation. The Reserve Bank of India (RBI) has decided, in consultation with the government, to permit Indian banks operating International Financial Services Centre (IFSC) Banking Units (IBUs) to participate in the NDF market from June 1, 2020.

### **3.5 Conclusion**

This chapter describes on the evolution of banking in India, major changes took place in the independent India such as establishment of State Bank of India, policy of social control, nationalisation of banks, regional rural banks, financial sector reforms, technology adoption in banking, SARFAESI ACT, 2002, financial inclusion, differentiated banking and mergers among Indian Banks. Besides, it also describes the measures adopted by RBI during Covid-19 Pandemic.

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## CHAPTER IV

# RESEARCH METHODOLOGY

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## **4.1 Introduction**

This chapter describes the research methodology adopted to carry out the study. The materials and methods discusses the research design, period of the study, sample of the study, database from which the data was obtained for analysis, and performance analysis methods such as trend analysis, ratio analysis, data envelopment analysis, and the Malmquist productivity index. It also explains economic and statistical tools used for the analysis, such as panel tobit regression and fixed and random effect models, the Shapiro-Wilk test, the Analysis of Variance, the Kruskal-Wallis H test, and others.

## **4.2 Research Design**

The present study is designed as both descriptive and analytical in nature to systematically review the performance of commercial banks in India in terms of growth, profitability, efficiency, and productivity.

## **4.3 Period of the study**

In 1992, India launched the first phase of financial sector reforms in accordance with the recommendations of the Committee on Financial Systems (CFS). These changes were implemented to increase the efficiency, profitability, and productivity of the financial sector, particularly commercial banks. The operation of commercial banks has been significantly changed as a result of reforms introduced to the country's financial system. The study thus encompasses the entire post-deregulatory period. A longer sample period of 29 years, ranging from the time span of 1992–1993 to 2020–21, has been used for this study.

#### **4.4 Population and sample of the study**

The population of the study consists of all banks operating in India. Commercial banks, regional rural banks, cooperative banks, developmental banks, small finance banks, and payment banks constitute the Indian banking system. This study aims to assess the performance of Indian commercial banks based on its ownership. Commercial banks are divided into three categories based on their ownership: public sector banks, private sector banks, and foreign banks. Public sector banks are banks in which the government holds a considerable stake, as opposed to private sector banks, in which the majority of shares are held by private parties rather than the government. Foreign banks are banks whose branches operate in India but which are incorporated outside India and hence have their headquarters outside India. However, they must comply with the laws of both their home and host nations. In this study, the growth and profitability of various categories of commercial banks are assessed and compared. The data relating to each group of commercial banks are collected for this purpose. The efficiency of distinct groups of banks is determined by taking the average of each bank's efficiency scores. The number of banks studied may vary from one year to the next due to bank closures, mergers, and acquisitions, as well as the unavailability of data. India had 78 scheduled commercial banks as of March 31, 2021, including 12 public sector banks, 21 private sector banks and 45 foreign banks. Table 4.1 displays the number of public sector banks, private sector banks, foreign banks, and all commercial banks evaluated for the study.

**Table 4.1***Number of Sample banks under study*

Sl. No	Year	Public sector banks	Private sector banks	Foreign banks	All Scheduled commercial banks
1.	1992-93	27	25	23	75
2.	1993-94	27	25	23	75
3.	1994-95	27	25	26	78
4.	1995-96	27	34	29	90
5.	1996-97	27	30	31	88
6.	1997-98	27	30	32	89
7.	1998-99	27	30	36	93
8.	1999-00	27	31	36	94
9.	2000-01	27	28	42	87
10.	2001-02	27	29	31	87
11.	2002-03	27	29	31	87
12.	2003-04	27	29	31	87
13.	2004-05	27	30	32	89
14.	2005-06	27	22	30	79
15.	2006-07	27	22	30	79
16.	2007-08	27	22	30	79
17.	2008-09	27	22	32	81
18.	2009-10	25	22	33	80
19.	2010-11	25	20	35	80
20.	2011-12	25	20	41	86
21.	2012-13	25	20	43	88
22.	2013-14	26	20	43	89
23.	2014-15	26	20	44	90
24.	2015-16	26	21	45	92
25.	2016-17	25	22	46	94
26.	2017-18	25	22	46	94
27.	2018-19	20	22	46	94
28.	2019-20	12	22	46	80
29.	2020-21	12	21	45	78

Source: Author's compilation from Statistical Tables Relating to Banks in India

In this study, balanced panel data were used for productivity analysis since the Malmquist productivity index may be applied to panel data. During the study period, there were an average of 85 commercial banks operating in India. Since the study employed a balanced panel to calculate the Malmquist productivity index, only banks that were functioning during the entire study period were considered. Hence, a total of 952 observations for 34 banks that have been operational continuously from 1992–1993 through 2020–2021 have been used in the research. Of these 34 banks, 12 are private sector banks, 11 are public sector banks, and the remaining 11 are foreign banks. The groups of commercial banks that were chosen for the analysis of productivity are listed below:

**Table 4.2**

*Banks Considered for Malmquist Productivity Index*

<b>Group of bank</b>	<b>Bank</b>
A. Public sector banks	<ol style="list-style-type: none"> <li>1. State Bank Of India</li> <li>2. Bank Of Baroda</li> <li>3. Bank Of India</li> <li>4. Bank Of Maharashtra</li> <li>5. Canara Bank</li> <li>6. Central Bank Of India</li> <li>7. Indian Bank</li> <li>8. Indian Overseas Bank</li> <li>9. Punjab And Sind Bank</li> <li>10. Punjab National Bank</li> <li>11. UCO Bank</li> <li>12. Union Bank Of India</li> </ol>
B. Private sector banks	<ol style="list-style-type: none"> <li>1. Catholic Syrian Bank Ltd</li> <li>2. City Union Bank Limited</li> <li>3. Dhanalaxmi Bank</li> <li>4. Federal Bank</li> <li>5. Jammu &amp; Kashmir Bank Ltd</li> <li>6. Karnataka Bank Ltd</li> </ol>

<b>Group of bank</b>	<b>Bank</b>
	<ol style="list-style-type: none"> <li>7. Karur Vysya Bank</li> <li>8. Nainital Bank</li> <li>9. Ratnakar Bank</li> <li>10. South Indian Bank</li> <li>11. Tamilnad Mercantile Bank Ltd</li> </ol>
C. Foreign banks	<ol style="list-style-type: none"> <li>1. Bank Of America</li> <li>2. Bank Of Bahrain &amp; Kuwait B.S.C.</li> <li>3. Bank Of Nova Scotia</li> <li>4. Barclays Bank</li> <li>5. Citibank</li> <li>6. Deutsche Bank Ag</li> <li>7. Mashreq Bank</li> <li>8. Banque Nationale De Paris (BNP Paribas)</li> <li>9. Hongkong And Shangai Bank</li> <li>10. Societe Generale</li> <li>11. Standard Chartered Bank</li> </ol>

Source: Researcher's compilation from Statistical Tables Relating to Banks in India

#### **4.5 Sources and type of the data**

The whole analysis of data in the current study is based purely on secondary sources. The relevant secondary data were obtained mostly from the RBI's yearly publication titled "Statistical tables relating to banks in India." In addition, the study relies on "Trends and Progress of Banks in India," the Reserve Bank of India Bulletin, and the Reserve Bank of India Annual Report. Since the Reserve Bank of India is the supreme regulatory and supervisory body over India's banking system, its database is regarded as the most reliable and comprehensive. Additionally, information is collected from special issues of the Indian Bankers Association Bulletins. The study also gathered sufficient information from the investigated banks' websites, annual reports, journals, and newspapers.

The collected data have been adjusted for inflation before use. The data are typically deflated using the consumer price index (CPI) and the GDP deflator. All



variables in this study are deflated using the GDP deflator at constant prices, using 2011–12 as the base year.

#### 4.6 Variables used for the study

The variables used for computing growth, profitability, efficiency and productivity are depicted in the table 4.3. It also presents the independent variables used for finding the determinants of efficiency and productivity.

**Table 4.3**

*Variables used for the study*

<b>Performance indicators</b>	<b>Variables</b>
Growth	<ol style="list-style-type: none"> <li>1. Advances</li> <li>2. Investment</li> <li>3. Deposits</li> <li>4. Borrowings</li> <li>5. Interest income</li> <li>6. Non-interest income</li> <li>7. Interest expenses</li> <li>8. Operating expenses</li> </ol>
Profitability	<ol style="list-style-type: none"> <li>1. Spread ratios</li> <li>2. Burden ratios</li> <li>3. Profitability ratios</li> </ol>
Efficiency and Productivity	<ol style="list-style-type: none"> <li>1. Loanable fund</li> <li>2. Deposits</li> <li>3. Labour</li> <li>4. Advances</li> <li>5. Investment</li> </ol>
Determinants of efficiency and productivity	<ol style="list-style-type: none"> <li>1. Total assets</li> <li>2. Return on assets</li> <li>3. Ratio of gross non-performing assets to gross advances</li> <li>4. Ratio of total loans to total deposits</li> <li>5. Ratio of non interest income to total assets</li> <li>6. Capital adequacy ratio</li> <li>7. GDP</li> </ol>

Performance indicators	Variables
	8. Inflation
	9. Dummy variable for reforms
	10. Dummy variable for crisis
	11. Dummy variable for demonetisation
	12. Dummy for public sector banks
	13. Dummy for foreign banks

Source: Researcher's compilation

#### **4.7 Tools and techniques used for the study**

The tools and techniques used in the present study for analysing the growth of banking sector, profitability, efficiency and productivity of commercial banks are explained in the following part:

##### **4.7.1 Trend analysis**

Trend analysis is used to determine the degree to which the values of the variables have changed quantitatively over a period. It shows both the direction of change and the pattern of the trend, which makes it easier to understand how the variables change over time.

The present research makes use of trend analysis to investigate the growth of commercial banking in India from 1992–1993 to 2020–2021. Data were collected on each bank group for the purpose of this analysis. The growth of commercial banks is analysed in terms of their assets, liabilities, revenues, and expenses. Under each of these aspects, different variables were identified. The variables and their respective aspects are given below.

- |                |    |                                       |
|----------------|----|---------------------------------------|
| 1. Assets      | —→ | Advances, Investment                  |
| 2. Liabilities | —→ | Deposits, Borrowings                  |
| 3. Incomes     | —→ | Interest income, Non-interest income  |
| 4. Expenses    | —→ | Interest expenses, Operating expenses |

In the present study, advances and investments are used to examine the asset growth of various groups of commercial banks. These two variables together account for 84% of the total assets of India's commercial banks as on 31<sup>st</sup> March 2021. The growth of liabilities was examined using deposits and borrowings. This is due to the fact that deposits represent the largest liability for banks, followed by borrowings as the next largest liability. As of the 31<sup>st</sup> of March in the year 2021, deposits and borrowings accounted for 85 percentage of the total liabilities of commercial banks. Therefore, it is reasonable to use advances and investments for analysing the growth of assets and deposits and borrowings for analysing the growth of liabilities. Further, to examine the growth of income at various categories of commercial banks over the research period, both interest income and non-interest income are evaluated. In a similar manner, expenses are classified as interest expenses and operating expenses. During the study period, both interest expenses and operating expenses are looked at to figure out how much expenses at different groups of commercial banks have grown or increased.

The growth of commercial banks is examined using the mean, standard deviation, compound annual growth rate, and simple annual growth rate. The following formula was used to figure out the simple annual growth rate of the variable:

$$\text{Annual growth rate} = \frac{\text{Current year value} - \text{Previous year value}}{\text{Previous year value}} \times 100$$

According to Investopedia, the compound annual growth rate (CAGR) is the mean annual growth rate of a value over a specified period of time longer than one year. It is one of the most accurate calculations used to determine the returns on individual assets, investment portfolios whose value might rise or fall over time. The present study computed the growth rate using semi log model as given by Gujarati (2004). The generic exponential growth function can be written as follows

$$Y = Y_0(1+r)^t \quad (1)$$

Where  $r$  is the compound rate of growth of  $Y$ .  $t$  is the time period. By taking the natural logarithm of the above equation, we can write it as follows

$$\ln Y_t = \beta_1 + \beta_2 t \quad (2)$$

$\ln Y$  = natural log values of the dependent variable

$\beta_1 = \ln Y_0$ , natural logarithm of  $Y_0$

$\beta_2 = \ln(1+r)$ , natural logarithm of  $(1+r)$

The coefficient of the trend variable in the growth model (2) represents the instantaneous rate of growth (i.e growth rate at a point in time) rather than the compound rate of growth. However, the latter can be easily calculated by subtracting 1 from the antilog of the estimated  $\beta_2$  and multiplying the difference by 100. Thus, compound annual growth rate is calculated by the following

$$\text{CAGR} = \text{Antilog}(\beta_2) - 1$$

In the initial phase of the analysis, the annual growth rate, compound annual growth rate, mean, and standard deviation for each group of banks are calculated for each variable. In the second stage, the statistical significance difference in the growth rates of public sector banks, private sector banks, and foreign banks was determined using one-way ANOVA or the Kruskal-Wallis H test, based on the Shapiro-Wilk test for normality. Several hypotheses have been made and tested for this reason.

#### **4.7.2 Ratio analysis**

Ratio refers to the relationship between two figures. Ratio analysis involves comparing one figure with another. It is an effective instrument used to assess and compare the performance of organizations, particularly banks. Ratio analysis is the most popular and reliable method for evaluating banks' profitability since it is comparable, concise, and able to establish a direct relationship with a variety of banks' earning capability (Nagananthi, 2007). It uses the quantitative data to aid management in planning and decision-making processes. It helps management figure out why the banks' profitability changed over time and focus on the steps that

need to be taken to improve the banks' profitability performance (Kanjana, 2007). When evaluating the performance of various bank ownership groups using both time series and cross-sectional data, financial ratio analysis is one of the most useful diagnostic methods (Rao, N.V., et al., 2009).

The study used three different types of ratios to assess the profitability of Indian commercial banks: spread ratios, burden ratios, and profitability ratios. These ratios had been utilized by numerous studies to investigate the profitability of the banks. This set of ratios was used by Hemachandrika (2003), Nagananthi (2007), Kanjana (2007), Bansal (2010), Saluja (2012), and Krishnan (2014) between 1996 and 2011 to assess the profitability of commercial banks. Nagananthi (2007) measured the spread, burden, and profitability ratios based on the operating fund during 1995 and 2005, while Hemachandrika (2003) measured these ratios for public sector banks from 1970 to 2001. The ratios from the years 1995 to 2005 were also measured by Kanjana (2007). From 1996 to 2007, the spread, burden, and profitability ratios of banks were examined by Bansal (2010). Saluja (2012) assessed the profitability ratios from 2001 to 2010, whereas Krishnan (2014) used the spread, burden, and profitability ratios from 1992 to 2012. The primary source of income for banks is interest income, which is interest-based income, and the primary expense is interest expenses, which are spent on deposits. In light of this, profitability analysis based on the spread, burden, and profitability ratios is quite important. Working capital, income, deposits, and total assets are some of the key performance indicators used to gauge profitability in the banking industry (Krishnan, S., 2014). In the current study, profitability was calculated in terms of total assets. The total asset in this case is the average of the total assets for the current year and the preceding year. The ratios are explained below:

### **Spread ratios**

The spread is a significant determinant of bank profitability. It is the difference between interest earned and interest paid by banks. It represents the amount available for administrative, operating, and management costs. The purpose of the ratio is to determine how much of the total assets are generated as interest

income and how much is spent on interest. The greater the spread ratio, the greater the bank's profits, and vice versa (Saluja, R., 2012). Spread ratios aid in isolating the effect of interest rates on a bank's profit, allowing for a better understanding of the bank's profitability sources and earnings variability (Krishnan, S., 2014). Important spread ratios are outlined below:

**1. The ratio of interest income to total assets**

The ratio of interest income to total assets measures the relationship between the bank's interest income and its total assets. The ratio of interest income to total assets indicates the rate at which a bank generates interest income by lending its assets (Krishnan, S., 2014). This is a significant measure of the profitability of the bank. The greater the ratio, the greater the profitability, and vice versa (Saluja, R., 2012).

$$\text{The ratio of interest income to total assets} = \frac{\text{Interest Income}}{\text{Total Assets}} \times 100$$

**2. The ratio of interest expended to total assets**

The ratio of interest expended to total assets indicates the relationship between interest paid and total assets. This ratio illustrates the rate at which banks incur interest expenses when they borrow funds (Krishnan, S., 2014). Interest expenditure is the bank's fund-based expenditure. Therefore, this ratio measures the bank's cost of funds (Saluja, R., 2012). The calculation is as follows:

$$\text{The ratio of interest expended to total assets} = \frac{\text{Interest Expended}}{\text{Total Assets}} \times 100$$

**3. The ratio of spread to total assets**

The spread is the difference between interest income and interest expenses. It is sometimes referred to as the "net interest margin." This ratio has a significant impact on the profitability of banks. It illustrates the bank's basic earning capacity and portfolio management effectiveness (Krishnan, S., 2014). This ratio is an essential indicator of banks' operating profitability. The greater the estimated ratio,

the greater the profitability, and vice versa (Saluja, R., 2012). It is calculated as follows:

$$\text{The ratio of spread to total assets} = \frac{\text{Spread}}{\text{Total Assets}} \times 100$$

### **Burden ratios**

The burden is the difference between operating expenses, or non-interest expenses, and non-interest income, or other income. The burden indicates noninterest expenses that are not covered by noninterest income, with the remainder being paid by the spread. Therefore, burden influences profitability; if the burden is greater, the profit will be lower, and vice versa. Hence, careful management of the burden is essential for increasing the banks' profitability. Banks always attempt to boost non-interest income or minimize non-interest expenses to minimize the burden (Krishnan, S., 2014). The following are the ratios of burden used in the study:

#### **1. The ratio of non-interest income to total assets**

It is calculated by dividing non-interest income or other income by total bank assets. Non-interest income helps to reduce burdens, thereby increasing profits. Therefore, the ratio of non-interest income to total assets is an essential criterion for measuring banks' profitability. The higher the non-interest income, the greater the ratio and thus the profitability, and vice versa. Therefore, banks should maximize their non-interest income to increase their profitability (Saluja, R., 2012).

$$\text{The ratio of non-interest income to total assets} = \frac{\text{Non-interest income}}{\text{Total assets}} \times 100$$

#### **2. The ratio of operating expenses to total assets**

It is the ratio between overall operating expenses and total assets. It evaluates the amount of resources utilized in managing the banks' assets and represents the banks' overall operational efficiency (Krishnan, S., 2014). The smaller the ratio, the higher the profitability of the banks; conversely, the larger the ratio, the lower their profitability. Therefore, banks should pay close attention to minimizing their

operating expenses (Saluja, R., 2012). Following is the formula for computing the ratio:

$$\text{The ratio of operating expenses to total assets} = \frac{\text{Operating expenses}}{\text{Total Assets}} \times 100$$

### **3. The ratio of burden to total assets**

As previously said, the burden is a significant component in determining the profitability of banks. The burden is the gap between non-interest expenses and non-interest income. Profitability will be higher if the burden ratio is lower, and vice versa (Krishnan, S., 2014). Therefore, banks should make every effort to minimize the ratio by decreasing non-interest expenses and increasing non-interest income in order to increase their profitability (Saluja, R., 2012).

$$\text{The ratio of burden to total assets} = \frac{\text{Burden}}{\text{Total Assets}} \times 100$$

### **Profitability ratios**

Profitability ratios play a crucial role in evaluating an organization's performance. It is beneficial not only to management but also to shareholders, the government, creditors, customers, and others. For banks, operating profit represents the difference between spread and burden (Krishnan, S., 2014). The following profitability ratios were utilized in this analysis:

#### **1. The ratio of operating profit to total assets**

This ratio is calculated by dividing operating profit by total assets. It assesses the management's ability to maintain income relative to expenses. It illustrates how effectively a bank employs its total resources to maximize profit. Hence, it serves as a measure of both managerial efficiency and resource utilization (Krishnan, S., 2014). This ratio represents operating profit per unit of total assets. Higher ratios suggest greater profitability, whereas lower ratios indicate lower profitability (Saluja, R., 2012).

$$\text{The ratio of operating profit to total assets} = \frac{\text{operating profit}}{\text{total assets}} \times 100$$



## 2. The ratio of net profit to total assets

The ratio of net profit to total assets is calculated by dividing net profit by total assets. This ratio is also called "Return on Assets" (ROA). It illustrates the management's ability to transform assets into net earnings (Krishnan, S., 2014). Banks' net profit is determined by subtracting provisions and contingencies from their operating profit. This ratio indicates the percentage of total assets earned as net profit by the bank. The higher the ratio, the greater the profitability, and vice versa (Saluja, R., 2012).

$$\text{Ratio of net profit to total assets} = \frac{\text{Net profit}}{\text{Total Assets}} \times 100$$

### 4.7.3 Data envelopment analysis

Data Envelopment Analysis (DEA) is a linear programming technique for determining the relative efficiency of a set of units. It is a non-parametric, deterministic approach derived from the work of Edward Rhodes. In 1978, Charnes, Cooper, and Rhodes utilized it for the first time in their work "Measuring the Efficiency of Decision Making Units" to determine the effectiveness of nonprofit public sector organizations. Incorporating various inputs and outputs, they established DEA as the tool for quantifying the relative efficiency of all decision-making units (DMUs) (Kaur, S., & Gupta., 2015). The DMU may be banks, bank branches, or any service-providing entity. In DEA, the DMU's efficiency is calculated relative to the best-practice DMU, which establishes the efficient frontier. In this analysis, each DMU is evaluated separately, and relative efficiency is calculated with respect to the entire set being evaluated (Seiford & Thrall, 1990). The envelopment surface formed by the best-practice firms is known as the efficient frontier, and the firms that lie on the frontier are the efficient firms. Inefficient firms are those that fall below the frontier. The DEA method evaluates the DMU's capacity to generate revenue and control cost (Akeem & Moses, 2014). Numerous works, including those of Pareto (1927), Koopmans (1951), Debreu (1951), Farrell (1957), Cooper (1962), Aigner and Chu (1968), Shephard (1970), and Afriat (1972), provided sufficient support for the evolution of DEA (Seiford, 1996). Nowadays,

DEA is a popular and successful method for measuring the efficiency of decision-making units. Thanassoulis (1999) defined DEA as a linear programming-based method for comparing the relative efficiency of homogeneous organizational units such as banks, schools, tax offices, etc. During the past three decades, banks have extensively utilized this analysis. Ali et al. (1990), Niazi (2003), Ataulloh et al. (2004), Das et al. (2005), Hassan (2005), Das et al. (2006), Das & Ghosh (2009), Ray & Das (2009), Kumar & Gulati (2010), Reddy et al. (2011), Gupta et al. (2011), Raina et al. (2011), Gulati (2011), Sharma & Sharma (2012), Shaban et al. (2014), Jayaraman & Srinivasan (2014), Sahoo et.al (2014), Kabilavathani (2016), Gulti & Kumar (2016), Ragupathy (2014), Megha (2016), Jayachitra (2015), Sufian & Habibullah (2012), Sufian et.al (2016), Mahendu & Bhatia (2017), Kamarudin et.al (2019) etc. are some of the authors who applied DEA in their studies. Traditional ratio analysis is unable to take into account multiple inputs and outputs when attempting to quantify productivity and efficiency. On the other hand, data envelopment analysis is able to do so. "In this method, the frontier is constructed through the piecewise linear combination of the actual input and output correspondence set that envelopes the data of all the firms in the sample"(Das et al., 2006). DEA can identify likely peers or role models, and a simple efficiency score gives an advantage over alternative efficiency evaluation approaches (Nandy, 2008). The main benefit of this approach is that it avoids the need to provide a specific functional form, such as the Cobb-Douglas production function (Seiford & Thrall, 1990). Unlike parametric techniques such as the stochastic frontier approach (SFA), the distribution-free approach (DFA), and the thick frontier approach (TFA), DEA does not require extensive time series data (Kaur & Gupta, 2015). Cooper et al. (2007) say that DEA can find the benchmark members of the efficient set that are used for evaluations, as well as the sources and levels of inefficiency in each output and input for each DMU. DEA works better with small samples compared to other frontier methods (Ajlouni et al., 2011). However, it does not separate random error from inefficiency when it comes to differences from the efficient frontier. This makes it very sensitive to outliers. This study employed data envelopment analysis to assess the efficiency of Indian commercial banks.

Measuring efficiency from an economic standpoint is not a novel approach. Farrell (1957) introduced the concepts of technical efficiency, allocative efficiency, and overall efficiency. Later, a great deal of research was undertaken, and the various measurement methods, such as parametric and non-parametric methods, models for assessing efficiency (such as CCR, BCC, etc.), and efficiency concepts were extended in various ways. This study measured the economic efficiency of scheduled commercial banks in India by analysing their revenue, cost, and profit efficiency.

Researchers have examined the concept of economic efficiency in banks using a variety of efficiency approaches. Berger and Mester (1997) investigated economic efficiency by utilising cost, standard profit, and alternative profit efficiencies. They stated that this concept of efficiency had a solid economic foundation. Maudos (2002) examined the cost and alternative profit efficiency concepts for the study of performances of eleven European nations. Das et al. (2005), Kamarudin et al. (2014), Megha (2015), Mahendru & Bhatia (2016), Jayarani (2018) and Vidyarthi (2019) studied the economic efficiency of banks using revenue efficiency, cost efficiency, and profit efficiency. These measures provide a more accurate measurement of economic efficiency since they examine the financial competence of banks in relation to competition, market forces, market prices, and other business situations as opposed to analysing technology alone (Berger and Mester, 1997; Adongo et al., 2005; Megha & Bhatia, 2016). Hence, this research incorporated revenue, cost, and profit efficiencies.

Efficiency may be defined as the firm's ability to maximize its output without making changes in input or minimizing cost without making changes in output. A firm is said to be technically efficient if it uses the minimum level of input for producing a certain output (input orientation) or produces a maximum level of output for a given level of input (output orientation). In output oriented technical efficiency, observed or actual output level is compared with the maximum output level possible for a given level of input. Input oriented measure compares the actual input with the minimum input that could produce observed or actual level of output. Allocative efficiency is defined as the firm's ability to use an optimal combination

of input for given input prices. Technical efficiency is further decomposed into pure technical efficiency and scale efficiency. Pure technical efficiency is the ability of the management to use optimal level of input while scale efficiency refers to the ability of the bank to operate at optimal scale or size.

### Revenue efficiency

The measurement of revenue efficiency is based on output-oriented efficiency models, which optimise income or revenue for a given bundle of input quantities and output prices (Mahendru & Bhatia, 2016). It is the ratio between the observed revenue and the maximum revenue (Jayarani, 2018). Using the available inputs, an efficient firm generates the greatest amount of revenue (Ajlouni et al., 2011). The revenue efficiency value varies from one to zero. Fully efficient enterprises will receive a score of one, whereas inefficient firms will receive a score below one. In order to determine the cause of revenue inefficiency, it is possible to partition revenue efficiency into technical efficiency (output-oriented) and allocative efficiency (output-oriented). Output-oriented technical efficiency assesses the firm's ability to maximise output from a given set of inputs, whereas allocative efficiency measures the firm's ability to mix inputs and outputs in the optimal proportion, taking the pricing of inputs and outputs into account. In addition, the causes of technical inefficiency can be identified by dividing output-oriented technical efficiency into pure technical efficiency and scale efficiency. According to Zhu (2014), the following mathematical programming equation is used to calculate revenue efficiency:

$$Max = \sum_{r=1}^s q_r^o \tilde{y}_{ro}$$

$$\text{Subject to ; } \sum_{j=1}^n \lambda_j X_{ij} \leq \tilde{X}_{io} ; \quad i=1,2,\dots,m$$

$$\sum_{i=1}^n \lambda_j y_{rj} \geq \tilde{y}_{ro} ; \quad r=1,2,\dots,s$$

$$\lambda_j \geq 0 ; \quad \sum_{i=1}^n \lambda_j = 1$$

Where, n= Number of observation DMU, j= n<sup>th</sup> DMU, s= output observation, m= input observation, r= s<sup>th</sup> output, i= m<sup>th</sup> input,  $q_r^o$  = Unit price of

output  $r$  of DMUO (DMUO is one of the  $n$  DMU),  $\lambda_j$  = Non negative scalars,  $\tilde{y}_{ro}$  =  $r^{\text{th}}$  output that maximizes revenue for DMUO,  $X_{io}$  =  $i^{\text{th}}$  input that minimizes cost for DMUO,  $y_{rj}$  =  $s^{\text{th}}$  output for  $n^{\text{th}}$  DMU,  $X_{ij}$  =  $m^{\text{th}}$  input for  $n^{\text{th}}$  DMU.

### Cost efficiency

There are two options for the bank managers to earn maximum profit, i.e., either to earn maximum revenue or to minimize their costs. Unfortunately, bank managers do not have much control over their revenue, but they definitely have control over those practices that help to reduce and contain the cost (Bhatia & Mahendru, 2017). "Cost efficiency" measures how close the bank's cost is to what a "best practice" bank's cost would be for producing the same output bundle under the same conditions (Berger & Mester, 1997). It is the ratio between the minimum cost at which the firm is able to produce a given volume of output and the actual cost incurred (Maudos et al., 2002). A cost-efficient firm produces the given level of output at the minimum cost (Ajlouni et al., 2011). In the input oriented technical efficiency measurement, all the inputs are minimised in a similar proportion to the extent possible, and all the inputs are treated equally. That is, when one input becomes binding, no further reduction in any other input is considered. While considering the price of the inputs, greater priority is given to the reduction of costly inputs than that of the less costly inputs. Here, efficiency means producing the target output at the minimum cost (Das et al., 2005). The input-oriented model is used to calculate cost efficiency because it minimises the inputs required to produce a given level of output, given the prices of the inputs (Mahendru & Bhatia, 2016).

To find cost inefficiency, cost efficiency can be broken down into technical efficiency (input-oriented) and allocative efficiency. Allocative efficiency takes into account the costs of inputs, whereas input-oriented technical efficiency examines the firm's ability to create a particular output with the least quantity of inputs. In addition, the causes of technical inefficiency can be identified by decomposing technical efficiency (input-focused) into pure technical efficiency and scale efficiency. Pure technical inefficiency is caused by inefficiency in converting inputs to outputs, whereas scale inefficiency is the result of a deviation of the DMU from

the most productive scale size (Bhatia et al., 2017). The mathematical equation for calculating cost efficiency is as follows (Zhu, 2014):

$$\begin{aligned} \text{Min} &= \sum_{r=1}^m p_i^0 \tilde{x}_{io} \\ \text{Subject to ;} \quad & \sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} ; \quad i= 1, 2, \dots, m \\ & \sum_{i=1}^n \lambda_j y_{rj} \geq y_{ro} ; \quad r=1, 2, \dots, s \\ & \lambda_j, x_{io} \geq 0 ; \quad \sum_{i=1}^n \lambda_j = 1 \end{aligned}$$

Where, n= Number of observation DMU, j= n<sup>th</sup> DMU, s= output observation, m= input observation, r= s<sup>th</sup> output, i= m<sup>th</sup> input,  $\lambda_j$  =Non negative scalars,  $\tilde{x}_{io}$ = i<sup>th</sup> input that minimizes cost for DMU<sub>0</sub>,  $y_{ro}$ = r<sup>th</sup> output for DMU<sub>0</sub>,  $y_{rj}$ = s<sup>th</sup> output for n<sup>th</sup> DMU,  $x_{ij}$ = m<sup>th</sup> output for n<sup>th</sup> DMU.

### Profit efficiency

Profit maximisation is one of the primary goals of any enterprise. This goal is accomplished not only by manufacturing goods and services at the lowest possible cost but also by increasing sales and thereby maximising revenue volume. Therefore, measures of profit efficiency provide more helpful information to management than measures of cost efficiency, which only provide a partial picture of the business's condition. Profit efficiency is a broader concept than cost efficiency, as it takes into account the effects of production vector selection on costs and revenues (Maudos et al., 2002). A profit-maximizing enterprise maximises profit from inputs and outputs (Ajlouni et al., 2011). Simply put, it is the ratio of observed profit to maximum profit (Jayarani, 2018). Profit inefficiency can also be subdivided into technical inefficiency and allocation problem-related inefficiency (Berger et al., 1993). The formula for calculating profit efficiency is presented as follows (Zhu, 2014):

$$\text{Max} = \sum_{r=1}^s q_r^0 \tilde{y}_{ro} - \sum_{r=1}^m p_i^0 X_{io}$$

$$\begin{aligned} \sum_{j=1}^n \lambda_j X_{ij} &\leq \tilde{X}_{io} ; \quad i=1, 2, \dots, m \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq \tilde{y}_{ro} ; \quad r=1, 2, \dots, s \\ \tilde{X}_{io} &\leq X_{io} , \quad \tilde{y}_{ro} \geq y_{ro} \\ \lambda_j &\geq 0 \\ \sum_{j=1}^n \lambda_j &= 1 \end{aligned}$$

Where, n= Number of observation DMU, j= n<sup>th</sup> DMU, s= output observation, m= input observation, r= s<sup>th</sup> output, i= m<sup>th</sup> input,  $\lambda_j$  =Non negative scalars,  $\tilde{x}_{io}$ = i<sup>th</sup> input that minimizes cost for DMU<sub>0</sub>,  $\tilde{y}_{ro}$  = r<sup>th</sup> output that maximizes revenue for DMU<sub>0</sub>,  $y_{ro}$ = r<sup>th</sup> output for DMU<sub>0</sub>,  $y_{rj}$ = s<sup>th</sup> output for n<sup>th</sup> DMU,  $x_{ij}$ = m<sup>th</sup> output for n<sup>th</sup> DMU.

### Choice between common and separate frontier

Before starting the analysis, it is necessary to determine the type of frontier to be constructed for the analysis, i.e., whether a common or separate efficiency frontier will be constructed throughout the period and ownership. In the literature, efficiency is typically measured by establishing a grand or inter-temporal frontier for all years or an annual efficiency frontier. For benchmarking purposes, a grand or inter-temporal frontier encompasses the combined input-output data for all years and for all banks. In the annual efficiency frontier, different frontiers are established for each year to measure banks' year-by-year efficiency scores (Gulati, 2011). Bhattacharyya, Lovell, and Sahay (1997), Ataullah and Le (2006) observed that adopting the grand frontier has a number of advantages. The grand frontier is a better benchmark than the individual frontier, which creates new frontiers for each bank each year. Since the benchmark varies from year to year, the information on performance trends would be unavailable if we used a different benchmark for each year. When grand frontier is used, the number of degrees of freedom goes up, which is important for calculating efficiency scores with DEA, and the variation of efficiency scores measured over time and space goes up.

In contrast to this view, DeYoung & Hasan (1998), Isik & Hasan (2002), and Gulati (2011), Gulati & Kumar(2016) argue that annual efficiency frontiers are more

flexible than multi-year efficiency frontiers. This is due to the fact that, it permits the predicted coefficient to vary over time as technology evolves (DeYoung & Hasan, 1998). In a dynamic corporate climate, banks or technology may be most efficient during one period but not during another. In addition, adopting the yearly efficiency frontier helps to alleviate, at least to some extent, the difficulty associated with DEA's lack of random error. This is because the yearly frontier permits a bank to be efficient in one period and inefficient in another based on the idea that errors caused by chance or data problems are not consistent over time (Isik & Hassan (2002) and Gulati (2011)). Gulati (2011) noticed that the yearly efficiency frontier technique is more adaptable and gives more accurate estimations of efficiency under dynamic market conditions. Berger & Young (1997), DeYoung & Hasan (1998), Isik & Hassan (2002), Ataulloh et.al(2004), Sufian & Habibullah (2009), Ahmad & Noor (2010), Gulati (2011), Lakew (2013), Megha(2016), Sufian et.al(2016), Kamarudin et.al (2017), Bhatia & Mahendru (2018b), Bhatia & Mahendru (2018a), Gulati & Kumar(2016) have adopted separate frontier approach in measuring the efficiency of banks. Since the Indian banking industry has seen significant changes over the research period due to reforms, economic shocks, innovations, restructuring, etc., the yearly efficiency frontier was utilized in the present study. Consequently, 29 distinct yearly efficiency frontiers were established for each year examined.

Before employing DEA, it is also necessary to determine whether common or separate efficiency frontiers will be constructed for banks with different ownership groups. Megha (2016) found that the regulatory structure and business climate of all scheduled commercial banks in India are similar. The Reserve Bank of India regulates and controls these banks, which adhere to standard policies and guidelines for accepting deposits and making loans. To measure the efficiency of the banks, it is therefore appropriate to combine public sector banks, private sector banks, and foreign banks into a single sample. In contrast to this notion, it is argued that these distinct groups of banks operate with distinct production technologies and customer bases. Therefore, it is not feasible to combine distinct groupings of banks into a single sample (Megha, 2016). In this context, Gulati (2011) empirically examined whether a pooled frontier or a distinct frontier is more suited for the



various categories of Indian commercial banks. Both pooled and distinct frontiers are used to produce efficiency scores, and both parametric and nonparametric tests are used to evaluate the hypotheses. In the majority of years, the investigation failed to reject the null hypothesis that diverse bank ownership groups employ a common production technology. This is similar to the findings of Sathye (2001), Isik & Hassan (2002), and Burki & Niazi (2006), who demonstrated that different ownership groups of banks in Australia, Turkey, and Pakistan use the same production technology. In line with Sensarma (2005), Gulati (2011), and Megha (2016), the present analysis assumed that all banks operate in a similar environment and used a pooled or common frontier.

### **Specification of inputs and outputs**

Various studies have been conducted to measure the efficiency and productivity of banks in different nations. The ambiguity surrounding the selection of inputs and outputs has made bank performance evaluation challenging (Das & Kumbhakar, 2012). The most difficult aspect of measuring efficiency is selecting adequate inputs and outputs. In measuring efficiency, the choice of inputs and outputs has a substantial impact on the efficiency. Researchers have measured the efficiency of DMU using a range of inputs and outputs. In fact, there is no consensus or rule of thumb about the inputs and outputs of DMU in order to conduct an efficiency analysis.

Literature demonstrates that when selecting inputs and outputs, the production approach and the intermediation approach are frequently employed. Benston (1965) proposed the production approach, which views banks as service providers for customers. Therefore, in this method, output refers to the services that banks provide to their customers. These services can be quantified according to the type of transaction that was completed, the number of documents that were processed, the specialised services that were offered, and so on. Substitute data, such as the number of deposits or loans, are used when the original data are unavailable. The input variables consist of physical variables such as space, material, labour, or information systems, or their associated costs. The production method disregards

interest expenses and focuses on operating expenses. This method is appropriate for measuring efficiency at the branch level.

In the "intermediation approach," banks are considered intermediaries that connect savers and investors. The intermediation approach provides intermediation services by accepting deposits from savers and channeling them to investors. This method uses both operations and interest expenses as input variables, while loans and other assets serve as output variables. Gulati (2011) noted that both the production method and the intermediation approach apply the classic macroeconomic theory of the firm to banking, with the only difference being the specification of banking activity. Berger and Humphrey (1997) believed that neither of these two approaches can adequately portray the dual function that banks play as both service providers and intermediaries; therefore, neither of these approaches is ideal. Despite the fact that the literature provides a variety of other ways, such as the cost approach, the asset approach, the modern approach, and the value-added approach, a plethora of research has utilised these two methods. Numerous studies have utilised the intermediation strategy as opposed to the production approach. Ally et.al (2014), Sufian & Habibullah (2009), Garamu(2016), Kamau(2011) Yadav (2015), Qureshi & Shaikh (2012), Kaur & Kaur (2013), Akhtar (2002) Raphael (2013), Chandrasekaran & Gopal (2013), Roy(2014), Singh & Gupta (2013), Sufian et.al (2016), Kocisova (2014), Gulati (2011), Kumar (2014), Shaban & Lazar (2014), Raina & Sharma (2014), Lazar & Shaban (2012) , Gupta & Garg (2011), Jayachitra (2015), Das & Ghosh (2006), Wijesiri et.al (2019), Aly et.al (1990), Bhatia & Mahendru (2017), Vidyarthi(2019), Tandon et.al (2014) are some of researchers who adopted intermediation approach in their studies. Hence, the present study adopted an intermediation approach in selecting inputs and outputs for measuring the efficiency of Indian commercial banks, as their focus is on the utilisation of deposits and other inputs for granting loans to needy individuals, namely in priority and non-priority sectors. The following are the details of the inputs and outputs used for this study:

**Table 4.4***Definition of Inputs and Outputs Variables*

	Variable	Definitions	
Input	Loanable fund	It is combination of deposits and borrowings. Deposits include demand deposits and term deposits from banks and others and saving bank deposits. Borrowings means borrowings from banks and financial institution in India and outside India	(Interest on deposit+ interest on borrowings)/ Loanable fund
	Physical capital	Premises, assets under construction and other fixed assets and assets on lease	(Rent+Depreciation+Repairs+ Insurance)/Fixed assets
	Labour	Number of employees working in the banks.	Payments and provision for employees/ No. of employees
Output	Investment	Investment in India in government securities, other approved securities, shares, debentures and bonds, subsidiaries and joint ventures and others and Investments outside India in Government securities, subsidiaries and / or joint ventures and others.	Income received on Investment/ Investment
	Advances	Bills purchased and discounted, cash credit, overdrafts and loans repayable on loan, and term loans	Interest income / Loans and advances

Source: Researcher's Compilation

Number of inputs and outputs may affect the efficiency score of DMU considerably (Roy, 2014) Cooper *et.al* (2007) provides a rule that can be expressed as:

$$N \geq \max \{m \times s; 3(m + s)\}$$

Where  $N$  is number of DMUs,  $m$  = Number of inputs and  $s$  = number of outputs. According to the first rule, there must be more DMUs than the product of inputs and outputs. The current study uses an average of 85 commercial banks for analysis, with three inputs and two outputs. Thus, the study complies with this rule. In accordance with the second rule, the total number of DMUs must be three times higher than the total number of inputs and outputs. The study also complies with the second rule outlined by Cooper et al. (2007) because it analyses more than 15 DMUs.

Following Mostafa (2009), Megha (2016), and Jayachitra (2015), an isotonicity test was conducted to check the model specification's validity. Before undertaking the computation of efficiency using DEA, it is important to validate the model specification for DEA. The isotonicity test involves calculating all intercorrelations between the selected inputs and outputs and determining if an increase in inputs results in an increase in output. The variables with statistically significant positive intercorrelations between inputs and outputs must be chosen for the analysis (Chandrasekaran & Gopal, 2013).

The robustness of the DEA model is determined by the degree of correlation between inputs and outputs (Yang, 2009). For ensuring the soundness and validity of the DEA model, the intercorrelation between inputs and outputs should be calculated and verified. This test is called the isotonicity test, which ensures that, keeping other factors constant, increasing the value of the inputs should not decrease the value of any output, but instead should lead to an increase in the value of at least one output, i.e., the relationship between the inputs and outputs should not be erratic. If the intercorrelation between inputs and outputs is positive and significant, the DEA model satisfies the requirement of the isotonicity test, and hence the inclusion of the inputs and outputs in the DEA model can be justified (Mostafa 2009, Megha 2016, Jayachitra 2015). Jayachitra (2015) employed Spearman's rank correlation, whereas Megha (2016) used Pearson's correlation coefficient. The present study employed Pearson correlation. The result of the correlation is given below:

**Table 4.5***Pearson Correlation of Inputs and Outputs*

Variables	Loanable fund	Physical Capital	Labour	Advances	Investment
Loanable fund	<b>1.000</b>	0.943	0.840	0.997	0.990
Physical Capital	(0.000*)	<b>1.000</b>	0.830	0.924	0.942
Labour	(0.000*)	(0.000*)	<b>1.000</b>	0.836	0.791
Advances	(0.000*)	(0.000*)	(0.000*)	<b>1.000</b>	0.980
Investment	(0.000*)	(0.000*)	(0.000*)	(0.000*)	<b>1.000</b>

Source: Researcher's Estimates based on Statistical Tables Relating to Banks in India, various issues  
Figure in brackets indicates the p value and \* indicates correlation is significant at 5%

The result shows that the inter correlations between the selected inputs and outputs in the study are positive and significant. Hence, the inclusion of the selected inputs and outputs in the present DEA model is justified.

#### 4.7.4 Malmquist productivity index

Sten Malmquist (1953) pioneered the notion of productivity index, proposing the development of quantity indices as a ratio of distance functions for use in consumption analysis (Daskovska, 2008). Numerous authors have investigated and improved this measure further within a non-parametric framework (Cooper et al., 2007). After Sten Malmquist, Caves et al. (1982) reintroduced the Malmquist productivity measure and named it the Malmquist productivity index. In contrast to the Tornqvist index (1922), this index does not require input and output costs information. Using multiple inputs and outputs, MPI is able to calculate total factor productivity (Fare et al., 1994). Based on the DEA, Fare et al. proposed the Malmquist productivity index in 1994. The Malmquist productivity index (MPI) is used to quantify the change in productivity of a DMU between two periods or between two DMUs. It is the combination of the catch-up effect and the frontier shift effect. "Catch up" (or "recovery") refers to the degree to which DMU's efficiency improves or declines, whereas "frontier shift" (or "innovation") refers to the change in the efficiency frontiers between the two periods. The proposal for output-oriented MPI by Fare et al. (1994) is as follows:

$$m_o(x^{t+1}, y^{t+1}, x^t, y^t) = \left[ \left( \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)} \right) \left( \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

where  $m$  denotes the Malmquist productivity index for the most recent period  $(x^{t+1}, y^{t+1})$  in comparison to the previous period  $(x^t, y^t)$ .  $D$  corresponds to the distance function. Subscript  $o$  indicates output orientation, whereas  $x$  and  $y$  are inputs and outputs, respectively. Change in productivity between two successive periods is comprised of two components: change in technical efficiency (the catching-up effect) and change in production technology (the frontier shift effect). Fare et al. decomposed the MPI to determine the catching-up effect and the frontier shift effect by reiterating the previous calculation as follows:

$$m_o(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)} \left[ \left( \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})} \right) \left( \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

The ratio outside the bracket is used to measure the relative efficiency change between periods  $t$  and  $t+1$ . The ratio within the brackets is the geometric mean of two ratios that measure the change in technology between the two periods measured at  $x^t$  and  $x^{t+1}$  (Fare et al., 1994). The catch up effect ratio is thus calculated by dividing the technological efficiency of period  $t+1$  by the technical efficiency of period  $t$ . The frontier shift effect is determined by the geometric mean ratio of performance per unit relative to the frontier of both technologies.

$$\text{Efficiency change} = \frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}$$

$$\text{Technical change} = \left[ \left( \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})} \right) \left( \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

Thus, it is obvious that the Malmquist productivity index is the product of technological change and efficiency change (Vinh, 2012). If MPI is equal to 1, it means that productivity has not changed. If it is more than one, efficiency has improved, while a value below one implies a decline in productivity throughout the

period. Fare et al. (1994) also decomposed the efficiency change component calculated under the constant returns to scale assumption into the pure technical efficiency change component (calculated under the variable returns to scale assumption) and the residual scale component, which captures the difference between the constant and variable returns to scale technologies. The change in scale efficiency is the ratio of scale efficiency from period t to period t+1. Now the division is as follows:

$$m_o(x^{t+1}, y^{t+1}, x^t, y^t) = \text{TECHCH} \times \text{PEFFCH} \times \text{SCH}$$

where TECHCH stands for technical change, PEFFCH is pure technical efficiency change, and SCH indicates scale efficiency change. The pure technical efficiency change and scale efficiency change are calculated as follows:

$$\text{PEFFCH} = \frac{D_{O,VRS}^{t+1}(x^{t+1}, y^{t+1})}{D_{O,VRS}^t(x^t, y^t)}$$

$$\text{SCH} = \frac{D_{O,CRS}^{t+1}(x^{t+1}, y^{t+1})}{D_{O,CRS}^t(x^t, y^t)} \bigg/ \frac{D_{O,VRS}^{t+1}(x^{t+1}, y^{t+1})}{D_{O,VRS}^t(x^t, y^t)}$$

The productivity change index of the Indian banking industry is derived by computing the geometric mean of TFPCH for the public sector, private sector, and foreign banks. Malmquist productivity index values greater than one indicate an increase in productivity or a positive shift in productivity, whereas productivity index values less than one indicate a decrease in productivity. A Malmquist productivity index of one indicates that productivity has not changed or has remained unchanged.

#### 4.7.5 Panel Tobit regression

The primary advantage of a panel data set over a cross-sectional data collection is the researcher's freedom in modelling differences in individual behaviour (Greene, 2012). In this work, panel tobit regression and fixed and random effect models were applied to the panel data set. The current study begins with the

calculation of various efficiency measures of revenue, cost, and profit efficiency. These efficiency scores are used to determine the effect of independent variables in the second stage of analysis. To do this, panel tobit regression is employed. Since the estimated efficiency scores fall between zero and one, the Tobit model with two-sided censoring is the proper theoretical specification (Das & Ghosh, 2009a). The dependent variable whose values are constrained is referred to as a limited dependent variable, and in this case, usual least square method of regression cannot be used since it will yield estimates that are biased and inconsistent (Gujarati 2004, Kumar & Gulati 2008, Gulati 2012). This is due to the fact that, the expected errors will not necessarily be zero. In the DEA research that has been done so far, it is generally agreed that tobit regression can give unbiased and consistent estimates when the dependent variable is limited. James Tobin, the Nobel Prize-winning economist, conceived the Tobit model. This model is also known as "limited dependent variable regression models" since the dependent variable's values are restricted (Gujarati, 2004). Below is the statistical expression of the model proposed by Gujarati (2004):

$$\begin{aligned}
 Y_i &= \beta_1 + \beta_2 X_i + u_i && \text{If RHS} > 0 \\
 &= 0 && \text{otherwise}
 \end{aligned}$$

where RHS refers to the right side. In line with Sufian (2009), Sharma & Sharma (2012), Gulati (2012), Rosman & Wahab (2013), Raina & Sharma (2013), Tandon et al. (2014), and Bhatia & Mahendru (2015), the present study utilised the tobit regression model to investigate the factors influencing the efficiency of commercial banks in India. According to Mester (1996) and Ariff (2008), deciding which variables to include in a model is a challenging matter due to the lack of theory that provides assistance in this regard. Therefore, the only criterion used to pick the variables is prior study relating to efficiency analysis. This study estimates the following regression model by using cost efficiency, revenue efficiency, and profit efficiency as dependent variables. Based on the availability of the data, two models were formulated including NPA and capital adequacy.



## Model 1

$$\begin{aligned}\theta_{it} = & \beta_0 + \beta_1 \text{Log\_size} + \beta_2 \text{Log\_ROA} + \beta_4 \text{Liquidity} \\ & + \beta_5 \text{Offbalancesheet} + \beta_7 \text{Log\_GDP} + \beta_8 \text{Inflation} \\ & + \beta_9 \text{Dummy\_Reform} + \beta_{11} \text{Dummy\_Crisis} \\ & + \beta_{12} \text{Dummy\_Demonetisation} + \beta_{13} \text{Dummy\_Public} \\ & + \beta_{14} \text{Dummy\_Foreign} + u_{it}\end{aligned}$$

## Model 2

$$\begin{aligned}\theta_{it} = & \beta_0 + \beta_1 \text{Log\_size} + \beta_2 \text{Log\_ROA} + \beta_4 \text{Liquidity} \\ & + \beta_5 \text{Offbalancesheet} + \beta_7 \text{Log\_GDP} + \beta_8 \text{Inflation} \\ & + \beta_9 \text{Dummy\_Reform} + \beta_{11} \text{Dummy\_Crisis} \\ & + \beta_{12} \text{Dummy\_Demonetisation} + \beta_{13} \text{Dummy\_Public} \\ & + \beta_{14} \text{Dummy\_Foreign} + u_{it}\end{aligned}$$

Where  $\theta_{it}$  is the efficiency variable,  $u_i$  means Error term and  $\beta_0, \beta_1, \beta_2, \dots, \beta_{14}$  are the regression parameters to be estimated using tobit regression. The independent variables, their description, symbol, and expected sign with efficiency are presented in Table 4.4

**Table 4.6**

*Description and Expected sign of the Independent Variables*

Independent variable	Description	Symbol	Expected sign
Size	Total assets	Log_size	+
Profitability	Return on assets- ratio of net profit to total asset	Log_ROA	±
Nonperforming assets	Ratio of gross non-performing assets to gross advances	NPA	-
Liquidity	Ratio of total loans to total deposits	Liquidity	±
Off balance sheet activities	Ratio of non interest income to total assets	Off balance sheet	+
Capital Adequacy	Capital adequacy ratio- ratio of Tier I and Tier II capital to risk weighted assets	Capital adequacy	+

Independent variable	Description	Symbol	Expected sign
GDP	Growth rate of gross domestic product	Log_GDP	+
Inflation	Change in average CPI	Inflation	-
Dummy Financial Sector Reform	Dummy variable taking 1 for period 1992-93 to 2001-02 and 0 for rest of the year	Dummy_Reform	+
Dummy global Crisis	Dummy variable taking 1 for period 2007-08 to 2010-11 and 0 for rest of the year	Dummy_Crisis	-
Dummy Demonetisation	Dummy variable taking 1 for period 2016-17 and 2017-18 and 0 for rest of the year	Dummy_demonetisation	-
Dummy Public	Giving 1 for public sector banks and 0 for private sector banks and foreign banks	Dummy_Public	±
Dummy Foreign	Giving 1 for foreign banks and 0 for private sector banks and public sector banks	Dummy_Foreign	±

Source: Researcher's compilation

Following Das & Ghosh (2009<sup>a</sup>), Das & Ghosh (2009<sup>b</sup>), Gulati (2011), Sharma & Sharma (2012), Reddy & Nirmala (2013), Tandon et al. (2014), Spaho (2015), and Sufian et al. (2016), total assets are included in the regression model as a proxy for the size of the banks. In the banking literature, it is argued that bank size should be strongly correlated with efficiency, as a certain size may be required to utilize all scale- and scope-related efficiencies. On the other hand, larger banks may have a more professional management team and/or be more cost-conscious because of increased pressure from shareholders regarding bottom-line profits (Isik & Hassan, 2003). Recently, the government has taken steps to merge public sector banks in order to increase their size. Hence, the size of the bank has an important bearing on its performance of the banks. According to Tandon et al. (2014), the size of the banks may affect their efficiency positively if there are significant economies of scale. On the other hand, size may also affect the bank's efficiency negatively due to bureaucratic and other reasons if it is extremely large. Hence, it is important to see

the precise impact of the size of the banks on the revenue, cost, and profit efficiency of commercial banks in India. With respect to the size of the banks, a hypothesis is formulating that bank size is positively related to efficiency.

Return on assets is included in the regression model as a proxy of profitability for the banks (Kumar & Gulati 2008; Sufian (2009); Sharma & Sharma (2012); Ally & Patel (2014); Spaho (2015); Singh & Thaker 2020). The return on asset is calculated by dividing the net profit by the total assets of the banks. Sharma & Sharma (2012) and Singh & Thaker (2020) found that profitability has a positive impact on the efficiency of commercial banks. Kumar & Gulati (2008) found that profitability has no significant impact on the overall technical efficiency of the public sector banks in India. The findings of Spaho (2015) indicate that profitability has no significant positive effect on all efficiency measures. Hence, it is important to see the precise impact of the profitability of the banks on the revenue, cost, and profit efficiency of commercial banks in India. With respect to the profitability of the banks, a null hypothesis was formulated that there is no positive impact between profitability and revenue, cost, and profit efficiencies.

Liquidity is included in the model in accordance with Arriff (2008), Das & Ghosh (2009a), Das & Ghosh (2009b), Reddy & Nirmala (2013), Ally & Patel (2014), Spaho (2015), Sufian et al. (2016), and Kamarudin (2019). The ratio of total loans to total deposits is included as a proxy for this variable. According to Das and Ghosh (2009a), Das and Ghosh (2009b), an increase in the loan ratio indicates a high-risk profile for the banks and, as a result, an increase in risk-weighted assets. Therefore, the banks will adopt prudential risk management practices, which will improve interest income and thus profit for the banks. Arriff (2008) found that liquidity has a positive impact on the cost efficiency of commercial banks, whereas Reddy & Nirmala (2013) and Das & Ghosh (2009<sup>a</sup>) observed a positive impact on the profit efficiency of commercial banks. Das & Ghosh (2009<sup>b</sup>) found an insignificant impact of liquidity on the profit efficiency of banks. Therefore, it is important to see the impact of the liquidity of the banks on the revenue, cost, and profit efficiency of commercial banks in India. With respect to the liquidity of the

banks, a null hypothesis was formulated that there is a negative impact between the liquidity and revenue, cost, and profit efficiencies.

In accordance with Arriff (2008), Kumar & Gulati (2008), Sufian (2009), Das & Ghosh (2009a), Das & Ghosh (2009b), Gulati (2011), Tandon et al. (2014), Ally & Patel (2014), Megha (2016), and Kamarudin (2019), the asset quality is incorporated into the regression model. In this study, the ratio of gross nonperforming assets to gross advances is used as a proxy for the asset quality of banks. Arriff (2008), Kumar and Gulati (2008) found that asset quality has no substantial impact on the efficiency of banks, whereas Gulati (2011) observed that asset quality has a negative impact on the efficiency of banks. Sufian (2009) observed a positive and significant influence on efficiency under the operating approach, a positive and insignificant impact under the value-added approach, and a negative and insignificant impact under the intermediation approach. Therefore, it is vital to determine if asset quality has any effect on the revenue, cost, and profit efficiency of commercial banks. In literature, there are two hypothesis are framed in relation to cost efficiency and non-performing loans i.e bad luck hypothesis and bad management hypothesis. Bad luck hypothesis states that non-performing loans are generally caused by the uncontrollable factors and bad management hypothesis states that non-performing loans caused by controllable factors. These two hypotheses suggests the null hypothesis that non-performing loans are negatively associated with cost efficiency. In literature there is another hypothesis that skimping hypothesis, which states that non performing loans A bank's large volume of problem loans may be a conscious decision made by its management to trade off between short-term operating costs and long-run profitability (Isik & Hassan, 2003). This hypothesis suggests that the non-performing assets are positively associated with cost efficiency. For this purpose, a null hypothesis is formulated stating that non-performing assets are negatively related with revenue, cost, and profit efficiency by assuming bad luck and bad management hypothesis.

The Capital Adequacy Ratio (CAR) indicates the capital adequacy of banks. It is the ratio between Tier I and Tier II capital and risk-weighted assets.

Investopedia tells by reducing the likelihood of bank insolvency, capital adequacy ratios promote the effectiveness and stability of a country's financial system. A bank with a high capital adequacy ratio is typically regarded as safe and likely to fulfil its financial obligations. According to Berger & Mester (1997), Isik & Hassan (2003), Pasiouras et al. (2007), and Tandon et al. (2014), well-capitalized banks are more efficient, thereby having a favourable effect on efficiency. One reason could be that efficient organisations make more profit, which could result in larger equity-to-asset ratios. On the other hand, this positive relationship could mean that less efficient banks with less capital have less to lose by taking a risky gamble than a more efficient bank (Isik & Hassan, 2003). Singh and Thaker (2020) reported a negative but insignificant effect on the efficiency of banks. In accordance with Isik & Hassan (2003), Pasiouras et al. (2007), Arriff (2008), Das & Ghosh (2009b), Reddy & Nirmala (2013), Tandon et al. (2014), Ally & Patel (2014), Megha (2016), Sufian et al. (2016), Kamarudin, (2019), and Singh & Thaker (2020), the current regression model incorporates the capital adequacy ratio. This study hypothesizes that well capitalized bank are more efficient.

In accordance with Kumar & Gulati (2008), Sufian (2009), Gulati (2011), Sharma & Sharma (2012), Sufian & Habibullah (2012), and Tandon et al. (2014), off-balance-sheet operations are incorporated into the regression analysis. It represents the It is calculated as the ratio of non-interest income to total assets and reflects the diversification and business risk of commercial banks. In the preceding chapter of the present study, it was discovered that the non-interest income of India's commercial banks has increased significantly during the study period. According to Gulati (2011), non-traditional operations are crucial in determining the efficiency of commercial banks in India. Therefore, non-interest income exposure is included in the current analysis, and it is anticipated that off-balance-sheet operations have a favourable relationship with the efficiency of banks. The null hypothesis here is that off-balance-sheet operations have a relationship with revenue, cost, and profit efficiency.

The variables GDP growth rate and inflation rate were included in the regression analysis to measure the effect of economic conditions and banking efficiency (Sufian, 2009; Sufian & Habibullah, 2012; Reddy & Nirmala, 2013; Sufian et al. (2016), Megha (2016, Kamarudin (2019), Singh and Thaker (2020)). The current study hypothesises that the GDP rate has a favourable impact on measures of efficiency, while inflation has a negative impact on the efficiency of commercial banks.

The regression model incorporated two distinct dummy variables to represent the effect of financial sector changes and the global financial crisis on the efficiency of banks. Megha (2016, 2018), Bhatia & Mahendru (2018), and Bhatia & Mahendru (2019) classified the reformatory period as 1991–92 to 2001–02 and the post-reform period as 2002–03 to 2012–13. The Narasimham Committee issued its first report in 1991, and several of its suggestions were gradually put into practise. In 1998, the Narasimham Committee submitted its second report. Anti-money laundering and know your customer regulations were implemented in 2002 (Bhatia & Mahendru, 2018; Bhatia & Mahendru, 2019) (Megha, 2016; Bhatia & Mahendru, 2018; Bhatia & Mahendru, 2019). In light of this, the reformatory period for this study spans from 1992-1993 to 2001-2002. There is a null hypothesis that there is no impact between dummy reform and revenue, cost, and profit efficiency.

Maredza & Ikhide (2013) found a significant negative impact of the financial crisis on the efficiency and productivity of the banking system in South Africa. Kumar & Gulati (2016) studied the periods of 2007–08 and 2008–09 to examine the impact of the global financial crisis on the profit efficiency of commercial banks in India and found that there was no significant impact on the efficiency. While analysing the cost, revenue, and profit efficiency of banks in the present study, it was observed that there was a decline in the efficiency score during 2008-09. Hence, it is important to know whether the global crisis affected the efficiency of commercial banks in India. A null hypothesis was made that there is a negative relationship between dummy crises and the efficiency.

The study estimated two different panel tobit models based on the data availability. The base model is estimated for the entire period from 1992–93 to 2020–21, and the second model is estimated for the period from 1995–96 to 2020–21 since two years of observation are lost with the inclusion of asset quality and capital adequacy as additional independent variables. Before using panel tobit regression, all model assumptions were checked and found to be satisfactory.

#### **4.7.6 Fixed and random effect models**

For identifying the factors influencing the productivity of commercial banks, fixed and random effect models has applied in the study. The pooled OLS estimators are biased and inconsistent because the omitted variables are potentially correlated with other regressors (Hsiao (2003), Gulati (2011)). Fixed and random effect models for panel data can overcome this issue (Gulati, 2011). The fixed effect model investigates the relationship between the independent variable and dependent variable within an entity like a company, country person etc. The individual characteristics of each entity may or may not affect the independent variable. The fixed effect model assumes that something within an individual may affect or bias the dependent and independent variables and it is necessary to control for it. This is why the assumption of correlation between the entity's error term and independent variable is made. The model thus removes the effect of that time in variant characteristics and assesses the net effect of dependent and independent variables. Another important premise of the model is that those time-in-variant characteristics are exclusive to individuals and should not be correlated with other individual characteristics. As each entity is different, the entity's error term and constant that captures the individual characteristics should not be correlated with others. Thus, the estimated coefficients of the fixed effect models cannot be biased by omitting time in-variant characteristics( like culture, religion, gender, race etc ) because the fixed effect model controls for all time in-variant differences between the individuals ( Reyna, 2007). The regression equation of the fixed effect model for panel data is as follows

$$y_{it} = a_i + \beta' X_{it} + \varepsilon_{it}$$

Where  $y$  is the dependent variable and  $X$  is the independent variable.  $a$  and  $\beta$  are the coefficients,  $i$  indicates the number of cross sections  $i = 1, 2, 3, \dots, N$  and  $t$  is the number of periods  $t = 1, 2, 3, \dots, t$ .

If an entity's error term and constant are correlated with one another, FE is not appropriate and it is necessary to characterize the relationship, often using a random effects model. This is the rationale behind the Hausman test (Reyna, 2007).

Unlike the fixed effect model, the **random effect model** assumes that the difference across entities is random and uncorrelated with the independent variable included in the model. If there is sufficient reason to believe that variation across individual entities has some effects on the dependent variable, then the random effect model should be employed. The major advantage of the random effect model is that it allows the inclusion of the time in-variant variable in the model. These variables are absorbed by the intercept in the fixed effect model (Reyna, 2007). The regression equation of the random effect model for panel data is as follows;

$$y_{it} = a + \beta' X_{it} + u_i + \varepsilon_{it}$$

Where  $y$  is the dependent variable and  $X$  is the independent variable.  $a$  and  $\beta$  are the coefficients, Where  $i = 1, 2, 3, \dots, N$ ,  $N$  is the number of observations or cross sections.  $t = 1, 2, 3, \dots, T$ ,  $T$  is the number of periods.  $\varepsilon_{it}$  is the residual as a whole i.e here residual is the combination of both cross-section and time series.  $u_i$  indicates the individual residual which is the random characteristic of unit observation the  $i$ -th and remains at all times. The individual characteristics that may or may not affect the independent variable are required to be specified in the model. The problem relating to this is that certain variables may not be available leading to omitted variable bias in the model. However, the random effect model enables the generalization of findings beyond the samples used in the model.



**The Hausman test** is used to decide between fixed and random models. It tests whether the unique errors are correlated with explanatory variables or not. The null hypothesis for the test is that the random effect model would be consistent and efficient and the alternative hypothesis is that the random effect model is inconsistent. If p-value is less than 0.05, the null hypothesis is rejected and therefore fixed effect is considered more suitable. If the p-value is more than 0.05, it does not reject the null hypothesis and in such case, the random effect model is appropriate.

The fixed effects and random effects models have been used by Kumar et.al (2010), Gulati (2011), Narwal & Pathneja (2015) and others to explain the determinants of productivity among the commercial banks in India. In this analysis, total factor productivity change, efficiency change and technical change are used as the dependent variable and both bank-specific and industry-specific variables are used as independent variables. The study estimated the variants of fixed and random effect models depending on the availability of the data. The base model is estimated for the entire 1992-93 to 2020-21 and the second model is estimated for the period of 1995-96 to 2020-21 since two years of observation are lost with the inclusion of asset quality and capital adequacy as the additional independent variable. The following regression equation is estimated where the dependent variable is total factor productivity change (TFPCH), efficiency change (EFFCH) and technological change (TECHCH).

Model 1

$$\begin{aligned} \text{TFPCH or EFFCH or TECHCH} = & a_i + \beta_1 \text{Log\_size}_{it} + \beta_2 \text{Log\_ROA}_{it} \\ & + \beta_3 \text{Liquidity}_{it} + \beta_4 \text{offbalancesheet}_{it} \\ & + \beta_5 \text{Log\_GDP}_{it} + \beta_6 \text{Inflation}_{it} \\ & + \beta_7 \text{Dummy\_reform}_{it} + \beta_8 \text{Dummy\_Crisis}_{it} \\ & + \beta_9 \text{Dummy\_Demonetisation}_{it} \\ & + \beta_{10} \text{Dummy\_Public}_{it} + \beta_{11} \text{Dummy\_Foreign}_{it} + \varepsilon_{it} \end{aligned}$$

Model 2

$$\begin{aligned}
 TFPCH \text{ or } EFFCH \text{ or } TECHCH = & a_i + \beta_1 Log\_size_{it} + \beta_2 Log\_ROA_{it} \\
 & + \beta_3 NPA_{it} + \beta_4 Liquidity_{it} + \beta_5 Offbalancesheet_{it} \\
 & + \beta_6 CapitaladequacyR_{it} + \beta_7 Log\_GDP_{it} \\
 & + \beta_8 Inflation_{it} + \beta_9 Dummy\_Reform_{it} \\
 & + \beta_{10} Dummy\_Crisis_{it} + \beta_{11} Dummy\_Demonetisation_{it} \\
 & + \beta_{12} Dummy\_Public_{it} + \beta_{13} Dummy\_Foreign_{it} + \varepsilon_{it}
 \end{aligned}$$

Where  $\beta_1, \beta_2, \dots, \beta_{13}$  are the parameters estimated by the panel regression models,  $\varepsilon_{it}$  is the normally distributed random error. In following Kumar et.al (2010), Gulati(2011) and Narwal & Pathneja (2015) the model included the size of the banks (*Log\_size*) measured by the total asset of the banks as an independent variable determining the productivity and its components. In the banking literature, it is argued that bank size should be strongly correlated with efficiency, as a certain size may be required to utilize all scale- and scope-related efficiencies. On the other hand, larger banks may have a more professional management team and/or be more cost-conscious because of increased pressure from shareholders regarding bottom-line profits (Isik & Hassan, 2003). The similar relationship is expected in the case of productivity also. Therefore, it is expected that bank size is positively related with the productivity of commercial banks.

The ratio of net profit to total assets known as return on asset (*Log\_ROA*) is included in the study as a proxy of profitability (Gulati,2011, Narwal & Pathneja,2015). It is expected that high profitability lead to higher productivity and vice versa. Thus, it is hypothesized that there is a positive relationship between profitability and total factor productivity change and its components. In following Gulati (2011), the study included the ratio of gross non-performing assets to gross advances as a proxy of asset quality (*NPA*). It is expected that a higher level of NPA lead to lower productivity and vice versa. In this regard, a null hypothesis developed that, there is a negative relationship between non-performing assets and productivity. The ratio of total loans to total deposits is included to capture the impacts of liquidity (*Liquidity*) management practices of banks on productivity and its components. Das & Ghosh (2009) observed that a high liquidity ratio indicates

poor cash management and thus low-interest income. Thus in the present study, it is hypothesized that the ratio of total loans to total deposits is negatively related to the total factor productivity of the banks. In following Gulati (2011), the exposure of the off-balance sheet activities on the productivity of commercial banks is checked. For this, the ratio of non-interest income to total assets is taken as the proxy of off-balance sheet activities (*Offbalancesheet*). Gulati (2011) hypothesized that off-balance sheet activities positively affected the productivity of banks and they found the same from the analysis. Therefore, the present study hypothesized that the ratio of non-interest income to total assets is positively related to productivity and its components. For identifying the impact of capital adequacy ratio (*CAR*) on the productivity of banks, the ratio of Tier I and Tier II capital to risk-weighted assets is included in the model. Capital adequacy ratio indicates the capital strength of the banks and Berger & Mester (1997), Isik & Hassan (2003), Pasiouras et.al (2007) and Tandon et, al (2014) state that well-capitalized banks are more efficient and thus it may affect the efficiency positively. Therefore, in the present study, it is hypothesized that the capital adequacy ratio is positively related to productivity and its components. To measure the effect of economic conditions and banking productivity, the regression analysis included the variables GDP growth rate (*GDP*) and Inflation rate(*Inflation*). The present study hypothesizes that the GDP rate has a positive effect on productivity measures and inflation negatively relates to the productivity of commercial banks. For examining the impact of reforms on the productivity of commercial banks, a dummy variable have included in the model. In the present study, the reformatory period is taken as 1992-93 to 2001-02 (Megha(2016), Bhatia & Mahendru (2018) and Bhatia & Mahendru (2019)). A null hypothesis formulated concerning this period is that there is a positive relationship between dummy reform(*Dummy\_Reform*) and the productivity of commercial banks. To identify the impact of a global financial crisis (*Dummy\_Crisis*) on the productivity of commercial banks, a dummy variable was included in the model. Similarly, the impact of demonetisation on the productivity of banks, dummy variable (*Dummy\_Demonetisation*) taking 1 for 2016-17 and 2018-19 and 0 for rest of the years are included in the model. In following Kumar & Gulati (2016) the year 2007-08 and 2008-09 is taken as a period of global crisis. A null hypothesis

formulated relating to the dummy crisis is that the global crisis is negatively related to the total factor productivity of the banks. In following Kumar et.al (2010), Gulati (2011) and Narwal & Pathneja (2015) dummy for ownership (*Dummy\_Public & Dummy\_Foreign*) of commercial banks is included in the model. The empirical findings of the study revealed that there is no particular sign of a relationship between the ownership of banks and the productivity of banks. Hence, the present study hypothesized that ownership of banks is positively/ negatively related to productivity and its components.

#### **4.7.7 Analysis of variance**

Analysis of variance (ANOVA) is a popular and sophisticated statistical method. The Analysis of Variance, or F test, is a statistical test developed by R.A. Fisher to test the significance of differences between more than two sample means and to make inferences about whether such samples are drawn from a population having the same mean. The F test is based on ratios rather than the difference between variances. It is the ratio between two variances: 1) between samples and 2) within samples. Its purpose is to find out the influence of different forces working on them. There is a one-way classification model and a two-way classification model (Tulsiann & Tulsian, 2008). The present study used a one-way classification model. A one-way classification model is used to study the effect of one factor in an experiment.

#### **4.7.8 Kruskal Wallis H test**

ANOVA is a common method when there are multiple independent samples present. ANOVA's value is questionable if its assumptions are not satisfied. Consequently, an alternative technique known as the Kruskal-Wallis one-way analysis of variance, or the H test, was devised. The test assists in testing the null hypothesis that k independent random samples are drawn from identical populations versus the alternative hypothesis that the sample means are not equal (Gupta, 2017). The statistic calculated during this test is known as the H statistic, and its formula is shown below:

$$H = \frac{12}{n(n+1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(n+1)$$

The null hypothesis is rejected if the estimated H is greater than the table value at (k-1) degrees of freedom; otherwise, the null hypothesis is accepted.

#### 4.7.9 Shapiro Wilk test

The Shapiro-Wilk test is the statistical test used to determine whether or not random samples are drawn from a normal distribution. It is used to test the data's normality. The usual KS test appears to no longer be advised due to its low power. Ghasemi and Zahediasl (2012) say that the Shapiro-Wilk test from SPSS, which evaluates both visually and statistically, is much better.

In the study, ANOVA and the Kruskal-Wallis H test were employed to determine whether or not there was a statistically significant difference between the performance of several groups of commercial banks. The selection of ANOVA and the Kruskal-Wallis H test was determined by the normality of the data. If the data were found to be normal by the Shapiro-Wilk test, an ANOVA was done; otherwise, the Kruskal-Wallis H test was used.

#### 4.8 Conclusion

This chapter consists of the methodology of the study, which describes the entire process of how the present study was conducted. The chapter delineates the research design, period, population, sample and sources and type of the data used in the study. It also describes variables, tools and techniques used for the analysis including trend analysis, ratio analysis, Data Envelopment Analysis, Malmquist Productivity Index, panel tobit regression, fixed and random effect model, Analysis of Variance, Kruskal wallis H test and Shapiro Wilk test.

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## CHAPTER V

# GROWTH AND PROFITABILITY OF COMMERCIAL BANKS IN INDIA

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Commercial banks constitute an important part of the Indian financial system. It plays a significant role in the economic development of the nation. Mobilization of savings and their effective allocation to the various sectors in the economy is the main function of the commercial banks. An efficient banking system enables to collect greater amount of fund, which can utilize to foster the economic development of the nation. Commercial bank forms the core of the development process of every country. Hence, the banking system needs to be monitored continuously and strengthened for the smooth functioning of the economy.

Until early 1990s, the Indian banking sector faced a number of problems like low capital base, lack of healthy competition, high intermediation cost and low productivity. All these were compelled the government to introduce a wide range of banking sector reforms in India. The key motive behind the introduction of the banking sector reforms in India was the enhancement of efficiency and stability of the banks by using three types of measures such as enabling measures, strengthening measures and institutional measures. Enabling measures include reduction in statutory pre-emptions, which ensures greater funds for commercial lending, interest rate deregulations, which helps in price discovery, liberalisation of entry norms and granting of operational autonomy for banks. On the other hand, strengthening measures ensure reduction of the vulnerability of the banks by introducing prudential norms regarding income recognition, asset classification and provisioning norms, capital adequacy, exposure norms, disclosure standards and improved level of transparency. Under institutional measures, the government introduced reforms in the legal framework of banks and financial institutions and establishment of new institutions (Akhtar & Alam, 2011). Since the implementation of reforms, Indian

banking sector has attained several remarkable achievements. Hence, assessing the performance of commercial banks is utmost important.

This chapter attempts to analyse growth and profitability performance of commercial banks operating in India. For the purpose of analysis, commercial banks are categorized into public sector banks, private sector banks and foreign banks. The data for the study are collected mainly from the Statistical Tables Relating to Banks in India, an annual publication of RBI. The data relating to the study are collected for the period of 1992-93 to 2020-21, thereby covering 29 years. For analysing the growth of the banks, annual growth rate, compound annual growth rate, percentage and mean have been used. Different ratios are used to analyse the profitability performance of commercial banks under study. To test the significance of difference in the growth rates and profitability ratios among different groups of commercial banks. Kruskal-Wallis H test or ANOVA has applied after conducting Shapiro Wilk test of testing normality. Before analysing the data, the data adjusted for inflation. Generally, the data deflated using consumer price index (CPI) and GDP deflator. In this study, all the variables are deflated using GDP deflator. This chapter has been divided into two sections i.e

5.1 Analysis of growth of commercial banks

5.2 Analysis of profitability of commercial banks

### **5.1 Analysis of growth of commercial banks**

This part of the analysis examines the growth of Indian banking industry over the period of 1992-93 to 2020-21. As mentioned earlier, all commercial banks are divided based on ownership i.e. public sector banks, private sector banks and foreign banks. The growth of the commercial has been analysed in terms of following four groups:

1. Growth in terms of bank's assets
2. Growth in terms of bank's liabilities
3. Growth in terms of bank's incomes
4. Growth in terms of bank's expenses



The major assets of the commercial banks incorporated in the study are advances and investment. The liabilities include deposits and borrowings. Major income of the commercial banks includes interest income and non-interest income and expenses include interest expenses and non-interest expenses. The analysis of the data has been done using simple annual growth rate, compound annual growth rate, mean and line graph.

### **5.1.1 Growth of commercial banks in terms of banks assets**

The study analyses major assets of the commercial banks over the period 1992-93 to 2020-21. For this purpose, advances and investment of different groups of banks are examined. As on 31<sup>st</sup> March 2021, the advances and investment together constitute 82.87 percentage of total assets of the commercial banks.

#### **1. Advances**

Banks play a significant role in the credit intermediation process by gathering financial resources from savers in the form of deposits and lending them to investors for different purposes. As of March 31, 2021, loans and advances constituted approximately 55.14 percent of total assets of public, private, and foreign banks. Lending money is one of the basic functions of commercial banks. Interest earned by lending advances constitutes the major source of income for the banks. The bank's advance includes bills purchased and discounted, cash credits, overdrafts, loans, and term loans. The annual growth rate, mean, and compound annual growth rate of advances for different groups of banks for the study period are presented in table 5.1.

**Table 5.1***Advances of Different groups of Commercial banks in India during 1992-93 to 2020-21*

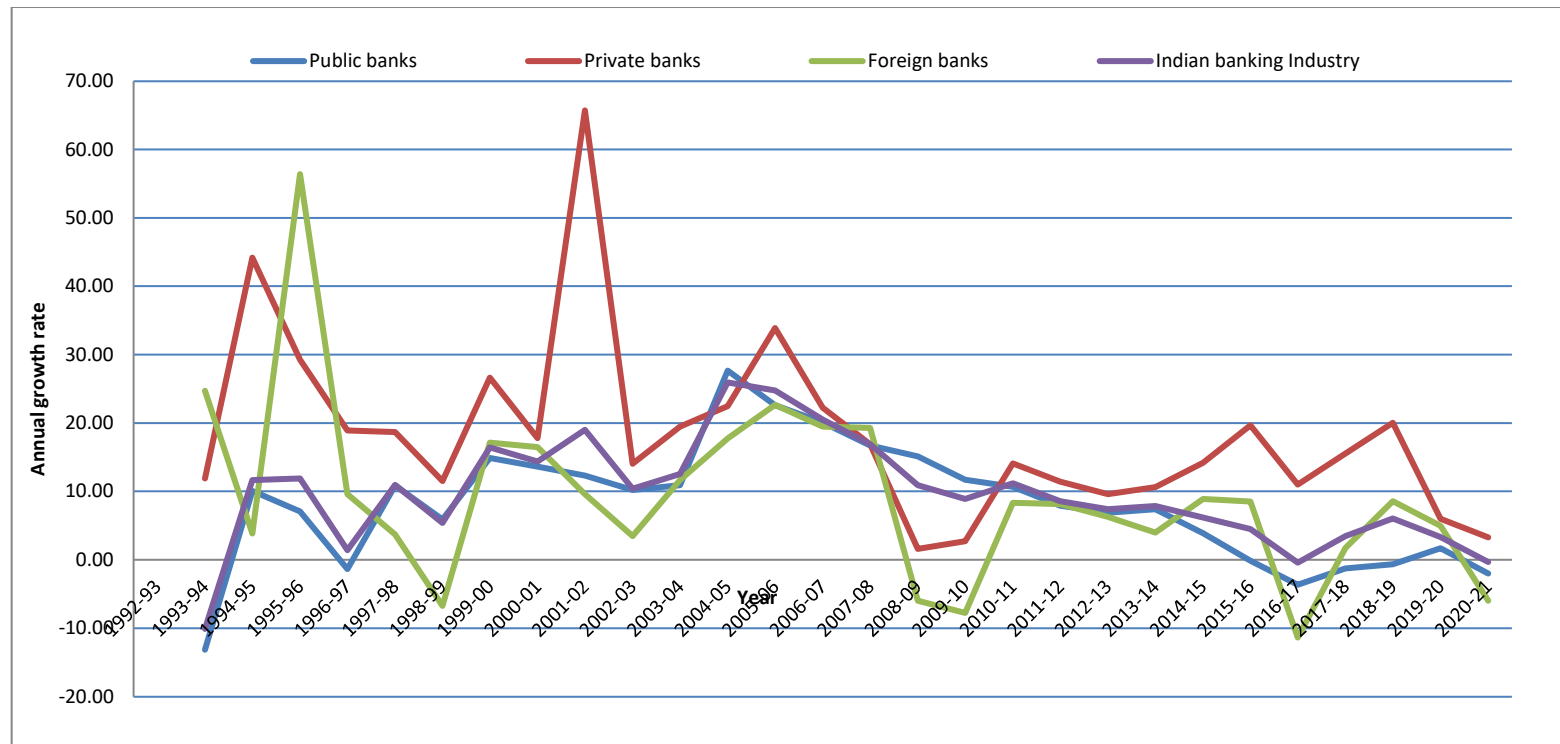
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
1992-93	466584.51(89)		28112.01(5)		29669.86(6)		524366.4(100)	
1993-94	470702.18(87)	0.88	31453.3(6)	11.89	37008.59(7)	24.73	539164.07(100)	2.82
1994-95	518116.53(86)	10.07	45351.65(7)	44.19	38433.40(7)	3.85	601901.58(100)	11.64
1995-96	554621.25(82)	7.05	58611.28(9)	29.24	60117.29(9)	56.42	673349.82(100)	11.87
1996-97	547071.49(80)	-1.36	69702.36(10)	18.92	65892.00(10)	9.61	682665.85(100)	1.38
1997-98	606398.86(80)	10.84	82709.71(11)	18.66	68339.73(9)	3.71	757448.30(100)	10.95
1998-99	642225.18(80)	5.91	92253.07(12)	11.54	63729.46(8)	-6.75	798207.71(100)	5.38
1999-00	737865.28(79)	14.89	116810.98(13)	26.62	74637.85(8)	17.12	929314.11(100)	16.43
2000-01	838309.75(79)	13.61	137602.1(13)	17.80	86932.88(8)	16.47	1062844.73(100)	14.37
2001-02	941586.68(74)	12.32	228070.52(18)	65.75	95263.47(8)	9.58	1264920.67(100)	19.01
2002-03	1037686.06(74)	10.21	260126.56(19)	14.06	98547.41(7)	3.45	1396360.03(100)	10.39
2003-04	1150645.57(73)	10.89	310776.51(20)	19.47	110032.73(7)	11.65	1571454.81(100)	12.54
2004-05	1469237.55(74)	27.69	380638.63(19)	22.48	129546.35(7)	17.73	1979422.53(100)	25.96
2005-06	1801478.11(73)	22.61	509626.74(21)	33.89	158869.78(6)	22.64	2469974.63(100)	24.78
2006-07	2163356.59(73)	20.09	623030.31(21)	22.25	189783.04(6)	19.46	2976169.94(100)	20.49
2007-08	2524793.89(73)	16.71	728195.56(21)	16.88	226341.97(6)	19.26	3479331.42(100)	16.91

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
2008-09	2906112.35(75)	15.10	740066.38(19)	1.63	212740.62(6)	-6.01	3858919.35(100)	10.91
2009-10	3246026.54(77)	11.70	760054.01(18)	2.70	196202.84(5)	-7.77	4202283.39(100)	8.90
2010-11	3592946.52(77)	10.69	867178.41(19)	14.09	212580.89(4)	8.35	4672705.82(100)	11.19
2011-12	3877307.49(76)	7.91	966402.95(19)	11.44	229848.75(5)	8.12	5073559.19(100)	8.58
2012-13	4144208.92(76)	6.88	1059250.05(19)	9.61	244306.48(5)	6.29	5447765.45(100)	7.38
2013-14	4450865.29(76)	7.40	1171742.97(20)	10.62	254028.34(4)	3.98	5876636.60(100)	7.87
2014-15	4624039.16(74)	3.89	1337762.27(22)	14.17	276617.91(4)	8.89	6238419.34(100)	6.16
2015-16	4617829.42(71)	-0.13	1601039.73(24)	19.68	300132.73(5)	8.50	6519001.88(100)	4.50
2016-17	4448988.58(69)	-3.66	1776859.39(27)	10.98	266059.58(4)	-11.35	6491907.55(100)	-0.42
2017-18	4392375.07(65)	-1.27	2052851.03(31)	15.53	270615.77(4)	1.71	6715841.87(100)	3.45
2018-19	4363645.84(61)	-0.65	2463957.4(35)	20.03	293783.99(4)	8.56	7121387.23(100)	6.04
2019-20	4436680.10(60)	1.67	2611782.76(36)	6.00	308409.19(4)	4.98	7356872.05(100)	3.31
2020-21	4346410.07(59)	-2.03	2696870.85(37)	3.26	289962.78(4)	-5.98	7333243.70(100)	-0.32
<b>Mean</b>	<b>2410969.48(71)</b>	<b>8.57</b>	<b>820996.19(24)</b>	<b>18.34</b>	<b>168566.75(5)</b>	<b>9.19</b>	<b>3400532.41(100)</b>	<b>10.09</b>
<b>CAGR</b>	<b>10.51</b>		<b>17.86</b>		<b>8.46</b>		<b>11.63</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parentheses indicate percentage of share of advances of each group of banks on the total of all these banks.

**Figure 5.1**

*Trends in the annual growth rates of advances in respect of different groups of commercial banks in India over 1992-93 to 2020-21*



The mean value of advances of public sector banks for the last 29 years calculated as 2410969.48 crores and for private sector banks is 820996.19 crores and foreign banks is 168566.75 crores. The average advance for all commercial banks is 3400532.41 crores. In comparing the mean of different groups of banks, it is clear that the value of advances is higher in public sector banks followed by private sector and foreign banks. Even though Indian banking sector has opened up for the new private sector banks and foreign banks as a part of introduction of new economic reforms, Indian banking industry has been still dominated by the public sector banks in terms of value of advances. However, the annual growth rate of public sector banks was negative during the year 1996-97, 2015-16, 2016-17, 2017-18, 2018-19 and 2020-21. During 1996-97, public sector banks have reported the growth rate of -1.36 where as growth rate of entire banking industry decreased to 1.38 from 11.87 in 1995-96. RBI observed that despite the remarkable improvement in the performance of the commercial banks in 1996-97, the growth in credit was sluggish as consequent to the deceleration in the industrial activity. This slow down in credit disbursement not only affected public sector banks but the advances of private sector banks and foreign banks also decreased during the year as compared to the previous year. After 1996-97, growth rate of advances of public sector banks again recorded negative growth in 2015-16. The growth rate of all commercial banks has also decreased to 4.50 from 6.16 in the previous year. This decline was mainly contributed by the public sector banks as the public sector banks has witnessed acceleration in the delinquent loans and resulting expansion in provisioning for non-performing loans. However, growth rate of private sector banks has increased in the year and the growth rate of foreign banks also improved but with a slight decline as compared to the previous year. In continuing with the year 2015-16, 2016-17 also earmarked a record fall of advances due to the persistent deterioration in the asset quality and consequent provisioning requirements. During this year, public sector banks and foreign banks have reported with a negative growth rate. However, private sector banks have improved in lending advances but with slow growth rate as compared to the previous year. RBI observed that, commercial banks share in meeting the credit requirement of the corporate dwindled in the year as compared to

the previous year. This was mainly due to the increased flow of resources from the non-bank sources especially by the way of private placement of corporate bonds and commercial papers. In 2017-18, in comparing previous year, the annual growth rate of public sector banks have changed to -1.27 from -3.66 in 2016-17. The growth of advances of Indian banking industry also improved to 3.45 from -0.42 in previous year. The year 2017-18 has reported with an upsurge in the credit growth rate of all groups of banks as compared to the previous year. This was due to the decline in the credit growth of non-bank sources. However, revival of growth in advances from this anemic condition, which was apparent from the year 2017-18, also continued in 2018-19 and public sector banks recorded the growth rate of -0.65% and 6.04% by all commercial banks. According to RBI, this improvement was mainly attributable by the deceleration in the non-performing assets, recapitalization of public sector banks and the resolution process of Insolvency and Bankruptcy Code. Despite the improvement in growth rate by public sector banks in 2019-20, the year 2020-21 reported with a negative growth rate of -2.03. The advances of foreign banks and Indian banking industry also showed a negative declining trend during the last year of the study. However, private sector banks have reported positive credit growth but the rate of growth has declined as compared to the previous year. This sluggish growth in advances was mainly due to the muted demand for advance and risk aversion followed by the spread of Covid-19 pandemic. The highest annual growth rate of 27.69 percentages was recorded by public sector banks in 2004-05. During this period, the entire commercial banks as a whole achieved a robust growth in lending advances. Both private sector banks and foreign bank registered a growth rate of 22.48% and 17.73% respectively during 2004-05.

In the case of private sector banks, the advances increased from 28112.01 in 1992-93 to 2696870.85 in 2020-21, with the maximum growth rate of 65.75 in 2001-02 and a minimum of 1.63 in 2008-09. The years 2001-02 also registered a growth rate of 12.32%, 9.58%, and 19.01%, respectively, for public sector banks, foreign banks, and all commercial banks. During 2008-09, as a consequence of the global financial crisis, the growth of advances by all groups of banks, especially private sector banks and public sector banks, recorded slow growth. The growth rate

of foreign banks turns negative this year after a long time. During this turbulent period, even though Indian banks remained robust, they were not insulated from the slowdown. Overall commercial bank growth slowed to 10.91 percent in 2008-09 from 16.91 percent in 2007-08.

The advances of foreign banks increased from 29669.86 in 1992–93 to 289962.78 in 2020–21, with the maximum growth rate of 56.42 in the year 1995–96. The main reason for this growth in 1995–1996 was that nine more foreign banks opened in India. In addition to that, banks that already existed grew by opening new branches. Hence, foreign banks could be able to channel more credit through these branches. The growth rate of advances by foreign banks was negative in 1998–99, 2008–09, 2009–10, 2016–17, and 2020–21. During 1998–99, the growth rate of foreign banks was -6.75%. For all other groups of banks, there was also a significant decline in bank credit during this time. The annual growth rate of public sector banks declined to 5.91 from 10.84 in the previous year, and the growth rate of private sector banks also decreased to 11.54 from 18.66 in 1997-98. As a result, the growth rate of all commercial banks also subdued from 10.95 to 5.38 in 1998–99. The majority of bank advances have been allocated to non-food credit. Advances in non-food credit grew at a slower rate in 1998–1999 than in the previous year, owing to cyclical industrial operations and a decline in exports. That could be the reason for slower credit expansion during the year. Foreign bank groups experienced continuous negative growth in 2008–09 and 2009–10. Unlike the previous year, the growth rate of advances by private sector banks exhibited a slight improvement. However, the Reserve Bank of India (RBI) reports that bank credit for public sector banks and the banking industry as a whole slowed in 2009–2010. This year was defined by the sluggish performance of Indian commercial banks, primarily in terms of asset quality and poor deposit growth. This slowdown in bank deposit growth may be due to a slowdown in bank advances since bank deposits constitute the major source of funds for the banks. An interesting observation here is that after the outbreak of the global financial crisis, notwithstanding the slowdown in the credit growth of both public and private sector banks, only the credit growth rate of foreign banks became negative. Therefore, from the analysis of the advances of different

groups of banks, it is observed that the global financial crisis affected the foreign bank group more than that of the Indian domestic banks.

The CAGR of advances for the different groups of banks indicates how the advance grows in value over the study period. The CAGRs for private sector banks, public sector banks, foreign banks, and all commercial banks are 10.51, 17.86, 8.46, and 11.63, respectively. The compound growth rate of private sector banks is higher than that of other groups of banks. It is important to mention that, unlike public sector banks and foreign banks, the annual growth rate of private sector banks never became negative during the period of the study. Foreign banks' compound growth rates are found to be higher than those of public sector banks. When the share of advances of each group of banks is examined, it is clear that public sector banks continue to dominate the banking industry in terms of the value of advances. An average of 71% of advances from all commercial banks are disbursed by the public sector banks, whereas private sector banks could lend only 24% of the entire amount and 5% to foreign banks. However, when the trend of share of advances for each group of banks is examined over the study period, the share of public sector banks gradually declines, while the share of private sector banks improves significantly. The share of foreign banks exhibited a declining trend over the period. During the period, foreign banks reported an average share of 5% of the advances of all commercial banks, and it is important to note that foreign banks were not able to lend even more than 10% of the total advances of all commercial banks in any one of the years under study.

Figure 5.1 shows the trends in the growth rates of advances for different groups of banks in India from 1992–93 to 2020–21. From the graph, it is observed that among different groups of banks, the highest growth rate was achieved by private sector banks in the year 2001-02 and the lowest growth rate was recorded by public sector banks in 1993-94.

From the above discussion, it is clear that there is a difference in the growth rate of advances among different groups of commercial banks in India. In order to



see whether this difference is statistically different, relevant statistical tests can be applied. Before choosing an appropriate test, the Shapiro-Wilk test was used to see if the distribution was normal or not. The p value obtained for the Shapiro-Wilk test is 0.000, with test statistics of 0.892. The null hypothesis relating to the test is that the data is normal. As the p value is less than 0.05, the null hypothesis is rejected, and hence the data is not normal. Hence, the Kruskal-Wallis H test has been applied to test whether the distribution is the same across different groups of banks.

**Table 5.2**

*Results of Kruskal Wallis H test for Advances of Commercial Banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	35.54	29		
Private Sector banks	56.27	29	13.381	<b>0.001*</b>
Foreign banks	35.70	29		

Source: Researcher's Estimates, \* indicates significant at 5% level

According to the Kruskal-Wallis H test result, the observed Chi-square statistic is 13.381 with a p value of 0.001. Since the p value is lower than 0.05, the null hypothesis that there is a significant difference in the advances of different groups of commercial banks is rejected. These findings indicate that at least one pair of banks differs significantly. In order to see which pairs of banks are significantly different, multiple comparison tests have been conducted. The result is presented in Table 5.3.

**Table 5.3**

*Result of Multiple Comparisons*

Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Public sector banks- Foreign banks	-0.161	6.519	-0.025	1.000
Public sector banks- Private Sector banks	-20.732	6.519	-3.180	<b>0.004**</b>
Private Sector banks- Foreign banks	20.571	6.519	3.156	<b>0.005**</b>

Source: Researcher's Estimates, \*\* indicates significant at 5% level

A pair-wise comparison reveals which bank groups have a significant difference. Here, the growth rate distribution of public sector banks and foreign banks does not have any statistically significant difference. However, the growth rates between public sector banks and private sector banks and between private sector banks and foreign banks exhibit a statistically significant difference.

## **2. Investments**

Investments constitute the second-largest component of the assets of the banks. Investments by commercial banks include investments in Indian government securities, other approved securities, shares, debentures, bonds, subsidiaries, joint ventures, and others. Investment also includes investment outside India in government securities, subsidiaries, joint ventures, and others. As of March 31, 2021, almost 30 percent of the total assets of public, private, and foreign banks were investments. The annual growth rate, mean, percentage, and compound annual growth rate of investment by public sector banks, private sector banks, and foreign banks for the study period are presented in table 5.4.

**Table 5.4***Investment of different groups of Commercial banks in India During 1992-93 to 2020-21*

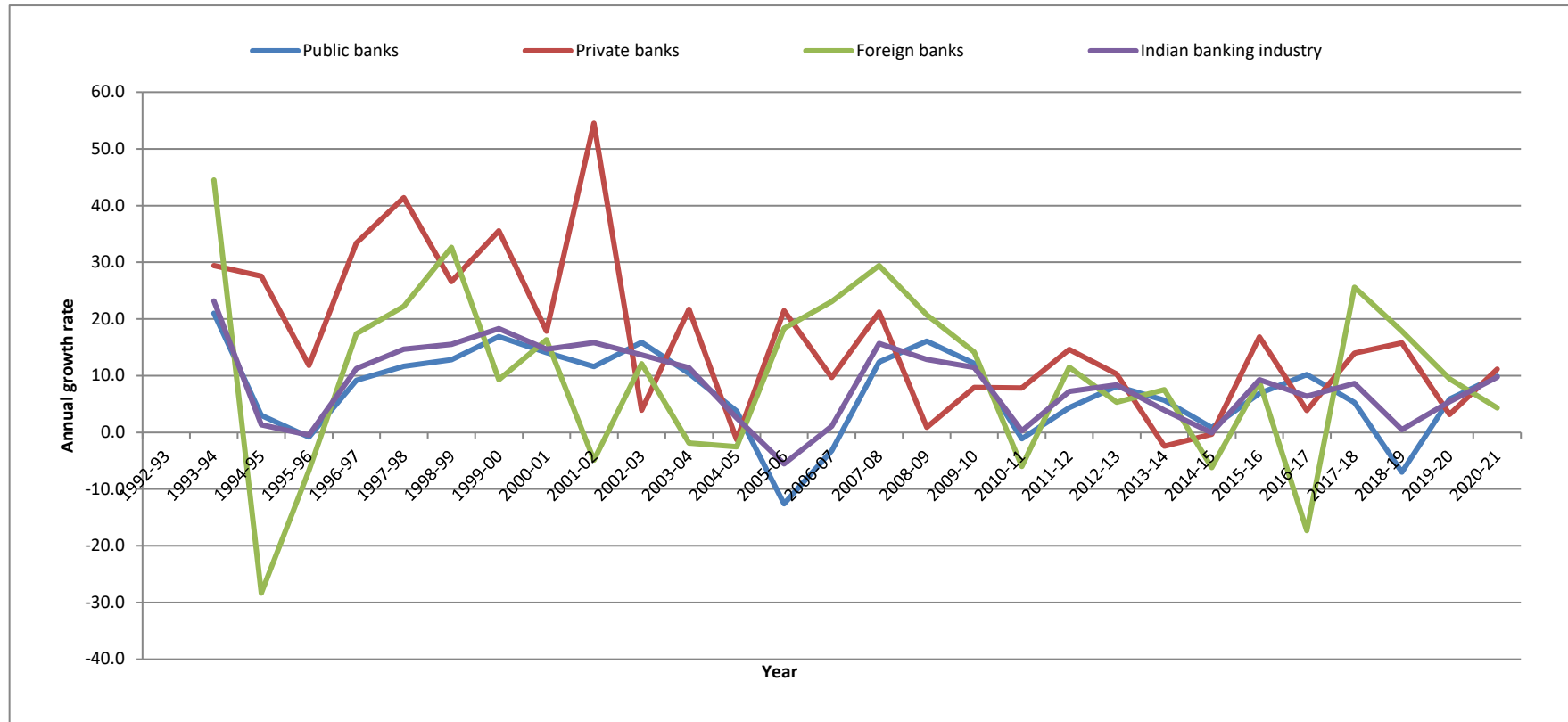
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
1992-93	351718.27(88)		17831.83(4)		30934.1(8)		400484.15(100)	
1993-94	425673.11(86)	21.0	23074.97(5)	29.4	44704(9)	44.5	493452.09(100)	23.2
1994-95	438447.51(88)	3.0	29426.38(6)	27.5	32049.1(6)	-28.3	499923(100)	1.3
1995-96	434705.42(87)	-0.9	32895.56(7)	11.8	29892.3(6)	-6.7	497493.31(100)	-0.5
1996-97	474552.26(86)	9.2	43883.58(8)	33.4	35095.5(6)	17.4	553531.32(100)	11.3
1997-98	529871.42(83)	11.7	62038.33(10)	41.4	42887.7(7)	22.2	634797.48(100)	14.7
1998-99	597844.92(81)	12.8	78524.17(11)	26.6	56884.3(8)	32.6	733253.41(100)	15.5
1999-00	698688.12(81)	16.9	106440.95(12)	35.6	62162.2(7)	9.3	867291.25(100)	18.3
2000-01	796819.65(80)	14.0	125428.63(13)	17.8	72302.9(7)	16.3	994551.15(100)	14.7
2001-02	889339.86(77)	11.6	193843.29(17)	54.5	68744.4(6)	-4.9	1151927.52(100)	15.8
2002-03	1030727.24(79)	15.9	201399.7(15)	3.9	77060.8(6)	12.1	1309187.76(100)	13.7
2003-04	1137803.24(78)	10.4	245139.12(17)	21.7	75624.7(5)	-1.9	1458567.02(100)	11.4
2004-05	1180278.64(79)	3.7	241947.02(16)	-1.3	73715.2(5)	-2.5	1495940.83(100)	2.6
2005-06	1031981.76(73)	-12.6	293908.16(21)	21.5	87220.3(6)	18.3	1413110.24(100)	-5.5
2006-07	998730.66(70)	-3.2	322450.05(23)	9.7	107362(7)	23.1	1428542.89(100)	1.1
2007-08	1122389.38(68)	12.4	390809.1(24)	21.2	138938(8)	29.4	1652136.53(100)	15.7

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
2008-09	1302631.57(70)	16.1	394303.02(21)	0.9	167679(9)	20.7	1864613.61(100)	12.9
2009-10	1460879.7(70)	12.1	425570.24(21)	7.9	191433(9)	14.2	2077882.46(100)	11.4
2010-11	1444529.74(69)	-1.1	458867.02(22)	7.8	179949(9)	-6.0	2083345.65(100)	0.3
2011-12	1507270(67)	4.3	525982(24)	14.6	200651(9)	11.5	2233903(100)	7.2
2012-13	1629858.24(67)	8.1	580103.77(24)	10.3	211306(9)	5.3	2421268.41(100)	8.4
2013-14	1722456.33(68)	5.7	566005.16(23)	-2.4	227254(9)	7.5	2515715.88(100)	3.9
2014-15	1736855.91(69)	0.8	564198.39(22)	-0.3	213167(9)	-6.2	2514221.35(100)	-0.1
2015-16	1855920.88(68)	6.9	659234.22(24)	16.8	232170(8)	8.9	2747324.79(100)	9.3
2016-17	2045299.29(70)	10.2	684573.61(23)	3.8	191919(7)	-17.3	2921792.12(100)	6.4
2017-18	2152384.48(67)	5.2	780058.64(25)	13.9	240985(8)	25.6	3173428.58(100)	8.6
2018-19	2001174.64(63)	-7.0	903078.18(28)	15.8	283927(9)	17.8	3188180.04(100)	0.5
2019-20	2118614.07(63)	5.9	931578.65(28)	3.2	310718(9)	9.4	3360910.84(100)	5.4
2020-21	2328279.61(63)	9.9	1035455.9(28)	11.2	324106.1(9)	4.3	3687841.57(100)	9.7
<b>Mean</b>	<b>1222266.41(70)</b>	<b>7.25</b>	<b>376484.47(22)</b>	<b>16.36</b>	<b>138304.88(8)</b>	<b>9.88</b>	<b>1737055.80(100)</b>	<b>8.47</b>
<b>CAGR</b>	<b>6.78</b>		<b>14.64</b>		<b>9.23</b>		<b>8.09</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of investment of each group of banks on the total investment of all these banks.

**Figure 5.2**

*Trends in the annual growth rates of investments in respect of different groups of commercial banks in India over 1992-93 to 2020-21*



The investment of the Indian banking industry ranges from 400484.15 crores in 1992–93 to 3687841.57 crores in 2020–21, while the investment of public sector banks varies from a minimum of 351718.27 crores in 1992–93 to a maximum of 2328279.61 crores in 2020–21, with an average of 1222266.41 crores. The annual growth rate of public sector banks over the study period was highest in 1993–94. The growth rate was negative during 1995–96, 2005–06, 2006–07, 2010–11, and 2018–19. The average investment of private sector banks over the study period is calculated as 376,484.47 crore. The maximum annual growth rate of 41.4 was registered in the years 1997–98. The negative growth rate was reported during 2004–05, 2013–14, and 2014–15. The investment of foreign banks ranges from a minimum of 29892.3 crore in 1995–96 to a maximum of 324106.1 crore in 2020–21. The maximum annual growth rate of 44.5 was recorded in the year 1993–94, and growth rates were negative during 1994–95, 2001–02, 2003–04, 2004–05, 2010–11, 2014–15, and 2016–17. During 1993-94, the investment of different groups of banks accelerated sharply as compared to the previous year. This is because of the availability of relatively high-yielding, risk-free government securities with different maturities issued at the market-related interest rate under the open market operations of the RBI in the capital market. As a result of the increase in advances during 1994–95, commercial bank investment fell sharply, and foreign banks experienced negative growth during the year. From 1996–97 to 2000–01, all bank groups' and the Indian banking industry's investment increased significantly. During 2001-02, there was a growth of investment for all groups of banks except foreign banks, and private sector banks recorded the highest growth of 54.5 over the entire period of the study. RBI (2001-02) observed that during this period, the investment in government securities was more than the statutory requirement. This preference for government securities by commercial banks was mainly due to lackluster demand for the loans and advances. All groups of banks have reported a strong growth in investment during 2002-03. In the following years, i.e., from 2003–04 to 2006–07, there was a decline in the investment of commercial banks. The growth rate of public sector banks was consistently negative during 2005–06 and 2006–07, while the growth rate

of foreign banks was consistently negative during 2003–04 and 2004–05. A negative growth rate of -1.3 was recorded by private sector banks during 2004–05. From 2007-08 to 2009-10, investment by all commercial banks exhibited substantial progress, and among bank groups, the growth rate of foreign bank groups was found to be higher than that of other groups of banks. During 2016–17, the growth of investment by all commercial banks declined as compared to the previous year, even though there was substantial growth in deposits due to demonetisation and considerable deceleration in advance growth. Among bank groups, public sector banks have registered a growth in investment as compared to the previous year, whereas the growth of investment by private sector banks and foreign banks decelerated considerably. In 2017–18, the investments of commercial banks have improved, and foreign banks and private sector banks have recorded progress in investment growth. However, in 2018-19, investment by commercial banks decelerated mainly because of the decline in investment by public sector commercial banks to accommodate the accelerated credit growth. During 2019–20 and 2020–21, while lending advances remained muted, accelerated deposits were matched by enhancing investment in the asset side. As a result, despite the outbreak of the COVID-19 pandemic, investment by all bank groups increased during the period. Figure 5.2 clearly presents the trend of the annual growth rate of investment with respect to different groups of banks. According to the graph, private sector banks experienced the highest peak in growth rate in 2001-02, while foreign banks experienced the greatest decline in growth rate in 1994-95. Since the major share of investment for all commercial banks is held by public sector banks, the trend for both public sector banks and all commercial banks shows an almost similar pattern.

The CAGR of investment for the different groups of banks indicates how the investment grows in value over the study period. The CAGRs for all commercial banks, foreign banks, private sector banks, and public sector banks were calculated to be 8.09%, 9.23%, 14.64%, and 6.78%, respectively. The compound growth rate of

private sector banks is higher than that of other groups of banks. Foreign banks' compound growth rates are found to be higher than those of public sector banks.

Apart from analysing the growth of each group of banks, it is also important to analyse the share of each group of banks in respect to investment. Table 5.3 also shows the share of investment by each group of banks in the total investment by all commercial banks from 1992–93 to 2020–21. From the table, it is clear that public sector banks are still holding the lion's share of investment in entire commercial banks. An average of 70 per cent of the investment of all commercial banks is held by public sector banks, 22 percent is held by private sector banks, and 8 percent is held by foreign banks. However, while analysing the trend of share of investment for each group of banks over the study period, it is observed that the share of public sector banks is declining gradually and the share of private sector banks is increasing substantially over the period. The share of foreign banks did not exhibit considerable change over the study period. On the asset side of all commercial banks, advances and investment together constitute almost 84% of the total assets of the banks. As a result, because the trend of shares of advances and investments exhibits a similar pattern, it can be attributed to the banks' total assets.

From what has been discussed so far, it is clear that the growth rates of investment for different groups of commercial banks in India are different. Relevant statistical tests can be used to determine whether this difference is statistically different. The Shapiro-Wilk test has been used to determine whether or not the distribution follows normality before selecting an appropriate test. With a test statistic of 0.976, the P value for the test is computed to be 0.114. Shapiro-Wilk test results with a p value greater than 0.05 indicate that the distribution is normal. As a result, the ANOVA test has been used to determine whether the distribution differs across various groups of banks.



**Table 5.5**

*Results of ANOVA in respect of investment of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1232.411	2	616.206		
Within Groups	13329.801	81	164.568	3.744	<b>0.028**</b>
Total	14562.213	83			

Source: Researcher's estimates, \*\*the mean difference is significant at the 0.05 level.

According to the ANOVA result, the observed F statistic is 3.744, with a p value of 0.028. The null hypothesis stated in relation to investment is that there is no significant difference in the growth rate of investment among public sector banks, private sector banks, and foreign banks. Since the p value is less than 0.05, the null hypothesis is rejected, which indicates that there is a significant difference in the growth rate of investment among different groups of commercial banks in India. According to the ANOVA results, there is a significant difference between at least one pair of banks. Multiple comparison tests have been carried out in an attempt to determine which pairs of banks are considerably different. Table 5.6 displays the result.

**Table 5.6**

*Result of Multiple Comparisons*

Banks		Mean Difference (I-J)	Std. Error	Sig.
Public sector banks	Private Sector banks	-9.14429*	3.42851	0.025*
	Foreign Banks	-2.62857	3.42851	0.724
Private Sector banks	Public sector banks	9.14429*	3.42851	0.025*
	Foreign Banks	6.48571	3.42851	0.148
Foreign Banks	Public sector banks	2.62857	3.42851	0.724
	Private Sector banks	-6.48571	3.42851	0.148

Source: Researcher's Estimates, \*the mean difference is significant at the 0.05 level

Pair-wise comparison shows which pairs of bank groups show the most significant difference. Here, the growth rate distributions of public sector banks and private sector banks have a statistically significant difference. This means that the

distributions of investment growth rates differ across domestic banking groups. However, the growth rates between public sector banks and foreign banks and between private sector banks and foreign banks do not exhibit a statistically significant difference.

### **5.1.2 Growth of commercial banks in terms of bank's liabilities**

Apart from analysing the growth of commercial banks in terms of assets, the study also analyses their major liabilities. In this study, the deposits and borrowings of different groups of banks are analysed. These deposits and borrowings together constitute 87.12 percent of the total liabilities of the commercial banks as of March 31, 2021.

#### **1. Deposits**

The most significant part of commercial banks' liabilities is made up of their customers' deposits. As of March 31, 2021, deposits made up almost 55% of the total liabilities of the commercial banks. Banks collect deposits from every source and every class in the economy. In order to collect deposits from all sources, the banks maintain different types of accounts, like fixed deposit accounts, current deposits, savings bank deposits, and recurring deposits. The present study analyses the deposits of public sector, private sector, and foreign commercial banks in India. The deposit includes demand deposits from banks and others, savings bank deposits, and term deposits from banks and others. The annual growth rate, mean, and compound annual growth rate of deposits at different commercial banks are shown in Table 5.7.

**Table 5.7***Deposits of different groups of commercial banks in India during 1992-93 to 2020-21*

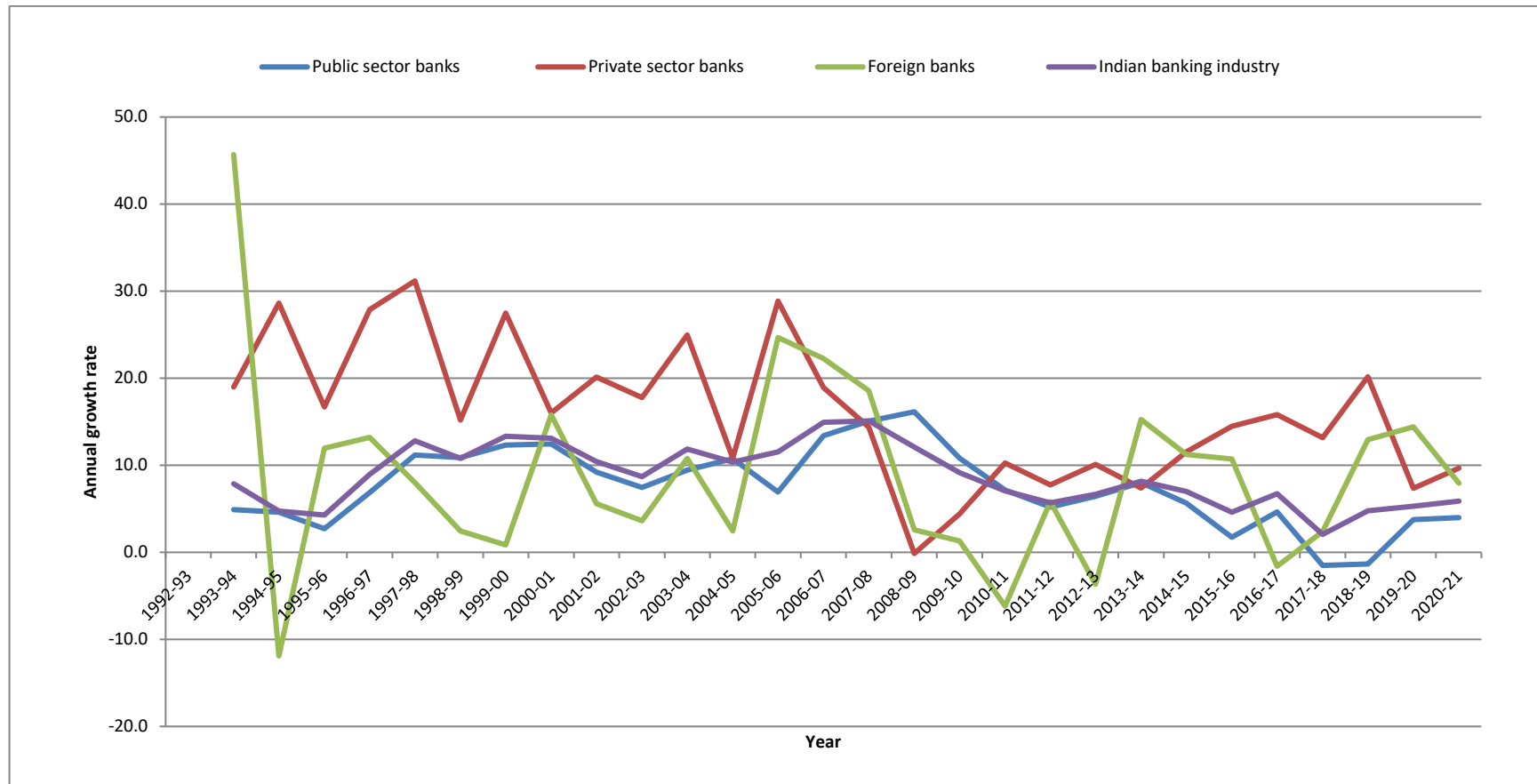
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
1992-93	927166.76(89)		54132.43(5)		56917.92(6)		1038217.11(100)	
1993-94	972411.73(87)	4.9	64414.74(6)	19.0	82930.64(7)	45.7	1119757.11(100)	7.9
1994-95	1017014.89(87)	4.6	82853.69(7)	28.6	73064.24(6)	-11.9	1172932.82(100)	4.7
1995-96	1044414.81(85)	2.7	96671.97(8)	16.7	81806.2(7)	12.0	1222892.98(100)	4.3
1996-97	1116068.53(84)	6.9	123627.67(9)	27.9	92610.31(7)	13.2	1332306.51(100)	8.9
1997-98	1240617.29(82)	11.2	162192.67(11)	31.2	100030.1(7)	8.0	1502840.06(100)	12.8
1998-99	1375507.79(83)	10.9	186838.49(11)	15.2	102491.02(6)	2.5	1664837.3(100)	10.8
1999-00	1545081.71(82)	12.3	238201.29(13)	27.5	103361.61(5)	0.8	1886644.61(100)	13.3
2000-01	1737519.21(81)	12.5	276318.24(13)	16.0	119672.46(6)	15.8	2133509.91(100)	13.1
2001-02	1897649.36(81)	9.2	331909.89(14)	20.1	126368.27(5)	5.6	2355927.52(100)	10.4
2002-03	2038902.53(80)	7.4	390851.91(15)	17.8	130925.58(5)	3.6	2560680.02(100)	8.7
2003-04	2231020.19(78)	9.4	488361.52(17)	24.9	145039.1(5)	10.8	2864420.81(100)	11.9
2004-05	2470830.75(78)	10.7	541157.55(17)	10.8	148589.61(5)	2.4	3160577.91(100)	10.3
2005-06	2642048.53(75)	6.9	697365.25(20)	28.9	185223.9(5)	24.7	3524637.68(100)	11.5
2006-07	2995642.18(74)	13.4	829182.82(20)	18.9	226453.36(6)	22.3	4051278.36(100)	14.9

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
2007-08	3446926.53(74)	15.1	948269.42(20)	14.4	268456.24(6)	18.5	4663652.19(100)	15.1
2008-09	4004048.24(77)	16.2	947231.29(18)	-0.1	275374.86(5)	2.6	5226654.39(100)	12.1
2009-10	4436990.75(78)	10.8	988824.66(17)	4.4	278931.62(5)	1.3	5704747.03(100)	9.1
2010-11	4754793.95(78)	7.2	1090310.97(18)	10.3	261703.82(4)	-6.2	6106808.74(100)	7.0
2011-12	5002013.00(78)	5.2	1174587(18)	7.7	276948(4)	5.8	6453548.00(100)	5.7
2012-13	5323540.26(77)	6.4	1293278.98(19)	10.1	266839.62(4)	-3.6	6883658.86(100)	6.7
2013-14	5749079.9(77)	8.0	1388791.3(19)	7.4	307528.82(4)	15.2	7445400.02(100)	8.2
2014-15	6074636.84(76)	5.7	1548990.72(20)	11.5	342122.68(4)	11.2	7965750.24(100)	7.0
2015-16	6180283.99(74)	1.7	1773031.70(21)	14.5	378766.62(5)	10.7	8332082.31(100)	4.6
2016-17	6466081.21(73)	4.6	2053349.58(23)	15.8	372690.41(4)	-1.6	8892121.20(100)	6.7
2017-18	6369841.79(70)	-1.5	2323404.57(26)	13.2	381544.58(4)	2.4	9074790.94(100)	2.1
2018-19	6284222.85(66)	-1.3	2791774.83(29)	20.2	430877.32(5)	12.9	9506875.00(100)	4.8
2019-20	6519034.42(65)	3.7	2996429.09(30)	7.3	493003.36(5)	14.4	10008466.87(100)	5.3
2020-21	6778142.87(64)	4.0	3286560.52(31)	9.7	532058.81(5)	7.9	10596762.2(100)	5.9
<b>Mean</b>	<b>3539363.20(74)</b>	<b>7.45</b>	<b>1005824.64(21)</b>	<b>16.06</b>	<b>229045.90(5)</b>	<b>8.82</b>	<b>4774233.75(100)</b>	<b>8.70</b>
<b>CAGR</b>	<b>8.50</b>		<b>15.17</b>		<b>7.72</b>		<b>9.46</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of deposits of each group of banks on the total of all these banks.

**Figure 5.3**

*Trends in the annual growth rates of deposits in respect of different groups of banks in India over 1992-93 to 2020-21*



The deposit of public sector banks has increased from 927166.76 crores in 1992–93 to 6778142.87 crores in 2020–21, with an average of 3539363.20 crores. The high growth rate was calculated in 2008–09, which was 16.2 per cent. During the study period, the deposits of private sector banks ranged from 54132.43 crores in 1992–93 to 3286560.52 crores in 2020–21. Private sector bank deposits have an average value of 1005824.64 crore. The annual growth rate of private sector banks varies from a minimum of -0.1 in 2008-09 to a maximum of 31.2 per cent in 1997-98. The average deposit of foreign banks was calculated at 20693.23, and the deposit increased from 36869.40 to 493003.36. The highest growth rate of 45.7 was recorded by the foreign banks in 1992–93. Along with foreign banks, public and private sector banks also registered growth in deposits during the year. RBI observed that this growth in deposits was heavily due to the substantial capital inflows from abroad. The growth rate of deposits in private sector banks registered remarkable growth since the implementation of the reform and continued until 2007-08. During 2008-09, the growth of deposits at private sector banks and foreign banks decelerated while the performance of public sector banks continued to improve. In 2016–17, the year of demonetisation, the growth rate of public sector banks increased to 4.6 percent, up from 1.7 percent in 2015–16. Besides, the growth rate of private sector banks and the growth rate of all commercial banks improved. Due to the rapid pace of remonetisation, the growth in deposits slowed in 2017–18, especially for public sector banks. Private sector banks and all commercial banks have registered decreases in deposits as compared to the previous year, whereas the growth rate of foreign banks accelerated during the year. The deposit growth of all groups of commercial banks showed an improvement during 2018–19, 2019–20, and 2020–21. The compound annual growth rate of private sector banks was higher than that of other groups of banks, followed by public sector banks and foreign banks. It is observed that, during the entire period of the study, private sector banks were more successful in mobilising deposits as compared to public sector banks and foreign banks. Figure 5.3 presents the trend of the annual growth rate of deposits for different groups of banks. According to the graph, the highest peak in growth rate for foreign sector banks was in 1993–94, and the greatest decline in growth rate was

recorded by foreign banks themselves in 1994–95. Since the major share of deposits held by all commercial banks is held by public sector banks, the trend of both public sector banks and all commercial banks shows an almost similar pattern. The CAGR of deposits for the different groups of banks indicates how the deposit grows in value over the study period. The calculated CAGRs of private sector banks, public sector banks, foreign banks, and all commercial banks are 15.17%, 8.50%, 7.72%, and 9.46%, respectively. The compound growth rate of private sector banks is higher than that of other groups of banks, followed by foreign banks and public sector banks.

When the share of deposits of each category of banks is examined, it is obvious that public sector banks continue to dominate the banking sector in terms of deposits. The public sector banks collect an average of 74% of the deposits of the entire banking industry, whereas the private sector banks could only accept 24% of the total deposits and 5% from foreign banks. Surprisingly, when analysing the trend of the proportion of deposits in each group of banks during the research period, the proportion of public sector banks is progressively declining, whereas the proportion of private sector banks is significantly increasing over the period. The proportion of foreign banks did not significantly increase during the period. It is significant to note that foreign banks were not able to gather even more than 10% of the total deposits of the banking industry in any one of the years under consideration. Foreign banks reported an average share of 5% of deposits during the period.

In light of the previous analysis, it can be seen that the average growth rate of deposits varies between groups of commercial banks in India. To determine whether or not this difference is statistically significant, parametric and nonparametric tests can be used. Before selecting an acceptable test, the Shapiro-Wilk test was conducted to determine whether or not the distribution followed normality. The calculated p value for the test is 0.010, and the statistic is 0.959%. As the Shapiro-Wilk test's computed p value is less than 0.05, the distribution is not normal. Thus, a non-parametric Kruskal-Wallis H test was conducted to see if the growth of deposits differed between groups of banks.

**Table 5.8***Results of Kruskal wallis H test for deposits of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	33.00	28		
Private Sector banks	58.30	28	17.873	<b>0.000**</b>
Foreign banks	36.20	28		

Source: Researcher's Estimates, \*\* indicates significant at 5% level

The Kruskal-Wallis H test shows that the observed Chi-square statistic is 17.873 with a 0.001 p-value. As the p value is less than 0.05, the null hypothesis that there is no significant difference between the deposit growth rates of different groups of commercial banks is rejected. This indicates that at least one pair of banks differ significantly. Multiple comparison tests have been performed to determine which pairs of banks are considerably dissimilar. The result is displayed in Table 5.9.

**Table 5.9***Result of Multiple Comparisons*

Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Public sector banks- Foreign banks	-3.196	6.519	-0.490	1.000
Public sector banks- Private Sector banks	-25.304	6.519	-3.882	<b>0.000**</b>
Private Sector banks- Foreign banks	22.107	6.519	3.391	<b>0.002**</b>

Source: Researcher's Estimates, \*\* indicates significant at 5% level

Pair-wise comparison shows which pairs of bank groups show the most significant difference. Here, the growth rate distribution of public sector banks and foreign banks does not have any statistically significant difference. However, the growth rates between public sector banks and private sector banks and between private sector banks and foreign banks exhibit a statistically significant difference.



## **2. Borrowings**

The borrowings of the commercial bank include borrowings in India and borrowings outside India. Borrowings in India include those from the Reserve Bank of India, other banks, and other institutions and agencies. The annual growth rate, mean, and compound annual growth rate of borrowings of different commercial banks are shown in Table 5.10.

**Table 5.10***Borrowings of different groups of commercial banks in India during 1992-93 to 2020-21*

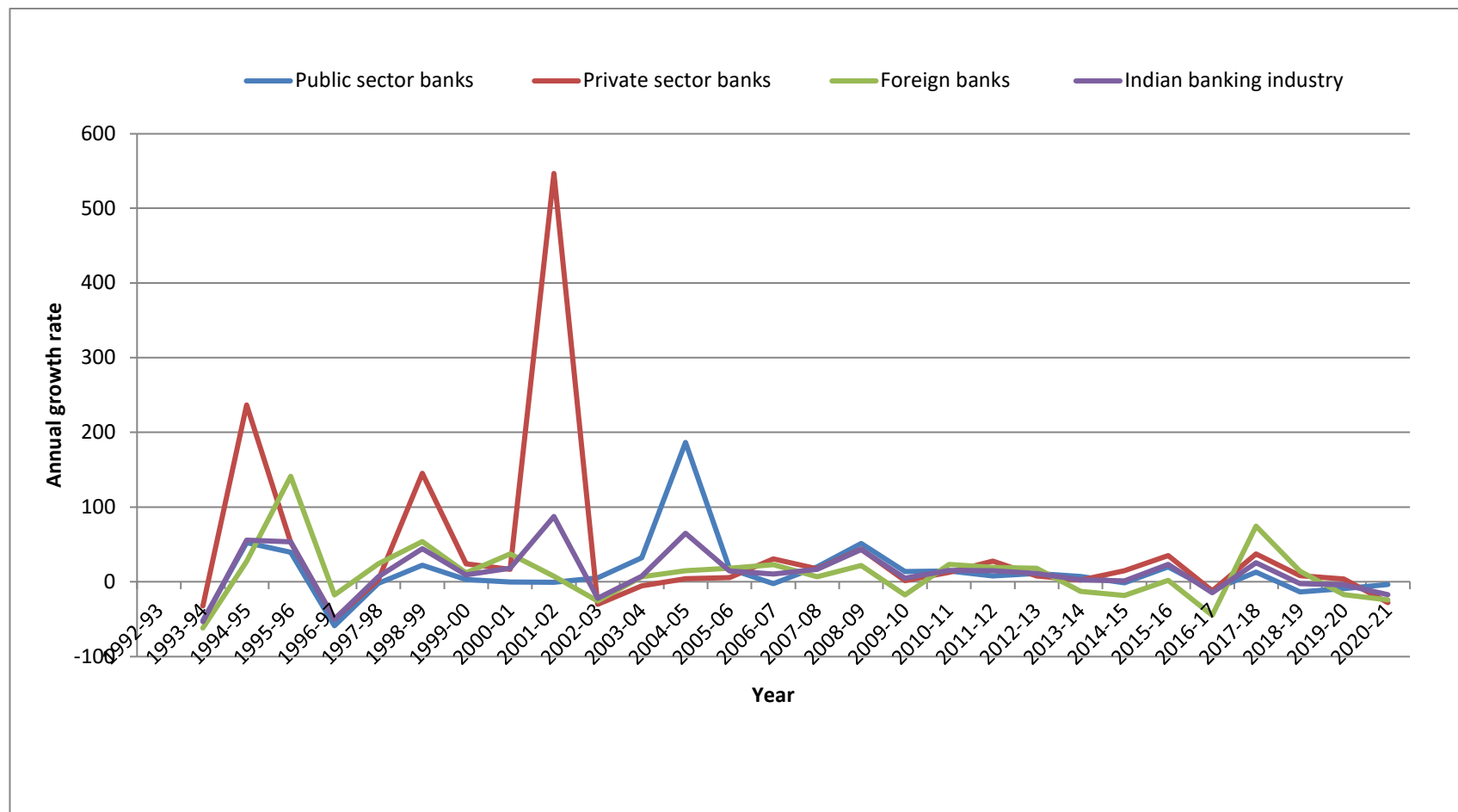
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
1992-93	79056.20(78)		2734.01(3)		19185.6(19)		100975.81(100)	
1993-94	38048.97(81)	-51.9	1842.31(4)	-32.6	7322.76(16)	-61.8	47214.04(100)	-53.2
1994-95	58033.55(79)	52.5	6202.07(8)	236.6	9312.01(13)	27.2	73547.63(100)	55.8
1995-96	81006.09(72)	39.6	9459.91(8)	52.5	22487.47(20)	141.5	112953.47(100)	53.6
1996-97	33235.99(59)	-59.0	4752.06(8)	-49.8	18542.7(33)	-17.5	56530.75(100)	-50.0
1997-98	32476.88(54)	-2.3	4864.63(8)	2.4	22992.65(38)	24.0	60334.16(100)	6.7
1998-99	39670.43(46)	22.1	11926.09(14)	145.2	35332.66(40)	53.7	86929.18(100)	44.1
1999-00	40808.91(43)	2.9	14766.72(16)	23.8	39478.27(41)	11.7	95053.9(100)	9.3
2000-01	40606.55(36)	-0.5	17224.02(15)	16.6	54221.59(49)	37.3	112052.16(100)	17.9
2001-02	40289.91(19)	-0.8	111377.08(53)	546.6	58285.99(28)	7.5	209952.98(100)	87.4
2002-03	42372.50(26)	5.2	77823.95(48)	-30.1	43264.07(26)	-25.8	163460.52(100)	-22.1
2003-04	55893.80(32)	31.9	73406.07(42)	-5.7	46170.21(26)	6.7	175470.08(100)	7.3
2004-05	160207.60(55)	186.6	76298.07(27)	3.9	53056.69(18)	14.9	289562.36(100)	65.0
2005-06	187673.12(57)	17.1	80583.83(24)	5.6	62548.95(19)	17.9	330805.9(100)	14.2
2006-07	182924.14(50)	-2.5	105349.89(29)	30.7	76770.41(21)	22.7	365044.44(100)	10.4
2007-08	219633.61(52)	20.1	123552.93(29)	17.3	81914.48(19)	6.7	425101.02(100)	16.5

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
2008-09	332397.90(55)	51.3	177135.35(29)	43.4	99673.12(16)	21.7	609206.37(100)	43.3
2009-10	377134.97(59)	13.5	179485.83(28)	1.3	82018.22(13)	-17.7	638639.02(100)	4.8
2010-11	431302.07(59)	14.4	202222.93(28)	12.7	100983.52(14)	23.1	734508.52(100)	15.0
2011-12	464932.27(55)	7.8	258419.87(31)	27.8	120422.3(14)	19.2	843774.44(100)	14.9
2012-13	516196.06(55)	11.0	277955.73(30)	7.6	141996.82(15)	17.9	936148.61(100)	10.9
2013-14	552753.87(57)	7.1	284609.63(30)	2.4	123544.71(13)	-13.0	960908.21(100)	2.6
2014-15	544208.27(56)	-1.5	326211.07(34)	14.6	100567.2(10)	-18.6	970986.54(100)	1.0
2015-16	652764.58(55)	19.9	440693.69(37)	35.1	102581.98(8)	2.0	1196040.25(100)	23.2
2016-17	577918.74(57)	-11.5	387053.85(38)	-12.2	56413.07(5)	-45.0	1021385.66(100)	-14.6
2017-18	653021.29(51)	13.0	530558.61(41)	37.1	98442.69(8)	74.5	1282022.59(100)	25.5
2018-19	563990.08(45)	-13.6	574143.98(46)	8.2	112090.34(9)	13.9	1250224.4(100)	-2.5
2019-20	511368.63(42)	-9.3	596235.48(50)	3.8	92713.86(8)	-17.3	1200317.97(100)	-4.0
2020-21	492130.75(50)	-3.8	428347.82(43)	-28.2	70056.28(7)	-24.4	990534.85(100)	-17.5
<b>Mean</b>	<b>275933.03(52)</b>	<b>12.84</b>	<b>185697.84(35)</b>	<b>39.87</b>	<b>67323.81(13)</b>	<b>10.82</b>	<b>528954.68(100)</b>	<b>13.06</b>
<b>CAGR</b>	<b>13.02</b>		<b>22.13</b>		<b>7.89</b>		<b>13.52</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of borrowings of each group of banks on the total of all these banks.

**Figure 5.4**

*Trends in the annual growth rates of borrowings of different groups of banks in India over 1992-93 to 2020-21*



The borrowings of all commercial banks range from 100975.81 crores in 1992–93 to 99053.41 crores in 2020–21 with an average annual growth rate of 13.06 per cent, whereas the borrowings of public sector banks vary from 79056.20 crores in 1992–93 to 492130.75 crores in 2020–21 with an average annual growth rate of 12.84%. The mean value of public sector banks is Rs. 275933.03 crore. The average borrowings of private sector banks over the study period were calculated at 185697.84 crores, with an average annual growth rate of 39.87 per cent. The growth of private sector banks in terms of borrowing is faster than that of other groups of banks. It increased from 2734.01 crores in 1992–93 to 428347.82 crores in 2020–21. The borrowings of foreign banks vary from 19185.6 crores in 1992–93 to 70056.28 crores in 2020–21, with an average annual growth rate of 10.82 per cent. Over the period, foreign banks borrowed an average of 67323.81 crores. In comparing different groups of banks, the growth rate of borrowings at private sector banks grew faster than that of other groups of banks, and the growth rate of borrowings at public sector banks was higher than that of foreign banks. All commercial banks have registered record growth in borrowings both in 2001-02 and 2004-05. Private sector banks grew at a rate of 546.6 percent in 2001-02, compared to 87.4 percent for all commercial banks. Public-sector banks grew by 186.6 percent in 2004-05, compared to 65.00 percent for all commercial banks. While analysing the advances of commercial banks, it was seen that in 2001-02, there was a 65.5% growth in the advances of private sector commercial banks. In 2004–05, there was a 27.7 per cent growth in advances registered by public sector banks. Hence, the rise in borrowings by commercial banks may be due to the rising credit demand of the economy. During 2007–08 and 2008–09, borrowing by all commercial banks increased considerably as compared to the previous year. Among different groups of banks, only public sector banks have recorded growth in both 2007-08 and 2008-09, and the growth rate of private sector banks and foreign banks increased in 2008-09. In 2016–17, the deposits of banks increased sharply due to the withdrawal of Specified Bank Notes (SBN) within a pre-announced timeframe, while the advances of banks registered a record fall due to deterioration in asset quality and consequent provisioning requirements. Therefore, due to the persisting deterioration in bank advances and acceleration in deposits, the borrowings of different groups of commercial banks declined sharply. However, in the next year, all groups of banks registered acceleration in the borrowings' growth, and in the subsequent year, the

borrowings of all commercial banks recorded a continuous decline. The RBI observed that, with the exception of private sector banks, commercial banks' borrowing requirements have slowed due to subdued credit growth and relatively strong deposit growth. As pointed out by the RBI (2020–21), historically, private sector banks depend heavily on borrowings for meeting credit demand, whereas public sector banks rely on their wide deposit base to fund their credit demand. However, in the last year, the borrowings of the private sector banks recorded negative growth for the first time since 2016–17. Private-sector banks have a greater CAGR than both foreign and public-sector banks. The calculated compound growth rate for public sector banks is 6.51 per cent, while that for private sector banks is 19.04 per cent. The foreign bank's CAGR is 4.57 percent, which is lower than both private and public sector banks. Along with the substantial growth of advances, investments, and deposits, private sector banks are more active in borrowing funds from a variety of sources in order to expand their operations. Analyzing the proportion of borrowings held by each category of bank reveals that public sector banks still own half of the proportion of borrowings held by all commercial banks. Public-sector banks account for an average of 52 percent of total industrial borrowings, compared to 35 percent for private-sector banks and 13 percent for foreign banks. Yet, when analysing the pattern of share of borrowings for each category of banks over the study period, the share of public sector banks declines gradually while the percentage of private sector banks rises significantly. The same pattern was seen in the case of these banks' advances and investments, since deposits and borrowings were formerly utilised for lending advances and investment operations. Over the first few years of the study, the proportion of foreign banks grew but then declined.

It was noticed that the average annual growth rate of different groups of banks calculated for the period showed differences. To determine whether this difference is statistically significant, the Kruskal-Wallis H test was performed after the Shapiro-Wilk test to ensure data normality. The p value calculated for the normality test is 0.000, with test statistics of 0.535. Since the p value obtained was 0.000, the null hypothesis relating to the test is rejected, and the data is not normal. The result of the Kruskal-Wallis H test is presented in Table 5.11.

**Table 5.11**

*Results of Kruskal wallis H test for borrowings of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	40.48	28		
Private Sector banks	45.34	28	0.603	0.740
Foreign banks	41.68	28		

Source: Researcher's Estimates, \* indicates significant at 5% level

The result of the Kruskal-Wallis H test shows that the mean rank calculated for public sector banks, private sector banks, and foreign banks is 40.48, 45.37, and 41.68, respectively. The test statistic calculated is 0.603, and the p value associated with the test statistic is 0.740. As the p value is greater than 0.05, it fails to reject the null hypothesis that there is no significant difference in the growth rate of borrowings among different groups of banks over the study period. Hence, the growth rates of borrowing by public sector banks, private sector banks, and foreign banks are the same.

### **5.1.3 Growth of commercial banks in terms of bank's incomes**

The total income of the commercial banks consists of interest income and non-interest income. The following section discusses the growth of interest and non-interest income for commercial banks in India.

#### **1. Interest income**

Interest income of the commercial banks includes interest or discounts earned on advances or bills, income on investments, interest on balances with the Reserve Bank of India and other interbank funds, and other interest income. Interest income accounted for approximately 83 percent of the commercial bank's total income as of March 31, 2021. The annual growth rate, mean, and compound annual growth rate of interest income of public sector commercial banks, private sector commercial banks, and foreign banks for the study period are given in table 5.12.

**Table 5.12***Interest income of commercial banks in India during 1992-93 to 2020-21*

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	Indian Banking Industry (₹ in Crores)	Annual Growth rate (%)
1992-93	112271.80(87)		5900.74(5)		9881.37(8)		128053.91(100)	
1993-94	104058.69(86)	-7.3	6611.19(5)	12.0	10709.74(9)	8.4	121379.62(100)	-5.2
1994-95	110306.53(86)	6.0	8485.11(7)	28.3	9760.13(7)	-8.9	128551.77(100)	5.9
1995-96	124586.50(82)	12.9	14793.91(10)	74.4	13277.98(8)	36.0	152658.39(100)	18.8
1996-97	133906.81(81)	7.5	15464.23(10)	4.5	15188.08(9)	14.4	164559.12(100)	7.8
1997-98	137813.42(80)	2.9	18390.43(11)	18.9	15826.2(9)	4.2	172030.05(100)	4.5
1998-99	150052.51(80)	8.9	21606.91(11)	17.5	16970.04(9)	7.2	188629.46(100)	9.6
1999-00	166512.41(80)	11.0	24876.63(12)	15.1	17133.40(8)	1.0	208522.44(100)	10.5
2000-01	183954.71(79)	10.5	29308.53(13)	17.8	19148.81(8)	11.8	232412.05(100)	11.5
2001-02	197306.56(79)	7.3	32417.24(13)	10.6	19000.98(8)	-0.8	248724.78(100)	7.0
2002-03	202480.17(76)	2.6	46050.25(17)	42.1	16951.27(7)	-10.8	265481.69(100)	6.7
2003-04	199119.84(76)	-1.7	46448.45(18)	0.9	16348.43(6)	-3.6	261916.72(100)	-1.3
2004-05	207024.42(77)	4.0	45177.16(17)	-2.7	15772.27(6)	-3.5	267973.85(100)	2.3
2005-06	224092.17(74)	8.2	56441.95(19)	24.9	19923.47(7)	26.3	300457.59(100)	12.1
2006-07	246635.12(71)	10.1	74459.97(21)	31.9	26925.04(8)	35.1	348020.13(100)	15.8

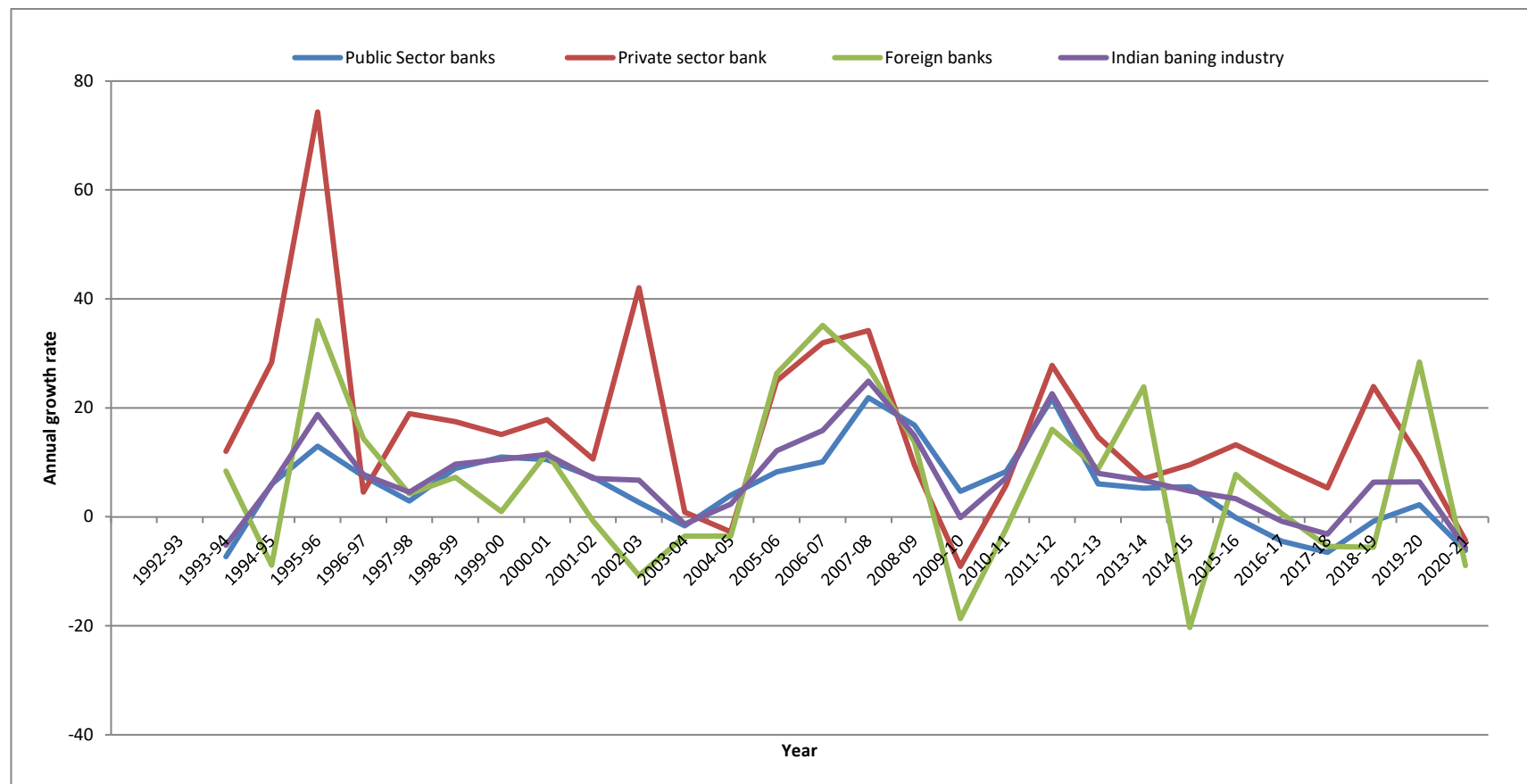


Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	Indian Banking Industry (₹ in Crores)	Annual Growth rate (%)
2007-08	300637.73(69)	21.9	99914.31(23)	34.2	34298.36(8)	27.4	434850.4(100)	24.9
2008-09	351284.04(70)	16.8	109430.61(22)	9.5	39004.45(8)	13.7	499719.1(100)	14.9
2009-10	367723.83(74)	4.7	99514.48(20)	-9.1	31714.94(6)	-18.7	498953.25(100)	-0.2
2010-11	398301.62(74)	8.3	105281.07(20)	5.8	31012.29(6)	-2.2	534594.98(100)	7.1
2011-12	484732.00(74)	21.7	134556.00(21)	27.8	35997.00(5)	16.1	655285.00(100)	22.6
2012-13	514108.22(73)	6.1	154253.68(22)	14.6	39144.82(5)	8.7	707506.72(100)	8.0
2013-14	541163.68(72)	5.3	165025.67(22)	7.0	48485.12(6)	23.9	754674.47(100)	6.7
2014-15	570957.40(72)	5.5	180820.28(23)	9.6	38646.36(5)	-20.3	790424.04(100)	4.7
2015-16	570167.39(70)	-0.1	204725.32(25)	13.2	41645.66(5)	7.8	816538.37(100)	3.3
2016-17	544613.09(67)	-4.5	223495.96(28)	9.2	41884.17(5)	0.6	809993.22(100)	-0.8
2017-18	509105.87(65)	-6.5	235332.28(35)	5.3	39612.87(5)	-5.4	784051.02(100)	-3.2
2018-19	504871.87(61)	-0.8	291536.14(35)	23.9	37398.99(4)	-5.6	833807.00(100)	6.3
2019-20	515996.48(58)	2.2	323174.08(37)	10.9	48035.35(5)	28.4	887205.91(100)	6.4
2020-21	484080.93(58)	-6.2	309180.91(37)	-4.3	43738.27(5)	-8.9	837000.11(100)	-5.7
<b>Mean</b>	<b>315788.48(70)</b>	<b>5.62</b>	<b>106299.09(24)</b>	<b>16.21</b>	<b>27359.86(6)</b>	<b>6.51</b>	<b>449447.42(100)</b>	<b>7.18</b>
<b>CAGR</b>	<b>6.99</b>		<b>14.93</b>		<b>5.85</b>		<b>8.25</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of interest income of each group of banks on the total of all these banks.

**Figure 5.5**

*Trends in the annual growth rates of interest income of different groups of banks in India over 1992-93 to 2020-21*



The average interest income of the public sector banks, private sector banks, and foreign banks for the entire period of the study is 315788.48, 106299.09, and 27359.86 crores, respectively. The interest income of public sector banks varies from 112271.80 crores in 1992–93 to 484080.93 crores in 2020–21, with an average annual growth rate of 5.62 per cent. The interest income of private sector banks has been increasing faster than that of public sector banks and foreign banks, with an average annual growth rate of 16.21 per cent. The interest income of foreign banks fluctuates from 9881.37 crores in 1992–93 to 43738.27 crores in 2020–21, with an annual average growth rate of 6.51 per cent per annum. By adding the interest income of all groups of banks, the interest income of the all commercial banks is also presented in Table 5.12. During the study period, the interest income of the Indian banking industry grew by 7.18 per cent and the value of interest income varied from 128053.91 crores in 1992–93 to 837000.11 crores in 2020–21. The annual growth rates of all groups of banks moved erratically over the study period. Public sector banks recorded the highest growth rate of 21.9% in 2007-08, whereas the highest growth rates of 74.4% and 36% were reported, respectively, by private sector banks and foreign banks during 1995-96. During 2003–2004, the interest income of all groups of banks decelerated and showed a negative growth rate, except for private sector banks. This was because of the substantial decline in the interest on advances and investments, which constitute the major source of interest income. During 2005-06 and 2006-07, the interest income of all groups of banks improved sharply because of the strong increase in credit volume and rise in interest rates. During this period, the interest income of foreign banks has registered the highest growth, followed by private sector banks and public sector banks. In the years following 2005–06 and 2006–07, the years 2007–08 and 2008–09 also registered higher growth in interest income. During 2007-08, among different groups of banks, private sector banks achieved higher growth followed by foreign banks and public sector banks, whereas in 2008-09, public sector banks reported higher growth followed by foreign banks and private sector banks. During 2009–10, the performance of the Indian banking industry was relatively sluggish, which is evident in the interest income of the commercial banks. The growth rate of public sector

banks decreased to 4.7% from 16.8% in the previous year, and the growth rates of private sector banks and foreign banks became negative during this year. In subsequent years, despite the slowdown in the domestic economy, the interest income of different groups of banks accelerated slowly and reported considerable growth in 2011–12. Deterioration in asset quality and low demand for credit adversely affected the interest income of the banks in the subsequent years. However, among bank groups, private sector banks performed better than the other groups of banks. During 2020–21, all bank groups have reported negative growth in interest income due to low credit offtake and a low interest rate. Figure 5.5 depicts the trend of the annual growth rate of interest income for different groups of banks. According to the graph, the highest peak in growth rate for private sector banks was in 1995-96, and the largest decline in growth rate was recorded by private sector banks themselves in 2014-15. Because public sector banks account for the lion's share of all commercial banks' interest income, the trend of both public sector banks and all commercial banks follows a nearly identical pattern. When the CAGR of interest income of the various groups of banks is compared, it is discovered that the compound annual growth rate of private sector banks is higher than that of the other group of banks. The calculated CAGRs of private sector banks, public sector banks, foreign banks, and all commercial banks are 14.93%, 6.99%, 5.85%, and 8.25%, respectively. The compound growth rates of foreign banks are found slightly higher than public sector banks.

While analysing the share of interest income of each group of banks, it is clear that public sector banks are still leading the banking industry in respect of interest income. An average of 70 per cent of the interest income of the entire banking industry is earned by the public sector banks, while 24 per cent is contributed by private sector banks and 6 per cent by foreign banks. However, while analysing the trend of the share of interest income of each group of banks over the study period, the share of public sector banks is deteriorating gradually, while the share of private sector banks is improving substantially over the period. The same trend was evident in the cases of advances and investments made by these banks. It may effect the trend of the share of interest income of public and private sector

banks, since the interest income from advances and investments is the primary source of interest income for commercial banks. The share of foreign banks did not exhibit substantial improvement over the period. An average share of 6 per cent of interest income is reported by foreign banks during the period, and it is important to note that foreign banks were not able to earn even more than 10 per cent of the total interest income of the banking industry in any one of the years under study.

From the above analysis, it was found that different groups of commercial banks in India have different average annual growth rates. So, after the Shapiro-Wilk test was done, the Kruskal-Wallis test was done to see if this difference in mean was statistically significant or not. The test statistics for the Shapiro-Wilk test were 0.930, and the p value was 0.000. Since the p value is less than 0.05, the null hypothesis that distributions are normal is rejected by the Shapiro-Wilk test. Table 5.13 shows the commercial banks' mean rank, test statistic, and p value for the growth rate of interest income.

**Table 5.13**

*Results of Kruskal wallis H test for interest income of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	35.93	28		
Private Sector banks	53.96	28	9.344	<b>0.009**</b>
Foreign banks	37.61	28		

Source: Researcher's Estimates, \*\* indicates significant at 5% level

The Kruskal-Wallis H test result shows that the observed Chi-square statistic is 9.344 with a p value of 0.009. Since the p value is lower than 0.05, the null hypothesis that there is a significant difference in the growth rate of interest income among different groups of commercial banks is rejected. This result tells us that at least one pair of banks are significantly different. In order to see which pairs of banks are significantly different, multiple comparison tests have been conducted. The result is presented in Table 5.14.

**Table 5.14***Result of Multiple Comparisons*

<b>Pairs of Banks</b>	<b>Test Statistics</b>	<b>Standard Error</b>	<b>Standard test statistics</b>	<b>Adj. Sig</b>
Public sector banks- Foreign banks	-1.679	6.519	-0.257	1.000
Public sector banks- Private Sector banks	-18.036	6.519	-2.767	<b>0.017**</b>
Private Sector banks- Foreign banks	16.357	6.519	2.509	<b>0.036**</b>

Source: Researcher's Estimates, \*\* indicates significant at 5% level

The pair-wise comparison test is used to find out which pairs of banks have big differences. It is evident from the results that there is no significant difference between the growth rates of public sector banks and foreign banks. Comparing public sector banks and private sector banks, however, yields a p value of 0.017 and a p value of 0.036 for private sector banks and foreign banks, respectively. Therefore, it is clear that the growth of interest income for private sector banks is very different from that of other types of banks.

## **2. Non- interest income**

Non-interest income is one of the important components of the total income of commercial banks. Interest income is largely affected by economic and financial market cycles, but as compared to interest income, non-interest income is largely unaffected by these factors (Kumari, 2018). The non-interest is earned by way of commission, exchange, and brokerage; net profit or loss on sale of investment; net profit or loss on revaluation of investment; net profit or loss on sale of land and other assets; net profit or loss on exchange transactions; and miscellaneous income. The annual growth rate, mean, standard deviation, and compound annual growth rate of total assets of public sector commercial banks, private sector commercial banks, and foreign banks for the study period are given below in Table 5.15.

**Table 5.15***Non-interest income of commercial banks in India during 1992-93 to 2020-21*

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	Indian Banking Industry (₹ in Crores)	Annual Growth rate (%)
1992-93	13937.40(89)		711.44(4)		1069.01(7)		15717.81(100)	
1993-94	15527.40(82)	11.4	971.06(5)	36.5	2385.10(13)	123.1	18883.53(100)	20.1
1994-95	14868.10(79)	-4.2	1386.51(8)	42.8	2480.09(13)	4.0	18734.66(100)	-0.8
1995-96	18826.40(79)	26.6	2045.67(9)	47.5	2977.77(12)	20.1	23849.82(100)	27.3
1996-97	18281.60(76)	-2.9	2363.64(10)	15.5	3438.45(14)	15.5	24083.73(100)	1.0
1997-98	20147.50(71)	10.2	3655.69(13)	54.7	4466.26(16)	29.9	28269.41(100)	17.4
1998-99	20286.70(74)	0.7	3132.03(11)	-14.3	4022.81(15)	-9.9	27441.58(100)	-2.9
1999-00	23974.70(72)	18.2	4790.99(14)	53.0	4510.04(14)	12.1	33275.69(100)	21.3
2000-01	25303.30(73)	5.5	4243.83(12)	-11.4	5080.87(15)	12.7	34627.98(100)	4.1
2001-02	32374.10(69)	27.9	8362.39(18)	97.0	6385.90(13)	25.7	47122.43(100)	36.1
2002-03	40179.50(67)	24.1	13660.75(23)	63.4	5800.91(10)	-9.2	59641.11(100)	26.6
2003-04	51112.90(71)	27.2	13842.52(19)	1.3	7310.42(10)	26.0	72265.87(100)	21.2
2004-05	41616.80(70)	-18.6	10949.43(19)	-20.9	6647.75(11)	-9.1	59213.97(100)	-18.1
2005-06	37993.80(62)	-8.7	14927.54(24)	36.3	8467.68(14)	27.4	61389.03(100)	3.7
2006-07	35577.60(55)	-6.4	18496.32(28)	23.9	10581.34(17)	25.0	64655.25(100)	5.3

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	Indian Banking Industry (₹ in Crores)	Annual Growth rate (%)
2007-08	44830.70(54)	26.0	23695.74(28)	28.1	14792.81(18)	39.8	83319.28(100)	28.9
2008-09	54626.00(56)	21.8	22974.29(24)	-3.0	19158.69(20)	29.5	96758.93(100)	16.1
2009-10	58759.80(61)	7.6	24543.91(26)	6.8	11958.90(13)	-37.6	95262.57(100)	-1.5
2010-11	52044.10(60)	-11.4	22535.61(26)	-8.2	11929.90(14)	-0.2	86509.65(100)	-9.2
2011-12	50400.00(58)	-3.2	25048.00(29)	11.1	10896.00(13)	-8.7	86344.00(100)	-0.2
2012-13	52609.10(58)	4.4	27604.00(30)	10.2	10389.14(12)	-4.7	90602.24(100)	4.9
2013-14	56826.80(57)	8.0	30952.11(31)	12.1	12435.78(12)	19.7	100214.71(100)	10.6
2014-15	63833.10(58)	12.3	35330.36(32)	14.1	11390.10(10)	-8.4	110553.51(100)	10.3
2015-16	67613.30(56)	5.9	40992.57(34)	16.0	12358.81(10)	8.5	120964.64(100)	9.4
2016-17	91097.30(60)	34.7	50812.75(33)	24.0	10038.24(7)	-18.8	151948.24(100)	25.6
2017-18	88471.40(59)	-2.9	51522.67(34)	1.4	10150.93(7)	1.1	150145.04(100)	-1.2
2018-19	69427.80(52)	-21.5	54370.39(40)	5.5	10613.18(8)	4.6	134411.32(100)	-10.5
2019-20	85098.50(51)	22.6	70227.33(42)	29.2	11923.69(7)	12.3	167249.48(100)	24.4
2020-21	80863.61(51)	-5.0	66732.52(42)	-5.0	11330.32(7)	-5.0	158926.45(100)	-5.0
<b>Mean</b>	<b>45741.69(60)</b>	<b>7.51</b>	<b>22444.21(29)</b>	<b>20.27</b>	<b>8447.96(11)</b>	<b>11.62</b>	<b>76633.86(100)</b>	<b>9.46</b>
<b>CAGR</b>	<b>6.78</b>		<b>16.27</b>		<b>6.83</b>		<b>8.59</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of non-interest income of each group of banks on the total of all these banks.



**Figure 5.6**

*Trends in the growth rates of non-interest income of different groups of banks in India over 1992-93 to 2020-21*

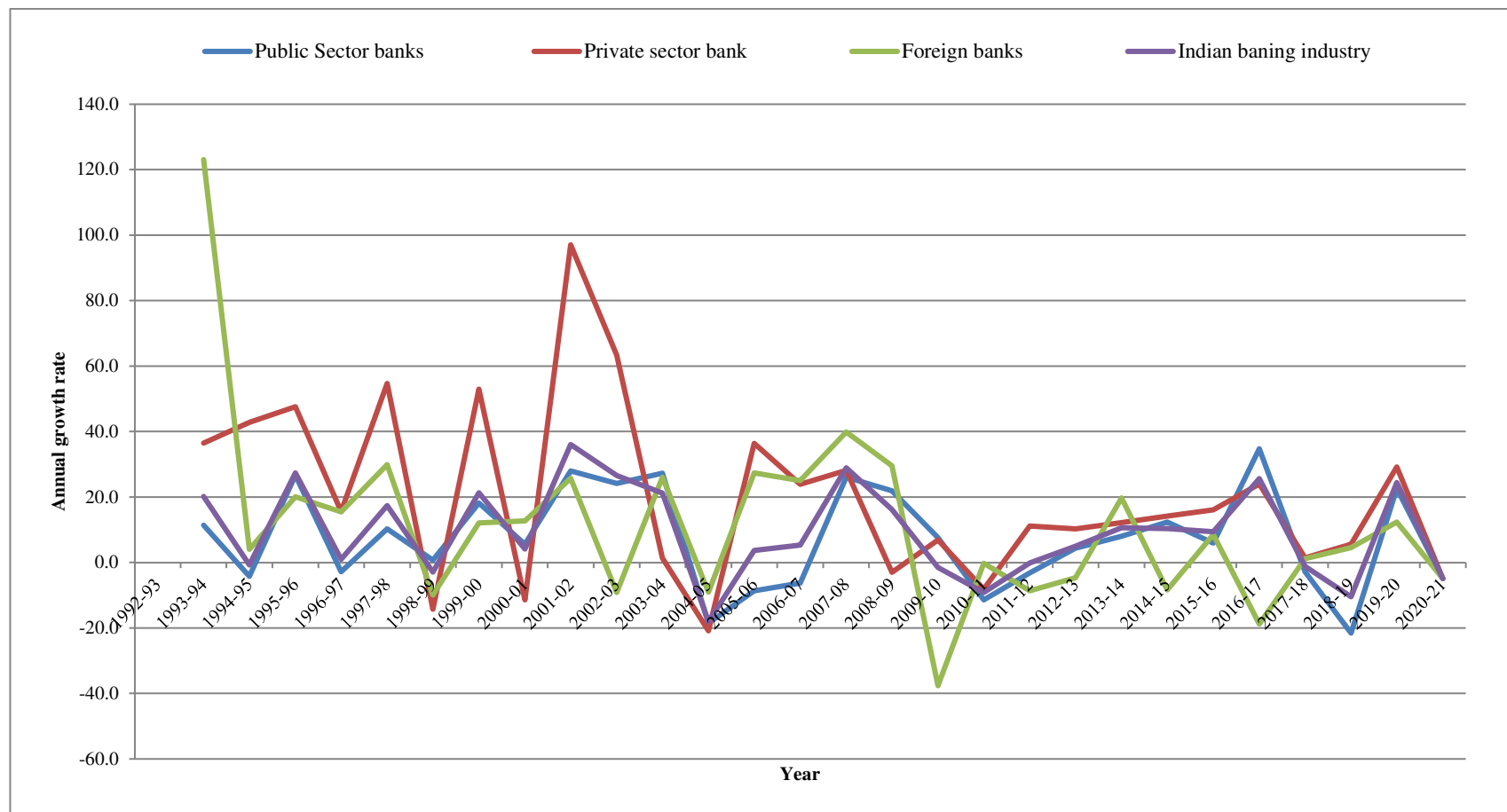


Table 5.15 shows that non-interest income at public sector banks increased by 7.51 percent per year to 80863.61 in 2020–21 from 13937.4 in 1992–93. The mean value of the non-interest income of the public sector banks is ₹ 45741.69 crore, and a high annual growth rate of 34.7 was recorded in 2016–17. Private sector banks, like public sector banks, saw significant growth in non-interest income. According to RBI, the total income of the commercial banks increased marginally, mainly because of the accelerated non-performing assets rather than interest income. The average non-interest income of the private sector banks over the study period was 22444.21 crores, and it increased to 66732.52 crores in 2020–21 from 711.44 crores in 2020–21, with an average annual growth rate of 20.27 per cent. The highest annual growth rate of 97.00 per cent was secured in 2001-02, whereas the highest growth rate in non-interest income by foreign banks was reported in 1993-94. The average non-interest income of foreign banks for the study period is 8447.96 crores, with an average annual growth rate of 11.62 per cent. Like in the case of interest income, the average annual growth rate of private sector banks is higher than the other groups of banks, followed by foreign banks and public sector banks. By adding the non-interest income of all groups of banks, the non-interest income of the Indian banking industry is computed and presented in Table 5.15. The non-interest income of the Indian banking industry improved from 15717.81 in 1992–93 to 158926.45 in 2020–21, with an average annual growth rate of 9.46 per cent. The year 1995–96 recorded substantial progress in non-interest income because of the wide-ranging reform measures. Among bank groups, private sector banks achieved the highest growth, followed by public sector banks and foreign banks. The years 1997–98 and 1999–2000 showed considerable growth in non-interest income as compared to the previous year, and private sector banks registered the highest growth rate in these years. Despite the decline in the interest income of the banks during 2003–04, the profits of the commercial banks increased substantially because of the increase in the non-interest income and the considerable decline in the interest on deposits. During the period, the non-interest income of public sector banks and foreign banks showed significant progress, and the income of private sector banks also improved but not as much as compared to the previous year. Another notable

advancement occurred during the global financial crisis. From 2007-08 to 2009-10, public sector banks earned considerable growth in interest income, but the growth rate became negative in the subsequent two years. A higher growth rate was registered by private sector banks in 2007–08, but it turned negative in 2008–09 and improved in 2009–10. The year 2016–17, in which demonetization was announced, registered a remarkable growth rate for both public sector banks and private sector banks. Later, during 2019-20, all types of banks experienced significant growth, with private sector banks experiencing the greatest growth, followed by public sector banks and foreign banks. Finally, in the terminal year, the growth of non-interest income for all groups of banks decreased by 5 per cent. The CAGRs of the non-interest income of the different groups of banks indicate how the non-interest income grows in value over the study period. The calculated CAGRs of private sector banks, public sector banks, foreign banks, and all commercial banks are 16.27%, 6.78%, 6.83%, and 8.59%, respectively. The compound growth rate of private sector banks is higher than that of other groups of banks. Foreign banks' compound growth rates are found to be higher than those of public sector banks.

While examining the share of each group of banks in respect of non-interest income to Indian banking industry, it is evident that public sector banks are still dominating the banking industry with average 60 per cent of non-interest income. However, the share of the public sector banks showing a decreasing trend over the study period and the percentage of share decreased from 89 percentage in 1992-93 to 51 percentage in 2020-21. On the contrary, the share of non-interest income of the private sector banks improved from 4 per cent in 1992-93 to 42 percentage in 2020-21. The share of foreign banks in the non-interest income to the banking industry is not tiny. An average of 11 per cent of non-interest income was earned by foreign banks. Figure 5.6 depicts the trend of annual growth rate of non-interest income in respect of different groups of banks. From the figure, it is noticed that the highest peak in growth rate was in the year 1993-94 by foreign banks and the biggest decline in growth rate was recorded by foreign banks itself in 2009-10. Since the major share of non-interest income of all commercial banks are holding by public sector

banks, the trend of both public sector banks and all commercial banks shows almost similar pattern.

From the above analysis, it was found that there is difference in the mean annual growth of different groups of commercial banks in India. Hence, to test whether this mean difference is statistically significant or not Kruskal wallis test has conducted after conducting Shapiro wilk test. The p value of Shapiro Wilk test was 0.000 with the test statistics of 0.894. Since the p value is less than 0.05, the null hypothesis relating to Shapiro wilk test is rejected that distributions is not normal. The mean rank, test statistic and corresponding p value of the growth rate of non-interest income of the commercial banks are given in the table 5.16

**Table 5.16**

*Result of Kruskal wallis H test of non-interest income of commercial banks*

<b>Groups of banks</b>	<b>Mean rank</b>	<b>Test statistic (p value)</b>
Public sector banks	37.96	
Private sector banks	49.34	3.420(0.181)
Foreign banks	40.20	

Source: Researcher's estimates

The mean rank calculated for public sector banks, private sector banks and foreign banks are 37.96, 49.34 and 40.20 respectively. The test statistic calculated is 3.420 and the p value associated with the test statistic is 0.181. As the p value is more than 0.05, it is fail to reject the null hypothesis that there is no significant difference in the growth rate of non-interest income of different groups of banks over the study period.

#### **5.1.4 Growth of commercial banks in terms of bank's expenses**

The total expenses of commercial banks are categorized into two; interest expenses and operating expenses. Analysis of growth of interest and operating expenses of commercial in India over the period 1992-93 to 2020-21 is presented below.

## **1. Interest expenses**

Interest expenses are the major form of expenses of commercial banks. As on 31<sup>st</sup> March 2021, 66 percent of total expenses of commercial is incurred by the way of interest expenses. Interest expenses include interest on deposits, interest on RBI/inter-bank borrowings and others. The annual growth rate, mean and compound annual growth rate of interest expenses of public sector banks, private sector banks and foreign banks for the study period is given below in the table 5.17

**Table 5.17***Interest expenses of commercial banks in India during 1992-93 to 2020-21*

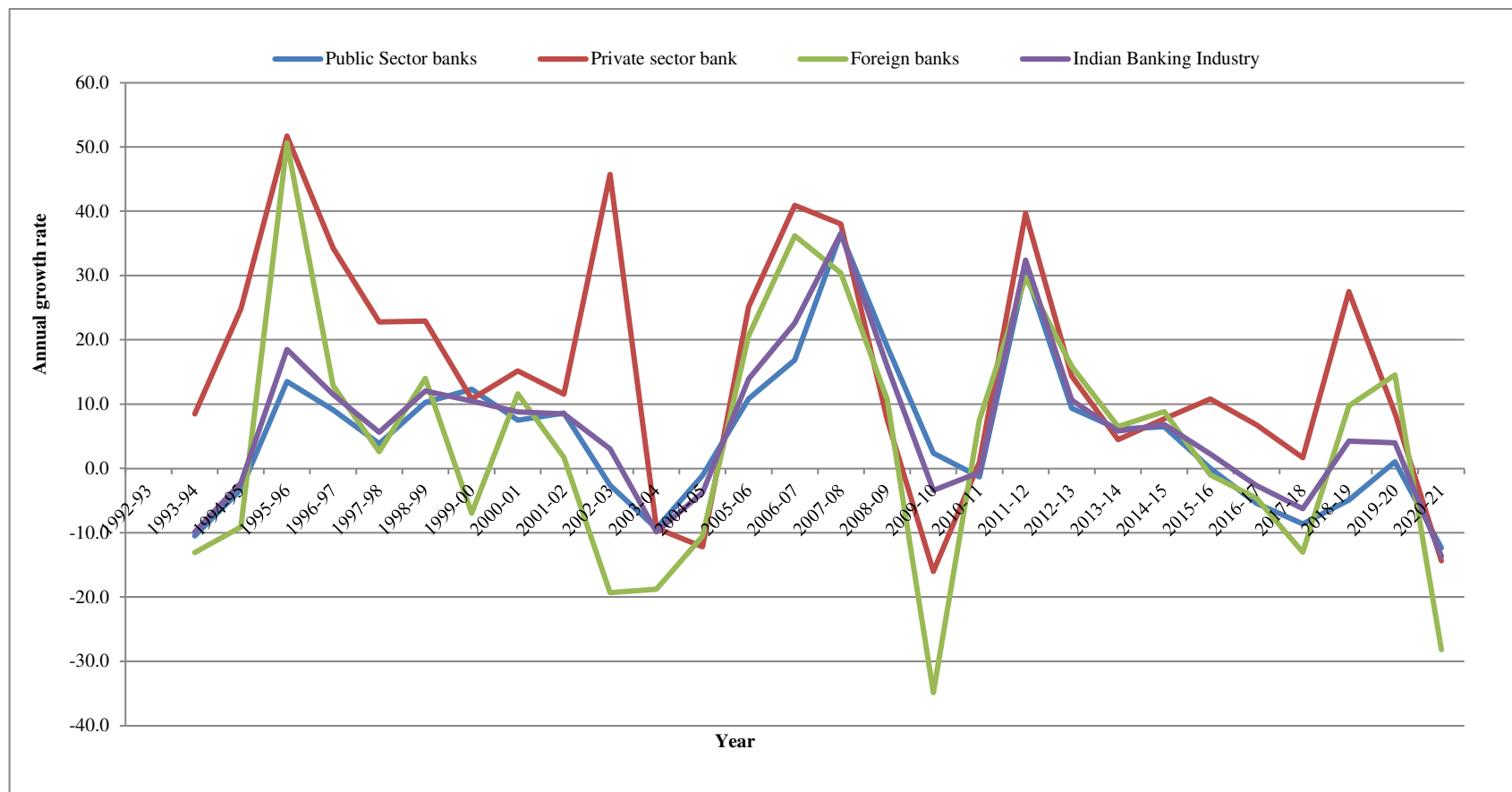
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial bank (₹ in Crores)	Annual Growth rate (%)
1992-93	84197.85(88)		4067.64(4)		7148.7(8)		95414.19(100)	
1993-94	75355.26(88)	-10.5	4412.66(5)	8.5	6213.53(7)	-13.1	85981.45(100)	-9.9
1994-95	72897.55(87)	-3.3	5508.25(7)	24.8	5648.15(6)	-9.1	84053.95(100)	-2.2
1995-96	82738.62(83)	13.5	8357.7(8)	51.7	8507.86(9)	50.6	99604.18(100)	18.5
1996-97	90259.79(81)	9.1	11220.91(10)	34.3	9603.68(9)	12.9	111084.38(100)	11.5
1997-98	93711.22(80)	3.8	13776.78(12)	22.8	9851.31(8)	2.6	117339.31(100)	5.6
1998-99	103325.61(79)	10.3	16936.18(13)	22.9	11232.33(8)	14.0	131494.12(100)	12.1
1999-00	116042.10(80)	12.3	18766.85(13)	10.8	10448.87(7)	-7.0	145257.82(100)	10.5
2000-01	124733.12(79)	7.5	21615.44(14)	15.2	11661.95(7)	11.6	158010.51(100)	8.8
2001-02	135463.27(79)	8.6	24109.7(14)	11.5	11858.96(7)	1.7	171431.93(100)	8.5
2002-03	131947.49(75)	-2.6	35137.89(20)	45.7	9567.43(5)	-19.3	176652.81(100)	3.0
2003-04	119596.29(75)	-9.4	31876.7(20)	-9.3	7768.69(5)	-18.8	159241.68(100)	-9.9
2004-05	118273.91(77)	-1.1	27989.77(18)	-12.2	6951.24(5)	-10.5	153214.92(100)	-3.8
2005-06	131093.01(75)	10.8	35022.73(20)	25.1	8385.44(5)	20.6	174501.18(100)	13.9
2006-07	153161.94(72)	16.8	49356.29(23)	40.9	11421.8(5)	36.2	213940.03(100)	22.6
2007-08	209161.60(72)	36.6	68120.65(23)	38.0	14895.18(5)	30.4	292177.43(100)	36.6

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial bank (₹ in Crores)	Annual Growth rate (%)
2008-09	248838.01(73)	19.0	73266.53(22)	7.6	16489.74(5)	10.7	338594.28(100)	15.9
2009-10	254705.04(78)	2.4	61537.86(19)	-16.0	10741.34(3)	-34.9	326984.24(100)	-3.4
2010-11	251335.24(77)	-1.3	62138.85(19)	1.0	11550.16(4)	7.5	325024.25(100)	-0.6
2011-12	328588.93(76)	30.7	86784.32(20)	39.7	14982.43(4)	29.7	430355.68(100)	32.4
2012-13	359426.46(75)	9.4	99261.73(21)	14.4	17361.99(4)	15.9	476050.18(100)	10.6
2013-14	381414.48(76)	6.1	103685.11(20)	4.5	18490.68(4)	6.5	503590.27(100)	5.8
2014-15	406126.8(75)	6.5	111668.86(21)	7.7	20123.19(4)	8.8	537918.85(100)	6.8
2015-16	406251.64(74)	0.0	123706.32(22)	10.8	19916.56(4)	-1.0	549874.52(100)	2.2
2016-17	384163.07(72)	-5.4	132100.63(25)	6.8	18995.05(3)	-4.6	535258.75(100)	-2.7
2017-18	350953.02(70)	-8.6	134307.93(27)	1.7	16515.35(3)	-13.1	501776.3(100)	-6.3
2018-19	333688.97(64)	-4.9	171250.51(33)	27.5	18125.16(3)	9.7	523064.64(100)	4.2
2019-20	337179.59(62)	1.0	185906.04(34)	8.6	20756.38(4)	14.5	543842.01(100)	4.0
2020-21	295495.39(63)	-12.4	159208.69(34)	-14.4	14903.04(3)	-28.2	469607.12(100)	-13.7
<b>Mean</b>	<b>213107.77(73)</b>	<b>5.16</b>	<b>64865.50(22)</b>	<b>15.38</b>	<b>12762.63(5)</b>	<b>4.44</b>	<b>290735.90(100)</b>	<b>6.46</b>
<b>CAGR</b>	<b>6.91</b>		<b>13.98</b>		<b>3.85</b>		<b>7.86</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of interest expenses of each group of banks on the total of all these banks.

**Figure 5.7**

*Trends in the annual growth rates of interest expenses of different groups of banks in India over 1992-93 to 2020-21*





The interest expenses of Indian banking industry ranges from 95414.19 crores in 1992-93 to 469607.12 crores in 2020-21 with the average annual growth rate of 6.46 per cent whereas the interest expenses of public sector banks varies from the 84197.85 crores in 1992-93 to the maximum of 295495.39 crores in 2020-21 with the average growth rate of 5.16 per cent. The mean value of public sector banks is 213107.77 crores. The average interest expense of private sector banks over the study period is calculated as 64865.50 crores with the average annual growth rate of 15.38 per cent. The growth of private sector banks in terms of interest expenses is faster than other groups of banks. It increased from 4067.64 crores in 1992-93 to 159208.69 crores in 2020-21. The average interest expenses of foreign banks varies from 7148.7 crores in 1992-93 to 14903.04 crores in 2020-21 with average annual growth rate of 4.44 per cent. The mean interest expense of foreign banks over the period is 12762.63 crores. In the reformatory period, high growth rate was recorded in 1995-96, 1996-97, 1998-99 and 1999-2000. In all the years except 1999-2000, high growth rate was registered by private sector banks followed by foreign banks and public sector banks. In 1999-2000, all commercial banks recorded a growth rate of 10.5 per cent and public sector banks reported highest growth rate followed by private sector banks and foreign banks. From the table it was observed that during 2005-06 to 2008-09, there is significant growth rate in the interest expenses of all groups of banks. In 2008-09, even though there is growth in interest expenses of all commercial banks, the rate of growth of interest expenses is decreased as compared to the previous year. During 2016-17, interest expenses of all groups of banks declined considerably due to increase in low cost funding in current and savings account because of announcement of demonetisation. The year 2017-18 also witnessed a sharp decline in the growth rate of interest expenses of all groups of banks due to lower interest rates and decline in deposit growth. Increase in deposit growth caused the increase in interest expenses of commercial banks during 2018-19. However, in 2019-20 and 2020-21, the growth rate of interest expenses of all commercial banks declined significantly mainly on account of moderation of interest rates and contraction in total borrowings. Among bank groups, biggest decline was recorded by foreign banks followed by private sector banks and public

sector banks. The CAGR of interest expenses of the different groups of banks indicate how the interest expenses grows in value over the study period. The calculated CAGR of private sector banks, public sector banks, foreign banks and all commercial banks are 13.98%, 6.91%, 3.85%, 7.86% respectively. The compound growth rate of private sector banks is higher than the other group of banks. The compound growth rates of public sector banks are found higher than foreign banks.

While analysing the share of interest expenses of each groups of banks, it is clear that public sector banks are still leading the banking industry in respect of interest expenses. An average of 73 per cent of interest expense of the entire banking industry is expended by the public sector banks where as 22 per cent is shared by private sector banks and 5 percentage by foreign banks. However, while analysing the trend of share of interest expenses of each groups of banks over the study period, the share of public sector banks is deteriorating gradually and the share of private sector banks increasing substantially over the period. The same trend was evident in the case of deposits and borrowings of these banks. This may effect the trend in the share of interest expenses of the public and private sector banks since the interest expended for deposits and borrowings constitutes the major source of interest expenses of the commercial banks. The share of foreign banks did not exhibit substantial change over the period. The percentage of share in interest expenses of foreign banks vary from 8% in 1992-93 to 3% in 2020-21 with the average share of 6% over the entire period. Figure 5.7 depicts the trend of annual growth rate of interest expenses in respect of different groups of banks. From the figure, it is noticed that the highest peak in growth rate was in the year 1995-96 by private sector banks and the biggest decline in growth rate was recorded by foreign banks in 2009-10. Since the major share of interest expenses of all commercial banks are holding by public sector banks, the trend of both public sector banks and all commercial banks shows almost same.

From the above discussion, it is clear that there is difference in the growth rate of interest expense of different groups of commercial banks in India. In order to see whether this difference is statistically different, appropriate statistical tests can

be applied. Before choosing the test, Shapiro wilk test has applied in order to see whether the distribution follows normality or not. The p value obtained for the Shapiro wilk test is 0.223 with statistics 0.980, which is higher than 0.05, then the distribution found normal. Hence, ANOVA test has applied to test whether the distribution is same across different groups of banks.

**Table 5.18**

*Results of ANOVA in respect of interest expenses of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2093.673	2	1046.837		
Within Groups	22774.786	81	281.170	3.723	<b>0.028*</b>
Total	24868.460	83			

Source: Researcher's estimates, \*the mean difference is significant at the 0.05 level.

ANOVA result shows that the observed F statistic is 3.723 with the p value of 0.028. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the growth rate of interest expenses of different groups of commercial banks in India. ANOVA results tells that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.19

**Table 5.19**

*Result of Multiple Comparisons*

	Banks	Mean Difference (I-J)	Std. Error	Sig.
Public sector banks	Private Sector banks	-10.2035*	4.48147	0.065
	Foreign Banks	0.73571	4.48147	0.985
Private Sector banks	Public sector banks	10.20357*	4.48147	0.065
	Foreign Banks	10.93929*	4.48147	0.044*
Foreign Banks	Public sector banks	-0.73571	4.48147	0.985
	Private Sector banks	-10.93929*	4.48147	0.044*

Source: Researcher's Estimates, \* indicates mean difference is significant at 5% level of significance

Pair-wise comparison shows which pairs of bank groups shows the significant difference. Here, the growth rate of interest expenses in between private sector banks and foreign banks exhibits statistically significant difference at 5% level of significance. However, no statistically significant difference is found in between the public sector banks and foreign banks, Public sector banks and private sector banks.

## **2. Operating expenses**

Operating expenses of the commercial bank means payment to and provisions for employees, rent, taxes and lighting, printing and stationery, advertisement and publicity, depreciation on banks property, directors fees, allowances and expenses, auditors' fees and expenses, law charges, postage, telegrams, telephones etc, repairs and maintenance, insurance and other expenditure. Among these expenses, payment and provisions to employees forms largest part of the operating expenses. As on 31<sup>st</sup> March 2021, 34 per cent of the total expenses of commercial banks forms by operating expenses. The annual growth rate, mean and compound annual growth rate of operating expenses of public sector commercial banks, private sector commercial banks and foreign banks for the study period is given below in the table 5.20.

**Table 5.20***Operating expenses of commercial banks in India during 1992-93 to 2020-21*

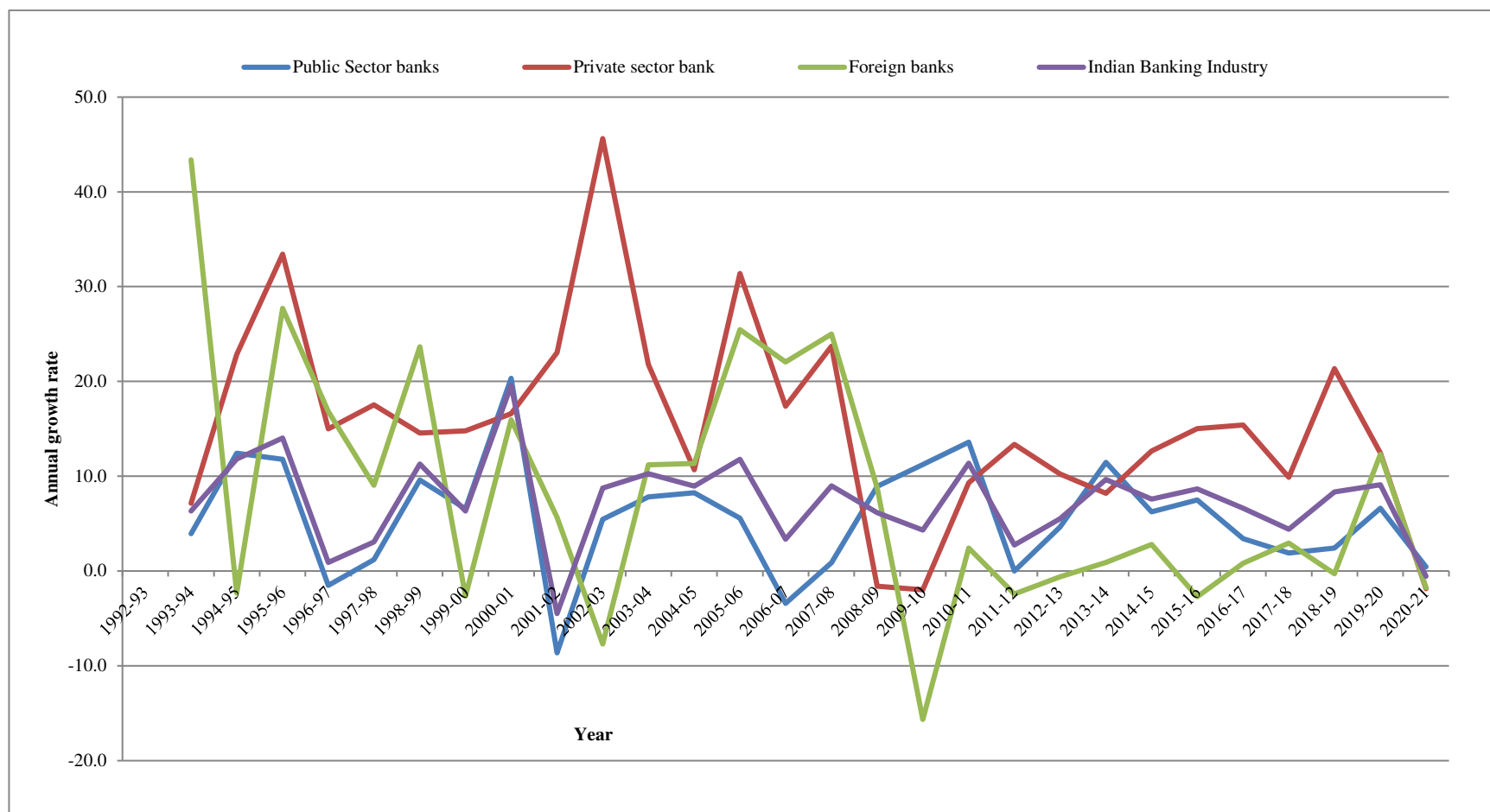
Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
1992-93	30971.23(89)		1698.52(5)		1977.43(6)		34647.18(100)	
1993-94	32186.96(87)	3.9	1819.68(5)	7.1	2835.48(8)	43.4	36842.12(100)	6.3
1994-95	36186.80(88)	12.4	2235.5(5)	22.9	2769.28(7)	-2.3	41191.58(100)	11.8
1995-96	40447.41(86)	11.8	2982.92(6)	33.4	3536.34(8)	27.7	46966.67(100)	14.0
1996-97	39827.92(84)	-1.5	3429.96(7)	15.0	4131.77(9)	16.8	47389.65(100)	0.9
1997-98	40303.01(83)	1.2	4031.12(8)	17.5	4505.83(9)	9.1	48839.96(100)	3.1
1998-99	44168.06(81)	9.6	4617.49(9)	14.5	5571.30(10)	23.6	54356.85(100)	11.3
1999-00	47068.57(82)	6.6	5299.87(9)	14.8	5423.93(9)	-2.6	57792.37(100)	6.3
2000-01	56639.71(82)	20.3	6178.73(9)	16.6	6289.93(9)	16.0	69108.37(100)	19.6
2001-02	51757.10(78)	-8.6	7602.35(12)	23.0	6646.43(10)	5.7	66005.88(100)	-4.5
2002-03	54580.66(76)	5.5	11071.02(15)	45.6	6135.25(9)	-7.7	71786.93(100)	8.8
2003-04	58848.88(74)	7.8	13482.45(17)	21.8	6823.06(9)	11.2	79154.39(100)	10.3
2004-05	63714.24(74)	8.3	14919.93(17)	10.7	7597.88(9)	11.4	86232.05(100)	8.9
2005-06	67266.41(70)	5.6	19603.29(20)	31.4	9532.86(10)	25.5	96402.56(100)	11.8
2006-07	64976.00(65)	-3.4	23013.56(23)	17.4	11633.80(12)	22.0	99623.36(100)	3.3
2007-08	65546.65(60)	0.9	28469.07(26)	23.7	14542.58(14)	25.0	108558.3(100)	9.0

Year	Public Sector banks (₹ in Crores)	Annual Growth rate (%)	Private sector bank (₹ in Crores)	Annual Growth rate (%)	Foreign banks (₹ in Crores)	Annual Growth rate (%)	All commercial banks (₹ in Crores)	Annual Growth rate (%)
2008-09	71396.55(62)	8.9	28015.63(24)	-1.6	15819.93(14)	8.8	115232.11(100)	6.1
2009-10	79407.44(66)	11.2	27461.87(23)	-2.0	13342.05(11)	-15.7	120211.36(100)	4.3
2010-11	90208.98(67)	13.6	30016.78(23)	9.3	13666.01(10)	2.4	133891.77(100)	11.4
2011-12	90205.20(65)	0.0	34030.15(25)	13.4	13336.68(10)	-2.4	137572.03(100)	2.7
2012-13	94382.26(65)	4.6	37515.13(26)	10.2	13255.60(9)	-0.6	145152.99(100)	5.5
2013-14	105196.96(66)	11.5	40589.84(26)	8.2	13375.26(8)	0.9	159162.06(100)	9.7
2014-15	111766.89(65)	6.2	45724.99(27)	12.7	13750.68(8)	2.8	171242.56(100)	7.6
2015-16	120130.3(65)	7.5	52591.41(28)	15.0	13378.25(7)	-2.7	186099.96(100)	8.7
2016-17	124237.95(63)	3.4	60692.02(30)	15.4	13487.41(7)	0.8	198417.38(100)	6.6
2017-18	126595.07(61)	1.9	66690.69(32)	9.9	13885.41(7)	3.0	207171.17(100)	4.4
2018-19	129675.89(58)	2.4	80921.17(36)	21.3	13845.62(6)	-0.3	224442.68(100)	8.3
2019-20	138274.47(57)	6.6	91008.50(37)	12.5	15550.76(6)	12.3	244833.73(100)	9.1
2020-21	138892.80(57)	0.4	89311.18(37)	-1.9	15279.17(6)	-1.7	243483.15(100)	-0.6
<b>Mean</b>	<b>76374.50(66)</b>	<b>5.66</b>	<b>28793.96(25)</b>	<b>15.64</b>	<b>9721.59(9)</b>	<b>8.3</b>	<b>114890.04(100)</b>	<b>7.31</b>
<b>CAGR</b>	<b>5.62</b>		<b>15.59</b>		<b>6.89</b>		<b>7.34</b>	

Source: Statistical Tables Relating to Banks in India, Figures in the parenthesis indicates percentage of share of operating expenses of each group of banks on the total of all these banks.

**Figure 5.8**

*Trends in the annual growth rates of operating expenses of different groups of banks in India over 1992-93 to 2020-21*



The average operating expenses of the public sector bank calculated for the entire period is 76374.50 crores with average annual growth of 5.66 per cent. The operating expenses of the banks increased from 30971.23 crores in 1992-93 to 138892.80 crores in 2020-21. The annual growth rate of 20.3 was highest in 2000-01 and growth rate was negative in 1991-92, 1996-97, 2001-02, 2006-07 and 2011-12. The mean private sector bank is 28793.96 crores with average annual growth rate of 15.64. The annual growth rate of private sector bank is highest in the year 2002-03 which is 45.6 and it was found to be negative in the years of 2008-09, 2009-10 and 2020-21. The operating expenses of the foreign bank in 1992-93 was 1977.43 crores and it increased to 15279.17 crores in 2019-20. The highest annual growth rate 43.4 was recorded in 1993-94. The mean operating expenses of the foreign bank is 9721.59 crores average annual growth rate of 8.3. Public sector banks and Indian banking industry as a whole have recorded a large increase in operating expenses during 2000-01. This acceleration was largely due to allocations for the voluntary retirement schemes. During this period, public sector banks have registered highest growth followed by private sector banks and foreign banks. During 2002-03, there was a sharp decline in the operating expenses of the foreign banks due to considerable control in the wage cost and provision and contingencies. On the other hand, operating expenses of public sector banks and private sector banks increased marginally especially by private sector banks. There was considerable growth in operating expenses until 2005-06. Indian banks were able to decrease their operating expenses during 2006-07 but it improved marginally in 2007-08. In 2008-09 and 2009-10, the growth of operating expenses of all commercial banks showed considerable decline except public sector banks. From 2008-09 to 2010-11, public sector banks are unable to reduce their operating expenses as compared to other groups of banks. They registered a continuous increase in operating expenses during the period. In 2011-12, the growth of operating expenses of public sector banks and foreign banks declined and private sector banks witnessed an upsurge in operating expenses. During 2012-13 and 2013-14, operating expenses of all commercial banks have increased mainly due to increase in the operating expenses of public sector



banks. However, the growth of operating expenses of private sector banks declined continuously during the period. In 2014-15 and 2015-16, private sector banks have registered continuous growth in operating expenses whereas public sector banks recorded a decline in operating expenses in 2014-15 and an upsurge in 2015-16. On the contrary, foreign banks registered a growth in 2014-15 and decline in 2015-16. In 2016-17 and 2017-18, the operating expenses of all commercial banks have declined due to rationalization of branches and manpower. However, operating expense of all commercial banks increased during 2018-19 and 2019-20 mainly due to increase in wage bill. Among different groups of banks, private sector banks scored the highest growth rate. In 2020-21, the operating expenses of all commercial banks decreased considerably. The CAGR of operating expenses of the different groups of banks indicate how the operating expenses increases in value over the study period. The calculated CAGR of private sector banks, public sector banks, foreign banks and all commercial banks are 15.59%, 5.62%, 6.89%, 7.34% respectively. The compound growth rate of private sector banks is higher than the other group of banks. The compound growth rates of foreign banks are found higher than public sector banks.

While examining the share of each group of banks in respect of operating expenses of all commercial banks, it is observed that public sector banks are still dominating the banking industry with average of 66 per cent of operating expenses. However, the share of the public sector banks showing a decreasing trend over the study period and the percentage of share decreased from 89 % in 1992-93 to 57 per cent in 2020-21. On the contrary, the operating expenses of the private sector banks increased from 5 per cent in 1992-93 to 37 per cent in 2020-21 in accordance with the expansion of business. The share of foreign banks in the operating expenses to the banking industry is not much high as that of public and private sector banks. An average of 9 per cent out of total operating expenses was expended by foreign banks. Figure 5.8 depicts the trend of annual growth rate of operating expenses in respect of different groups of banks. From the figure, it is observed that the highest peak in

growth rate was in the year 2002-03 by private sector banks and the biggest decline in growth rate was recorded by foreign banks in 2009-10. Since the major share of operating expense of all commercial banks are holding by public sector banks, the trend of both public sector banks and all commercial banks shows almost same pattern.

From the above discussion, it is clear that there is difference in the growth rate of operating expenses of different groups of commercial banks in India. Figure 5.8 shows the trends in the growth rates of advances of different groups of banks in India over 1992-93 to 2020-21. Shapiro wilk test has applied in order to see whether the distribution follows normality or not. As the p value (0.012 with test statistic 0.961) for the Shapiro wilk test is less than 0.05, the distribution found not normal. Hence, Kruskal wallis H test has applied whether the distribution is same across different groups of banks.

**Table 5.21**

*Results of Kruskal wallis H test for operating expenses of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	33.05	28		
Private Sector banks	56.82	28	14.970	0.001*
Foreign banks	37.63	28		

Source: Researcher's Estimates, \* indicates significant at 5% level

Kruskal wallis H test result shows that the observed Chi square statistic is 14.970 with the p value of 0.001. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the growth rate of operating expenses of different groups of commercial banks. Kruskal wallis H test results tells that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.22

**Table 5.22**

*Result of Multiple Comparisons*

Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Public sector banks- Foreign banks	-4.571	6.519	-0.701	1.000
Public sector banks- Private Sector banks	-23.768	6.519	-3.646	<b>0.001*</b>
Private Sector banks- Foreign banks	19.196	6.519	2.945	<b>0.010*</b>

Source: Researcher's Estimates, \* indicates significant at 5% level

Pair-wise comparison test has conducted in order to see which pairs of banks shows significant difference. From the results, it is clear that there is no significant difference in the growth rate of public and foreign banks. However, the p value obtained in comparing public sector banks and private sector bank is 0.017 and 0.036 for private sector banks and foreign banks. Hence, it is obvious that there is significant difference in the growth of interest income of private sector banks from the other groups of banks.

## **5.2. Analysis of profitability of commercial banks**

Most commonly, profit is the difference between total revenue and total cost. It is the excess of revenue over cost. However, the concept of profit is different in different contexts. For instance, the concept of profit under accountant's point of view is different from profit concept under economist's point of view. That is there are different types of profit like accounting profit, economic profit and social profit. Accounting profit is calculated by deducting explicit cost associated with the revenue of a period from the revenue of that period. Economic profit considers both explicit and implicit cost associated with the revenue of the period. It is calculated by deducting explicit and implicit cost from the revenue. On the other hand, economic profit is the excess of accounting profit over implicit cost. Social profit considers social cost and social benefits. It is the excess of social benefits made available by the business over the social cost (Toshniwal, 2016).

The term profitability is the combination of two words i.e profit and ability. As already discussed, profit simply means excess of the total revenue over total cost. The term ability means the power of the organization to earn something. Thus, profitability is the power of the organizations to earn profit. Profitability analysis involves the critical analysis and interpreting the current and prospective earning capacity of the business organization. It helps the internal and external stakeholders to evaluate the performance of the business enterprise (Toshniwal, 2016).

The second part of this chapter deals with the profitability of the commercial banks in India over the period of 1992-93 to 2020-21. The profitability of the commercial banks has examined using different ratios like spread ratios, burden ratios and profitability ratios.

### **5.2.1 Spread ratios**

Spread ratios deal with the interest earned and interest expended by the commercial banks. Various spread ratios used in this study are described and analysed as follows:

1. Interest income to total assets
2. Interest expenses to total assets
3. Spread to total assets

#### **1. Interest income to total assets**

Interest income is one of the important sources of income for banks. As on 31<sup>st</sup> March 2021, 83.75% of total income of all commercial banks constitutes the interest income of the banks. Interest income of the banks includes interest or discount earned on advances or bills, income on investment, interest on balances with RBI and other interbank funds and others. Interest income to total assets ratio indicates what percentage of total assets is earned as interest income. Higher the ratio indicates higher profitability and lower the ratio signifies the low profitability. This ratio is calculated by dividing interest income earned by the banks by the average total assets for current and previous year and multiplied by 100.

**Table 5.23**

*Ratio of interest income to total assets of different groups of commercial banks in India during 1992-93 to 2020-21*

Year	Public sector banks (%)	Annual Growth rate	Private sector banks (%)	Annual Growth rate	Foreign banks (%)	Annual Growth rate	All commercial banks (%)	Annual Growth rate
1992-93	9.55		9.39		11.62		10.19	
1993-94	8.56	-10.37	8.91	-5.11	10.04	-13.60	9.17	-10.01
1994-95	8.61	0.58	7.67	-13.92	9.88	-1.59	8.72	-4.91
1995-96	9.20	6.85	9.97	29.99	10.46	5.87	9.88	13.30
1996-97	9.69	5.33	10.51	5.42	11.08	5.93	10.43	5.57
1997-98	9.10	-6.09	9.77	-7.04	10.42	-5.96	9.76	-6.42
1998-99	9.01	-0.99	9.65	-1.23	10.27	-1.44	9.64	-1.23
1999-00	8.92	-1.00	8.74	-9.43	9.93	-3.31	9.20	-4.56
2000-01	8.85	-0.78	8.87	1.49	9.27	-6.65	9.00	-2.17
2001-02	8.72	-1.47	6.18	-30.33	8.56	-7.66	7.82	-13.11
2002-03	8.34	-4.36	8.26	33.66	7.68	-10.28	8.09	3.45
2003-04	7.44	-10.79	6.95	-15.86	6.60	-14.06	7.00	-13.47
2004-05	7.42	-0.27	6.61	-4.89	6.33	-4.09	6.79	-3.00
2005-06	7.28	-1.89	7.05	6.66	6.96	9.95	7.10	4.57
2006-07	7.37	1.24	7.53	6.81	7.57	8.76	7.49	5.49
2007-08	7.80	5.83	8.42	11.82	7.65	1.06	7.96	6.28
2008-09	8.05	3.21	8.65	2.73	7.49	-2.09	8.06	1.26
2009-10	7.46	-7.33	7.60	-12.14	5.99	-20.03	7.02	-12.90
2010-11	7.52	0.80	7.59	-0.13	6.15	2.67	7.09	1.00
2011-12	8.55	13.70	8.71	14.76	6.67	8.46	7.98	12.55
2012-13	8.54	-0.12	9.04	3.79	6.89	3.30	8.16	2.26
2013-14	8.31	-2.69	8.90	-1.55	6.60	-4.21	7.94	-2.70
2014-15	8.12	-2.29	8.81	-1.01	6.71	1.67	7.88	-0.76
2015-16	7.74	-4.68	8.63	-2.04	6.67	-0.60	7.68	-2.54
2016-17	7.20	-6.98	8.27	-4.17	6.27	-6.00	7.25	-5.60
2017-18	6.68	-7.22	7.73	-6.53	5.96	-4.94	6.79	-6.34
2018-19	6.87	2.84	7.91	2.33	5.77	-3.19	6.85	0.88
2019-20	6.84	-0.44	8.07	2.02	5.74	-0.52	6.88	0.44
2020-21	6.28	-8.19	7.38	-8.55	5.00	-12.89	6.22	-9.59
<b>Average</b>	<b>8.07</b>	<b>-1.34</b>	<b>8.34</b>	<b>-0.09</b>	<b>7.80</b>	<b>-2.69</b>	<b>8.07</b>	<b>-1.51</b>
<b>SD</b>	<b>0.89</b>		<b>1.02</b>		<b>1.89</b>		<b>1.16</b>	
<b>CAGR</b>	<b>-0.58</b>		<b>-0.41</b>		<b>-1.37</b>		<b>-0.80</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

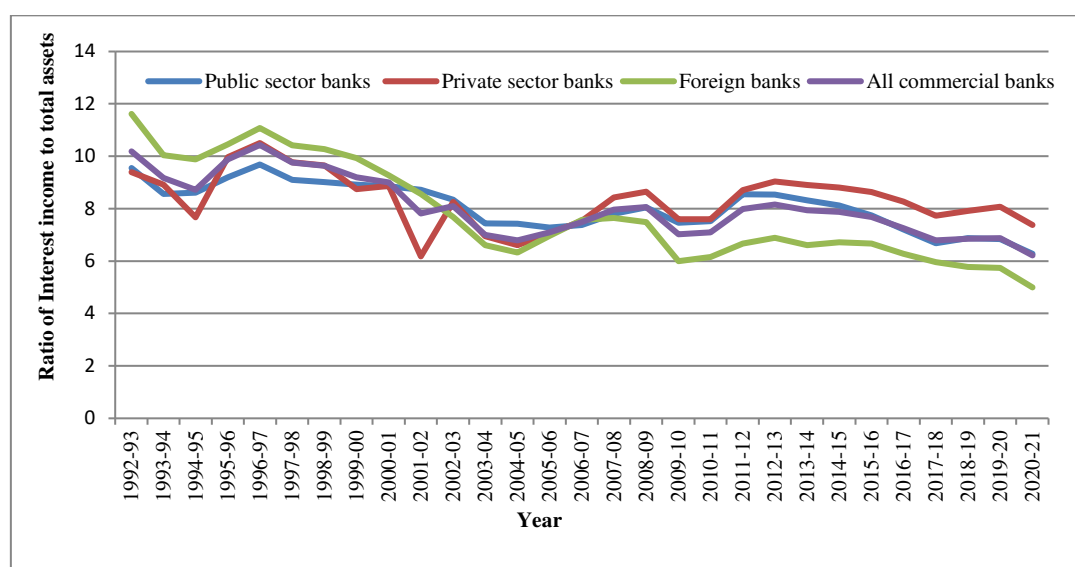
The above table shows the ratio of interest income to total assets of different groups of banks over the period of 1992-93 to 2020-21. The ratio of public sector banks fluctuated from 9.55% in 1992-93 to 6.28% in 2020-21. The average ratio for public sector banks and all commercial banks for the entire study period calculated as 8.07%. The ratio for private sector bank ranges from the minimum of 6.18% in the year 2001-02 and maximum of 10.51 in the year 1995-96. The average ratio of private sector banks for the study period is calculated as 8.34%. The ratio for the foreign banks fluctuated from 11.62% in 1992-93 to 5% in 2020-21 whereas the average ratio calculated as 7.80%, which is lower than that of the average of public and private sector banks. This result is similar to the findings of Saluja (2012), who estimated average ratio for the study period of 2001 to 2010 and found that the average ratio of the foreign banks is lower than the other groups of banks. While analysing the standard deviation of banks, it is observed that the value is higher for foreign banks (Saluja, 2012) i.e 1.89, which indicates greater variability in the ratio and the value is lower for public sector banks i.e 0.89 that point out the high degree of uniformity and homogeneity in the ratio. The CAGR analysis indicates that the ratio has grown negatively for all groups of banks during the study period. Krishnan (2014) also found that average annual growth rate of both public and private sector banks was negative. Higher the ratio is the sign of higher profitability and vice versa. In the present study as the average ratio of private sector banks are higher than the other bank groups, the performance of the private sector bank is better. This result is in contrary with the result of Saluja (2012), who found that during the period of 2001 to 2010, the performance of the public sector banks was better than private sector banks and foreign banks. The average ratio of public sector banks calculated for the period of 1995 to 2005 by Kanjana (2007) was 8.06 while Saluja (2012) found 7.03 for the study period of 2001 to 2010. The average of ratio of the old private sector banks and new private sector banks calculated by Krishnan (2014) are 8.54 and 7.88 respectively. The average value calculated for entire private sector banks in the present study lies in between these two averages. RBI observed that all groups of banks registered substantial growth in the ratio during 1995-96 and 1996-97 as a result wide ranging reform measures. During 2005-06 to 2007-08, all commercial banks have reported continuous growth in the ratio of interest income to total assets. However, among the bank groups, private sector banks performing

better than the other groups of banks. In 2011-12, all bank groups have registered a remarkable progress because of substantial increase in the interest income of commercial banks during that year. From 2013-14 to 2017-18 the growth rate of ratio of public sector banks and all commercial banks exhibited negative trend. In 2018-19, the growth rate of ratio of interest income to total assets of all commercial banks showed an improvement and in next years it decreased and finally declined sharply and all groups of banks registered a negative growth rate in the final year of the study.

Figure 5.9 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of interest income to total assets of foreign banks was higher than other groups of banks until 2000-01. After that, public sector banks dominated the other banks and continued the same trend until 2005-06. During 2006-07, the ratio of all groups of banks was almost equal but after that ratio of interest income to total assets of private sector banks have accelerated and become higher than the other groups of banks. During the last six years, the ratio of public sector banks and all commercial banks are almost equal and the ratio of foreign banks found lower than the other groups of banks and continued this trend until the last year of the study.

**Figure 5.9**

*Trends in the ratio of interest income to total assets of different groups of banks in India over 1992-93 to 2020-21*



From the table 5.23, it is observed mean ratio of public sector banks, private sector banks and foreign banks are 8.07%, 8.34% and 7.80% respectively. That is the average ratio of each groups of banks are different. In order to see whether this difference is statistically significant, appropriate parametric and non-parametric test can apply based on normality. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.760 with test statistic 0.990. The null hypothesis relating to the normality test is that the data is normal. As the p value is higher than 0.05, it is fail to reject the null hypothesis that the data is normal. Hence, ANOVA test is conducted to test whether there is any significant difference exists in the ratio of interest income to total assets of different groups of commercial banks.

**Table 5.24**

*ANOVA result of ratio of interest income to total assets of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.164	2	2.082		
Within Groups	152.360	84	1.814	1.148	0.322
Total	156.524	86			

Source: Researcher's Estimates,

From the table 5.24, it is observed F statistic is 1.148 with the p value of 0.322. Since the p value is higher than 0.05, it is fails to reject the null hypothesis that there is no significant difference in the ratio of interest income to total assets in respect of different groups of commercial banks. Even though there was a significant difference in the growth rate of interest income of different groups of commercial banks, the ratio of interest income to total asset, do not show significant difference.

## **2. Ratio of interest expenses to total assets**

The expenses of the bank comprise interest expense and operating expenses. The interest expended by banks includes interest paid on deposits, interest on RBI/ inter bank borrowings and others. The ratio of interest expenses to total assets indicates the rate at which the banks incur expenses by borrowing funds (Krishnan, 2014). This is calculated by dividing the interest expenses by the average of total assets for current and previous year and multiplied by 100. Higher the ratio indicates lower profitability and vice versa.



**Table 5.25**

*Ratio of interest expenses to total assets of different groups of commercial banks in India during 1992-93 to 2020-21*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Annual Growth rate	All commercial banks (%)	Annual Growth rate
1992-93	7.25		6.93		8.09		7.42	
1993-94	6.31	-12.95	6.50	-6.12	6.41	-20.79	6.41	-13.67
1994-95	5.85	-7.32	6.41	-1.48	5.49	-14.33	5.91	-7.68
1995-96	6.29	7.60	7.58	18.26	7.53	37.15	7.13	20.59
1996-97	6.60	5.00	8.39	10.68	7.28	-3.28	7.42	4.10
1997-98	6.47	-2.01	8.22	-1.95	6.81	-6.38	7.17	-3.42
1998-99	6.50	0.47	8.20	-0.23	7.07	3.73	7.26	1.23
1999-00	6.57	1.10	7.36	-10.28	6.16	-12.82	6.70	-7.71
2000-01	6.32	-3.90	7.01	-4.73	6.15	-0.27	6.49	-3.09
2001-02	6.23	-1.32	5.64	-19.54	5.57	-9.30	5.82	-10.40
2002-03	5.62	-9.77	6.50	15.14	4.35	-21.89	5.49	-5.59
2003-04	4.69	-16.68	5.20	-19.91	3.32	-23.72	4.40	-19.81
2004-05	4.13	-11.87	3.99	-23.36	2.71	-18.28	3.61	-18.01
2005-06	4.14	0.24	4.20	5.41	2.83	4.27	3.72	3.16
2006-07	4.41	6.50	4.81	14.55	3.09	9.00	4.10	10.16
2007-08	5.29	19.92	5.58	15.95	3.23	4.55	4.70	14.51
2008-09	5.48	3.54	5.54	-0.68	3.04	-5.68	4.69	-0.24
2009-10	5.00	-8.62	4.55	-17.94	1.96	-35.56	3.84	-18.12
2010-11	4.53	-9.44	4.28	-5.92	2.18	11.41	3.67	-4.50
2011-12	5.57	22.95	5.40	26.18	2.67	22.21	4.55	24.06
2012-13	5.76	3.30	5.61	3.92	2.98	11.76	4.78	5.20
2013-14	5.69	-1.11	5.44	-3.15	3.01	0.85	4.71	-1.50
2014-15	5.69	-0.07	5.36	-1.46	3.12	3.64	4.72	0.19
2015-16	5.45	-4.11	5.16	-3.70	3.04	-2.46	4.55	-3.59
2016-17	5.00	-8.31	4.82	-6.56	2.85	-6.25	4.22	-7.19
2017-18	4.52	-9.63	4.33	-10.08	2.48	-12.92	3.78	-10.54
2018-19	4.37	-3.24	4.73	9.18	2.49	0.50	3.87	2.33
2019-20	4.41	0.83	4.58	-3.30	2.45	-1.79	3.81	-1.42
2020-21	3.68	-16.55	3.62	-20.98	1.72	-29.75	3.01	-21.15
<b>Average</b>	<b>5.44</b>	<b>-1.98</b>	<b>5.72</b>	<b>-1.50</b>	<b>4.14</b>	<b>-4.16</b>	<b>5.10</b>	<b>-2.57</b>
<b>SD</b>	<b>0.92</b>		<b>1.34</b>		<b>1.97</b>		<b>1.36</b>	
<b>CAGR</b>	<b>-2.31</b>		<b>-2.22</b>		<b>-5.19</b>		<b>-3.07</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

Table 5.25 shows the ratio of interest expenses to total assets of public sector banks, private sector banks and foreign banks over the study period of 1992-93 to 2020-21. For the group of all commercial banks, the average calculated for the period of the study is 5.10% and CAGR indicates that the industry ratio has grown at the rate of -3.07 over the entire study period. The average ratio calculated for public sector banks for the study period is 5.44% with the standard deviation of 0.92. The maximum ratio of 7.25 was estimated for the year 1992-93 and 3.68 is the minimum ratio calculated in the year 2020-21. Saluja (2012) got the average of 4.75 for the period of 2001 to 2010 where as Krishnan (2014) estimated the average ratio for SBI group as 5.05 and for nationalised banks as 5.29 for the period of 1996 to 2011. The standard deviation of the public sector banks for the ratio is 0.92, which is less than the standard deviation of both private sector banks and foreign banks. This indicates there is more homogeneity in the values of public sector banks. The CAGR of the public sector banks indicates that, the ratio has grown negatively at the rate of -2.31 over the study period.

The average of private sector banks calculated for the study period is 5.72, which is higher than the average of the public sector banks. Kanjana (2007) estimated the ratio of interest paid as percentage of working fund for the study period 1995 to 2005 as 5.74 where as Krishnan (2014) got the average of 5.93 for old private sector banks and 5.56 for new private sector banks. The average calculated in the present study is lower than the averages found by Krishnan (2014) for both old and new private sector banks. In the present study, the minimum ratio of 3.62 was recorded in the year 2020-21 and in the year 1996-97 private sector banks secured the highest ratio of 8.39. The standard deviation calculated for private sector banks is 1.34, which is more than standard deviation of public sector banks and less than foreign banks. It means that there is more variability in the ratio of interest expense to total assets of private sector banks as compared to public sector banks and less variability as compared to foreign banks. The CAGR of the private sector banks indicates that the ratio has grown negatively at the rate of -2.22 over the entire study period.

In the case of the foreign banks, the minimum ratio of 1.72 estimated in the year 2020-21 while highest ratio of 8.09 measured in the year 1992-93. The average ratio calculated is 4.14%, which is lower than the averages of public sector banks and private sector banks. Saluja (2012) calculated the ratio for foreign banks as 3.18, which was also lower than the calculated averages of the public and private sector banks during their study period. Lower the ratio indicates the better profitability. Hence, according to the ratio of interest expense to total assets, performance of foreign banks is better than that of the other groups of banks. In analysing the standard deviation, it is clear that as compared to other groups of banks, variability in the ratio is higher for foreign banks since the standard deviation value is higher for foreign banks. The CAGR of the foreign banks indicates that the ratio of foreign banks has grown negatively at the rate of -5.19 over the study period.

**Figure 5.10**

*Trends in the ratio of interest expenses to total assets of different groups of banks in India over 1992-93 to 2020-21*

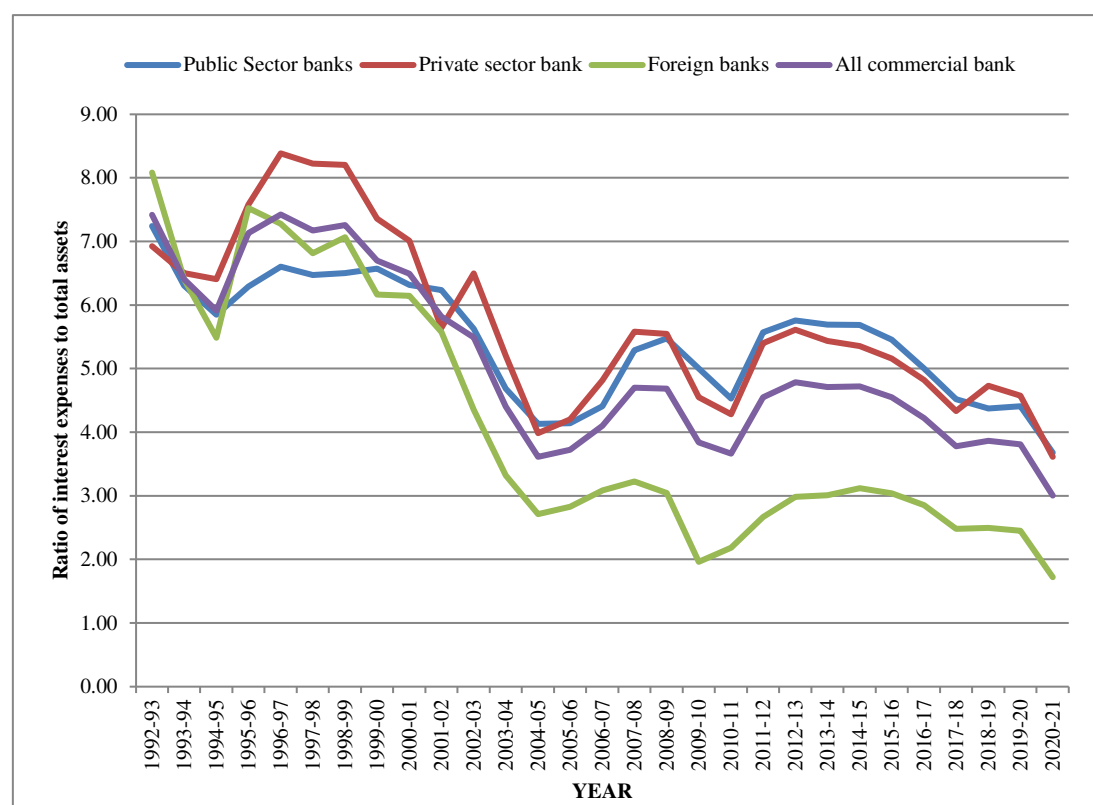


Figure 5.10 presents the ratio of interest expenses to total assets of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is observed that the ratio of interest expenses to total assets showing a decreasing trend over the period of the study. From the year 1999-2000, the ratio of foreign banks become lower than the other groups of banks and it continued till the last year of the study. In the entire study period, ratio of public sector banks and private sector banks are moving almost together and in the final year it become almost equal.

From the table 5.25, the mean ratio of public sector banks, private sector banks and foreign banks are 5.44, 5.72 and 4.14 respectively. That is the average ratio of each groups of banks are different. In order to see whether this difference is statistically significant, appropriate parametric and non-parametric test can apply based on normality. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.184 with test statistic 0.980. The null hypothesis relating to the normality test is that the data is normal. As the p value is higher than 0.05, it is fail to reject the null hypothesis that the data is normal. Hence, ANOVA test is conducted to test whether there is any significant difference exists in the ratio of interest expenses to total assets of different groups of commercial banks.

**Table 5.26**

*ANOVA result of ratio of interest expenses to total assets of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	41.303	2	20.652		
Within Groups	183.204	84	2.181	9.469	<b>0.000*</b>
Total	224.507	86			

Source: Researcher's Estimates, \* indicates significant at 5% level of significance

ANOVA result shows that the observed F statistic is 9.469 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of interest expenses to total assets in respect of different groups of commercial banks. ANOVA results tell that at least one pair of banks are significantly different. In order to see which pair banks are

significantly different, multiple comparison tests have conducted. The result is presented in the table 5.27

**Table 5.27**

*Result of Multiple Comparisons*

Banks		Mean Difference (I-J)	Std. Error	Sig.
Public sector banks	Private Sector banks	-0.28000	0.38783	0.751
	Foreign Banks	1.30138*	0.38783	<b>0.003*</b>
Private Sector banks	Public sector banks	0.28000	0.38783	0.751
	Foreign Banks	1.58138*	0.38783	<b>0.000*</b>
Foreign Banks	Public sector banks	-1.30138*	0.38783	<b>0.003*</b>
	Private Sector banks	-1.58138*	0.38783	<b>0.000*</b>

Source: Researcher's Estimates, \*the mean difference is significant at the 0.05 level.

From the table it is evident that there is statistically significant difference in the ratio of interest expenses to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign banks. No significant difference was found in between the private sector banks and public sector banks. This means that the distribution of interest expenses to total assets of domestic banks is almost same.

### **3. Spread (Net Interest Margin) to total assets**

Spread or net interest margin is the difference between interest income and interest expenses during the year. Spread as a percentage of total assets indicates the operating profitability of the banks. Banks major function is accepting deposits and lending money. Hence, analysis of profitability based on spread is highly relevant as far as the banks are concerned. Lower ratio indicates lower profitability and higher ratio indicates higher profitability. The ratio is calculated by dividing net interest margin by the average of total assets of current and previous year and is multiplied by 100.

**Table 5.28**

*Ratio of spread to total assets of different groups of commercial banks during 1992-93 to 2020-21*

Year	Public sector banks (%)	Annual Growth rate	Private sector banks (%)	Annual Growth rate	Foreign banks (%)	Annual Growth rate	All commercial banks (%)	Annual Growth rate
1992-93	2.39		2.91		3.56		2.95	
1993-94	2.36	-1.26	2.97	2.06	4.21	18.26	3.18	7.67
1994-95	2.92	23.73	2.69	-9.43	4.24	0.71	3.28	3.25
1995-96	3.08	5.48	3.08	14.50	3.74	-11.79	3.30	0.51
1996-97	3.16	2.60	2.94	-4.55	4.09	9.36	3.40	2.93
1997-98	2.91	-7.91	2.46	-16.33	3.93	-3.91	3.10	-8.73
1998-99	2.80	-3.78	2.09	-15.04	3.47	-11.70	2.79	-10.11
1999-00	2.70	-3.57	2.16	3.35	3.92	12.97	2.93	5.02
2000-01	2.86	5.93	2.33	7.87	3.63	-7.40	2.94	0.46
2001-02	2.73	-4.55	1.58	-32.19	3.22	-11.29	2.51	-14.63
2002-03	2.91	6.59	1.97	24.68	3.36	4.35	2.75	9.43
2003-04	2.98	2.41	2.21	12.18	3.59	6.85	2.93	6.55
2004-05	3.18	6.71	2.51	13.57	3.54	-1.39	3.08	5.13
2005-06	3.03	-4.72	2.74	9.16	4.05	14.41	3.27	6.39
2006-07	2.79	-7.92	2.54	-7.30	4.36	7.65	3.23	-1.32
2007-08	2.35	-15.77	2.67	5.12	4.33	-0.69	3.12	-3.51
2008-09	2.35	0.00	2.86	7.12	4.33	0.00	3.18	2.03
2009-10	2.29	-2.55	2.90	1.40	3.96	-8.55	3.05	-4.09
2010-11	2.77	20.96	3.10	6.90	3.86	-2.53	3.24	6.34
2011-12	2.76	-0.36	3.09	-0.32	3.89	0.78	3.25	0.10
2012-13	2.57	-6.88	3.22	4.21	3.88	-0.26	3.22	-0.72
2013-14	2.45	-4.67	3.31	2.80	3.54	-8.76	3.10	-3.83
2014-15	2.35	-4.08	3.37	1.81	3.37	-4.80	3.03	-2.26
2015-16	2.23	-5.11	3.41	1.19	3.59	6.53	3.08	1.54
2016-17	2.12	-4.93	3.38	-0.88	3.38	-5.85	2.96	-3.79
2017-18	2.08	-1.89	3.32	-1.78	3.43	1.48	2.94	-0.56
2018-19	2.33	12.02	3.26	-1.81	3.23	-5.83	2.94	-0.11
2019-20	2.37	1.72	3.43	5.21	3.26	0.93	3.02	2.72
2020-21	2.45	3.38	3.58	4.37	3.30	1.23	3.11	2.98
<b>Average</b>	<b>2.63</b>	<b>0.41</b>	<b>2.83</b>	<b>1.35</b>	<b>3.73</b>	<b>0.03</b>	<b>3.06</b>	<b>0.34</b>
<b>SD</b>	<b>0.32</b>		<b>0.51</b>		<b>0.36</b>		<b>0.19</b>	
<b>CAGR</b>	<b>0.09</b>		<b>0.72</b>		<b>-0.26</b>		<b>0.18</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

The spread ratio of public sector banks fluctuated from 2.39 in 1992-93 to 2.45 in the 2020-21. The highest ratio of 3.18 was reported in the year 2004-05 and lowest ratio of 2.08 was reported in the year 2017-18. During 2004-05, there was an improvement in the interest income of public sector banks and along with that interest expenses decreased considerably. In 2017-18, even though there was a decline in the interest expenses of banks, the interest income of the banks also declined noticeably. During the entire study period, the highest growth rate was reported in the year 1994-95. From 2005-06 to 2007-08, the spread ratio of public sector banks reported negative growth. In 2016-17, the demonetisation has announced the spread ratio declined substantially. The average ratio of public sector banks for the entire period is calculated as 2.63 with standard deviation of 0.32 and CAGR of 0.09. While comparing the average of different groups of banks the average spread ratio of public sector bank is lower than the private sector banks and foreign banks. Hemachandika (2003) calculated the average of the ratio of spread as percentage of working fund for the public sector banks from the period 1981 to 2001 is 2.4. The average of the spread ratio of public sector banks calculated by Saluja (2012) for the period 2001-02 to 2009-10 is 2.59 where as Krishnan (2014) estimated the spread ratio of nationalised banks and SBI and associates separately. They found that average spread ratio of nationalised banks for the period of 1996 to 2011 is 2.72 and SBI and associates is 2.81.

The spread ratio of the private sector bank was highest in the year 2020-21 (3.58) and lowest ratio of 1.58 was calculated in the year 2001-02. The highest growth rate of spread ratio was recored in 2002-03. The average spread ratio of private sector banks for the entire period is 2.83. Among the different groups of banks, the average of private sector banks are found higher than public sector banks and lower than the foreign banks. Kanjana (2007) estimated the average spread ratio of the private sector banks for the period of 1995-2005 is 2.32 and 2.28 by Saluja (2012) for the period of 2001-02 to 2009-10. Krishnan (2014) measured the spread ratio of new and old generation private sector banks separately and it was 2.33 for new private sector banks and 2.60 for old private sector banks. In analysing the spread ratio of private sector banks, it is observed that during the last decade of the study period, the spread ratio was more than 3% in all years and showed an increasing trend in most of the years.

Among the three groups of banks, the average ratio of foreign banks is found higher than the other group of banks. Higher value of ratio indicates the better profitability of the bank and vice versa. Hence, in the case of spread to total assets ratio, the operating profitability performance of foreign banks is better than the domestic banks. Similarly, as the ratio obtained by the public sector banks is lower than other groups of banks, the profitability performance of public sector banks is not satisfactory. The average spread ratio of foreign banks for the study period is calculated as 3.73 with the standard deviation 0.36 and CAGR of -0.26. The growth rate of foreign banks indicates that the ratio grow at a negative growth rate over the study period. The spread ratio of the banks varies from 3.56 in 1992-93 to 3.30 in 2020-21. Saluja (2012) calculated the average spread ratio of foreign banks from the period 2001 to 2010 was 3.60. As in the present study, Saluja (2012) also found that the average spread ratio of the foreign banks is higher than the other groups of banks. During the study period, CAGR of private sector banks (0.72) is higher than the public sector banks (0.09) and foreign banks (-0.26). In the present study, the growth rate of foreign banks is found dissatisfactory and the CAGR of the private sector banks is higher than the public sector banks.

**Figure 5.11**

*Trends in the ratio of spread to total assets of different groups of banks in India over 1992-93 to 2020-21*

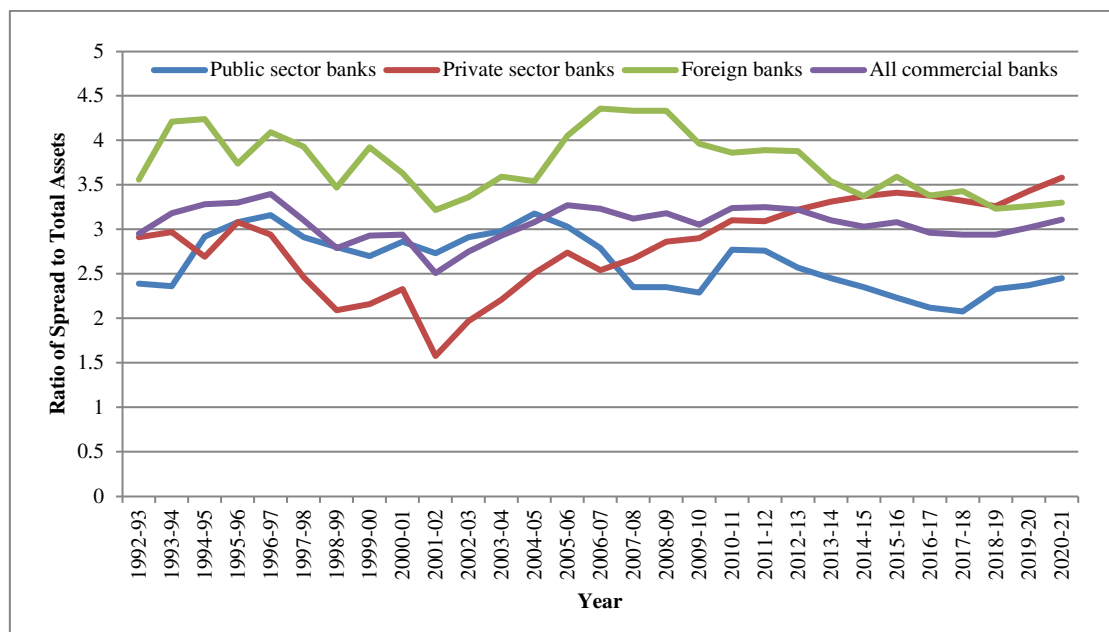




Figure 5.11 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of spread to total assets of foreign banks was higher than other groups of banks until 2017-18. After that, private sector banks dominated the other groups of banks. From 1996-97 to 2006-07, the ratio of private sector banks have found lower than the other groups of banks. After 2006-07, private sector banks showed a gradual improvement and the ratio of public sector banks decelerated and found lower than the other groups of banks.

From the table 5.28, the mean ratio of public sector banks, private sector banks and foreign banks are 2.63, 2.83 and 3.73 respectively. That is the average ratio of each groups of banks are different. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.345 with test statistic 0.984. The null hypothesis relating to the normality test is that the data is normal. As the p value is higher than 0.05, it is fail to reject the null hypothesis that the data is normal. Hence, ANOVA test is conducted to test whether there is any significant difference exists in the ratio spread to total assets of different groups of commercial banks.

**Table 5.29**

*ANOVA result of ratio of spread as percentage of total assets of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20.029	2	10.014		
Within Groups	13.761	84	0.164	61.130	0.000*
Total	33.790	86			

Source: Researcher's Estimates, \* indicates significant at 5% level

ANOVA result shows that the observed F statistic is 61.130 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of spread as percentage of total assets in respect of different groups of commercial banks. ANOVA result tells that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.30.

**Table 5.30***Result of Multiple Comparisons*

Banks		Mean Difference (I-J)	Std. Error	Sig.
Public sector banks	Private Sector banks	-.20034	0.10629	0.149
	Foreign Banks	-1.10310*	0.10629	<b>0.000*</b>
Private Sector banks	Public sector banks	.20034	0.10629	0.149
	Foreign Banks	-0.90276*	0.10629	<b>0.000*</b>
Foreign Banks	Public sector banks	1.10310*	0.10629	<b>0.000*</b>
	Private Sector banks	0.90276*	0.10629	<b>0.000*</b>

Source: Researcher's Estimates, \*the mean difference is significant at the 0.05 level.

From the table it is evident that there is statistically significant difference in the ratio of spread to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign banks. No significant difference was found in between the private sector banks and public sector banks. This means that the distribution of spread ratio of domestic banks are almost same.

### 5.2.2 Burden ratios

Burden ratios deal with the non-interest income and operating expenses of the commercial banks. Ratios based on these variables are described as follows:

1. Non-interest income to total assets
2. Operating expenses to total assets
3. Burden to total assets

#### 1. Non-interest income as percentage of total assets

Non-interest income of the banks includes commission, exchange and brokerage, net profit on sale of investment, net profit on revaluation of investment, net profit on sale of land and other assets, net profit on exchange transactions and miscellaneous income. Lower ratio indicates lower income and thus low profitability. On the other hand, higher the ratio higher will be the profitability. The ratio calculated by dividing non-interest income by the average total assets for current and previous year and multiplied by 100.

**Table 5.31**

*Ratio of Non-interest income to total assets of public sector banks, private sector banks and foreign banks during 1992-93 to 2019-20*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Growth rate	All commercial banks (%)	Growth rate
1992-93	1.20		1.21		1.21		1.21	
1993-94	1.30	8.36	1.43	18.12	2.46	103.3	1.73	43.35
1994-95	1.19	-8.27	1.61	12.69	2.41	-2.0	1.74	0.48
1995-96	1.43	20.04	1.85	15.00	2.63	9.3	1.97	13.53
1996-97	1.34	-6.54	1.77	-4.75	2.61	-1.1	1.90	-3.54
1997-98	1.39	4.01	2.18	23.51	3.09	18.5	2.22	16.68
1998-99	1.28	-8.25	1.52	-30.47	2.53	-18.1	1.78	-20.07
1999-00	1.36	6.39	1.88	23.86	2.66	5.1	1.97	10.74
2000-01	1.28	-5.64	1.38	-26.73	2.68	0.7	1.78	-9.51
2001-02	1.49	16.26	1.96	42.14	3.00	12.1	2.15	20.85
2002-03	2.18	46.25	2.53	29.06	2.64	-12.0	2.45	13.89
2003-04	1.63	-25.15	2.26	-10.54	3.13	18.4	2.34	-4.47
2004-05	1.49	-8.64	1.6	-29.18	2.67	-14.6	1.92	-17.90
2005-06	1.16	-22.15	1.62	1.25	3.04	13.9	1.94	1.04
2006-07	1.06	-8.62	1.87	15.43	2.97	-2.3	1.97	1.37
2007-08	1.2	13.21	2.02	8.02	3.32	11.8	2.18	10.85
2008-09	1.25	4.17	1.82	-9.90	3.68	10.8	2.25	3.21
2009-10	1.19	-4.80	1.87	2.75	2.26	-38.6	1.77	-21.19
2010-11	0.99	-16.81	1.64	-12.30	2.38	5.3	1.67	-5.83
2011-12	0.89	-10.10	1.62	-1.22	2.02	-15.1	1.51	-9.58
2012-13	0.87	-2.25	1.62	0.00	1.83	-9.4	1.44	-4.64
2013-14	0.87	0.00	1.67	3.09	1.95	6.6	1.50	3.94
2014-15	0.91	4.60	1.72	2.99	1.99	2.1	1.54	2.90
2015-16	0.92	1.10	1.73	0.58	1.6	-19.6	1.42	-8.01
2016-17	1.2	30.43	1.88	8.67	1.93	20.6	1.67	17.88
2017-18	1.16	-3.33	1.69	-10.11	1.55	-19.7	1.47	-12.18
2018-19	0.95	-18.10	1.48	-12.43	1.49	-3.9	1.31	-10.91
2019-20	1.13	18.95	1.75	18.24	1.43	-4.0	1.44	9.95
2020-21	1.11	-1.77	1.54	-12.00	1.42	-0.7	1.36	-5.57
<b>Average</b>	<b>1.22</b>	<b>0.83</b>	<b>1.75</b>	<b>2.35</b>	<b>2.36</b>	<b>2.76</b>	<b>1.78</b>	<b>1.33</b>
<b>SD</b>	<b>0.27</b>		<b>0.27</b>		<b>0.64</b>		<b>0.33</b>	
<b>CAGR</b>	<b>-0.27</b>		<b>0.83</b>		<b>0.56</b>		<b>0.40</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

Table 5.31 presents the ratio of the non-interest income to total assets of public sector banks, private sector banks and foreign banks for the period of 1992-93 to 2020-21. The average ratio of the public sector bank is calculated as 1.22% with the standard deviation of 0.27. The average of public sector bank is less than the private sector banks and foreign banks. The ratio of the public sector banks varies from 1.20% in 1992-93 and 1.11% in 2020-21. Krishnan (2014) measured the non-interest income of the SBI group and nationalized banks for the period of 1996 to 2011. As per this study, the average ratio of SBI group and nationalized banks are 1.38 % and 1.12% and the average ratio found in the present study lies in between these two averages. Saluja (2012) calculated the non-interest income as percentage of working fund for public sector banks for the period of 2001-10 as 1.31%, which is higher than the average ratio found in the present study. The CAGR value of public sector banks indicates that the ratio has grown at the rate of -0.27 over the study period.

The average ratio of non-interest income to total assets for private sector bank in the present study is higher than the public sector banks. The average ratio scored by private sector banks for the study period is 1.75 and the ratio ranges from the minimum of 1.21 in 1992-93 and the maximum of 2.53 in 2002-03. The mean value calculated by Saluja (2012) for private sector banks was also 1.57%. The average ratio of non-interest income as percentage of working fund found by Kanjana (2007) for private sector bank was 1.52%. The average ratio calculated for old private sector banks and new private sector banks from the period of 1996 to 2011 by Krishnan (2014) was 1.28% and 1.80% respectively. The average ratio calculated for all private sector banks lies in between these two ratio averages.

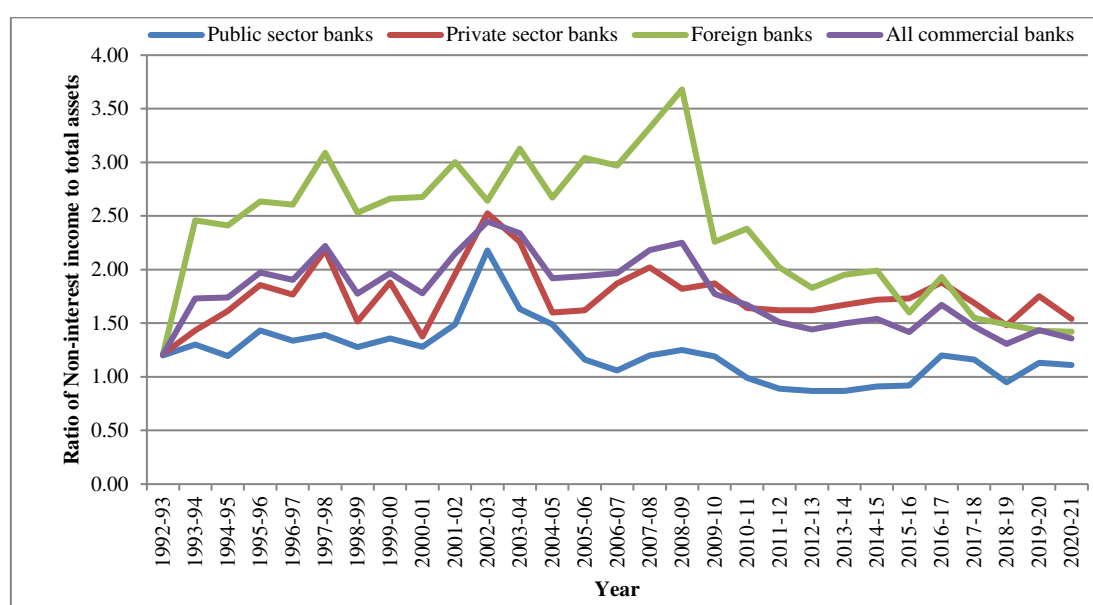
The average of non-interest income to total assets of foreign banks is 2.36%. while analysing the average of ratio of all groups of banks, it is observed that the ratio of foreign banks is higher than the public sector banks and private sector banks. This result is similar to the result of Saluja (2012) who measured the average ratio of foreign banks for the period of 2001 to 2010 was 2.74%. The maximum ratio of 3.35 scored in the year 2008-09 while the minimum ratio of 0.58 in the year 1992-93 by the foreign banks. The CAGR calculated for private sector banks is higher than the public sector banks and foreign banks. The CAGR of the foreign banks during the study period is calculated as 0.56 and where the ratio of private sector banks has

grown at the rate of 0.83%. Higher value of ratio indicates higher profitability and thus better performance. As the mean of ratio of foreign banks is higher than the domestic banks, the performance of foreign banks is better during the period of the study. Private sector bank are better in terms of growth rate than public and foreign banks. The value of standard deviation is high for foreign banks indicating high variability and low for both public and private sector banks indicating less variability as compared to foreign banks.

Figure 5.12 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of non-interest income to total assets of foreign banks was higher than other groups of banks until 2015-16. After that, the ratio of foreign banks started to fluctuates and the ratio of private sector banks improving. During the last two years, the ratio of private sector banks has dominated the other groups of banks. During the entire period of the study, the ratio of public sector banks are lower than the other groups of banks. Thus, from the figure it is more visible that as compared to private sector banks and foreign banks the performance of public sector banks in terms of ratio of non- interest income to total assets is dissatisfactory.

**Figure 5.12**

*Trends in the ratio of Non-interest income to total assets of different groups of banks in India over 1992-93 to 2020-21*



From the table 5.31, the mean ratio of public sector banks, private sector banks and foreign banks are 1.22, 1.75 and 2.36 respectively. That is the average ratio of each groups of banks are different. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.00 with test statistic 0.934. The null hypothesis relating to the normality test is that the data is normal. As the p value is less than 0.05, it rejects the null hypothesis and therefore the data is not normal. Hence, Kruskal Wallis H test is conducted to test whether there is any significant difference exists in the ratio non-interest income to total assets of different groups of commercial banks.

**Table 5.32**

*Result of Kruskal Wallis H test of ratio of non-interest income to total assets of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	18.09	29		
Private Sector banks	48.45	29	52.381	<b>0.000*</b>
Foreign banks	65.47	29		

Source: Researcher's Estimates, \* indicates significant at 5% level

Kruskal wallis H test result shows that the observed Chi square statistic is 52.381 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of spread as percentage of total assets in respect of different groups of commercial banks. This results tells that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.33

**Table 5.33**

*Result of Multiple Comparisons*

Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Public sector banks- Foreign banks	-47.379	6.632	-7.144	<b>0.000*</b>
Public sector banks- Private Sector banks	-30.362	6.632	-4.578	<b>0.000*</b>
Private Sector banks- Foreign banks	-17.017	6.632	-2.566	<b>0.031*</b>

Source: Researcher's Estimates, \* indicates significant at 5% level

From the table it is evident that there is statistically significant difference in the ratio of non- interest income to total assets for the all pairs of banks. The p value obtained in comparing public sector bank and foreign banks is 0.000. Therefore, as the p value is lower than 0.05 the null hypothesis relating to the test is rejected that there is significant difference in the ratio of public sector banks and foreign banks. Likewise, the p value obtained in comparing the pairs of public sector banks and private sector banks, private sector banks and foreign banks are less than 0.05. Hence, there is statistically significant difference in the ratio of public sector banks and private sector banks as well as private sector banks and foreign banks.

## **2. Operating expenses as percentage of total assets**

In order to improve the profitability of the banks, greater attention must be paid to control the operating expenses of the banks. Operating expenses of the banks includes payment and provisions for employees, rent, taxes and lighting, printing and stationery, advertisement and publicity, depreciation on banks property, directors fees, allowances and expenses, auditors fees and expenses, law charges, postage, telegram, telephone, repairs and maintenance, insurance and other expenditure. Ratio of operating expenses as percentage of total assets is calculated by dividing operating expenses by the average total assets for the current and previous year and it is multiplied by 100. Lower value of this ratio indicates high profitability and higher value hows low profitability.

**Table 5.34**

*Ratio of operating expenses to total assets of different groups of banks during 1992-93 to 2020-21*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Growth rate	All commercial banks (%)	Growth rate
1992-93	2.63		2.72		2.64		2.66	
1993-94	2.65	0.76	2.45	-9.93	2.64	0.00	2.58	-3.13
1994-95	2.83	6.79	2.01	-17.96	2.76	4.55	2.53	-1.81
1995-96	2.99	5.65	2.46	22.39	2.77	0.36	2.74	8.16
1996-97	2.88	-3.68	2.36	-4.07	3	8.30	2.75	0.24
1997-98	2.66	-7.64	2.14	-9.32	2.97	-1.00	2.59	-5.70
1998-99	2.66	0.00	2.07	-3.27	3.59	20.88	2.77	7.08
1999-00	2.53	-4.89	1.83	-11.59	3.22	-10.31	2.53	-8.89
2000-01	2.72	7.51	1.87	2.19	3.05	-5.28	2.55	0.79
2001-02	2.29	-15.81	1.44	-22.99	3	-1.64	2.24	-11.91
2002-03	2.25	-1.75	1.99	38.19	2.79	-7.00	2.34	4.46
2003-04	2.2	-2.22	2.02	1.51	2.75	-1.43	2.32	-0.85
2004-05	2.28	3.64	2.18	7.92	3.05	10.91	2.50	7.75
2005-06	2.18	-4.39	2.41	10.55	3.32	8.85	2.64	5.33
2006-07	1.94	-11.01	2.33	-3.32	3.27	-1.51	2.51	-4.68
2007-08	1.71	-11.86	2.4	3.00	3.24	-0.92	2.45	-2.52
2008-09	1.64	-4.09	2.21	-7.92	3.04	-6.17	2.30	-6.26
2009-10	1.61	-1.83	2.1	-4.98	2.52	-17.11	2.08	-9.58
2010-11	1.7	5.59	2.17	3.33	2.71	7.54	2.19	5.62
2011-12	1.59	-6.47	2.2	1.38	2.47	-8.86	2.09	-4.86
2012-13	1.57	-1.26	2.2	0.00	2.33	-5.67	2.03	-2.56
2013-14	1.62	3.18	2.19	-0.45	2.21	-5.15	2.01	-1.31
2014-15	1.6	-1.23	2.23	1.83	2.17	-1.81	2.00	-0.33
2015-16	1.63	1.87	2.22	-0.45	2.07	-4.61	1.97	-1.33
2016-17	1.64	0.61	2.25	1.35	2.06	-0.48	1.98	0.51
2017-18	1.66	1.22	2.19	-2.67	2.13	3.40	1.99	0.50
2018-19	1.77	6.63	2.2	0.46	1.94	-8.92	1.97	-1.17
2019-20	1.84	3.95	2.28	3.64	1.86	-4.12	1.99	1.18
2020-21	1.8	-2.17	2.13	-6.58	1.75	-5.91	1.89	-5.02
<b>Average</b>	<b>2.11</b>	<b>-1.17</b>	<b>2.18</b>	<b>-0.28</b>	<b>2.67</b>	<b>-1.18</b>	<b>2.32</b>	<b>-1.08</b>
<b>SD</b>	<b>0.48</b>		<b>0.23</b>		<b>0.49</b>		<b>0.29</b>	
<b>CAGR</b>	<b>-1.30</b>		<b>-0.84</b>		<b>-1.41</b>		<b>-1.17</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India



Table 5.34 depicts the ratio of operating expenses as percentage of total assets of public sector banks, private sector banks and foreign banks for the period of 1992-93 to 2020-21. For all the commercial banks, the average value calculated for the period of the study is 2.32%. The ratio of industry has grown at the rate of -1.17 over the entire study period. The mean of ratio for public sector banks for the study period calculated as 2.11 and the ratio fluctuated from the minimum of 1.57 in 2012-13 and maximum of 2.99 in 1995-96 and. Kanjana (2007) measured the non-expenditure as percentage to working fund of SBI group and Nationalised banks for the period of 1995-96 to 2004-05. During this period, the average ratio of SBI group was 2.51 and average ratio of nationalised banks was 2.55. The average ratio calculated by Krishnan (2014) for SBI group and nationalized banks are 2.24 percentage and 2.16 percentage respectively. The average ratio calculated in the present study is less than these two average ratios. However, the ratio calculated in the present study is higher than the average ratio calculated by Saluja (2012) during the study period of 2001 to 2010, which was 1.90%.

The ratio of operating expenses to total assets for private sector banks ranges from the minimum of 1.44 in 2001-02 and maximum of 2.72 in 1992-93. The mean calculated for the study period is 2.18 per cent. As per the findings of Kanjana (2007), the average ratio of private sector banks was 1.82% during 1995 to 2005 and Saluja (2012) got the average ratio of 1.94 per cent. Krishnan (2014) estimated the ratio for old private sector banks and new private sector banks, which are 2.03% and 1.97% respectively. The mean ratio of the present study is higher than the average ratio estimated by the above studies. The CAGR calculated for the private sector bank indicates that the ratio has grown at the rate of -0.84, which is higher than the other groups of banks. From the initial year to 2004-05, the ratio of private sector banks is lower than the public sector banks. After that ratio of public sector banks declined and private sector banks dominated the public sector banks.

The foreign banks secured the average ratio of 2.67 percentage during the period under study and it varies from 2.64% in 1992-93 and 1.75 in 2020-21. The average ratio of foreign banks is higher than both private sector banks and public

sector banks. This result is similar to the result of Saluja (2012), who calculated the ratio for the period of 2001 to 2010. Saluja (2012) got the average ratio of 2.80 for foreign banks. Higher the ratio indicates low profitability. Therefore, in the case of this ratio, the performance of foreign banks is not satisfactory. As the average ratio of public sector bank is lower than the foreign banks and private sector banks, the performance of public sector banks is better than the other bank groups. In the present study, the CAGR of all banks are found negative. However, the CAGR of the private sector bank is higher than the other groups. Similar to this result, Saluja (2012) also found the CAGR of the private sector bank was positive and higher than other groups. Standard deviation of foreign banks is higher than the other groups of banks which indicates high variability in the ratio as compared to other bank groups.

**Figure 5.13**

*Trends in the ratio of operating expenses to total assets of different groups of banks in India over 1992-93 to 2020-21*

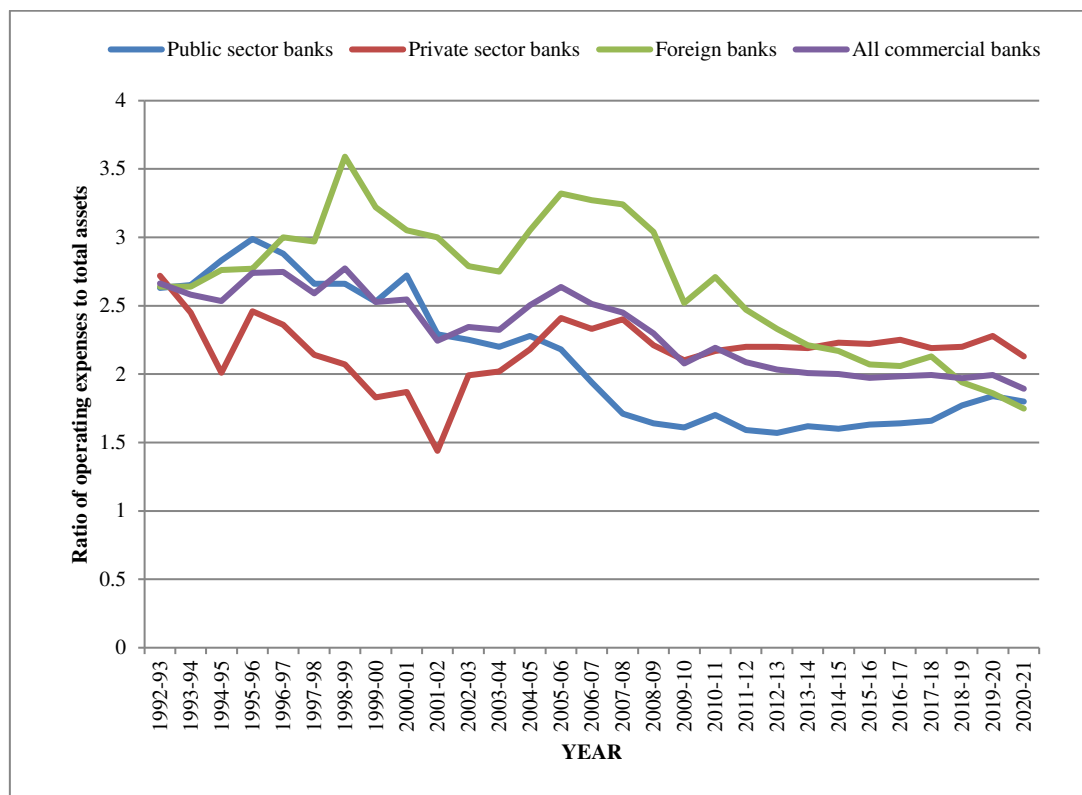


Figure 5.13 shows the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of operating expenses to total assets of foreign banks was higher than other groups of banks in majority of years. From 1996-97 to 2013-14, the ratio of foreign banks was higher than private sector banks, public sector banks and all commercial banks. After that, ratio of private sector banks increased and the ratio of foreign banks have showed a declining trend.

Table 5.34 depicts that the mean ratio of public sector banks, private sector banks and foreign banks are 2.11, 2.18 and 2.67 respectively. That is the average ratio of each groups of banks are different. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.056 with test statistic 0.972. The null hypothesis relating to the normality test is that the data is normal. As the p value is higher than 0.05, it is fail reject the null hypothesis that the data is normal. Hence, ANOVA test is conducted to test whether there is any significant difference exists in the ratio operating expenses to total assets of different groups of commercial banks.

**Table 5.35**

*ANOVA result of ratio of operating expenses to total assets of commercial banks*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.365	2	2.683		
Within Groups	14.753	84	0.173	15.274	0.000*
Total	20.119	86			

Source: Researcher's estimates, \*the mean difference is significant at the 0.05 level.

ANOVA result shows that the observed F statistic is 15.274 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of operating expenses to total assets in respect of different groups of commercial banks. ANOVA result reveals that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.36.

**Table 5.36***Result of Multiple Comparisons*

	Banks	Mean Difference (I-J)	Std. Error	Sig.
Public sector banks	Private Sector banks	-0.07517	0.11006	0.774
	Foreign Banks	-0.56034*	0.11006	<b>0.000*</b>
Private Sector banks	Public sector banks	0.07517	0.11006	0.774
	Foreign Banks	-0.48517*	0.11006	<b>0.000*</b>
Foreign Banks	Public sector banks	0.56034*	0.11006	<b>0.000*</b>
	Private Sector banks	0.48517*	0.11006	<b>0.000*</b>

Source: Researcher's Estimates, \*the mean difference is significant at the 0.05 level.

From the table it is evident that there is statistically significant difference in the ratio of operating expense to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign banks. No significant difference was found in between the private sector banks and public sector banks. It means that the distribution of operating expenses to total assets ratio of domestic bank groups are almost same.

### 3. Ratio of burden to total assets

Burden is calculated by deducting the operating expenses from the non-interest income. In other words, burden represents excess of the operating expenses over non-interest income. This ratio is calculated by dividing the amount of burden by the average of total assets for current and previous year and multiplied it by 100. If the value of the burden ratio is lower, the profitability will be higher and if the value of the ratio is higher, profitability will be lower. Hence, in order to enhance the profitability, the banks should try to minimize their burden. For reducing the burden, the banks should either reduce their operating expenses or maximize their non-interest income.

**Table 5.37**

*Ratio of burden to total assets of different groups of commercial banks during 1992-93 to 2020-21*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Growth rate	All commercial banks (%)	Growth rate
1992-93	1.47		1.68		1.03		1.39	
1993-94	1.39	-4.87	1.25	-25.60	0.46	-54.82	1.04	-25.51
1994-95	1.71	22.60	0.99	-21.04	0.28	-39.48	0.99	-4.22
1995-96	1.64	-3.86	0.85	-13.96	0.49	75.86	1.00	0.32
1996-97	1.58	-4.08	0.80	-6.21	0.53	6.36	0.97	-2.96
1997-98	1.39	-11.72	0.22	-71.88	0.03	-94.79	0.55	-43.32
1998-99	1.50	7.97	0.72	221.12	0.97	3460.02	1.07	94.54
1999-00	1.31	-12.95	0.20	-72.26	0.54	-44.69	0.68	-35.97
2000-01	1.59	21.32	0.63	214.51	0.64	18.22	0.95	39.34
2001-02	0.89	-43.79	-0.18	-128.33	0.12	-80.78	0.28	-70.66
2002-03	0.61	-31.18	-0.48	169.19	0.15	24.25	0.10	-65.66
2003-04	0.30	-50.62	-0.06	-87.73	-0.21	-236.94	0.01	-87.47
2004-05	0.77	154.55	0.57	-1062.49	0.37	-278.05	0.57	4645.39
2005-06	1.02	32.18	0.79	39.66	0.27	-27.23	0.69	21.75
2006-07	0.88	-13.73	0.46	-41.77	0.30	11.11	0.55	-21.15
2007-08	0.51	-42.05	0.39	-15.22	-0.07	-123.33	0.28	-49.39
2008-09	0.38	-25.49	0.40	2.56	-0.64	814.29	0.05	-83.13
2009-10	0.42	10.53	0.22	-45.00	0.26	-140.63	0.30	542.86
2010-11	0.72	71.43	0.53	140.91	0.34	30.77	0.53	76.67
2011-12	0.70	-2.78	0.58	9.43	0.45	32.35	0.58	8.81
2012-13	0.69	-1.43	0.58	0.00	0.50	11.11	0.59	2.31
2013-14	0.74	7.25	0.52	-10.34	0.27	-46.00	0.51	-13.56
2014-15	0.70	-5.41	0.51	-1.92	0.17	-37.04	0.46	-9.80
2015-16	0.71	1.43	0.49	-3.92	0.47	176.47	0.56	21.01
2016-17	0.44	-38.03	0.37	-24.49	0.13	-72.34	0.31	-43.71
2017-18	0.50	13.64	0.50	35.14	0.57	338.46	0.52	67.02
2018-19	0.82	64.00	0.72	44.00	0.45	-21.05	0.66	26.75
2019-20	0.71	-13.41	0.53	-26.39	0.43	-4.44	0.56	-16.08
2020-21	0.69	-2.82	0.59	11.32	0.32	-25.58	0.53	-4.19
<b>Average</b>	<b>0.92</b>	<b>3.52</b>	<b>0.53</b>	<b>-27.53</b>	<b>0.33</b>	<b>131.15</b>	<b>0.60</b>	<b>177.50</b>
<b>SD</b>	<b>0.43</b>		<b>0.41</b>		<b>0.32</b>		<b>0.33</b>	
<b>CAGR</b>	<b>-1.58</b>		<b>-3.90</b>		<b>-3.82</b>		<b>-3.25</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

Table 5.37 reveals the ratio of burden as a percentage of total assets of public sector banks, private sector banks and foreign banks during 1992-93 to 2020-21. The average ratio of public sector banks is higher than the other groups of banks. The estimated average ratio for public sector banks is 0.92 and maximum ratio of 1.64 attained in 1995-96 where as minimum ratio of 0.30 in 2003-04. Burden as percentage of working fund calculated by Kanjana (2007) for the period of 1995 to 2005 reveals the average ratio of SBI group as 0.93 and nationalized banks as 1.24. The average ratio calculated in the present study also close to the mean calculated by Kanjana (2007). Similarly Krishnan (2014) estimated the ratio for SBI group and nationalized banks and found the mean ratio of 0.86% and 1.05% respectively for 2 groups of banks. The mean ratio measured in the present study lies in between these two averages. According to the findings of Saluja (2012) the average burden ratio for public sector bank was 0.60, which is lower than the average found in the present study.

Average ratio for private sector banks calculated over the study period is 0.53, which is lower than the public sector banks and higher than the foreign banks. The highest ratio of burden to total assets recorded in the year 1992-93, which is 1.68 and the lowest ratio marked in the year 2002-03. The average ratio for private sector banks estimated by Kanjana (2007) for the 10 year ranging from 1995 to 2005 was 0.24 per cent and Saluja (2012) for the period of 2001 to 2010 was 0.36. The mean ratio calculated for private sector banks in the present study lies in between the mean ratios of old private sector banks (0.73%) and new generation banks (0.18 percentage) estimated by Krishnan (2014).

The estimated average ratio of foreign banks is only 0.33%, which is lower than both public sector banks and private sector banks. The highest ratio of 2.45 estimated in the year 1990-91 and in the next year, foreign banks recorded the lowest ratio of -0.97. During the period of 2001 to 2010, foreign banks average ratio calculated by Saluja (2012) was only 0.06%. The CAGR of the three groups of banks was negative during the study period. However, the growth rate of public sector banks have found higher followed by private sector banks and foreign banks. Among these three groups of banks, mean ratio of private sector banks is lower and hence the performance of private sector banks is better than the other groups of

banks in terms of growth of ratio of burden to total assets. By analysing the standard deviation of each group of banks, it is understood that, as the value of SD is higher for public sector banks followed by private sector banks and foreign banks the variability in the ratio of burden to total assets of public sector bank is high as compared to private sector banks and foreign banks.

Figure 5.14 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. It is clear that the ratio of burden to total assets of public sector banks was higher than other groups of banks in almost all years. In 2017-18, the ratios of public and private sector banks are almost equal. After that, ratio of public sector banks again increased and the ratio of private sector banks have decreased. Thus, from the figure it is more visible that as compared to private sector banks and foreign banks the performance of public sector banks in terms of ratio of burden to total assets is dissatisfactory. The performance of foreign banks is found satisfactory as compared to public sector banks and private sector banks.

**Figure 5.14**

*Trends in the ratio of Burden to total assets of different groups of banks in India over 1992-93 to 2020-21*

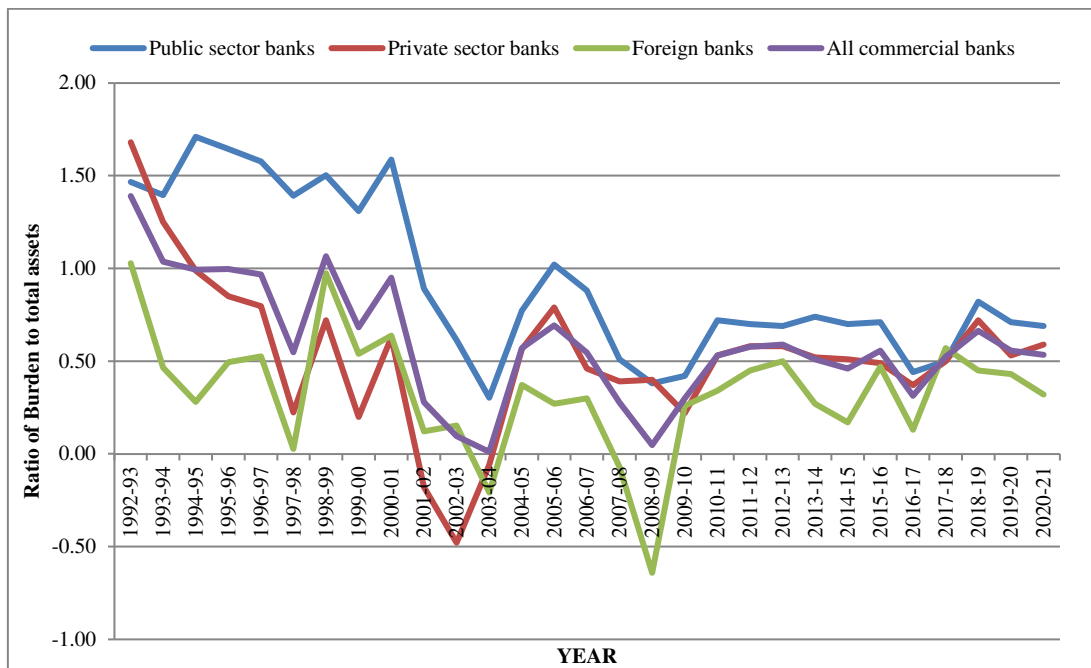


Table 5.37 depicts that the mean ratio of public sector banks, private sector banks and foreign banks are 0.92, 0.53 and 0.33 respectively. That is the average ratio of each groups of banks are different. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.002 with test statistic 0.949. The null hypothesis relating to the normality test is that the data is normal. As the p value is less than 0.05, the null hypothesis is rejected and hence the data is not normal. Hence, Kruskal Wallis H test is conducted to test whether there is any significant difference exists in the ratio burden to total assets of different groups of commercial banks.

**Table 5.38**

*Result of Kruskal Wallis H test of ratio of Burden to total assets of commercial banks*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	62.31	29		
Private Sector banks	42.57	29	28.290	<b>0.000*</b>
Foreign banks	27.12	29		

Source: Researcher's Estimates, \* indicates significant at 5% level

Kruskal wallis H test result shows that the observed Chi square statistic is 28.290 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of burden to total assets in respect of different groups of commercial banks. This results shows that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.39.



**Table 5.39**

*Result of Multiple Comparisons*

Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Public sector banks- Foreign banks	35.190	6.632	5.306	<b>0.000*</b>
Public sector banks- Private Sector banks	19.741	6.632	2.976	<b>0.009*</b>
Private Sector banks- Foreign banks	15.448	6.632	-2.566	<b>0.031*</b>

Source: Researcher's Estimates, \* indicates significant at 5% level

From the table 5.39 it is observed that there is statistically significant difference in the ratio of burden to total assets for the all pairs of banks. The p value obtained in comparing public sector bank and foreign banks is 0.000. As the p value is lower than 0.05 the null hypothesis is rejected that there is significant difference in the ratio of public sector banks and foreign banks. Likewise, the p value obtained in comparing the pairs of public sector banks and private sector banks, private sector banks and foreign banks are less than 0.05. Hence, there is statistically significant difference in the ratio of public sector banks and private sector banks as well as private sector banks and foreign banks.

### 5.2.3. Profitability ratios

#### 1. Ratio of net profit to total assets

One of the important ratios, which measure the profitability of the banks, is net profit as percentage of total assets. This ratio is otherwise known as Return on assets. It is an important indicator of profitability of a company. Return on asset for a bank group is obtained as weighted average of return on assets of individual banks in the group and the weights being the proportion of total assets of the bank as percentage to total assets of all banks in the corresponding bank group. If the ratio is high, the profitability of the banks will be higher and if the ratio is low profitability will be low.

**Table 5.40**

*Ratio of net profit to total assets of different groups of banks during 1992-93 to 2020-21*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Growth rate	All commercial banks (%)	Growth rate
1992-93	-0.28		0.12		-1.05		-0.40	
1993-94	-1.15	310.7	0.65	441.67	1.72	-263.81	0.41	-200.83
1994-95	0.25	-121.7	1.17	80.00	1.84	6.98	1.09	167.21
1995-96	-0.07	-128.0	1.21	3.42	1.58	-14.13	0.91	-16.56
1996-97	0.57	-914.3	1.13	-6.61	1.19	-24.68	0.96	6.25
1997-98	0.77	35.1	1.04	-7.96	0.97	-18.49	0.93	-3.81
1998-99	0.42	-45.5	0.68	-34.62	0.69	-28.87	0.60	-35.61
1999-00	0.57	35.7	0.88	29.41	1.17	69.57	0.87	46.37
2000-01	0.42	-26.3	0.71	-19.32	0.93	-20.51	0.69	-21.37
2001-02	0.72	71.4	0.66	-7.04	1.33	43.01	0.90	31.55
2002-03	0.96	33.3	1	51.52	1.56	17.29	1.17	29.89
2003-04	1.12	16.7	0.95	-5.00	1.64	5.13	1.24	5.40
2004-05	0.95	-15.2	1.06	11.58	1.61	-1.83	1.21	-2.43
2005-06	0.88	-7.4	1.07	0.94	2.08	29.19	1.34	11.33
2006-07	0.92	4.5	1.02	-4.67	2.28	9.62	1.41	4.71
2007-08	1	8.7	1.13	10.78	2.09	-8.33	1.41	0.00
2008-09	1.03	3.0	1.13	0.00	1.99	-4.78	1.38	-1.66
2009-10	0.97	-5.8	1.28	13.27	1.26	-36.68	1.17	-15.42
2010-11	0.96	-1.0	1.43	11.72	1.75	38.89	1.38	17.95
2011-12	0.88	-8.3	1.53	6.99	1.76	0.57	1.39	0.72
2012-13	0.8	-9.1	1.63	6.54	1.92	9.09	1.45	4.32
2013-14	0.5	-37.5	1.65	1.23	1.54	-19.79	1.23	-15.17
2014-15	0.46	-8.0	1.68	1.82	1.84	19.48	1.33	7.86
2015-16	-0.07	-115.2	1.5	-10.71	1.45	-21.20	0.96	-27.64
2016-17	-0.1	42.9	1.3	-13.33	1.61	11.03	0.94	-2.43
2017-18	-0.84	740.0	1.14	-12.31	1.34	-16.77	0.55	-41.64
2018-19	-0.65	-22.6	0.63	-44.74	1.56	16.42	0.51	-6.10
2019-20	-0.23	-64.6	0.51	-19.05	1.55	-0.64	0.61	18.83
2020-21	0.28	-221.7	1.17	129.41	1.56	0.65	1.00	64.48
<b>Average</b>	<b>0.42</b>	<b>-16.08</b>	<b>1.07</b>	<b>21.96</b>	<b>1.47</b>	<b>-7.27</b>	<b>0.99</b>	<b>0.94</b>
<b>SD</b>	<b>0.61</b>		<b>0.37</b>		<b>0.41</b>		<b>0.61</b>	
<b>CAGR</b>	<b>-200</b>		<b>8.17</b>		<b>-201.37</b>		<b>-203.19</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

Table 5.40 shows the ratio of net profit to total assets for public sector banks, private sector banks and foreign banks for the period of 1992-93 to 2020-21. The average ratio of all commercial banks is 0.99 per cent with the standard deviation of 0.61. The ratio of industry has grown negatively at the rate of -203.19%. The average ratio of foreign banks is higher than the public sector banks and private sector banks. This result is similar to the finding of Saluja (2012), who evaluated the ratio of return on assets over the period of 2001-02 to 2009-10. The highest yearly ratio of 1.86 percentage was attained by the foreign banks in the year 2012-13 and lowest ratio of -3.75 percentage was estimated in the year 1992-93. The ratio of foreign banks has grown negatively during the study period at the rate of -201.37%.

Public sector banks have registered an average ratio of 0.34 over the study period, which is lower than the foreign banks and private sector banks. This average is also lower than the average ratio found Krishnan (2014) for SBI bank group as 0.78 percentage and nationalized bank as 0.71 percentage for a period of 1996 to 2011. The highest ratio of 1.12 is attained by the public sector banks in the year 2003-04 while the lowest yearly ratio estimated in the year 1993-9, which is -1.15. Public sector banks continuously making net loss for last 5 years i.e from 2015-16 to 2019-20 due to deterioration in the asset quality but the loss is decreasing during the last 3 years. The ratio of public sector banks has grown negatively at the rate of -200 over the entire study period. The standard deviation of ratio of public sector bank is higher than the other groups of banks, which indicates higher variability.

The average of the private sector banks is 1.07, which is lower than the average of foreign banks but far higher than the public sector banks. The maximum yearly ratio of the private sector bank is 1.68 in 2014-15 and the minimum ratio is 0.12 in the year 1992-93. Krishnan (2014) estimated the average ratio for old private sector banks and new private sector banks for a period of 1996 to 2011, which was 0.78 percentage and 1.11 percentage respectively. The average ratio found in the present study lies in between these two average found by Krishnan (2014). The CAGR calculated for the private sector banks is 8.17, which is higher than the CAGR calculated for public sector banks and foreign banks in this study. While

comparing the standard deviation of different groups of banks, it is observed that the standard deviation is lower for private sector banks, which means homogeneity or low variability in the ratio. As the average of foreign banks is higher than the other groups of banks the performance of foreign banks is better in terms of this ratio followed private sector banks and public sector banks.

Figure 5.15 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of net profit to total assets of foreign banks was higher than other groups of banks in almost all years. The graph shows wide fluctuation in the ratio of all groups of banks. The ratio of public sector banks is lower than the other groups of banks including all commercial banks except few years. The ratio of Public sector banks also becomes negative in some years. Thus, from the figure it is more visible that as compared to private sector banks and foreign banks the performance of public sector banks in terms of ratio of net profit to total assets is dissatisfactory.

**Figure 5.15**

*Trends in the ratio of net profit to total assets of different groups of banks in India over 1992-93 to 2020-21*

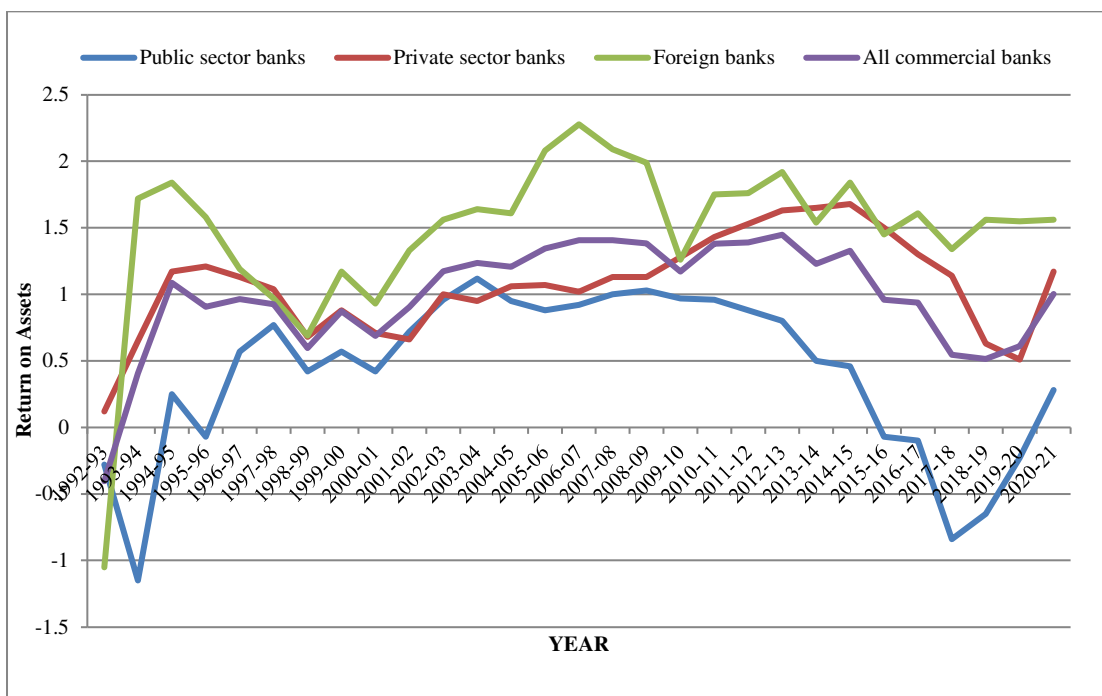


Table 5.40 presented that the mean ratio of public sector banks, private sector banks and foreign banks are 0.42, 1.07 and 1.47 respectively. That is the average ratio of each groups of banks are different. In order to see whether this difference is statistically significant, appropriate parametric and non-parametric test can apply based on normality. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.001with test statistic 0.944. The null hypothesis relating to the normality test is that the data is normal. As the p value is less than 0.05, it is reject the null hypothesis that the data is not normal. Hence, Kruskal Wallis H test is conducted to test whether there is any significant difference exists in the ratio net profit to total assets of different groups of commercial banks.

**Table 5.41**

*Result of Kruskal Wallis H test of ratio of return on assets of commercial banks in India*

Banks	Mean Rank	N	Chi Square	Sig.
Public Sector Banks	21.05	29		
Private Sector banks	45.34	29	45.244	<b>0.000*</b>
Foreign banks	65.60	29		

Source: Researcher's Estimates, \* indicates significant at 5% level

Kruskal wallis H test result shows that the observed Chi square statistic is 45.244 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of net profit to total assets in respect of different groups of commercial banks. This results revealed that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.42

**Table 5.42***Result of Multiple Comparisons*

<b>Pairs of Banks</b>	<b>Test Statistics</b>	<b>Standard Error</b>	<b>Standard test statistics</b>	<b>Adj. Sig</b>
Public sector banks- Foreign banks	-44.552	6.632	-6.717	<b>0.000*</b>
Public sector banks- Private Sector banks	-24.293	6.632	-3.663	<b>0.001*</b>
Private Sector banks- Foreign banks	-20.259	6.632	-3.054	<b>0.007*</b>

Source: Researcher's Estimates, \* indicates significant at 5% level

From the table 5.42 it is observed that there is statistically significant difference in the ratio of net profit to total assets for the all pairs of banks. The p value obtained in comparing public sector bank and foreign banks is 0.000. As the p value is lower than 0.05 the null hypothesis relating to the test is rejected that there is significant difference in the ratio of public sector banks and foreign banks. Likewise, the p value obtained in comparing the pairs of public sector banks and private sector banks, private sector banks and foreign banks are less than 0.05. Hence, there is statistically significant difference in the ratio of public sector banks and private sector banks as well as private sector banks and foreign banks.

## **2. Ratio of operating profit as a percentage of total assets**

This ratio is calculated by dividing operating profit by the average of total assets for the current and previous year and it is multiplied by 100. Operating profit is obtained by deducting total expenses from total income of the banks. Total income includes interest income and other income where as total expenses comprises interest expenses and operating expenses. If the ratio is higher it indicates better profitability and if the value of the ratio is lower the profitability will be low.

**Table 5.43**

*Ratio of operating profit to total assets of different groups of banks during 1992-93 to 2020-21*

Year	Public sector banks (%)	Growth rate	Private sector banks (%)	Growth rate	Foreign banks (%)	Growth rate	All commercial banks (%)	Growth rate
1992-93	0.95		1.44		2.06		1.48	
1993-94	1.01	6.11	1.99	38.08	4.17	102.11	2.39	60.92
1994-95	1.29	27.99	2.48	24.41	3.71	-10.95	2.49	4.34
1995-96	1.54	19.17	4.99	101.42	3.73	0.31	3.42	37.02
1996-97	1.62	5.16	2.37	-52.37	3.71	-0.49	2.57	-24.88
1997-98	1.65	2.26	2.53	6.53	4.11	10.75	2.76	7.67
1998-99	1.44	-13.07	1.54	-39.01	2.64	-35.79	1.87	-32.24
1999-00	1.55	7.87	2.20	42.37	3.40	29.10	2.38	27.31
2000-01	1.41	-8.93	1.87	-14.96	3.31	-2.79	2.20	-7.86
2001-02	1.95	38.36	-5.46	-392.51	3.23	-2.23	-0.09	-104.17
2002-03	2.39	22.46	2.50	-145.68	3.21	-0.82	2.70	-3043.94
2003-04	2.81	17.57	2.44	-2.37	3.88	20.84	3.04	12.72
2004-05	2.39	-15.04	1.93	-20.81	3.16	-18.49	2.49	-18.05
2005-06	2	-16.32	1.95	1.04	3.77	19.30	2.57	3.21
2006-07	1.91	-4.50	2.08	6.67	4.06	7.69	2.68	4.27
2007-08	1.84	-3.66	2.28	9.62	4.4	8.37	2.84	5.84
2008-09	1.96	6.52	2.46	7.89	4.97	12.95	3.13	10.21
2009-10	1.87	-4.59	2.68	8.94	3.7	-25.55	2.75	-12.14
2010-11	2.05	9.63	2.58	-3.73	3.52	-4.86	2.72	-1.21
2011-12	2.05	0.00	2.51	-2.71	3.44	-2.27	2.67	-1.84
2012-13	1.87	-8.78	2.64	5.18	3.33	-3.20	2.61	-2.00
2013-14	1.71	-8.56	2.79	5.68	3.28	-1.50	2.59	-0.77
2014-15	1.7	-0.58	2.86	2.51	3.36	2.44	2.64	1.80
2015-16	1.51	-11.18	2.92	2.10	3.13	-6.85	2.52	-4.55
2016-17	1.68	11.26	3.02	3.42	3.25	3.83	2.65	5.16
2017-18	1.57	-6.55	2.82	-6.62	2.86	-12.00	2.42	-8.81
2018-19	1.51	-3.82	2.54	-9.93	2.78	-2.80	2.28	-5.79
2019-20	1.66	9.93	2.9	14.17	2.83	1.80	2.46	8.20
2020-21	1.75	5.42	2.99	3.10	2.98	5.30	2.57	4.47
<b>Average</b>	<b>1.75</b>	<b>3.00</b>	<b>2.24</b>	<b>-14.56</b>	<b>3.45</b>	<b>3.37</b>	<b>2.48</b>	<b>-109.82</b>
<b>SD</b>	<b>0.39</b>		<b>1.61</b>		<b>0.58</b>		<b>0.61</b>	
<b>CAGR</b>	<b>2.13</b>		<b>2.55</b>		<b>1.28</b>		<b>1.91</b>	

Source: Statistical Tables Relating to Banks in India and Report on Trends and Progress of Banking in India

Table 5.43 reveals the ratio of operating profit to total assets of the public sector banks, private sector banks and foreign banks for the period of 1992-93 to 2020-21. The mean value of the ratio of private sector bank is 2.24 percentage. This is higher than the mean ratio of the public sector banks and lower than the foreign banks. The maximum ratio secured by the private sector banks is 4.99 percentage, which is calculated in the year 1995-96 and the minimum ratio is -5.46 percentage recorded in 2001-02. The average ratio calculated in the present study is also higher than the mean ratio calculated by Krishnan (2014) for old private sector banks (1.88%) and new private sector banks (2.18 %) for the period 1996 to 2011.

The average ratio of the public sector banks is 1.75 percentage, which is lower than both private sector banks and foreign banks. The minimum ratio obtained by public sector banks is 0.95 percentage in 1992-93 and maximum is 2.81percentage in 2003-04. Krishnan (2014) measured the ratio of operating profit as a percentage of total assets for SBI group and nationalized banks for the period of 1996 to 2011 and found the mean of 1.95% and 1.71% respectively for SBI group and Nationalised banks. The mean value obtained in the present study lies in between these two averages.

Foreign banks secured the average ratio of 3.22 percentage during the period of the study. The average ratio of the foreign banks is 3.45, which is higher than the private sector banks and public sector banks. Ratio of foreign banks fluctuated from 2.06 per cent in 1992-93 to 2.98% in 2020-21. As the average ratio of foreign banks is higher, the performance of foreign banks is better than other group of banks. However, the CAGR of the private sector bank is higher than other banks followed by public sector banks and foreign banks. The calculated Standard deviation is higher for private sector banks, which indicates greater variability in the ratio of operating profit to total assets and it is lower for public sector banks indicating less variability in the ratio.



Figure 5.16 presents the ratio of different groups of banks over the period of 1992-93 to 2020-21. From the figure, it is clear that the ratio of operating profit to total assets of foreign banks was higher than other groups of banks in majority of years. The ratio of public sector banks is lower than the other groups of banks including all commercial banks except few years. The ratio of private sector banks declined sharply in 2001-02. From 2006-07 to 2020-21, the ratio of operating profit to total assets of public sector banks are lower than the other groups of banks. Thus, from the figure it is observed, that as compared to private sector banks and foreign banks the performance of public sector banks in terms of ratio of operating profit to total assets is dissatisfactory.

**Figure 5.16**

*Trends in the ratio of operating profit to total assets of different groups of banks in India over 1992-93 to 2020-21*

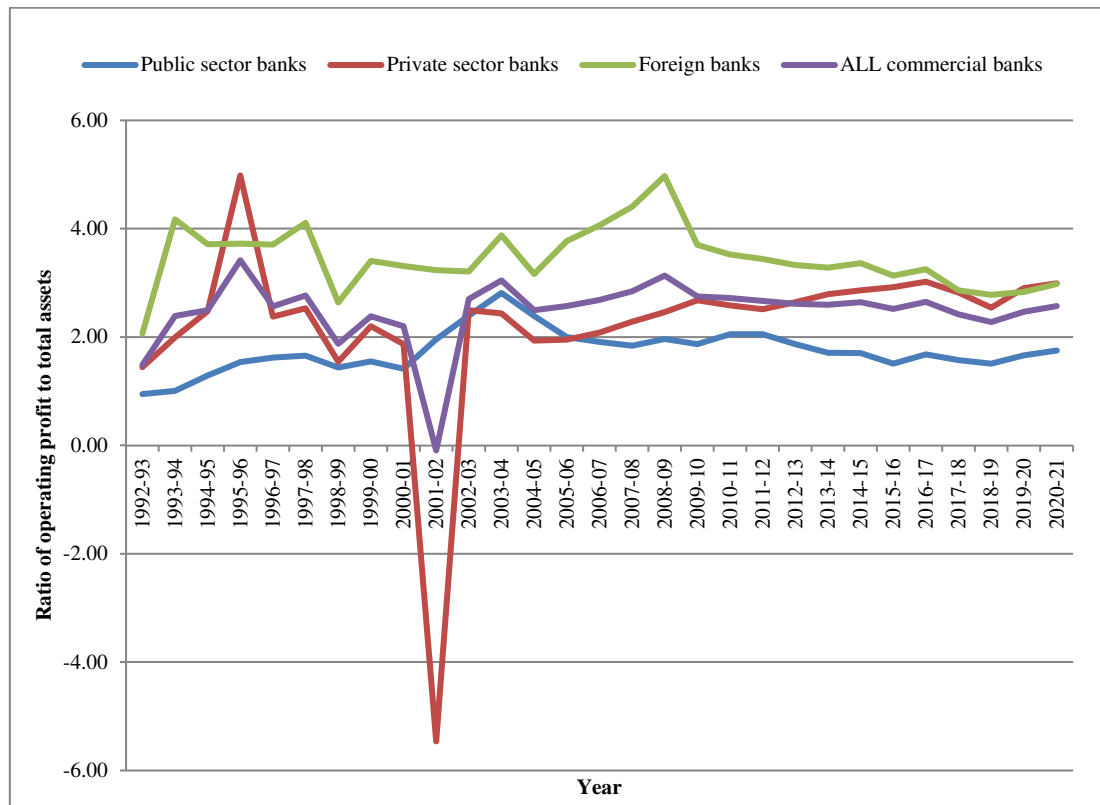


Table 5.43 presented that the mean ratio of public sector banks, private sector banks and foreign banks are 1.75, 2.24 and 3.45 respectively. That is the average ratio of each groups of banks are different. Normality of the data was checked by conducting Shapiro wilk test. The p value obtained from Shapiro wilk test is 0.000 with test statistic 0.774. The null hypothesis relating to the normality test is that the data is normal. As the p value is less than 0.05, it is reject the null hypothesis that the data is not normal. Hence, Kruskal Wallis H test is conducted to test whether there is any significant difference exists in the ratio of operating profit to total assets of different groups of commercial banks.

**Table 5.44**

*Result of Kruskal Wallis H test of ratio of operating profit to total assets of commercial banks in India*

<b>Banks</b>	<b>Mean Rank</b>	<b>N</b>	<b>Chi Square</b>	<b>Sig.</b>
Public Sector Banks	19.64	29		
Private Sector banks	42.19	29	58.270	<b>0.000*</b>
Foreign banks	70.17	29		

Source: Researcher's Estimates, \* indicates significant at 5% level

Kruskal wallis H test result shows that the observed Chi square statistic is 58.270 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of operating profit to total assets in respect of different groups of commercial banks. This results tell that at least one pair of banks are significantly different. In order to see which pair banks are significantly different, multiple comparison tests have conducted. The result is presented in the table 5.45

**Table 5.45**

*Result of Multiple Comparisons*

<b>Pairs of Banks</b>	<b>Test Statistics</b>	<b>Standard Error</b>	<b>Standard test statistics</b>	<b>Adj. Sig</b>
Public sector banks- Foreign banks	-50.534	6.633	-7.619	<b>0.000*</b>
Public sector banks- Private Sector banks	-22.552	6.633	-3.400	<b>0.002*</b>
Private Sector banks- Foreign banks	-27.983	6.633	-4.219	<b>0.000*</b>

Source: Researcher's Estimates, \* indicates significant at 5% level

From the table 5.45 it is observed that there is statistically significant difference in the ratio of operating profit to total assets for the all pairs of banks. The p value obtained in comparing public sector bank and foreign banks is 0.000. As the p value is lower than 0.05 the null hypothesis relating to the test is rejected that there is significant difference in the ratio of public sector banks and foreign banks. Likewise, the p value obtained in comparing the pairs of public sector banks and private sector banks, private sector banks and foreign banks are less than 0.05. Hence, there is statistically significant difference in the ratio of public sector banks and private sector banks as well as private sector banks and foreign banks.

### 5.3 Conclusion

Growth, profitability, efficiency and productivity are the indicators that evaluate the performance of commercial banks. The present chapter dealt with the growth and profitability of commercial banks in India over the study period of 1992-93 to 2020-21. The commercial banks in India have been categorized into 3 such as private sector banks, public sector bank and foreign banks. Annual growth rate, mean and compound annual growth rates have been used to evaluate the growth of the commercial banks. The growth of the banks was measured in terms of assets,

liabilities, income and expenses. The major assets selected are advances and investment. From the analysis of advances and investment, it is observed that the compound annual growth rates of the private sector banks are higher than other banks. Share of each groups of banks to the aggregate of all three of banks are measured. From the analysis it was understood that, almost 70 percentage of total advances and investment of all commercial banks are still in the hands of public sector banks and the least share of assets are owned by the foreign banks. However, an interesting finding relating to the share of assets is that, even though the share of private sector banks is less than the public sector banks, its share is increasing over the years and if the trend follows, private sector banks will dominate the Indian banking industry in the future. Deposits and borrowings are the important liabilities analysed in the present study. The result of the study is similar with the results obtained from the analysis of assets. Interest income and non- interest income are the different components of total income of the banks. In the case of interest income and non-interest income, the CAGR of the private sector banks is higher than other groups of banks and CAGR of the public sector banks are lower than both private sector banks and foreign banks. The trend of share of each group of banks is similar to the trend of different assets and liabilities found in the present study. Expenses of the commercial banks include interest expenses and operating expenses. The analysis of these expenses reveals that the growth rate of private sector banks is higher than the public sector banks and foreign banks and the major share of expenses is still from the part of the public sector banks but its share is decreasing and the share of private sector banks is increasing. In addition to the above analysis, the ANOVA/ Kruskal wallis H tests was conducted to check whether there is any significant difference in the annual growth rate of each variable for each groups of banks under study. The hypotheses tests result show that there is significant difference in the growth rate of advances, investment, deposits, interest income, interest expenses and operating expenses of different groups of commercial banks.

No significant difference was found in the growth rate of non-interest income of different groups of banks under study.

The profitability of the commercial banks was estimated in terms of spread ratios, burden ratios and profitability ratios. The spread ratios include interest income to total assets, interest expenses to total assets and spread to total assets. Regarding the ratio of interest income to total assets and the ratio of interest expenses to total assets, the mean value of the private sector banks found higher than public sector banks foreign banks. ANOVA/ Kruskal-wallis H test result shows that no significant difference was found in the ratio of interest income to total assets of different groups of banks and significant difference was found in the ratio of interest expenses to total assets of different groups of banks. In the case of spread to total assets, the performance of foreign banks found better than other banks and significant difference was found in the ratio among different groups of banks under study. The burden ratios include non-interest income to total assets, operating expenses to total assets and burden to total assets. Except the ratio of burden as percentage of total assets, mean value of foreign banks are higher than both private sector banks and public sector banks and the mean ratio of public sector banks are lower. However, in the case of burden to total assets, the average ratio of public sector banks found higher followed by private sector banks and foreign banks. The profitability ratios include net profit to total assets and operating profit to total assets. In all the profitability ratios, the mean ratio of foreign banks is higher and thus the performance of foreign banks found better than other bank groups. The average ratio of public sector banks is lower than the private sector banks are foreign banks and hence, the performance of the public sector banks is not satisfactory. ANOVA/Kruskal-wallis H test result shows that in all the cases except the ratio of interest income to total assets, statistically significant difference was found in the ratios of public sector banks, private sector banks and foreign banks.

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## CHAPTER VI

# EFFICIENCY AND PRODUCTIVITY OF COMMERCIAL BANKS IN INDIA

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Banks play a pivotal role in the nation's overall financial system since they are responsible for carrying out the primary duties of financial intermediation. These duties include the transformation of risks, the maintenance of liquid assets, and the management of maturities. Banks serve as a connecting medium between individuals who save money and those who invest that money because finance is the driving force behind all economic activity. Consequently, the productivity and efficiency of banks have a significant influence on the productivity and efficiency of all economic activity. Therefore, the effectiveness and productivity of commercial banks are of major significance to policymakers and economic analysts (Chakrabarty, 2013). This chapter discusses the efficiency and productivity of commercial banks in India. For determining the efficiency of banks, data envelopment analysis is employed. Data envelopment analysis is a method of non-parametric linear programming for evaluating the efficiency of data. DEA is the most used tool for determining the efficiency of commercial banks. In accordance with the intermediation method, the study utilised loanable funds, physical capital, and labour as inputs, and advances and investments as outputs. For purposes of study, commercial banks are divided into three categories: public sector banks, private sector banks, and foreign banks. To establish a comprehensive sample, the study included all commercial banks operating throughout the study period, including public sector, private sector, and foreign banks. Due to a lack of data and mergers among commercial banks, the effective sample size of banks changes from year to year. Thus, 2,560 sample banks are employed in total. The mean, standard deviation, and minimum and maximum values are used for the purpose of evaluating the effectiveness of commercial banks.



The Malmquist productivity index has been employed for the purpose of determining the total factor productivity change. For this purpose, 34 commercial banks that have been operational throughout the study period have been selected. The index scores of several groupings of commercial banks were evaluated using the geometric mean. Following the application of the Shapiro–Wilk test of assessing normality, the Kruskal–Wallis H test was carried out in order to examine the significance of differences in levels of efficiency and productivity between various groups of commercial banks. The data for the study were primarily gathered from the RBI's yearly publication, *Statistical Tables Relating to Banks in India*. The data were collected from 1992–1993 to 2020–21, a span of 29 years. Throughout the time, the inflation rate (as measured by the Gross Domestic Product implicit deflator) fluctuated significantly, ranging from 28.4 in 1992 to 146.06 in 2020. In accordance with Gulati (2011), Megha (2015), Jayachitra (2015), and Das & Kumbhakar (2010), the study used the inflation-adjusted real values of all inputs and outputs (with the exception of labour). The study employed the implicit gross domestic product deflator with 2011–12 as the base year to transform monetary value variables into their equivalent real values. This chapter is broken up into the following four sections:

1. Analysis of Revenue Efficiency
2. Analysis of Cost Efficiency
3. Analysis of Profit Efficiency
4. Analysis of Total Factor Productivity

### **6.1 Analysis of Revenue Efficiency**

Revenue efficiency estimates the relative performance of the banks in terms of revenue against the best-practise banks. As stated in the methodology chapter, the computation of revenue efficiency requires data relating to inputs, outputs, and price data for outputs. As stated in the previous chapter, revenue efficiency is the product of allocative efficiency (output-oriented) and technical efficiency (output-oriented). Thus, the revenue inefficiency may be either because the firm is not producing the maximum possible output (technical inefficiency) or because the firm is not

producing the output in the right proportions in order to maximise the revenue given the output prices (allocative inefficiency) (Sanchez et al., 2002). Technical efficiency is the product of pure technical efficiency and scale efficiency. The following part discusses the revenue efficiency (RE), allocative efficiency (AE), technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) of all commercial banks, public sector banks, private sector banks, and foreign banks over the period of 1992–1993 to 2020–2021.

### **6.1.1 Revenue efficiency of all commercial banks in India**

The revenue efficiency of all scheduled commercial banks that are operating in India is outlined in Table 6.1. Public sector banks, private sector banks, and foreign banks are among the scheduled commercial banks. The individual revenue score of each bank is calculated first in each year and then the average of these scores is calculated to arrive at the annual efficiency score and its components.

**Table 6.1**

*Revenue efficiency of all commercial banks in India*

<b>Year</b>	<b>No.of Banks</b>	<b>RE</b>	<b>AE</b>	<b>TE</b>	<b>PTE</b>	<b>SE</b>
1992-93	70	0.742	0.850	0.873	0.916	0.956
1993-94	74	0.572	0.787	0.725	0.867	0.838
1994-95	72	0.598	0.793	0.756	0.902	0.841
1995-96	86	0.619	0.812	0.765	0.893	0.854
1996-97	92	0.452	0.727	0.620	0.831	0.749
1997-98	95	0.615	0.783	0.778	0.919	0.843
1998-99	96	0.629	0.829	0.752	0.922	0.814
1999-2000	98	0.615	0.903	0.684	0.882	0.779
2000-01	98	0.533	0.805	0.662	0.909	0.728
2001-02	93	0.523	0.840	0.616	0.865	0.707
2002-03	85	0.586	0.926	0.630	0.884	0.716
2003-04	86	0.675	0.929	0.726	0.888	0.816
2004-05	91	0.651	0.938	0.696	0.895	0.778
2005-06	85	0.516	0.899	0.569	0.848	0.680

Year	No.of Banks	RE	AE	TE	PTE	SE
2006-07	82	0.633	0.912	0.688	0.885	0.787
2007-08	78	0.711	0.961	0.738	0.893	0.832
2008-09	77	0.590	0.884	0.670	0.914	0.738
2009-10	80	0.554	0.931	0.597	0.899	0.679
2010-11	79	0.539	0.945	0.568	0.869	0.675
2011-12	81	0.505	0.919	0.550	0.895	0.633
2012-13	84	0.584	0.935	0.626	0.893	0.715
2013-14	89	0.624	0.902	0.699	0.923	0.760
2014-15	89	0.507	0.883	0.572	0.895	0.653
2015-16	90	0.594	0.935	0.638	0.911	0.703
2016-17	89	0.394	0.930	0.430	0.838	0.530
2017-18	84	0.514	0.896	0.585	0.900	0.656
2018-19	84	0.532	0.905	0.585	0.856	0.691
2019-20	81	0.598	0.887	0.678	0.906	0.747
2020-21	74	0.482	0.739	0.645	0.929	0.690
<b>Mean</b>	85	<b>0.575</b>	<b>0.875</b>	<b>0.659</b>	<b>0.891</b>	<b>0.744</b>
<b>Standard deviation</b>		<b>0.075</b>	<b>0.065</b>	<b>0.088</b>	<b>0.025</b>	<b>0.086</b>
<b>Maximum</b>		<b>0.742</b>	<b>0.961</b>	<b>0.873</b>	<b>0.929</b>	<b>0.956</b>
<b>Minimum</b>		<b>0.394</b>	<b>0.727</b>	<b>0.430</b>	<b>0.831</b>	<b>0.530</b>

Source: Researcher's estimates based on Statistical Tables Relating to Banks in India, various issues

According to Table 6.1, the average revenue efficiency of all commercial banks in India from 1992–1993 to 2020–21 is 0.575 (the inefficiency is 0.425). Throughout the period of the study, the revenue efficiency score ranges from its lowest score of 0.394 in 2016–17 to its highest score of 0.742 in the year 1993–94. The Reserve Bank of India (RBI) reported in 1992–1993 that during the year 1992–1993 a number of developments took place in the banking industry, each of which had a substantial impact on the growth and efficiency of the banking system. This may be the reason for the highest efficiency score obtained in 1992–93. Throughout the research period, a pattern of inconsistency was observed regarding the revenue efficiency and its components of commercial banks in India. During the course of the research, all commercial banks in India scored an allocative efficiency that, on

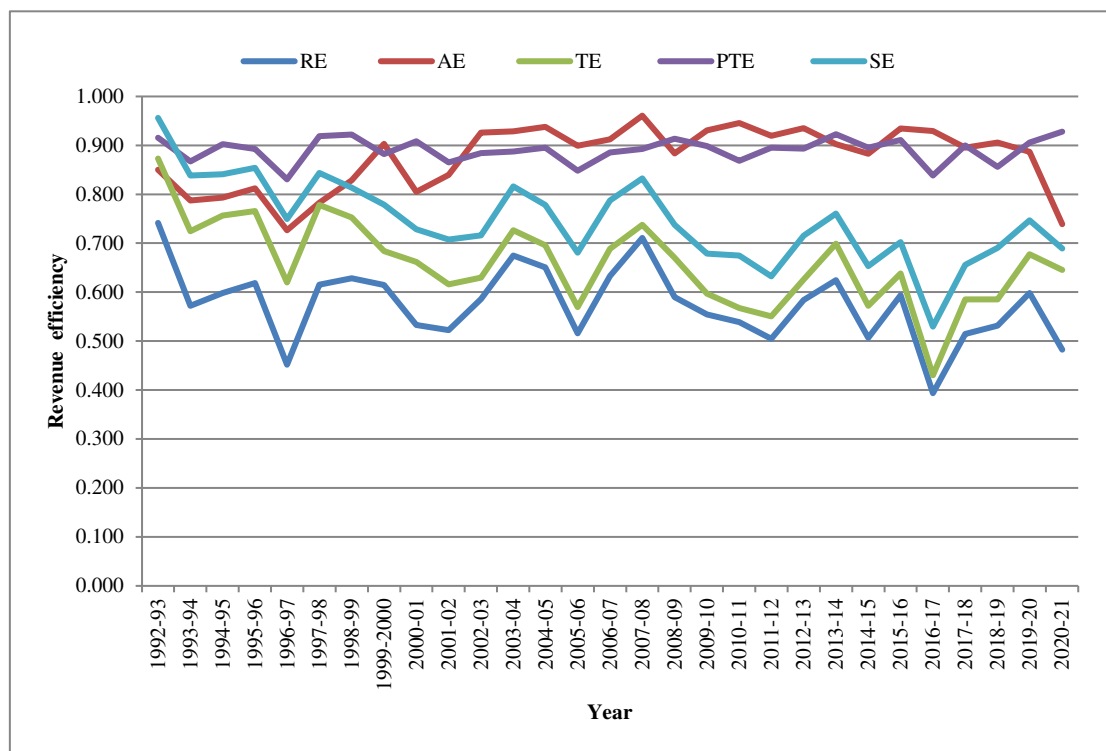
average, was 0.875 (inefficiency: 0.125). The highest score of 0.961 for allocative efficiency was achieved in 2007-08, while the lowest score of 0.727 was achieved in 1996-97. In the same manner, the average level of technical efficiency is assessed to be 0.659 (the level of inefficiency is 0.341), while the highest level of technical efficiency ever recorded was 0.873 in the year 1992-1993. The lowest score of technical efficiency during the study period is found to be 0.430 in the year 2016–2017, with a standard deviation of 0.088. The concept of technical efficiency can be broken down into two categories: scale efficiency and pure technical efficiency. During the period, the average level of pure technical efficiency of the banks was 0.891 (the level of inefficiency was 0.109), and the standard deviation was 0.025. The highest estimated score of pure technical efficiency is 0.929 in 2020-21, while the minimum level of pure technical efficiency was calculated to be 0.831 in 1996–97. In terms of the scale efficiency, the estimated average is 0.744 (the value for inefficiency is 0.256), while the standard deviation is 0.086. The lowest score of scale efficiency was calculated to be 0.530 in 2016–17, while the highest value of scale efficiency was calculated to be 0.956 in 1992–93.

The above results show that, except for the year 1992–1993, the technical inefficiency is higher than the allocative inefficiency. Therefore, it is very clear that the primary source of revenue inefficiency among the commercial banks during the period was technical inefficiency rather than allocative inefficiency. This finding contradicts the findings of Megha (2016), Bhatia & Mahendru (2018) who analysed the revenue efficiency from 1991–1992 to 2012–2013. According to her findings, the most significant contributor to revenue inefficiency was not technical inefficiency but allocative inefficiency. Another significant finding of the present study is that no year over the whole study period has seen revenue efficiency and its components reach a full efficiency score of 1. This is identical to Megha's finding (2016). The examination of the components of technical efficiency that are calculated in this study reveals, with the exception of 1992-1993, the scale inefficiency is greater than the pure technical inefficiency. Because of this, it is clearly evident that the primary reason for the technical inefficiency is not pure technical inefficiency but the inefficiency of scale. This result resembles the

observation of Megha (2016), Bhatia & Mahendru (2018). Revenue efficiency and its components exhibited irregular behaviour during the study period. The following is a diagrammatic illustration of revenue efficiency and its components:

**Figure: 6.1**

*Trends in mean revenue efficiency and its components of commercial banks during 1992-93 to 2020-21.*



In 1993 and 1994, the revenue efficiency consistently exhibited a downward trend, but the following two years have seen an improvement. During the year 1996–97, there was a significant drop in revenue efficiency. The revenue efficiency increased in the following two years, 1997–1998 and 1998–1999, but it again declined in the subsequent three years. Again, a downward trend was reported in the efficiency score between 1999–2000 and 2001–2002. The revenue efficiency scores for 2002–03 and 2003–04 were calculated to be 0.586 and 0.675, respectively. Again, revenue efficiency was lower in 2004–05 and 2005–06, coming in at 0.651 and 0.516, respectively. Efficiency grew in the years 2006–2007 and 2007–2008, which were 0.633 and 0.711, respectively, compared to the prior years. After that,

revenue efficiency went down from 0.590 in 2008–09 to 0.505 in 2011–12. On the other hand, efficiency increased and reached a score of 0.584 and 0.624, respectively in 2012–2013 and 2013–2014. The efficiency score dropped to 0.507 during the year 2014–2015, but it rose to 0.594 in the next year. During the whole study period, the year 2016–17 had the lowest revenue efficiency, which was 0.394. After 2016–17, efficiency increased throughout the next three years. Estimates of the revenue efficiency for the years 2017–2018, 2018–2019, and 2019–2020 each came in at 0.5144, 0.532, and 0.598, respectively. However, RE fell to 0.482 in 2020–21.

The calculated allocative efficiency score for 1992–93 was 0.850. After that, it decreased to 0.787% in 1993–1994. In 1995–96, it reached a score of 0.812 after a minor improvement over the next two years. Similar to the reduction in revenue efficiency in 1996–97, allocative efficiency decreased to a score of 0.727 in the same year, but it increased over the next three years and reached a score of 0.903 in 1999–2000. In 2000–2001, the efficiency score decreased again to 0.805. In the following years, allocative efficiency increased and attained a score of 0.938 in 2004–2005. 2005–2006 witnessed a minor fall in the output-oriented allocative efficiency of commercial banks, but during 2006–2007 and 2007–2008, as revenue efficiency increased, allocative efficiency also increased and reached its highest score of 0.961% in 2007–08. Even while allocative efficiency declined to 0.884% in 2008–2009, it increased rapidly in 2009–2010 and 2010–2011. In 2011–12, AE declined to 0.919, then, in the following year, it increased to 0.935. In contrast to 2013–14 and 2014–15, which saw a decline in output-oriented allocative efficiency, 2015–16 saw an increase in AE and a value of 0.935%. In the subsequent two years, 2016–17 (0.9295) and 2017–18 (0.8955), there was a modest decrease compared to 2015–16. In 2018–19, there was a slight improvement (0.9054), but it declined to 0.8869 in 2019–20 and 0.737 in 2020–21.

Technical efficiency is a measure of a firm's success or ability to produce maximum output from a given set of inputs. The analysis of the technical efficiency of commercial banks in India from 1992–93 to 2020–21 also reveals an irregular pattern. In 1992–93, the calculated technical efficiency was 0.873, but it decreased

to 0.72 in the subsequent year. In 1995–96, the TE score improved to 0.765. In 1996–1997, as RE and AE declined, banks' technical efficiency also decreased (0.620). It increased to 0.778 in 1997–98 but then began to decline until 2001–02 (0.616). The technical efficiency showed an upward trend over the following two years, scoring 0.726 in 2003–2004. Again, TE fell to 0.696 in 2004–05 and 0.569 in 2005–06. In 2007–08, the efficiency score increased to 0.737. After this growing trend, TE had a continuous falling trend from 2008–09 to 2011–12. In 2013–2014, however, it rose to 0.699%. Even though it declined to 0.572 in 2014–2015, it increased to 0.638 in 2015–2016. Similar to revenue efficiency scores, the minimal TE, which is 0.430, was estimated in the year 2016–17. In 2019–20, it reached a score of 0.678 on the TE scale, and in the last year of the study, the TE score fell to 0.645.

Pure technical efficiency and scale efficiency are the components of technological efficiency. When it comes to purely technological efficiency, commercial banks had a score of 0.916 in 1992–93, but it dropped to 0.867 in 1993–94. In the year 1994–95, PTE reached a new high of 0.902. Again, it exhibited a declining tendency, and its PTE score arrived at 0.831 in the years 1996–97. In 1997–98 and 1998–99, the calculated pure technical efficiency was 0.919 and 0.922, respectively. Even though the PTE decreased to 0.882 in 1999–2000, it increased to 0.909 in 2000–01 and then declined slightly in 2001–02 (0.865). After that, the pure technical efficiency began to exhibit an upward trend, and it eventually reached 0.895 in the years 2004–2005. In the year 2005–06, there was a modest drop, but in the years that followed, there was an increase until it reached 0.914 in 2008–2009. In 2009–10 and 2010–11, PTE decreased to 0.899 and 0.869, respectively. It continued to show an upward trend and eventually reached a score of 0.923 in 2013–14. After this, the pure technical efficiency of banks continued to show both a downward and an upward trend year after year and scored 0.906 in 2019–20. In the final year of the study, the PTE score increased to 0.929.

According to this study, the biggest source of technical inefficiency in the Indian banking system is scale inefficiency. The estimated scale efficiency in 1992–

1993 was 0.956. During 1993–1994, it reached a low of 0.838. In the year 1994–1995, the scale efficiency was calculated to be 0.841, whereas in the year 1995–1996, it was 0.854. Similar to other aspects of revenue efficiency, scale efficiency declined to 0.749 in 1996–1997. Again, it grew to 0.843 in 1997–98 but showed a consistent declining trend over the next four years, reaching 0.707 in 2001–02. Following that, SE grew to 0.816 in 2003–2004 and then declined to 0.680 in 2005–2006. SE increased during 2006–07 and 2007–08, reaching 0.787 and 0.832, respectively. Then, after four years, the SE of commercial banks exhibited a declining tendency and reached 0.633 in 2011–12. The score continued to rise and eventually reached a maximum of 0.760 in the year 2013–14. In 2014–2015, the SE decreased to 0.653; however, in 2015–2016, it increased to 0.703. Similar to the other components of revenue efficiency, the years 2016–2017 had a lower efficiency score of 0.530. After that, the scale efficiency of commercial banks continued its upward trend until 2019–20, eventually reaching a score of 0.747 in that year. Once again, it fell to 0.610 in 2020–21.

### **6.1.2 Revenue efficiency across different ownership groups of banks**

Table 6.2 depicts the year-wise average revenue efficiency, allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency of public sector commercial banks in India. It also shows the mean, standard deviation, minimum score, and maximum score of revenue efficiency and its components over the period 1992–1993 to 2020–2021.



**Table 6.2***Revenue efficiency and its components of different groups of commercial banks in India*

Year	Public sector banks					Private sector banks					Foreign banks				
	RE	AE	TE	PTE	SE	RE	AE	TE	PTE	SE	RE	AE	TE	PTE	SE
1992-93	0.806	0.879	0.917	0.959	0.958	0.708	0.864	0.819	0.844	0.973	0.694	0.791	0.880	0.945	0.934
1993-94	0.550	0.754	0.725	0.912	0.800	0.517	0.818	0.629	0.759	0.834	0.656	0.794	0.825	0.929	0.889
1994-95	0.595	0.756	0.787	0.954	0.826	0.539	0.784	0.694	0.820	0.850	0.671	0.853	0.788	0.929	0.851
1995-96	0.630	0.743	0.846	0.958	0.882	0.545	0.802	0.688	0.817	0.839	0.701	0.898	0.781	0.922	0.846
1996-97	0.449	0.627	0.711	0.960	0.736	0.356	0.714	0.505	0.688	0.735	0.546	0.822	0.657	0.863	0.774
1997-98	0.609	0.717	0.846	0.983	0.860	0.525	0.756	0.688	0.849	0.802	0.700	0.856	0.808	0.932	0.867
1998-99	0.567	0.777	0.729	0.962	0.759	0.547	0.815	0.669	0.866	0.769	0.745	0.879	0.842	0.941	0.893
1999-2000	0.604	0.879	0.689	0.953	0.722	0.577	0.929	0.621	0.838	0.743	0.653	0.898	0.732	0.869	0.848
2000-01	0.444	0.722	0.617	0.950	0.648	0.498	0.797	0.619	0.879	0.703	0.622	0.868	0.725	0.902	0.803
2001-02	0.487	0.790	0.618	0.940	0.654	0.424	0.842	0.504	0.840	0.591	0.632	0.875	0.709	0.830	0.844
2002-03	0.611	0.937	0.650	0.961	0.676	0.459	0.911	0.502	0.808	0.634	0.682	0.929	0.731	0.886	0.829
2003-04	0.757	0.965	0.783	0.957	0.818	0.594	0.931	0.636	0.825	0.772	0.679	0.894	0.762	0.885	0.857
2004-05	0.697	0.982	0.709	0.960	0.739	0.571	0.941	0.605	0.809	0.756	0.685	0.893	0.770	0.918	0.837
2005-06	0.465	0.899	0.516	0.944	0.544	0.441	0.903	0.484	0.790	0.618	0.638	0.895	0.703	0.812	0.873
2006-07	0.661	0.976	0.677	0.950	0.713	0.603	0.923	0.655	0.836	0.792	0.632	0.842	0.728	0.866	0.854
2007-08	0.711	0.988	0.720	0.937	0.768	0.676	0.974	0.695	0.823	0.851	0.740	0.922	0.794	0.906	0.883
2008-09	0.575	0.930	0.618	0.959	0.644	0.536	0.867	0.619	0.859	0.723	0.645	0.852	0.761	0.913	0.840
2009-10	0.527	0.944	0.557	0.969	0.574	0.537	0.961	0.556	0.878	0.639	0.591	0.898	0.661	0.852	0.799

Year	Public sector banks					Private sector banks					Foreign banks				
	RE	AE	TE	PTE	SE	RE	AE	TE	PTE	SE	RE	AE	TE	PTE	SE
2010-11	0.498	0.984	0.506	0.966	0.523	0.451	0.946	0.473	0.842	0.581	0.630	0.913	0.680	0.806	0.859
2011-12	0.464	0.963	0.480	0.972	0.494	0.421	0.928	0.454	0.880	0.526	0.582	0.881	0.658	0.847	0.797
2012-13	0.578	0.975	0.593	0.969	0.610	0.533	0.972	0.546	0.878	0.627	0.615	0.889	0.691	0.849	0.834
2013-14	0.583	0.935	0.623	0.958	0.649	0.509	0.938	0.540	0.879	0.619	0.707	0.864	0.823	0.921	0.899
2014-15	0.397	0.899	0.442	0.946	0.472	0.374	0.862	0.433	0.881	0.498	0.640	0.883	0.722	0.869	0.844
2015-16	0.461	0.974	0.474	0.905	0.526	0.499	0.961	0.520	0.885	0.593	0.726	0.896	0.803	0.927	0.871
2016-17	0.273	0.960	0.283	0.871	0.324	0.261	0.956	0.274	0.870	0.319	0.542	0.896	0.607	0.800	0.774
2017-18	0.386	0.950	0.407	0.906	0.449	0.377	0.923	0.410	0.903	0.458	0.647	0.854	0.761	0.895	0.859
2018-19	0.338	0.917	0.370	0.867	0.427	0.396	0.886	0.449	0.855	0.531	0.696	0.910	0.759	0.851	0.900
2019-20	0.477	0.928	0.515	0.887	0.582	0.515	0.905	0.568	0.900	0.631	0.696	0.859	0.808	0.917	0.881
2020-21	0.298	0.714	0.422	0.911	0.466	0.334	0.712	0.473	0.911	0.518	0.612	0.760	0.799	0.942	0.843
<b>Mean</b>	<b>0.534</b>	<b>0.878</b>	<b>0.615</b>	<b>0.942</b>	<b>0.650</b>	<b>0.494</b>	<b>0.880</b>	<b>0.563</b>	<b>0.845</b>	<b>0.673</b>	<b>0.655</b>	<b>0.871</b>	<b>0.751</b>	<b>0.887</b>	<b>0.851</b>
<b>SD</b>	<b>0.130</b>	<b>0.106</b>	<b>0.155</b>	<b>0.030</b>	<b>0.154</b>	<b>0.100</b>	<b>0.077</b>	<b>0.113</b>	<b>0.047</b>	<b>0.144</b>	<b>0.052</b>	<b>0.040</b>	<b>0.064</b>	<b>0.043</b>	<b>0.037</b>
<b>Minimum</b>	<b>0.273</b>	<b>0.627</b>	<b>0.283</b>	<b>0.867</b>	<b>0.324</b>	<b>0.261</b>	<b>0.712</b>	<b>0.274</b>	<b>0.688</b>	<b>0.319</b>	<b>0.542</b>	<b>0.760</b>	<b>0.607</b>	<b>0.800</b>	<b>0.774</b>
<b>Maximum</b>	<b>0.806</b>	<b>0.988</b>	<b>0.917</b>	<b>0.983</b>	<b>0.958</b>	<b>0.708</b>	<b>0.974</b>	<b>0.819</b>	<b>0.911</b>	<b>0.973</b>	<b>0.745</b>	<b>0.929</b>	<b>0.880</b>	<b>0.945</b>	<b>0.934</b>

Source: Researcher's Estimates based on Statistical Tables Relating to Banks in India, various issues

As noticed in the case of all commercial banks in India, revenue efficiency and its components in public sector banks also exhibit an inconsistent pattern during the entire study period. The finding in Megha (2015) supports this. The average revenue efficiency of public sector banks ranges from a minimum of 0.273 in 2016–17 to a maximum of 0.806 in 1992–93. The grand mean of revenue efficiency (or inefficiency) over the entire study period is 0.534 (0.466). This means that a commercial public sector bank in India could generate only 53.4 percent of its output from the given level of input, wasting 46.6 percent of its input. As seen in the case of all commercial banks, the public sector banks never achieved a full efficiency score of 1 in revenue efficiency and its components during the entire study period. Initially, RE showed a downward trend and reached a score of 0.550 in 1993–94. In the next two years, RE improved and reached a score of 0.630 in 1995–96. Unfortunately, the RE score of public sector banks declined sharply to 0.449 in 1996–97, but it improved in the next year to 0.609. Again, in 1998–1999, RE was reduced to 0.5667, and the next year it improved to 0.604. In 2000–2001, the RE score of public sector banks dropped to 0.444, which was a significant decrease. Following that, it showed an increasing trend for three years in a row, reaching 0.757 in 2003–04. The next two years exhibited a reduction in RE for banks, and they scored 0.465 in 2005–06. Again, it improved in the following two years, i.e., 0.661 in 2006–07 and 0.711 in 2007–08. Following that, the RE score of public sector banks fell steadily over the next four years, reaching 0.464 in 2011–12. Then it improved to 0.583 in 2013–14. Even though it decreased to 0.397 in 2014–15, it increased to 0.461 in 2015–16. The year 2016–17 had the lowest efficiency score of 0.273, and in 2017–18, it increased to 0.386. A reduction in RE was observed in 2018–19, but the score improved to 0.477 in 2019–20. In the final year, RE dropped to 0.298.

During the study period, the allocation efficiency of public sector banks ranged from 0.627 in 1996–97 to 0.988 in 2007–08. The grand mean of allocative efficiency (or inefficiency) is found to be 0.878 (0.122). Likewise, the technical efficiency of public sector banks ranges from a minimum of 0.283 in 2016–17 to a maximum of 0.917 in 1992–93. The grand mean of technical efficiency (or

inefficiency) for the study period is estimated at 0.615 (0.385). The grand mean of allocative efficiency is higher than the average technical efficiency. Hence, it is clear that the dominant source of revenue efficiency among public sector banks is technical efficiency rather than allocative efficiency. It also indicates that Indian public sector banks are not relatively good at maximising the level of output from a given level of input. This result is contrary to the results of Megha (2015) and Bhatia & Mahendru (2018). The technical efficiency of public sector banks is again decomposed into pure technical efficiency and scale efficiency. During the study period, the pure technical efficiency varies from a low of 0.867 in 2018–19 to a high of 0.983 in 1997–98. The scale efficiency score during the period ranges from a minimum of 0.324 in 2016–17 to a maximum of 0.958 in 1992–93. The grand mean score of PTE (or inefficiency) over the entire period is 0.942 (0.058), whereas the grand mean score of SE (or inefficiency) is 0.650 (0.350). Hence, it is evident that as scale inefficiency is superior to pure technical inefficiency, the dominant source of technical inefficiency is scale inefficiency rather than pure technical inefficiency.

Table 6.2 also depicts the year-wise average revenue efficiency, allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency of private sector commercial banks in India. It also shows the mean, standard deviation, minimum score, and maximum score of cost efficiency and its components over the period 1992–1993 to 2020–2021. Table 6.3 reveals that the grand mean of RE (or inefficiency) in private sector commercial banks is 0.494 (0.506). During the entire period of the study, the RE score ranges from a minimum of 0.261 in 2016–17 to a maximum of 0.70 in 1992–93. During 1992–93 and 1993–94, the RE score showed a declining trend, and it was lowered to 0.517 in 1993–94 from 0.708 in 1992–93. In 1994–95 and 1995–96, it improved slightly and scored 0.545 in 1995–96. Unfortunately, a sharp decline in RE was reported in 1996–97, and the score dropped to 0.356 from 0.545 in the previous year. By the next three years, the revenue efficiency had improved and reached 0.577 in 1999–2000. Subsequently, the years 2000–2001 and 2001–2002 showed a decreasing pattern, and the scores were 0.498 and 0.424, respectively. During 2002–03 and 2003–04, the revenue efficiency score improved to 0.594, but again it decreased in the following two years, i.e., to 0.571 in

2004-05 and 0.441 in 2005-06. Yet again, in the following two years, the RE score of private sector banks improved and scored 0.676 in 2007-08. From 2007-08 to 2011-12, the RE showed a downward trend and arrived at a score of 0.421 in 2011-12. Following this downward trend over the last 4 years, revenue efficiency improved in 2012-13 and scored 0.533, but it decreased continuously in 2013-14 and 2014-15. Even though revenue efficiency improved in 2015-16 to 0.499, it dropped to the lowest score of 0.261 in the next year. Following this rapid reduction, revenue efficiency improved, and by the year 2019-20, it reached a score of 0.515. Just like public sector banks, the RE score of private sector banks also declined in the final year as compared to the previous year.

The revenue efficiency of commercial banks is also bifurcated into allocative efficiency and technical efficiency. The grand mean of allocative efficiency (inefficiency) in private sector banks is 0.880 (0.120), whereas the grand mean of technical efficiency (inefficiency) over the entire study period is 0.563 (0.437). Thus, both allocative inefficiency and technical inefficiency result in revenue inefficiency. However, as the technical inefficiency is higher than the allocative inefficiency, the major reason for the revenue inefficiency is the technical inefficiency rather than the allocative inefficiency. The allocative efficiency of private sector banks fluctuates between a minimum of 0.712 in 2020-21 and a maximum of 0.974 in 2007-08. The technical efficiency ranges between the lowest score of 0.274 in 2016-17 and the highest score of 0.819 in 1992-93. The pure technical efficiency of commercial banks varies from a low score of 0.688 in 1996-97 to a high score of 0.911 in 2020-21. Similarly, the scale efficiency of private sector banks ranges from a minimum score of 0.319 in 2016-17 to a maximum score of 0.973 in 1992-93. The grand mean score of the pure technical efficiency (or inefficiency) of the banks over the study period is 0.845 (0.155). Likewise, the grand mean scale efficiency of banks for the study period is 0.673 (0.327). From this, it is clear that the major reason for the technical inefficiency among private sector commercial banks in India is scale efficiency rather than pure technical efficiency.

Table 6.2 also depicts the year-wise average revenue efficiency, allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency of foreign banks operating in India. It also shows the mean, standard deviation, minimum score, and maximum score of cost efficiency and its components over the period 1992–1993 to 2020–2021. The grand mean score of the RE (inefficiency) of foreign banks calculated for the entire period of the study is 0.655 (0.345). The mean score ranges from a minimum of 0.542 in 2016–17 to a maximum of 0.745 in 1998–99. As in the case of other groups of banks, which were discussed earlier, the RE and its components of foreign banks also revealed an erratic pattern during the entire period of the study. RE of foreign banks showed a declining trend in the beginning and recorded a score of 0.656 in 1993-94. Even though it improved in the next two years, i.e., 0.671 in 1994–95 and 0.701 in 1995–96, it decreased to 0.546 in 1996–97. RE of foreign banks again improved in the following two years, i.e., 0.700 in 1997–98 and 0.745 in 1998–99. Thereafter, it exhibited a declining trend until 2000–01, and RE declined to 0.622 in 2000-01. During 2001-02 and 2002-03, the RE increased and reached a score of 0.682 in 2002-03, but it declined to 0.679 in 2003-04. Even though the RE score improved to 0.685 in 2004-05, it showed a declining trend in 2005-06 and 2006-07. The revenue efficiency score of foreign banks improved to 0.740 in 2007-08, but it decreased continuously in 2008-09 and 2009-10. As compared to 2009–10, RE improved in 2010–11 and scored 0.630, but it declined to 0.582 in 2011–12. Thereafter, it increased consecutively in two years, i.e., 0.615 in 2012–13 and 0.707 in 2013–14. In 2014–15, the mean revenue efficiency score decreased to 0.640, but it increased to 0.726 in 2015–16. Even though the RE score declined to 0.542 in 2016–17, it showed an increasing trend until 2019–20 and reached a score of 0.6962 in 2019–20. However, it declined to 0.612 in the final year of the study.

The mean AE of the foreign banks varies from a low score of 0.791 in 1992-93 to a maximum of 0.929 in 2002-03. The grand mean of AE (inefficiency) over the study period is 0.871 (0.129). Similarly, the mean TE score varies between a low of 0.607 in 2016-17 and a high of 0.88 in 2002-03. The grand mean TE (inefficiency) score estimated for the study period is 0.751 (0.249). As the technical

inefficiency of foreign banks is higher than the allocative inefficiency, the major source of revenue inefficiency among foreign banks operating in India is technical inefficiency, i.e., due to managerial inefficiency. Regarding the components of TE, the grand means of PTE (inefficiency) and SE (inefficiency) are 0.887 (0.113) and 0.851 (0.149), respectively. The minimum mean of the PTE is 0.8000 in 2016–17, whereas the maximum score is 0.945 in 1992–93. Similarly, the mean SE ranges from a minimum of 0.774 in 1996–97 to a maximum of 0.934 in 1992–93. As the scale inefficiency is higher than the pure technical inefficiency, the technical inefficiency among foreign banks is mainly due to scale inefficiency.

### 6.1.3 Best performing banks in banking industry

The top 10 best-performing banks in the Indian banking sector are listed in Table 6.3. This ranking is based on the average values of revenue efficiency and the components of revenue efficiency. However, in order to conduct this ranking, certain filters have been applied. These filters ensure that only financial institutions that are currently active are taken into consideration for the ranking. Financial institutions that have ceased their operations or merged with other financial institutions are omitted entirely from the ranking.

**Table 6.3**

*Best performing banks in terms of revenue efficiency*

<b>Banks</b>	<b>RE</b>	<b>AE</b>	<b>TE</b>	<b>PTE</b>	<b>SE</b>
Credit Suisse Ag	1.000	1.000	1.000	1.000	1.000
Sberbank	0.921	0.967	0.944	1.000	0.944
Jp Morgan Chase Bank N.A.	0.915	0.953	0.993	1.000	0.993
Bank of Nova Scotia	0.856	0.913	0.938	0.977	0.959
United Overseas Bank Ltd	0.837	0.925	0.982	0.999	0.983
Qatar National Bank (Q.P.S.C.)	0.831	0.883	0.941	0.947	0.993
Cooperative Rabobank U.A.	0.815	0.890	0.894	0.960	0.925
Bank of America	0.809	0.891	0.910	0.989	0.919
Mizuho Corporate Bank	0.808	0.920	0.879	0.955	0.922
Bank of Ceylon	0.794	0.945	0.834	0.897	0.926

Source: Researcher's estimates based on DEA analysis

According to the estimation, the top 10 commercial banks that have outstanding performance in terms of revenue efficiency are Credit Suisse AG, Sberbank, JP Morgan Chase Bank N.A., Bank of Nova Scotia, United Overseas Bank Ltd., Qatar National Bank (Q.P.S.C.), Cooperative Rabobank U.A., Bank of America, and Bank of Ceylon. There are no public or private sector banks on this list. Only Credit Suisse AG banks achieved 100% efficiency during the research period. In the case of these top 10 banks, the most significant factor contributing to the revenue inefficiency is the allocative inefficiency, with a few notable exceptions including Sberbank, Mizuho Corporate Bank, and Bank of Ceylon.

#### 6.1.4 Comparison of revenue efficiency across different groups of banks

After doing an analysis on revenue efficiency, it is essential to determine whether or not the differences in revenue efficiency and the components of revenue efficiency are statistically significant across the entire period for public sector banks, private sector banks, and foreign banks. The Shapiro-Wilk test was conducted and found that the data did not follow the expected normal distribution, so a non-parametric Kruskal-Wallis H test was performed. The results of the Kruskal-Wallis H test are presented in the table below.

**Table 6.4**

*Results of Kruskal-Wallis H test*

Efficiency Measures	Mean			Mean rank			Chi Square	P value
	Public sector banks	Private sector banks	Foreign banks	Public sector banks	Private sector banks	Foreign banks		
RE	0.534	0.494	0.655	38.09	28.33	65.59	33.93	0.001*
AE	0.878	0.88	0.871	49.69	45.66	36.66	4.05	0.132
TE	0.615	0.563	0.751	38.93	28.31	64.76	31.95	0.001*
PTE	0.942	0.845	0.887	68.36	23.19	40.45	47.24	0.001*
SE	0.65	0.673	0.851	31.16	33.48	67.36	37.34	0.001*

Source: Researcher's estimates based on DEA analysis, \* indicates significant at 5% level of significance

It is clear from the table that the mean revenue efficiency and its components vary across different ownership groups of banks, such as public sector banks, private sector banks, and foreign banks. The calculated chi-square value for revenue



efficiency is 33.93 with a p value of 0.001. The p-value is less than 0.01, so the null hypothesis that there is no significant difference in the revenue efficiency of different commercial bank groups is rejected. Since the null hypothesis is rejected, there are statistically significant differences in the revenue efficiency of commercial bank groups. Regarding allocative efficiency, the obtained chi square value is 4.05 and the p value is 0.132. Since the p value is greater than 0.05, the null hypothesis that there is no significant difference in the allocative efficiency of public sector banks, private banks, and foreign banks cannot be rejected. Since the null hypothesis is not rejected, it is concluded that there is no significant difference in the allocative efficiency of various commercial bank groups.

The obtained chi square value for technical efficiency is 31.95, and the calculated p value for technical efficiency is less than 0.001. Since p is less than 0.01, the null hypothesis is rejected at the 1% level of significance. Therefore, there are statistically significant differences between the technical efficiency of public sector banks, private banks, and foreign banks. Similar to technical efficiency, statistically significant differences are observed between commercial banks' pure technical efficiency and scale efficiency. The chi square values for pure technical efficiency and scale efficiency are calculated to be 47.24 and 37.34, respectively. The calculated p value for both pure technical efficiency and scale efficiency is less than 0.01. Thus, the null hypotheses regarding both pure technical efficiency and scale efficiency are rejected, indicating that there is a statistically significant difference in the efficiency scores of the various groups of commercial banks. Except for allocative efficiency, there are considerable differences between public sector banks, private sector banks, and foreign banks in terms of revenue efficiency and its components. To determine which pair of banks varies considerably in terms of revenue efficiency and its components, pair-wise comparison tests were done. The result is displayed in Table 6.5.

**Table 6.5**

*Result of pair wise comparisons*

Efficiency	Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Revenue efficiency	Public sector banks- Foreign banks	-27.500	6.633	-4.146	<b>0.001*</b>
	Public sector banks- Private Sector banks	9.759	6.633	1.471	0.424
	Private Sector banks- Foreign banks	-37.259	6.633	-5.617	<b>0.001*</b>
Technical efficiency	Public sector banks- Foreign banks	-25.828	6.633	-3.894	<b>0.001*</b>
	Public sector banks- Private Sector banks	-10.621	6.633	-1.601	0.328
	Private Sector banks- Foreign banks	-36.448	6.633	-5.495	<b>0.001*</b>
Pure technical efficiency	Public sector banks- Foreign banks	-27.914	6.633	-4.208	<b>0.001*</b>
	Public sector banks- Private Sector banks	45.172	6.633	6.810	<b>0.001*</b>
	Private Sector banks- Foreign banks	-17.259	6.632	-2.602	<b>0.028*</b>
Scale efficiency	Public sector banks- Foreign banks	-36.207	6.633	-5.485	<b>0.001*</b>
	Public sector banks- Private Sector banks	-2.328	6.633	-0.351	1.000
	Private Sector banks- Foreign banks	-33.879	6.633	-5.108	<b>0.001*</b>

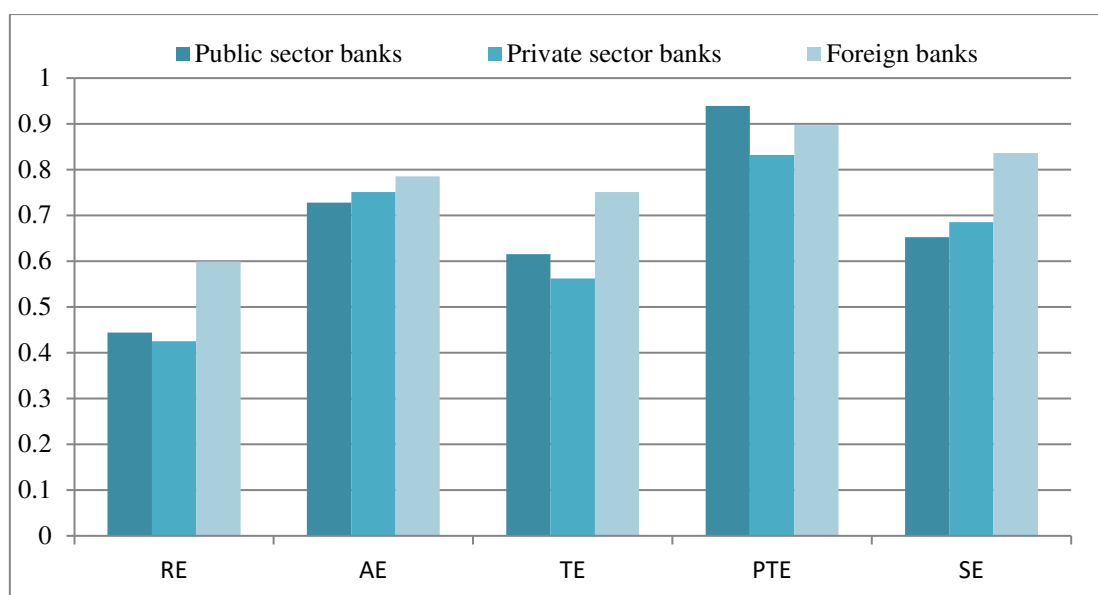
Source: Researcher's estimates, \*indicates significance at 5% level of significance

The pair wise comparison of revenue efficiency indicated that the mean rank difference between public sector banks and foreign banks and private sector banks and foreign banks is significant at the 1% level of significance. However, the findings showed that there was no substantial difference between the public sector banks and the private sector banks. That is, the revenue efficiency of the domestic banks is almost the same. This result is consistent with both technical and scale efficiency findings. For both technical efficiency and scale efficiency, the difference in mean rank between public sector banks and foreign banks and private sector banks and foreign banks is significant at the 1% level of significance. In terms of scale and technical efficiency, there was no significant difference between public and private sector banks. On the other hand, a statistically significant difference was found between all pairs of bank groups, such as public sector banks and foreign banks, private sector banks and foreign banks, and public sector banks and private sector banks in the case of pure technical efficiency.

Figure 6.2 depicts the mean revenue efficiency and its components for the different groups of commercial banks being studied.

**Figure 6.2**

*Mean revenue efficiency and its components for different groups of commercial banks*



In terms of revenue efficiency, foreign banks (0.599) outperform other groups of banks. Following foreign banks, public sector banks (0.456) do better in terms of revenue efficiency, whereas private sector banks underperform relative to other groups of banks. As a result, the order of the various categories of banks according to their revenue efficiency is as follows: Foreign banks > Public sector banks > Private sector banks. In terms of both allocative efficiency and scale efficiency, the performance of foreign banks is superior to that of domestic banks; nevertheless, private sector banks are outperforming public sector banks when compared within the context of domestic banks. Therefore, in terms of allocative efficiency and scale efficiency, foreign banks rank higher than private sector banks and public sector banks. In addition, in terms of technical efficiency, foreign banks do better than those in the public and private sector banks. Public-sector banks outperform private-sector banks among domestic banks. Hence, the ranking of different bank groups in terms of technical efficiency is: foreign banks > public sector banks > private sector banks. In the case of pure technical efficiency, public sector banks performed better than private sector banks and foreign banks. Following public sector banks, foreign banks are outperforming private sector banks. Therefore, the ranking of different bank groups in terms of pure technical efficiency is: public sector banks > foreign banks > private sector banks.

#### **6.1.5 Year wise comparison of revenue efficiency of different groups of commercial banks**

In the previous part of this chapter, Kruskal Wallis H test has conducted to check whether there is any significant difference in the revenue efficiency and its components over the entire period as a whole among the different groups of commercial banks in India. Since the Indian banking sector has undergone constant changes over the study period, it is also relevant to see in which of the year the revenue efficiency among commercial banks has found significant difference. For this purpose, Kruskal wallis H test was also used and subsequently pair wise comparison was also conducted to see which of the bank groups shows significant differences.

From the table 6.6, it is clear that revenue efficiency in almost all years is significantly different among different groups of commercial banks in India. Among the 29 years, in four years no statistically significant difference was found in the revenue efficiency of commercial banks in India. 1993-94, 2006-07, 2009-10 and 2012-13 are the years in which the revenue efficiency of different groups of commercial banks are almost statistically similar. Rest of the years under study, shows statistically significant difference in the revenue efficiency among commercial banks. The pair wise comparison shows which of the pair shows statistically significant difference. From the table it is clear that revenue efficiency among private sector banks and public sector banks are almost similar in majority of the years. Only during 1992-93, 1996-97, 2002-03, 2003-04 and 2004-05 revenue efficiency was significantly different among the domestic banks. While comparing the efficiency among public sector banks and foreign banks, more number of years shows significant difference. In 1992-93, 1998-99, 2000-01, 2005-06 and from the year 2013-14 to 2020-21, revenue efficiency was significantly different between public sector banks and foreign banks.

The revenue efficiency among private sector banks and foreign banks was statistically different in majority years under study. During 1992-93 and 2000-01 the revenue efficiency of private and foreign banks are found no significant difference. Hence, it is observed that significant difference obtained in the Kruskal-Wallis H test was mainly due to significant difference in the efficiency among private sector banks and foreign banks.

Another observation from the analysis is that, from the period 2013–14 to 2020–21, a significant difference was found between the public sector banks and foreign banks and between private sector banks and foreign banks at the 1% level of significance. Further, during this period, revenue efficiency among the domestic banks was almost the same, with no statistically significant difference among them. This means that, during this period, the revenue efficiency of domestic and foreign banks is significantly different. During this period, the foreign banks outperformed other groups of banks, and there was a declining trend in the revenue efficiency of both public and private sector commercial banks.

**Table 6.6***Year wise comparison of revenue efficiency of commercial banks in India*

Year	Kruskal Wallis H test					Pairwise Comparison					
	Mean Rank			Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB	
	PUB	PVB	FB			Std.Test statistic	P value	Std. Test statistic	P value	Std.Test statistic	P value
1992-93	48.00	26.00	29.74	16.940	0.001*	3.853	0.001*	2.997	0.008***	0.598	1.000
1993-94	36.15	32.08	44.74	4.236	0.120	-	-	-	-	-	-
1994-95	37.96	27.38	45.05	8.198	0.017**	1.803	0.214	-1.163	0.734	-2.826	0.014**
1995-96	46.67	33.32	53.13	9.795	0.007*	2.060	0.118	-0.943	1.000	-3.027	0.007*
1996-97	49.11	32.89	57.56	14.237	0.001*	2.325	0.060***	-1.220	0.668	-3.724	0.001*
1997-98	48.70	35.44	58.64	12.029	0.002*	1.824	0.196	-1.416	0.470	-3.465	0.002*
1998-99	42.48	35.81	63.86	19.162	0.001*	0.916	1.000	-3.033	0.007*	-4.172	0.000*
1999-2000	47.19	40.34	58.62	7.506	0.023**	0.921	1.000	-1.606	0.325	-2.694	0.021**
2000-01	36.78	46.03	60.41	11.897	0.003*	-1.227	0.659	-3.355	0.002*	-2.106	0.106
2001-02	45.15	35.73	57.78	11.099	0.004*	1.315	0.565	-1.838	0.198	-3.305	0.003*
2002-03	49.22	26.36	52.93	19.317	0.001*	3.436	0.002*	-0.567	1.000	-4.099	0.000*
2003-04	56.63	30.22	44.52	15.718	0.000*	3.955	0.000*	1.829	0.202	-2.198	0.084***
2004-05	55.86	28.66	47.77	17.542	0.000*	4.065	0.000*	1.219	0.669	-2.906	0.011**
2005-06	40.57	32.79	55.21	12.163	0.002**	1.180	0.713	-2.238	0.076***	-3.429	0.002*
2006-07	48.61	35.12	40.14	4.384	0.112	-	-	-	-	-	-
2007-08	39.39	31.43	46.48	5.477	0.065***	1.248	0.636	-1.160	0.738	-2.340	0.058***

Year	Kruskal Wallis H test					Pairwise Comparison					
	Mean Rank			Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB	
	PUB	PVB	FB			Std.Test statistic	P value	Std. Test statistic	P value	Std.Test statistic	P value
2008-09	36.52	29.64	48.75	9.504	0.009*	1.071	0.852	-2.207	0.128	-2.999	0.008*
2009-10	39.30	40.61	41.47	0.129	0.939	-	-	-	-	-	-
2010-11	37.46	30.38	48.38	8.275	0.016**	1.052	0.878	-1.802	0.215	-2.793	0.016**
2011-12	37.85	29.90	49.69	9.692	0.008*	1.136	0.768	-1.944	0.156	-3.001	0.008*
2012-13	40.92	34.45	47.82	4.092	0.129	-	-	-	-	-	-
2013-14	39.04	26.20	57.79	22.235	0.000*	1.685	0.276	-2.943	0.010*	-4.501	0.000*
2014-15	33.22	28.10	60.62	29.527	0.000*	0.672	1.000	-4.300	0.000*	-4.634	0.000*
2015-16	23.81	37.95	63.21	39.694	0.000*	-1.861	0.188	-6.116	0.000*	-3.619	0.001*
2016-17	31.00	26.43	63.73	40.334	0.000*	0.608	1.000	-5.112	0.000*	-5.381	0.000*
2017-18	26.38	24.19	59.71	41.928	0.000*	0.291	1.000	-5.114	0.000*	-5.450	0.000*
2018-19	18.00	32.36	59.48	44.372	0.000*	-1.907	0.170	-6.263	0.000*	-4.226	0.000*
2019-20	22.83	31.09	54.29	27.730	0.000*	-1.104	0.808	-4.730	0.000*	-3.732	0.001*
2020-21	15.50	26.38	49.63	31.228	0.000*	-1.398	0.486	-4.836	0.000*	-4.030	0.000*

Source: Researcher's estimates based on DEA analysis, \*, \*\*and \*\*\* indicates statistical significance at 1%, 5% and 10% respectively.

### **6.1.6 Analysis of returns to scale of revenue efficiency**

In this section, the study analyses the nature of returns to scale for the different groups of commercial banks in order to ascertain the presence of economies or diseconomies of scale in the Indian banking sector. The information about the nature of returns to scale may be used by the management to achieve the most productive scale size by either downsizing or expanding the scale of operations (Gulati, 2011). In the previous part, it was observed that scale inefficiency is the major form of inefficiency that causes technical inefficiency. Therefore, it is worth examining the nature of returns to scale in the Indian banking industry.

In the case of all commercial banks, an average of 85 banks were analyzed, and among this total, an average of 11 banks are operating below their optimal scale size and experiencing IRS. An average of 65 banks have been observed to be operating in the DRS zone. This means that these banks are not able to generate proportionate outputs from the inputs at the present scale. An average of nine banks are operating at their most productive scale and experiencing CRS. That is, the majority of banks operating in the Indian banking industry are operating in the DRS zone, followed by the IRS zone and the CRS zone. Since the number of banks experiencing DRS is higher than the number of banks experiencing IRS and CRS, decreasing returns to scale are observed to be the predominant form of scale inefficiency in the Indian banking industry. This finding is consistent with Megha's (2016) findings. As observed by Megha (2016), as a part of accomplishing the social objectives, public sector banks are required to open their branches in semi-urban and rural areas, but the banks are not able to generate as many outputs from these branches as from the urban ones.



**Table 6.7***Returns to scale of revenue efficiency in Indian banking sector*

Year	All commercial banks				Public sector banks				Private sector banks				Foreign banks			
	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total
1992-93	15	53	6	74	0	27	0	27	8	16	0	24	7	10	6	23
1993-94	10	59	5	74	0	27	0	27	7	17	0	24	3	15	5	23
1994-95	5	63	4	72	0	27	0	27	4	20	0	24	1	16	4	21
1995-96	10	65	11	86	0	26	1	27	5	26	2	33	5	13	8	26
1996-97	5	77	10	92	0	26	1	27	0	29	3	32	5	22	6	33
1997-98	3	78	14	95	0	25	2	27	1	29	2	32	2	24	10	36
1998-99	3	86	7	96	0	27	0	27	0	32	0	32	3	27	7	37
1999-2000	7	86	5	98	0	26	1	27	0	31	1	32	7	29	3	39
2000-01	6	81	11	98	0	27	0	27	0	29	1	30	6	25	10	41
2001-02	4	82	8	94	0	27	0	27	0	30	0	30	4	25	8	37
2002-03	5	73	7	85	0	27	0	27	0	28	0	28	5	18	7	30
2003-04	10	70	6	86	0	27	0	27	0	28	1	29	10	15	5	30
2004-05	6	76	4	86	0	27	0	27	0	29	0	29	6	20	4	30
2005-06	8	72	5	85	0	28	0	28	0	27	1	28	8	17	4	29
2006-07	7	68	6	81	0	28	0	28	0	25	0	25	7	15	6	28
2007-08	6	69	3	78	0	28	0	28	0	23	0	23	6	18	3	27
2008-09	8	67	2	77	0	27	0	27	0	22	0	22	8	18	2	28
2009-10	8	64	8	80	0	27	0	27	0	21	1	22	8	16	7	31

Year	All commercial banks				Public sector banks				Private sector banks				Foreign banks			
	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total
2010-11	12	56	11	79	0	26	0	26	0	21	0	21	12	9	11	32
2011-12	13	63	5	81	0	26	0	26	0	20	0	20	13	17	5	35
2012-13	13	67	4	84	0	26	0	26	1	19	0	20	12	22	4	38
2013-14	14	68	7	89	0	26	1	27	0	20	0	20	14	22	6	42
2014-15	6	77	6	89	0	27	0	27	0	20	0	20	6	30	6	42
2015-16	11	71	8	90	0	27	0	27	0	21	0	21	11	23	8	42
2016-17	5	80	4	89	0	27	0	27	0	21	0	21	5	32	4	41
2017-18	6	73	5	84	0	21	0	21	0	21	0	21	6	31	5	42
2018-19	6	69	11	84	0	20	0	20	0	22	2	22	6	27	9	42
2019-20	10	59	12	81	0	18	0	18	0	22	0	22	10	19	12	41
2020-21	10	60	4	74	0	12	0	12	0	21	0	21	10	27	4	41
<b>Total</b>	<b>232</b>	<b>2032</b>	<b>199</b>	<b>2461</b>	<b>0</b>	<b>740</b>	<b>6</b>	<b>746</b>	<b>26</b>	<b>690</b>	<b>14</b>	<b>728</b>	<b>206</b>	<b>602</b>	<b>179</b>	<b>987</b>
<b>Average</b>	<b>11</b>	<b>65</b>	<b>9</b>	<b>85</b>	<b>0</b>	<b>25</b>	<b>0</b>	<b>25</b>	<b>2</b>	<b>23</b>	<b>0</b>	<b>25</b>	<b>9</b>	<b>16</b>	<b>9</b>	<b>34</b>

Source: Researcher's Estimates based on DEA analysis

This is due to the requirement that public sector banks have to lend a larger portion of their deposits to priority sectors such as agriculture.

From the table, it is clear that, among the different groups of commercial banks, the largest are the public sector banks, which operate in the DRS zone, followed by private sector banks and foreign banks. This finding is consistent with the findings of Megha (2016). The maximum number of banks operating in the CRS zone belongs to foreign banks, followed by private sector banks and public sector banks. Megha (2016) observed that this is because the foreign banks are operating for classes and not masses, and they are adopting the "cherry picking" strategy by focusing only on the wealthiest and most lucrative segment of society, i.e., affluent people and creditworthy corporations, by offering diversified services rather than the usual banking services. Hence, a larger number of foreign banks are able to operate on the CRS.

## **6.2 Analysis of Cost Efficiency**

This section examines the trends in the cost efficiency of all commercial banks, public sector banks, private sector banks, and foreign banks over the post-liberalization period from 1992–1993 to 2020–2021. As shown in the methodology section, the cost efficiency score ranges from 0 to 1. Allocative efficiency (AE) and technical efficiency make up cost efficiency (TE). Again, technical efficiency is subdivided into pure technical efficiency (PTE) and scale efficiency (SE). This section of the analysis also discusses the nature of the returns to scale for India's commercial banks and examines whether there is a significant difference in cost efficiency and its components among commercial bank groups.

### **6.2.1 Cost efficiency of all commercial banks**

This part of the analysis delineates the cost efficiency for all commercial banks in India during the post-liberalization period. All commercial banks include public-sector banks, private-sector banks, and foreign banks. The calculated mean cost efficiency score of all commercial banks is reported in Table 6.8

**Table 6.8**

*Cost efficiency scores of commercial banks in India*

<b>Year</b>	<b>No. of Banks</b>	<b>CE</b>	<b>AE</b>	<b>TE</b>	<b>PTE</b>	<b>SE</b>
1992-93	70	0.720	0.821	0.873	0.918	0.954
1993-94	74	0.566	0.780	0.725	0.859	0.851
1994-95	72	0.606	0.797	0.756	0.895	0.850
1995-96	86	0.597	0.790	0.765	0.888	0.860
1996-97	92	0.232	0.397	0.620	0.811	0.768
1997-98	95	0.545	0.699	0.778	0.914	0.848
1998-99	96	0.613	0.814	0.752	0.923	0.813
1999-2000	98	0.574	0.835	0.684	0.877	0.782
2000-01	98	0.469	0.712	0.662	0.906	0.730
2001-02	93	0.286	0.448	0.616	0.872	0.697
2002-03	85	0.466	0.744	0.630	0.880	0.716
2003-04	86	0.562	0.771	0.726	0.889	0.816
2004-05	87	0.511	0.735	0.696	0.890	0.783
2005-06	85	0.471	0.827	0.569	0.850	0.674
2006-07	82	0.568	0.824	0.688	0.881	0.791
2007-08	78	0.626	0.847	0.738	0.889	0.836
2008-09	77	0.554	0.823	0.670	0.910	0.742
2009-10	80	0.499	0.835	0.597	0.896	0.672
2010-11	79	0.427	0.741	0.568	0.876	0.656
2011-12	81	0.347	0.599	0.550	0.902	0.620
2012-13	84	0.482	0.759	0.626	0.901	0.697
2013-14	89	0.583	0.848	0.699	0.925	0.756
2014-15	89	0.454	0.807	0.572	0.900	0.639
2015-16	90	0.524	0.833	0.638	0.910	0.702
2016-17	89	0.273	0.564	0.430	0.848	0.516
2017-18	84	0.412	0.666	0.585	0.901	0.650
2018-19	84	0.500	0.874	0.585	0.859	0.680
2019-20	81	0.597	0.888	0.678	0.909	0.744
2020-21	74	0.537	0.844	0.645	0.932	0.689
<b>Mean</b>	85	<b>0.503</b>	<b>0.756</b>	<b>0.659</b>	<b>0.890</b>	<b>0.742</b>
<b>SD</b>		<b>0.119</b>	<b>0.119</b>	<b>0.095</b>	<b>0.026</b>	<b>0.098</b>
<b>Maximum</b>	98	<b>0.720</b>	<b>0.888</b>	<b>0.873</b>	<b>0.932</b>	<b>0.954</b>
<b>Minimum</b>	70	<b>0.232</b>	<b>0.397</b>	<b>0.430</b>	<b>0.811</b>	<b>0.516</b>

Source: Researcher's estimates based on Statistical Tables Relating to Banks in India, various issues

The analysis of the cost efficiency scores of commercial banks demonstrates that there is an inconsistent trend in the CE scores throughout the study period. This irregular pattern was also observed by Gulati (2011), Megha (2016), Raina & Sharma (2013), Raina (2016), and Bhatia & Mahendru (2018) on the CE score of Indian commercial banks. During the research period, the cost efficiency of all Indian commercial banks declined from 0.720 in 1992–93 to 0.537 in 2020–21. The average cost efficiency (inefficiency) of all banks during the entire study period is 0.503 (0.497), indicating that, on average, banks in the Indian banking industry during the study period could have produced the same level of output using only 50.3% of the resources employed if they were producing at the efficient frontier rather than their current position. To put it another way, the Indian banking industry is only 50.34 percent efficient in terms of making optimal use of input costs when compared to the most best-practicing banks that are operating in the same environment. It means, banks can lower input costs by 49.66% while maintaining the same output level. Therefore, there is potential for cost savings if the bank uses its inputs more efficiently. According to the results, the highest CE score was 0.720 in 1992–1993; it then fell the following year and increased to 0.606 in 1994–1995. In the years that followed, however, the CE score went down, reaching a low of 0.232 in 1996–97, which was the lowest CE score during the whole study period. According to the RBI annual report (1996–1997), the primary focus of the year 1996–97 was on imparting a greater degree of market orientation in pursuit of increasing the quality of financial intermediation and allocative and operational efficiency. During 1996-97, RBI noted that the performance of the Indian banking system has improved. This year, however, is characterised by a drop in credit expansion and a decline in the credit deposit ratio and investment deposit ratio. This may be the cause of this year's low cost efficiency. Subsequently, it increased for two consecutive years, 1997–98 and 1998–99, to 0.545 and 0.613, respectively. In the three years that followed, the CE score continued to fall, reaching 0.286 in 2001-02. Megha (2016) observed that low cost efficiency in the early 2000 may be due to huge cost incurred on the technological up-gradation and infrastructure that was envisaged as a part of recommendations of the Narsimham Committee. CE

improved in the years 2002–03 and 2003–04, with scores of 0.466 and 0.562, respectively. Then, over the next two years, it went down, and in 2005-06, it got a CE score of 0.471. In the subsequent two years, the CE score of all commercial banks continued to rise, from 0.568 in 2006-07 to 0.626 in 2007-08. In the following four years of 2008-09, 2009-10, 2010-11, and 2011-12, the CE fell gradually, culminating in a score of 0.347 in 2011-12.

However, it follows an upward trend over the next two years, with scores of 0.482 in 2012–13 and 0.583 in 2013–14. In 2014-2015, the CE score of the Indian banking industry decreased to 0.454, but it increased to 0.524 in 2015-2016. The score for the year 2016-2017, which is 0.273, shows a significant drop that took place. In the subsequent three years, the CE score improved, reaching 0.412 in 2017–18, 0.500 in 2018–19, and 0.597 in 2019–20 before falling to 0.537 in 2020–21.

**Figure 6.3**

*Trends in mean cost efficiency and its components of all commercial banks*

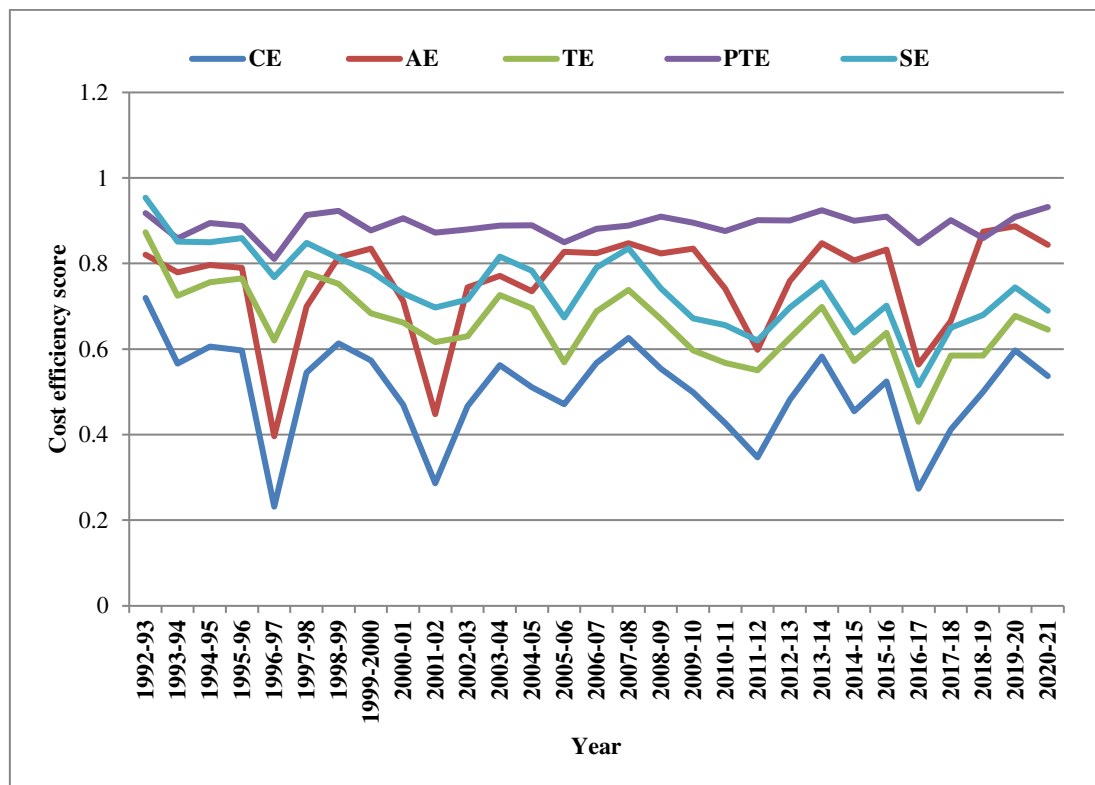


Table 6.8 also includes the various components of cost efficiency, including allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency. It demonstrates that, similar to CE, the components of CE exhibit significant variation across the whole study period. The mean AE scores range from the lowest point of 0.397 in 1996–97 to the highest point of 0.888 in 2019–20, with an overall mean of 0.756. This shows that all commercial banks, or the Indian banking industry, have suffered 24.4 percent greater production costs than necessary as a consequence of selecting an improper combination of inputs based on their prices. In the initial years of the study period, the average AE scores demonstrated a declining trend, reaching 0.78 in 1993–94. On the other hand, it increased to 0.797 in the following year, after which it slightly decreased in 1995–1996. As with the CE score, the minimum AE score was determined in 1996–97, although it increased over the following three years and reached 0.835% in 1999–2000. Subsequently, all commercial banks had a decline in AE, with scores of 0.712 in 2000-01 and 0.448 in 2001-02, before increasing to 0.771 in 2003-04. The AE score exhibited a constant trend with some slight ups and downs from 2005–2006 to 2009–2010. In 2011–12, the score declined to 0.599; however, in 2013–14, it increased to 0.848. In 2014–2015, the average AE score decreased to 0.807, and the following year, it increased to 0.833. As stated in CE, the 2016–17 year saw a significant fall to a score of 0.564. Subsequently, significant improvement has been made, and the AE score will increase to 0.888 in 2019-20 before falling to 0.844 in the final year.

The TE score ranges from a low of 0.430 in 2016–17 to a high of 0.873 in 1992–93, with an overall mean of 0.659. This indicates that all commercial banks in the Indian banking industry are, on average, 65.9% efficient at minimizing inputs in order to achieve a given output. With the existing technology, an average Indian bank wastes approximately 34.1% of its inputs when producing output. During the first two years of the study period, there was a general downward tendency in the technical efficiency, but this trend was reversed during the third and fourth years. TE fell to 0.620 in 1996–97 and increased to 0.777 in 1997–98. Subsequently, the mean TE score demonstrated a downward tendency and reached 0.616 in 2001-02, but it increased in the subsequent two years, achieving scores of 0.630 in 2002-03 and

0.726 in 2003-04. In 2005-06, the mean TE score was 0.569, a decline from the previous year's score of 0.570. In the subsequent two years, the TE score increased once again, reaching 0.738 in 2007-08. However, a declining trend was visible in the subsequent four years, and by 2011-12, the score had dropped to 0.550. In 2013-14, the score increased to 0.699. Even though it fell to 0.572 in 2014-2015, it increased the following year. The TE went into a sharp decline in 2016-17, but then started to improve until 2019-20. The TE fell to 0.645 in the final year of the study, continuing its downward trend from the previous year.

It is evident from the preceding discussion that the Indian banking industry's cost inefficiency (49.7) is the result of both allocative inefficiency (24.4) and technical inefficiency (34.1). However, technical inefficiency rather than allocative inefficiency is the primary source of cost inefficiency. In other words, the Indian banking industry's cost inefficiency is caused more by management functional inefficiencies than by an inefficient combination of input mix given their costs. This result is consistent with the findings of Jayachitra (2015) and RBI (2008) but contradicts those of Gulati (2011), Megha (2015), Raina (2016), Bhatia & Mahendru (2018), and Kaur & Kaur (2013). There is also international evidence supporting the findings of the present study by Isik & Hassan (2003) in Turkey.

To examine the causes of technical inefficiency, components of technical inefficiency, such as pure technical inefficiency and scale inefficiency, have been assessed. When returns to scale are variable, pure technical efficiency is the technical efficiency. PTE scores range from 0.811 in 1996-1997 to 0.932 in 2020-21, with a mean PTE (inefficiency) of 0.890 (0.110). In 1992-93, the score was 0.918, but it decreased the next year. In the subsequent two years, i.e., 1995-96 and 1996-97, the cost efficiency decreased in comparison to the score in 1994-95. Following that, the score rose to 0.914 in 1997-98 and 0.923 in 1998-99. Again, the score fell to 0.877 in 1999-2000, but it immediately increased to 0.906% the following year. Even though the average PTE score decreased to 0.872 in 2001-02, the score continued to rise until 2004-05. In the next year, the efficiency score dropped to 0.850 and then increased to reach 0.910 in 2008-09. The PTE score



declined significantly over the next two years, reaching 0.876 in 2010–2011. From 2011–2012 to 2015–2016, the average score on the PTE was greater than 90 percent. In 2016–17, the efficiency score had a significant fall, but in 2017–18, the score increased. In 2018–2019, the score decreased to 0.859, but it showed an upward trend for the final two years of the study period.

As stated previously, the grand mean PTE (inefficiency) score for the entire study period is 0.890 (0.110), but the grand mean scale efficiency (inefficiency) for the entire study period is 0.742 (0.258). Therefore, it is evident that 34.1% of technical inefficiency is due to both technical inefficiency and scale inefficiency. Thus, technological inefficiency in the Indian banking sector is emerging due to managerial incompetence in regulating the inputs in the production process and the inability of banks to operate at the optimal size or scale. Secondly, scale inefficiency is greater than pure technical inefficiency, indicating that the primary cause of technical inefficiency in the Indian banking sector is scale inefficiency rather than pure technical inefficiency, i.e., an inappropriate choice of scale of operation. The research reveals that there is a greater opportunity to improve technical efficiency through the adoption of an appropriate choice of inputs than through the effective exploitation of resources by management. This conclusion is consistent with the findings of Megha (2015) and Bhatia and Mahendru (2018) but contradicts the findings of Jayachitra (2015) and Gulati (2018). (2011). Thus, by picking the most suitable inputs, banks will be able to increase their scale efficiency, which will lead to an increase in technical efficiency and, ultimately, a rise in the cost efficiency of the Indian banking sector. There are international evidences supporting the findings of scale inefficiency is the major source of technical inefficiency by Isik & Hassan (2003) in Turkey.

The average scale efficiency for the entire period ranges from a low of 0.516 in 2016–17 to a high of 0.954 in 1992–93. In 1994–1995, the mean SE score demonstrated a downward trend and fell to 0.850. Even though the score improved slightly the next year, it slipped to 0.768 in 1996–97. In 1997–98, the average SE score increased again to 0.848%. From 1998–1999 to 2001–2002, SE exhibited a

downward trend. In 2003–2004, efficiency increased to 0.816%. In the subsequent two years, the average scale efficiency decreased further, scoring 0.674% in 2005–2006. However, the scale efficiency score improved in 2006–07 and 2007–08, reaching 0.836 during 2007–08. The efficiency score declined from 2008–09 to 2011–12, scoring 0.620 in 2011–12. In the subsequent years, the SE score increased, from 0.697 in 2012–13 to 0.756 in 2013–14. In the next two years, scale efficiency dropped and then increased again. In 2016–2017, a severe decline happened, and the score dropped to 0.516. However, the average SE score increased over the subsequent years, reaching 0.744% in 2019–2020. In the last year of the study, the efficiency score fell to 0.689.

### **6.2.2 Cost efficiency across different ownership groups of banks**

The Indian banking industry is comprised of many categories of banks based on their ownership. Based on their ownership, banks are classified as either public, private, or foreign. In this section, the study examines the cost-efficiency of public, private, and foreign banks from 1992–1993 to 2020–21, as well as its components.

**Table 6.9***Cost efficiency and its components of different groups of commercial banks in India*

Year	Public sector banks					Private sector banks					Foreign banks				
	CE	AE	TE	PTE	SE	CE	AE	TE	PTE	SE	CE	AE	TE	PTE	SE
1992-93	0.734	0.800	0.917	0.958	0.959	0.625	0.763	0.819	0.846	0.971	0.821	0.922	0.880	0.952	0.926
1993-94	0.559	0.773	0.725	0.907	0.805	0.452	0.732	0.629	0.749	0.852	0.693	0.837	0.825	0.916	0.905
1994-95	0.599	0.762	0.787	0.953	0.827	0.529	0.765	0.694	0.815	0.858	0.701	0.878	0.788	0.912	0.871
1995-96	0.633	0.753	0.846	0.956	0.884	0.536	0.792	0.688	0.804	0.854	0.637	0.827	0.781	0.924	0.841
1996-97	0.159	0.232	0.711	0.957	0.739	0.162	0.375	0.505	0.644	0.780	0.360	0.553	0.657	0.854	0.782
1997-98	0.526	0.619	0.846	0.982	0.861	0.446	0.659	0.688	0.841	0.810	0.648	0.795	0.808	0.927	0.872
1998-99	0.561	0.773	0.729	0.960	0.761	0.534	0.809	0.669	0.860	0.774	0.719	0.849	0.842	0.951	0.884
1999-2000	0.525	0.766	0.689	0.950	0.724	0.526	0.846	0.621	0.825	0.757	0.647	0.873	0.732	0.870	0.842
2000-01	0.402	0.658	0.617	0.947	0.650	0.433	0.701	0.619	0.872	0.711	0.540	0.755	0.723	0.904	0.796
2001-02	0.201	0.330	0.618	0.938	0.656	0.179	0.347	0.504	0.831	0.597	0.439	0.621	0.709	0.857	0.811
2002-03	0.446	0.690	0.650	0.959	0.677	0.387	0.765	0.502	0.793	0.646	0.559	0.774	0.731	0.889	0.817
2003-04	0.524	0.670	0.783	0.955	0.820	0.508	0.806	0.636	0.812	0.791	0.649	0.828	0.762	0.903	0.836
2004-05	0.493	0.696	0.709	0.958	0.740	0.462	0.764	0.605	0.794	0.774	0.576	0.744	0.770	0.919	0.833
2005-06	0.420	0.819	0.516	0.942	0.545	0.391	0.833	0.484	0.769	0.637	0.597	0.829	0.703	0.839	0.835
2006-07	0.591	0.872	0.677	0.948	0.715	0.566	0.864	0.655	0.826	0.803	0.548	0.744	0.728	0.864	0.854
2007-08	0.641	0.892	0.720	0.934	0.770	0.610	0.879	0.695	0.814	0.861	0.623	0.773	0.794	0.907	0.881
2008-09	0.526	0.854	0.618	0.958	0.645	0.516	0.836	0.619	0.848	0.733	0.611	0.784	0.761	0.912	0.842
2009-10	0.487	0.879	0.557	0.968	0.575	0.460	0.870	0.532	0.840	0.651	0.536	0.772	0.679	0.873	0.771

Year	Public sector banks					Private sector banks					Foreign banks				
	CE	AE	TE	PTE	SE	CE	AE	TE	PTE	SE	CE	AE	TE	PTE	SE
2010-11	0.340	0.695	0.506	0.965	0.524	0.352	0.762	0.473	0.822	0.599	0.546	0.765	0.680	0.840	0.801
2011-12	0.216	0.446	0.480	0.971	0.494	0.230	0.503	0.454	0.862	0.540	0.510	0.767	0.658	0.872	0.759
2012-13	0.405	0.699	0.593	0.967	0.611	0.407	0.757	0.546	0.861	0.640	0.574	0.801	0.691	0.876	0.786
2013-14	0.512	0.847	0.623	0.956	0.650	0.489	0.905	0.540	0.866	0.630	0.673	0.821	0.823	0.933	0.883
2014-15	0.360	0.825	0.442	0.943	0.475	0.366	0.851	0.433	0.872	0.506	0.557	0.774	0.722	0.886	0.808
2015-16	0.437	0.924	0.474	0.900	0.528	0.454	0.873	0.520	0.876	0.602	0.614	0.754	0.803	0.933	0.863
2016-17	0.116	0.420	0.283	0.859	0.329	0.125	0.441	0.274	0.859	0.325	0.453	0.722	0.607	0.834	0.736
2017-18	0.222	0.553	0.407	0.901	0.451	0.220	0.537	0.410	0.892	0.467	0.602	0.787	0.761	0.906	0.841
2018-19	0.355	0.960	0.370	0.859	0.431	0.409	0.914	0.449	0.834	0.550	0.618	0.812	0.759	0.872	0.867
2019-20	0.502	0.973	0.515	0.882	0.585	0.528	0.933	0.568	0.896	0.635	0.675	0.825	0.808	0.927	0.873
2020-21	0.389	0.924	0.422	0.906	0.469	0.430	0.909	0.473	0.908	0.520	0.635	0.787	0.799	0.952	0.840
<b>Mean</b>	<b>0.444</b>	<b>0.728</b>	<b>0.615</b>	<b>0.939</b>	<b>0.652</b>	<b>0.425</b>	<b>0.751</b>	<b>0.562</b>	<b>0.832</b>	<b>0.685</b>	<b>0.599</b>	<b>0.785</b>	<b>0.751</b>	<b>0.897</b>	<b>0.836</b>
<b>SD</b>	<b>0.153</b>	<b>0.185</b>	<b>0.155</b>	<b>0.033</b>	<b>0.154</b>	<b>0.132</b>	<b>0.161</b>	<b>0.113</b>	<b>0.052</b>	<b>0.144</b>	<b>0.092</b>	<b>0.071</b>	<b>0.063</b>	<b>0.035</b>	<b>0.045</b>
<b>Minimum</b>	<b>0.116</b>	<b>0.232</b>	<b>0.283</b>	<b>0.859</b>	<b>0.329</b>	<b>0.125</b>	<b>0.347</b>	<b>0.274</b>	<b>0.644</b>	<b>0.325</b>	<b>0.36</b>	<b>0.553</b>	<b>0.607</b>	<b>0.834</b>	<b>0.736</b>
<b>Maximum</b>	<b>0.734</b>	<b>0.973</b>	<b>0.917</b>	<b>0.982</b>	<b>0.959</b>	<b>0.625</b>	<b>0.933</b>	<b>0.819</b>	<b>0.908</b>	<b>0.971</b>	<b>0.821</b>	<b>0.922</b>	<b>0.88</b>	<b>0.952</b>	<b>0.926</b>

*Source: Researcher's estimates based on Statistical Tables Banking in India*

Table 6.9 presents the average year-by-year cost efficiency, allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency of India's public sector banks, private sector banks, and foreign banks. In addition, it displays the mean, standard deviation, minimum score, and maximum score for cost efficiency and its components from 1992–1993 to 2020–2021. Cost efficiency and its components in public sector banks demonstrated an inconsistent trend during the whole study period, similar to that observed for all commercial banks in India. This study's result is supported by Megha's (2015) finding. The average cost efficiency of public sector banks ranges from 0.116 in 2016–17 to 0.737 in 1992–93, with a standard deviation of 0.153. The overall mean of cost efficiency (inefficiency) throughout the duration of the study is 0.444 (0.556). This means that, on average, commercial banks in India's public sector use 44.4% of their inputs to produce the same result, while wasting 55.6%. More than half of the inputs used by commercial banks in India's public sector are wasted. It also emphasises that there is significant potential for cost savings by limiting inputs and selecting the optimal mix of inputs at given pricing. During the entire research period, as was the case with all commercial banks, public sector banks never earned a full efficiency score of one for cost efficiency and its components. Initially, CE had a declining trend and reached 0.559 in 1993–1994. Even though the score rose over the following two years, it dropped significantly to 0.159 in 1996–97. The CE of public sector banks improved over the next two years, reaching 0.561 in 1998–99. Then it had a downward trend, but in 2003–04 it increased by 0.524%. 2004–05 and 2005–06 saw a decline in CE; however, 2006–07 and 2007–08 witnessed an increase. From 2008–2009 to 2011–2012, the CE score of public sector banks steadily dropped, reaching 0.216. In 2016–2017, the CE declined to 0.116, the lowest efficiency score throughout the study's duration. In 2019–20, efficiency improved to a score of 0.502. Eventually, CE fell to 0.389.

The minimum allocative efficiency during the research period was 0.232 in 1996–97, and the highest was 0.97 in 2019–20. Allocative efficiency (or inefficiency) is determined to have a grand mean of 0.733 (0.267). Given the prices of inputs, it is obvious that India's public sector banks experienced an additional

26.7% in manufacturing costs due to a poor choice of input combinations. The minimum technical efficiency of public sector banks was 0.283 in 2016–17, and the maximum was 0.91 in 1992–93. The estimated grand mean of technical efficiency (inefficiency) for the study period is 0.624 (0.376). The grand mean of allocative efficiency exceeds the mean of technical efficiency. Thus, it is evident that technical efficiency, rather than allocative efficiency, is the primary source of cost inefficiency in public-sector commercial banks. It also implies that Indian public sector banks are relatively good at selecting an optimal combination of inputs at their given pricing but not so good at limiting the number of inputs required to produce a specific output. This conclusion contradicts the findings of Gulati (2011), Megha (2015), Bhatia and Mahendru (2018), Kaur and Kaur (2017), and Bhatia and Mahendru (2017). The technical efficiency of banks in the public sector is subdivided once again into pure technical efficiency and scale efficiency. Throughout the study period, the pure technical efficiency ranges from a minimum of 0.859 in 2016 to a maximum of 0.982 in 1997–98. Throughout the period, the scale efficiency score goes from a minimum of 0.329 in 2016–17 to a maximum of 0.959 in 1992–93. The overall grand mean score for PTE (inefficiency) is 0.936 (0.064), whereas the overall grand mean score for SE (inefficiency) is 0.662 (0.338). Therefore, it is obvious that scale inefficiency contributes around 33.8% to the overall technical efficiency of India's public sector banks.

As observed in the examination of all commercial banks and public sector banks, the CE and its components in private sector commercial banks exhibit an inconsistent pattern throughout the whole study period. The grand mean of CE (inefficiency) for commercial banks in the private sector is 0.432 (0.568), indicating that, on average, commercial banks in the private sector waste 56.8 percent of the cost incurred to produce the same level of production. This cost inefficiency may be the result of poor input mix selection or management's inability to reduce input costs. Throughout the whole study period, the CE score ranges from a low of 0.125 in 2016–17 to a high of 0.64 in 1991–92. During 1993–94, the CE score demonstrated a downward trend, falling to 0.452 from 0.625 in 1992–93. It somewhat improved in 1994–95 and 1995–96, scoring 0.536 in 1995–96. Unfortunately, 1996–97 have seen a significant loss in CE, with the score falling

from 0.536 to 0.162. Over the following two years, the cost efficiency improved until it reached 0.534% in 1998–99. Subsequently, the years 1999–2000, 2000–2001, and 2001–2002 had a decreasing trend, with respective scores of 0.526, 0.433, and 0.179. During 2002–03 and 2003–04, the cost efficiency score increased to 0.508, but it declined again in the subsequent two years, falling to 0.462 in 2004–05 and 0.391 in 2005–06. In the following two years, the CE score of private sector banks improved once again, reaching 0.610 in 2007–08. From 2007–08 to 2011–12, the CE demonstrated a declining trend and reached a score of 0.230. Following this negative pattern over the past four years, cost efficiency increased over the next two years, achieving a score of 0.49 in 2013–14 before declining in 2014–15. Even while cost efficiency rose to 0.454 in 2015–16, it decreased to 0.125 the next year. Following this significant decrease, cost efficiency improved, and by 2019–2020, it had reached a score of 0.528.0. Similarly to public sector banks, private sector banks' CE scores decreased in the final year compared to the preceding year.

Commercial banks have both allocative and technical efficiencies that contribute to their overall cost efficiency. The grand mean of allocative efficiency (inefficiency) for private sector banks is 0.751% (0.249), but the grand mean of technical efficiency (inefficiency) over the entire study period is 0.562% (0.438). Therefore, both allocative and technical inefficiencies contribute to cost inefficiency. Since the technical inefficiency is greater than the allocative inefficiency, it may be inferred that the primary cause of the cost inefficiency is the technical inefficiency rather than the allocative inefficiency. The allocative efficiency of private sector banks ranges from a low of 0.347 in 2001–2002 to a high of 0.933 in 2019–2020. The technical efficiency ranges from a low of 0.274 in 2016–17 to a high of 0.819 in 1992–93. The pure technical efficiency of commercial banks ranges from 0.644 in 1996–1997 to 0.908 in 2020–21. Similarly, the scale efficiency of private sector banks ranges from 0.325 in 2016–17 to 0.971 in 1992–93. During the study period, the overall mean score for the pure technical efficiency (inefficiency) of the banks was 0.832 (0.168). Similarly, the overall scale efficiency of banks over the study period is 0.685 (0.315). It is evident that scale efficiency, rather than pure technical inefficiency, is the primary cause of private sector commercial banks' technical inefficiency in India.

Table 6.9 displays the average cost efficiency, allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency of foreign banks in India, year by year. In addition, it displays the mean, standard deviation, minimum score, and maximum score for cost efficiency and its components from 1992–1993 to 2020–2021. The grand mean score of the CE (inefficiency) of foreign banks calculated for the entire study period is 0.599 (0.401), indicating that the average foreign bank operating in India could only utilize 59.9% of its inputs to achieve the same level of output while wasting 39.3% of its inputs. The average cost efficiency score ranges from a minimum of 0.360 in 1996–97 to a high of 0.821 in 1992–93. When compared to the behavior of other categories of banks, such as those that were discussed earlier in this chapter, the CE and its components of foreign banks display an unpredictable pattern for the entire time period covered by the study. In the beginning, the CE of foreign banks had a downward trend and reached a score of 0.693 in 1993–94. Even though it showed a modest improvement the following year, it continued to decline after that for the next two years and eventually reached the lowest possible score of 0.360 in 1996–97. On the other hand, it increased once more in the next two years, reaching a score of 0.648 in 1997–1998 and 0.719 in 1998–1999, respectively. After that, it continued to show a downward trend up to 2001–02, and its CE continued to fall, eventually reaching 0.439 in 2001–02. The CE grew between 2002–03 and 2003–04, reaching 0.649 in 2003–04. Then, until 2007–08, the CE of foreign banks exhibited a highly uneven trend and scored 0.623 in 2007–08. Compared to 2007–08, CE decreased for the next two years, ending in a score of 0.536 in 2009–10. In spite of a minor improvement to 0.546 in 2010–11, the CE of foreign banks decreased to 0.510 in 2011–12. After that, it grew in two consecutive years, from 0.574 in 2012–2013 to 0.673 in 2013–2014. The mean cost efficiency score improved to 0.614 in 2015–16 after falling to 0.557 in 2014–15. Despite the fact that the CE score went down to 0.453 in 2016–17, it has since shown an upward trend and has now reached the level of 0.675 in 2019–20. In the final year of the research, however, it dropped to 0.635.

The foreign banks' average AE ranges from a minimum of 0.553 in 1996–97 to a high of 0.922 in 1992–93. During the study period, the overall mean of AE (inefficiency) was 0.785 (0.215). Similarly, the mean TE score fluctuates from a minimum of 0.607 in 2016–17 to a high of 0.938 in 1991–92. The estimated grand



mean TE (inefficiency) score for the study period is 0.757 (0.243). As the technical inefficiency of foreign banks is greater than their allocative inefficiency, the most significant cause of cost inefficiency among foreign banks operating in India is technical inefficiency, i.e., managerial inefficiency. Regarding the components of TE, the grand mean values for PTE (inefficiency) and SE (inefficiency) are 0.897 (0.103) and 0.836 (0.164), respectively. The maximum score on the PTE was 0.952 in 1992-1993, while the minimum score was 0.834 in 2016-2017. Similarly, the mean SE ranged from a low of 0.736 in 2016–17 to a high of 0.926 in 1992–93. As scale inefficiency is greater than pure technical inefficiency, foreign banks' technical inefficiency is mostly attributable to scale inefficiency.

### 6.2.3 Best performing banks in banking industry

Table 6.10 displays the top ten most efficient banks in the Indian banking industry in terms of average cost efficiency values. For this ranking, however, certain restrictions have been implemented so that only banks that are still in business are included, whereas banks that have ceased operations or merged with other banks are omitted entirely.

**Table 6.10**

*Best performing banks in terms of cost efficiency*

<b>Banks</b>	<b>CE</b>	<b>AE</b>	<b>TE</b>	<b>PTE</b>	<b>SE</b>
Credit Suisse Ag	0.996	0.996	1.000	1.000	1.000
United Overseas Bank Ltd	0.805	0.826	0.917	1.000	0.917
Industrial And Commercial Bank Of China	0.782	0.904	0.860	0.896	0.961
Credit Agricole Corporate And Investment Bank	0.779	0.879	0.884	0.919	0.958
Barclays Bank	0.770	0.874	0.879	0.945	0.931
Mizuho Corporate Bank	0.765	0.866	0.878	0.955	0.919
Bank of America	0.764	0.841	0.911	0.987	0.922
Mufg Bank, Ltd.	0.758	0.893	0.845	0.909	0.927
Sumitomo Mitsui Banking Corporation	0.754	0.819	0.912	0.948	0.960
Cooperatieve Rabobank U.A.	0.750	0.824	0.915	0.958	0.951

Source: Researcher's estimates based on DEA analysis

According to the estimation, the top 10 commercial banks that have remarkable performance in terms of cost efficiency are Credit Suisse AG, United Overseas Bank Ltd., Industrial and Commercial Bank of China, Credit Agricole Corporate and Investment Bank, Barclays Bank, Mizuho Corporate Bank, Bank of America, Mufg Bank, Ltd., Sumitomo Mitsui Banking Corporation, and Cooperative Rabobank U.A. These banks are suitable benchmarks for other banks in the Indian banking sector and can serve as models for other banks. An interesting fact is that all of the banks on this list are foreign, just like all of the banks on the list for revenue efficiency. This list contains neither public sector banks nor private sector banks. During the study period, no bank achieved full cost efficiency. However, Credit Suisse AG banks received a full score for their technical efficiency and its components. The majority of banks on this list exhibit greater technical than allocative efficiency. Average allocative inefficiency is greater than technical inefficiency for Credit Suisse AG, United Overseas Bank Ltd., Credit Agricole Corporate and Investment Bank, Barclays Bank, Mizuho Corporate Bank, Bank of America, Sumitomo Mitsui Banking Corporation, and Cooperative Rabobank U.A. Therefore, it is evident that for these banks, cost inefficiency stems more from the improper selection of inputs than from managerial inefficiency.

#### **6.2.4 Comparison of cost efficiency across different groups of banks**

After doing an analysis on the cost efficiency that was produced through DEA, it is essential to determine whether or not the differences in cost efficiency and the components of cost efficiency are statistically significant across the entire period for public sector banks, private sector banks, and foreign banks. The Shapiro-Wilk test concluded that the data did not follow the expected normal distribution, so a non-parametric Kruskal-Wallis H test was performed. The findings of the Kruskal-Wallis H test are presented in the table below.

**Table 6.11***Results of Kruskal Wallis test*

Efficiency Measures	Mean			Mean rank			Chi Square	P value
	Public sector banks	Private sector banks	Foreign banks	Public sector banks	Private sector banks	Foreign banks		
CE	0.456	0.432	0.607	35.43	31.83	64.74	29.63	0.001*
AE	0.733	0.753	0.789	40.72	45.19	46.09	0.75	0.687
TE	0.624	0.570	0.757	38.88	28.28	64.84	32.18	0.001*
PTE	0.939	0.832	0.899	67.93	15.55	48.52	63.75	0.001*
SE	0.662	0.695	0.840	31.48	35.83	64.69	29.62	0.001*

Source: Researcher's Estimates based on DEA analysis, \* indicates significant at 5% level of significance

It is evident from the table that the mean cost efficiency and its components vary across different ownership groups of banks, such as public sector banks, private sector banks, and foreign banks. The obtained chi-square value for cost efficiency is 29.63 with a p value of 0.001. The p-value is less than 0.01, so the null hypothesis that there is no significant difference in the cost efficiency of different commercial bank groups is rejected. Since the null hypothesis is rejected, there are statistically significant differences in the cost efficiency of commercial bank groups. Regarding allocative efficiency, the obtained chi square value is 0.75 and the p value is 0.687. Since the p value is greater than 0.05, the null hypothesis that there is no significant difference in the allocative efficiency of public sector banks, private banks, and foreign banks cannot be rejected. Since the null hypothesis is not rejected, there is no significant difference in the allocative efficiency of various commercial bank groups.

The obtained chi square value for technical efficiency is 32.18, and the calculated p value for technical efficiency is less than 0.001. Since p is less than 0.01, the null hypothesis is rejected at the 1% level of significance. Therefore, there are statistically significant differences between the technical efficiency of public sector banks, private banks, and foreign banks. Similar to technical efficiency,

statistically significant differences are observed between commercial banks' pure technical efficiency and scale efficiency. The chi square values for pure technical efficiency and scale efficiency are calculated to be 63.75 and 29.62, respectively. The calculated p value for both pure technical efficiency and scale efficiency is less than 0.01. Thus, the null hypotheses regarding both pure technical efficiency and scale efficiency are rejected, indicating that there is a statistically significant difference in the efficiency scores of the various groups of commercial banks. Except for allocative efficiency, there are considerable differences between public sector banks, private sector banks, and foreign banks in terms of cost efficiency and its other components. To determine which pair of banks varies considerably in terms of cost efficiency and its components, pair wise comparison tests were done. The result is displayed in Table 6.12.

**Table 6.12**

*Result of pair wise comparisons*

<b>Efficiency</b>	<b>Pairs of Banks</b>	<b>Test Statistics</b>	<b>Standard Error</b>	<b>Standard test statistics</b>	<b>Adj. Sig</b>
Cost efficiency	Public sector banks- Foreign banks	-29.310	6.633	-4.419	<b>0.001*</b>
	Public sector banks- Private Sector banks	3.603	6.633	0.543	1.000
	Private Sector banks- Foreign banks	-32.914	6.633	-4.962	<b>0.001*</b>
Technical efficiency	Public sector banks- Foreign banks	-25.966	6.633	-3.915	<b>0.001*</b>
	Public sector banks- Private Sector banks	10.603	6.633	1.599	0.330
	Private Sector banks- Foreign banks	-36.569	6.633	-5.513	<b>0.001*</b>

Efficiency	Pairs of Banks	Test Statistics	Standard Error	Standard test statistics	Adj. Sig
Pure technical efficiency	Public sector banks- Foreign banks	21.741	6.632	3.278	<b>0.001*</b>
	Public sector banks- Private Sector banks	47.362	6.632	7.141	<b>0.001*</b>
	Private Sector banks- Foreign banks	-25.621	6.632	-3.863	<b>0.001*</b>
Scale efficiency	Public sector banks- Foreign banks	-33.207	6.633	-5.006	<b>0.001*</b>
	Public sector banks- Private Sector banks	-4.345	6.633	-0.655	1.000
	Private Sector banks- Foreign banks	-28.862	6.633	-4.351	<b>0.001*</b>

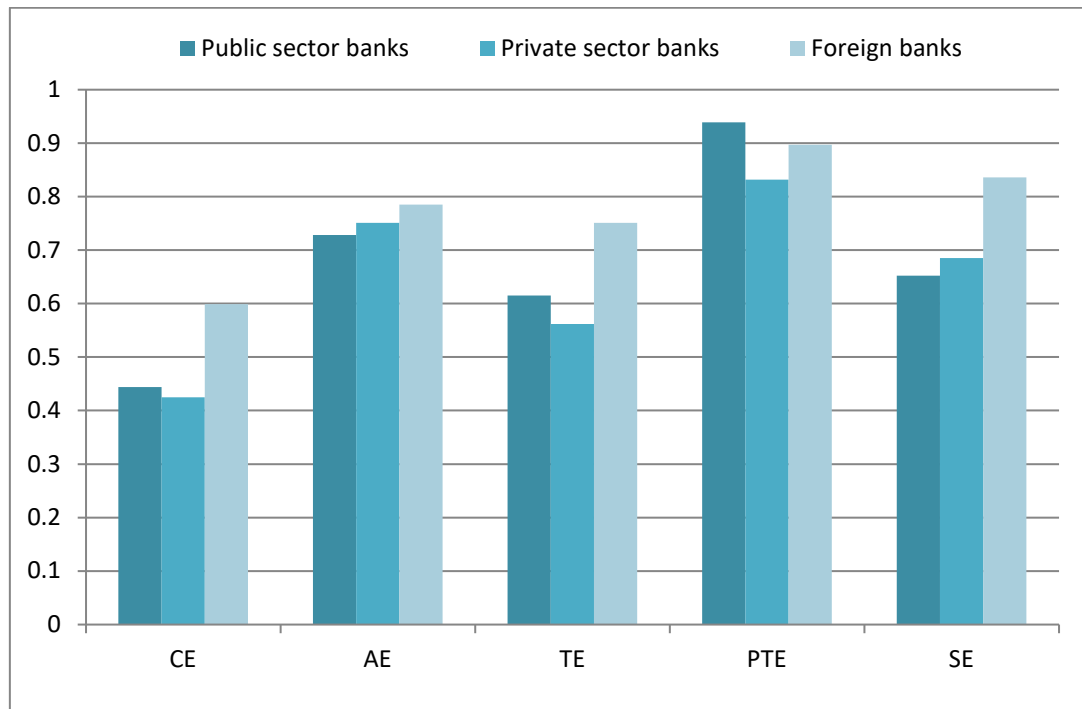
Source: Researcher's Estimates, \* indicates significant at 5% level of significance

The pair wise comparison of cost efficiency indicated that the mean rank difference between public sector banks and foreign banks and private sector banks and foreign banks is significant at the 1% level of significance. However, the findings showed that there was no substantial difference between the public sector banks and the private sector banks. That is, the cost efficiency of the domestic banks is almost the same. This result is similar to the findings of both the technical efficiency and the scale efficiency. For both technical efficiency and scale efficiency, the difference in mean rank between public sector banks and foreign banks and private sector banks and foreign banks is significant at the 1% level of significance. In terms of scale and technical efficiency, there was no significant difference between public and private sector banks. On the other hand, a statistically significant difference was found between all pairs of bank groups, such as public sector banks and foreign banks, private sector banks and foreign banks, and public sector banks and private sector banks in the case of pure technical efficiency.

Figure 6.4 depicts the mean cost efficiency and its components for the diverse groups of commercial banks under study.

**Figure 6.4**

*Mean cost efficiency and its components for different groups of commercial banks*



In terms of cost efficiency, foreign banks (0.607) outperform other groups of banks. This result is consistent with the findings of Gulati (2011) and Megha (2015). Following foreign banks, public sector banks (0.456) do better in terms of cost efficiency, whereas private sector banks underperform relative to other groups of banks. As a result, the order of the various categories of banks according to their cost efficiency is as follows: Foreign banks > Public sector banks > Private sector banks. In terms of both allocative efficiency and scale efficiency, the performance of foreign banks is superior to that of domestic banks; nevertheless, private sector banks are outperforming public sector banks when compared within the context of domestic banks. Therefore, in terms of allocative efficiency and scale efficiency, foreign banks rank higher than private sector banks and public sector banks. In addition, in terms of technical and pure technical efficiency, foreign banks do better than those in the public and private sectors. Public-sector banks outperform private-sector banks among domestic banks. As a result, the ranking of different bank groups in terms of both technical and pure technical efficiency Foreign banks > Public sector > Private sector.

## 6.2.5 Year wise comparison of cost efficiency of different groups of commercial banks

**Table 6.13**

*Year wise comparison of cost efficiency of commercial banks in India*

Year	Kruskal Wallis H test				Pairwise Comparison						
	Mean Rank			Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB	
	PUB	PVB	FB			Std.Test statistic	P value	Std. Test statistic	P value	Std.Test statistic	P value
1992-93	39.93	16.46	53.26	36.776	0.001*	4.111	0.001*	-2.189	0.089***	-5.890	0.001*
1993-94	40.07	19.13	53.65	30.882	0.001*	3.427	0.002*	-2.225	0.078***	-5.502	0.001*
1994-95	38.59	19.96	52.71	27.870	0.001*	3.174	0.005*	-2.319	0.061***	-5.238	0.001*
1995-96	57.04	29.55	47.15	18.799	0.001*	4.234	0.001*	1.441	0.449	-2.689	0.021
1996-97	32.93	34.53	69.21	37.282	0.001*	-0.230	1.000	-5.237	0.001*	-5.235	0.001*
1997-98	47.85	30.59	63.58	24.261	0.001*	2.396	0.001*	-2.241	0.075***	-4.925	0.001*
1998-99	39.93	33.13	68.05	30.538	0.001*	0.934	1.000	-3.989	0.001*	-5.194	0.001*
1999-2000	39.37	38.45	65.58	20.726	0.001*	0.123	1.000	-3.682	0.001*	-3.999	0.001*
2000-01	37.59	43.00	62.10	14.351	0.001*	-0.717	1.000	-3.477	0.002*	-2.796	0.016
2001-02	41.59	28.10	66.81	35.178	0.001*	1.884	0.179	-3.669	0.001*	-5.801	0.001*
2002-03	43.07	28.96	56.03	17.421	0.001*	2.120	0.102	-1.979	0.143	-4.174	0.001*
2003-04	40.85	35.26	53.85	8.620	0.013**	0.838	1.000	-1.963	0.149	-2.860	0.013
2004-05	43.39	35.55	52.73	6.847	0.033**	1.172	0.724	-1.407	0.478	-2.612	0.027
2005-06	38.79	31.57	58.10	17.681	0.001*	1.094	0.822	-2.954	0.009*	-4.058	0.001*
2006-07	45.57	41.88	37.24	1.752	0.416	-	-	-	-	-	-

Year	Kruskal Wallis H test					Pairwise Comparison					
	Mean Rank		Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB		
					Std.Test	P value	Std. Test	P value	Std.Test	P value	
2007-08	41.89	34.52	41.26	1.585	0.453	-	-	-	-	-	-
2008-09	35.96	33.41	46.32	4.871	0.088***	-	-	-	-	-	-
2009-10	41.52	31.95	45.68	4.566	0.102	-	-	-	-	-	-
2010-11	32.88	35.38	48.81	8.070	0.018**	-0.371	1.000	-2.629	0.026**	-2.084	0.111
2011-12	28.04	31.10	56.29	26.209	0.001*	-0.438	1.000	-4.637	<0.001*	-3.819	0.001*
2012-13	34.23	33.90	52.68	12.099	0.002*	0.046	1.000	-2.972	0.009*	-2.788	0.016
2013-14	36.15	28.35	58.62	23.148	0.001*	1.023	0.919	-3.526	<0.001*	-4.313	0.001*
2014-15	31.37	33.15	59.40	24.778	0.001*	-0.233	1.000	-4.399	<0.001*	-3.741	0.001
2015-16	33.07	36.33	58.07	18.422	0.001*	-0.429	1.000	-3.879	<0.001*	-3.114	0.006
2016-17	27.48	26.81	65.85	49.537	0.001*	0.089	1.000	-5.632	<0.001*	-5.993	0.001*
2017-18	27.29	23.24	59.74	42.225	0.001*	0.538	1.000	-4.979	<0.001*	-5.600	0.001*
2018-19	21.50	34.41	56.74	31.560	0.001*	-1.713	0.260	-5.318	<0.001*	-3.479	0.001*
2019-20	25.94	33.18	51.80	18.453	0.001*	-0.968	0.999	-3.888	<0.001*	-2.996	0.008
2020-21	21.33	30.19	45.98	15.580	0.001*	-1.138	0.765	-3.492	<0.001*	-2.736	0.019

Source: Researcher's estimates based on DEA analysis, \*, \*\*and \*\*\* indicates statistical significance at 1%, 5% and 10% respectively.



In the previous analysis, Kruskal Wallis H test has conducted to check whether there is any significant difference in the cost efficiency and its components over the entire period as a whole among the different groups of commercial banks in India. Since the Indian banking sector has undergone constant changes over the study period, it is also relevant to check in which of the year the cost efficiency among commercial banks has found significant difference. For this purpose, Kruskal wallis H test was also used and subsequently pair wise comparison was also conducted to see which of the bank groups shows significant differences. From the above table it is clear that cost efficiency in almost all years is significantly different among different groups of commercial banks in India. In all the years except 2006-07, 2007-08, 2008-09 and 2009-10, at 1% and 5% level of significance, there are differences in the cost efficiency of commercial banks in India. However, during 2008-09, significant difference was found at 10% level of significance. During 2006-07, 2007-08 and 2009-10 no significant difference was found in the cost efficiency of commercial banks.

#### **6.2.6 Analysis of returns to scale of cost efficiency**

In this section, the study analyses the nature of returns to scale for the different groups of commercial banks in order to ascertain the presence of economies or diseconomies of scale in the Indian banking sector. The information about the nature of returns to scale may be utilized by the management to achieve the most productive scale size by either downsizing or expanding the scale of operation (Gulati, 2011). In the previous part, it was observed that scale inefficiency is the major form of inefficiency that causes technical inefficiency. Therefore, it is worth to examine the nature of returns to scale in the Indian banking industry.

In the case of all commercial banks, an average of 85 banks were analysed and among this total, average of 11 banks are operating below their optimal scale size and experiencing IRS. The policy implication of these findings is that, these banks can enhance technical efficiency by increasing their size. An average of 65 banks have been observed to be operating on the zone of DRS. The policy implication of these banks is that downsizing seems to be an appropriate strategic

option for these banks in their pursuits to reduce the cost. Only 9 banks are operating on the most productive scale size and experiencing CRS. Since the number of banks, experiencing CRS is lower than the number of banks on IRS and CRS, decreasing returns to scale is observed to be the predominant form of scale inefficiency in the Indian banking industry. This findings is in similar with the findings of Megha(2016) and contrary with the result of Gulati(2011) and Raina (2016).

In the case of public sector banks, an average of 25 banks were analysed and these 25 banks are operating on the DRS. Throughout the study period, almost all of the public sector banks are operating on the decreasing returns to scale. During 1992-93, four banks were found operating on the IRS and during 1992-93, 1995-96, 1996-97, 1999-2000 and 2013-14; only one bank in each year is found operating on the optimal scale i.e. constant returns to scale. Since the majority of the public sector banks are operating on the zone of decreasing returns of scale, decreasing returns to scale is observed to be the predominant form of scale inefficiency among the Indian public sector banking Industry. This result is in line with the findings of Kumar & Gulati (2008).

**Table 6.14***Returns to scale in Indian banking sector*

Year	All commercial banks				Public sector banks				Private sector banks				Foreign banks			
	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total
1992-93	33	30	7	70	4	22	1	27	21	3	0	24	8	5	6	19
1993-94	14	55	5	74	0	27	0	27	7	17	0	24	7	11	5	23
1994-95	9	58	5	72	0	27	0	27	6	17	1	24	3	14	4	21
1995-96	12	63	11	86	0	26	1	27	5	26	2	33	7	11	8	26
1996-97	8	74	10	92	0	26	1	27	1	28	3	32	7	20	6	33
1997-98	4	77	14	95	0	25	2	27	1	29	2	32	3	23	10	36
1998-99	5	78	13	96	0	27	0.	27	0	31	1	32	5	20	12	37
1999-2000	11	77	10	98	0	26	1	27	0	31	1	32	11	20	8	39
2000-01	7	80	11	98	0	27	0.	27	0	29	1	30	7	24	10	41
2001-02	9	76	8	93	0	27	0.	27	0	29	0	29	9	20	8	37
2002-03	9	66	10	85	0	27	0.	27	1	27	0	28	8	12	10	30
2003-04	13	65	8	86	0	27	0.	27	3	25	1	29	10	13	7	30
2004-05	8	71	8	87	0	28	0.	28	1	28	0	29	7	15	8	30
2005-06	8	67	10	85	0	28	0	28	0	27	1	28	8	12	9	29
2006-07	10	66	6	82	0	28	0	28	0	25	0	25	10	13	6	29
2007-08	11	62	5	78	0	28	0	28	1	22	0	23	10	12	5	27
2008-09	6	65	6	77	0	27	0	27	0	22	0	22	6	16	6	28
2009-10	11	62	7	80	0	27	0	27	1	21	0	22	10	14	7	31
2010-11	14	54	11	79	0	26	0	26	1	20	0	21	13	8	11	32

Year	All commercial banks				Public sector banks				Private sector banks				Foreign banks			
	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total	IRS	DRS	CRS	Total
2011-12	14	59	8	81	0	26	0	26	0	20	0	20	14	13	8	35
2012-13	17	60	7	84	0	26	0	26	0	20	0	20	17	14	7	38
2013-14	15	59	15	89	0	26	1	27	0	20	0	20	15	13	14	42
2014-15	9	68	12	89	0	27	0	27	0	20	0	20	9	21	12	42
2015-16	9	69	12	90	0	27	0	27	0	21	0	21	9	21	12	42
2016-17	11	73	5	89	0	27	0	27	0	21	0	21	11	25	5	41
2017-18	8	65	11	84	0	21	0	21	0	21	0	21	8	23	11	42
2018-19	15	57	12	84	0	20	0	20	0	22	0	22	15	15	12	42
2019-20	11	58	12	81	0	18	0	18	0	22	0	22	11	18	12	41
2020-21	10	52	12	74	0	12	0	12	0	21	0	21	10	19	12	41
<b>Total</b>	<b>321(13)</b>	<b>1866(76)</b>	<b>271(11)</b>	<b>2458(100)</b>	<b>4(1)</b>	<b>736(99)</b>	<b>7(1)</b>	<b>747(100)</b>	<b>49(7)</b>	<b>665(91)</b>	<b>13(2)</b>	<b>727(100)</b>	<b>268(27)</b>	<b>465(47)</b>	<b>251(26)</b>	<b>984(100)</b>
<b>Average</b>	<b>11</b>	<b>65</b>	<b>9</b>	<b>85</b>	<b>0</b>	<b>25</b>	<b>0</b>	<b>25</b>	<b>2</b>	<b>23</b>	<b>0</b>	<b>25</b>	<b>9</b>	<b>16</b>	<b>9</b>	<b>34</b>

Source: Researcher's Estimates based on DEA analysis

Similar to public sector banks, majority of private sector banks are operating on the zone of decreasing returns to scale. 91% of private sector commercial banks are operating on the DRS and 7 percentages of commercial banks are operating on the IRS. Only two percentages of commercial banks are operating at CRS. Hence, it is clear that the predominant form of scale inefficiency among Indian private sector banks is decreasing returns to scale.

Like domestic banks, majority of foreign banks operating in India are operating on the zone of DRS. However, the percentage of commercial banks operating on DRS is less than the percentage of public and private sector commercial banks operating on DRS. 27 percentage of foreign banks are operating on IRS and 47 percentage of banks are operating on DRS (99% and 91% respectively for public sector banks and private sector banks). 26 percentages of foreign banks operating during the study period are operating on the constant returns to scale. As compared to public and private sector banks, the banks operating on the CRS are higher in the case of foreign banks. However, as the majority of the foreign banks operating on the zone of DRS, the prominent form of scale inefficiency among foreign banks is decreasing returns to scale.

### **6.3 Analysis of Profit Efficiency**

The major objective of commercial banks is to earn maximum profit. Das and Ghosh (2009) pointed out that profit maximisation requires not only that goods and services be produced at the lowest possible cost but also that revenues be maximised. This section discusses the trends in the profit efficiency of all commercial banks, including public sector banks, private sector banks, and foreign banks, during the post-liberalization period ranging from 1992–1993 to 2020–21. As already stated in the methodology part, the profit efficiency score varies from 0 to 1. Each bank's profit efficiency was calculated for each year of the study period. These efficiency scores are averaged to analyse the performance of the commercial banks in India. That is, the annual means for each group of banks are presented in order to determine whether a trend exists in the performance of banks over time.

### 6.3.1 Profit efficiency of Indian banking industry

Table 6.15 presents the year-wise profit efficiency of the Indian banking industry from 1992–93 to 2020–21. The average profit efficiency score varies from a minimum of 0.253 in 1996–97 to a maximum of 0.4901 in 1992–93. It was observed that the highest score of revenue efficiency, cost efficiency, and profit efficiency was estimated in 1992–93, while the lowest score of both cost and profit was reported in 1996–97. During the study period, 63 commercial banks were profit-efficient on average, while 22 banks were profit-inefficient. The grand mean of profit efficiency for commercial banks in India during the period is 0.320. From this, it is clear that the banks in India can increase their profit efficiency on average by 60 to 70 percent merely by adopting the best practices within their peer group. In other words, on average, Indian banks could improve their profits by 68% if they were able to operate on the efficient profit frontier. There appears to be substantial room for growth in potential profitability if Indian banks are able to utilise factor inputs effectively and select an optimal loan and investment portfolio mix. From the table, it is also noticed that the profit efficiency of commercial banks in the Indian banking industry never achieved a full efficiency score of 1 during any one of the years under study. During the entire period, the profit efficiency was lower than 50%.

**Table 6.15**

*Profit efficiency score of Indian banking industry*

Year	Total no. of banks	No. of efficient banks	No. of inefficient banks	PE
1992-93	70	30(43%)	40(57%)	0.490
1993-94	74	46(62%)	28(38%)	0.289
1994-95	72	52(72%)	20(28%)	0.255
1995-96	86	62(72%)	24(28%)	0.291
1996-97	92	67 (73%)	25(27%)	0.253
1997-98	95	58(61%)	37(39%)	0.394
1998-99	96	50(52%)	46(48%)	0.315
1999-2000	98	53(54%)	45(45%)	0.286

Year	Total no. of banks	No. of efficient banks	No. of inefficient banks	PE
2000-01	98	51(52%)	47(48%)	0.321
2001-02	93	52(56%)	41(44%)	0.258
2002-03	85	58(68%)	27(32%)	0.352
2003-04	87	67(77%)	20(23%)	0.355
2004-05	87	72(83%)	15(17%)	0.328
2005-06	85	71(84%)	14(16%)	0.289
2006-07	82	66(80%)	16(20%)	0.325
2007-08	78	67(86%)	11(14%)	0.325
2008-09	77	71(92%)	6(8%)	0.284
2009-10	80	65(81%)	15(19%)	0.316
2010-11	79	69(87%)	10(13%)	0.295
2011-12	81	71(88%)	10(12%)	0.282
2012-13	84	74(88%)	10(12%)	0.321
2013-14	89	75(84%)	14(16%)	0.350
2014-15	89	76(85%)	13(15%)	0.293
2015-16	90	75(83%)	15(17%)	0.342
2016-17	89	78(88%)	11(12%)	0.254
2017-18	84	68(81%)	16(19%)	0.315
2018-19	84	69(82%)	15(18%)	0.322
2019-20	81	70(86%)	11(14%)	0.358
2020-21	74	63(85%)	11(15%)	0.431
<b>Average</b>	<b>85</b>	<b>63(74%)</b>	<b>22(26%)</b>	<b>0.320</b>
<b>Std. deviation</b>	<b>8</b>			<b>0.052</b>
<b>Minimum</b>	<b>70</b>			<b>0.253</b>
<b>Maximum</b>	<b>98</b>			<b>0.490</b>

Source: Researcher's estimates based on Statistical Tables Relating to Banks in India (Note: Figures in the parenthesis indicates the percentage of number of efficient and inefficient banks)

Similar to the cost and revenue efficiency of Indian commercial banks, profit efficiency also showed an inconsistent pattern during the entire period of the study. In the initial years of the study, profit efficiency showed a declining trend, i.e., from 0.490 in 1992–93 to 0.255 in 1994–94. Then it improved to 0.291 in 1995–96 and decreased to 0.253 in 1996–97. During 1997–1988, profit efficiency improved to

0.394 from 0.253 in 1996–1997. However, in the next two years, the profit efficiency of banks showed a decreasing trend and was reported at 0.315 in 1998–99 and 0.286 in 1999–2000. During 2000–01, the profit efficiency of commercial banks in the Indian banking industry improved to 0.321, but in 2001–02, the score again came down to 0.258. During 2002–03 and 2003–04, the PE score of the banks improved and recorded 0.352 in 2002–03 and 0.355 in 2003–04. However, in 2004–05 and 2005–06, the profit efficiency score again showed a downward pattern, and PE came down to 0.289 in 2005–06. Even though this period showed a decreasing trend in the score, the percentage of inefficient banks has decreased to 16% from 23% in 2003–04, and of course, the number of efficient banks has improved to 84% from 77% in 2003–2004. The years 2006–07 witnessed an improvement in CE and reported a score of 0.325, but the percentage of inefficient banks increased to 20% from 16% in the previous year. According to the Reserve Bank of India, 2007–08 was marked by a number of challenges, including unprecedented capital flows, unstable foreign financial markets, and an increase in headline inflation and inflationary expectations. In 2007–08, the profit efficiency remained unchanged. This may be owing to the RBI's ongoing examination and revision of its regulatory and supervisory policies in order to maintain a strong capital base, efficient risk management, and the highest corporate governance standards in the banking industry. Additionally, RBI asserts that the Indian banking industry is insulated from the global financial crisis. In 2008–09, however, the PE fell to 0.284. This year, the number of inefficient banks reported was only 6, i.e., 8%, while 92% of banks were found to be efficient. In 2009–10, the score improved to 0.316 and showed a decreasing trend in the next two years, i.e., 0.2954 in 2010–11 and 0.2824 in 2011–12. Conversely, in the following two years, the profit efficiency score showed an increasing trend and reported a score of 0.3504 in 2013–14. Until 2016–17, profit efficiency fluctuated, and in 2016–17, the PE calculated was 0.2538, a significant decrease from the previous year's score of 0.3423. From 2017–18 to 2020–21, the profit efficiency of commercial banks in the Indian banking industry showed an increasing pattern and recorded a score of 0.4313 in 2020–21, which is the second highest PE score during the entire study period. Despite the spread of the COVID-19



pandemic and the consequent lockdown in the country, the profit efficiency scores of the Indian banking sector have improved considerably during 2019–20 and 2020–21.

### **6.3.2 Profit efficiency across different ownership group of banks**

In order to get a clear picture about the profit efficiency of banks in India, profit efficiency is evaluated based on the different ownership groups of banks. For this purpose, banks are classified into public sector banks, private sector banks and foreign banks. The year wise and ownership group wise profit efficiency is presented in the table 6.16.

**Table 6.16***Profit efficiency across different ownership group of banks*

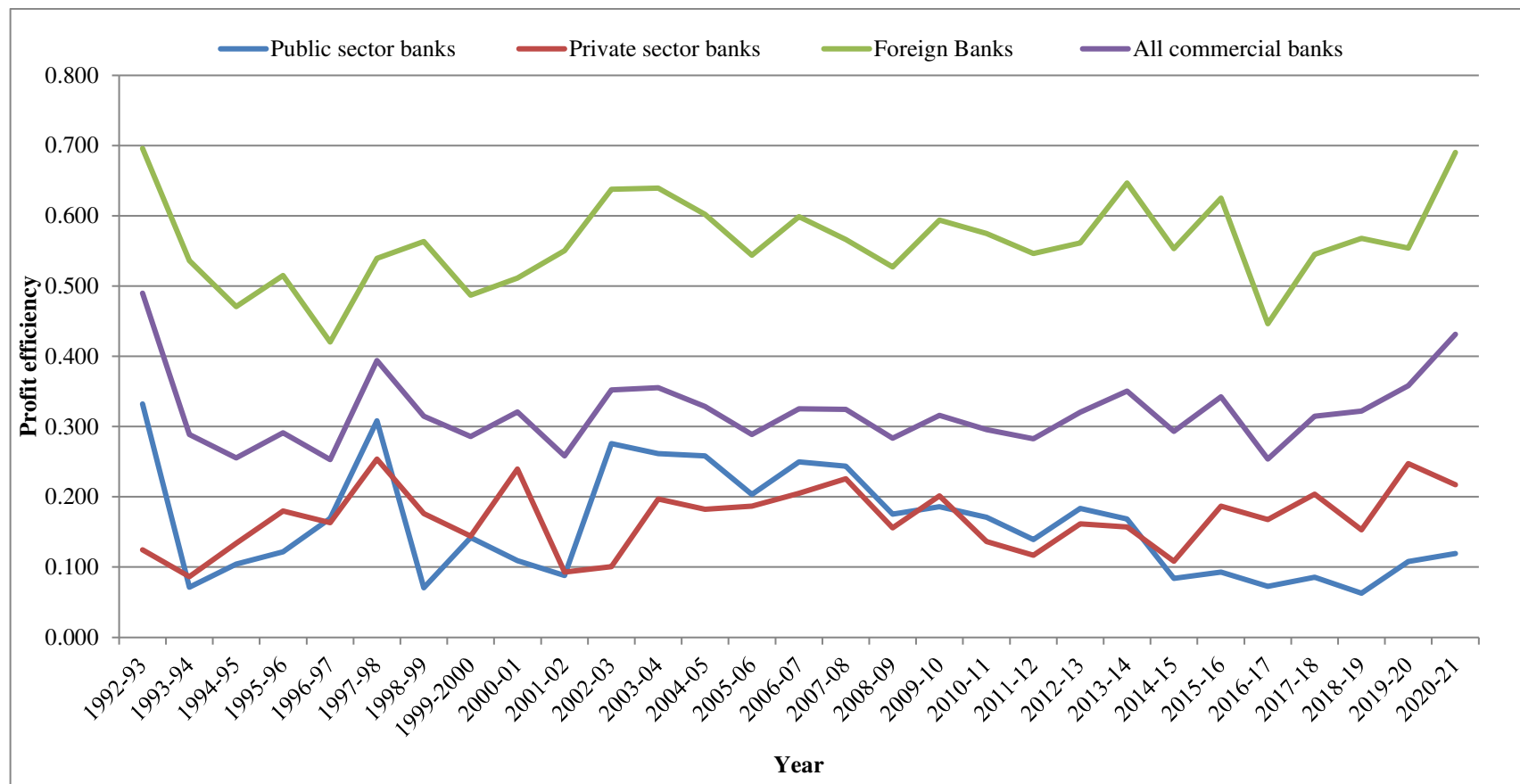
Year	Public sector banks			Private sector banks			Foreign banks		
	No. of Efficient banks	No. of inefficient banks	PE	No. of Efficient banks	No. of inefficient banks	PE	No. of Efficient banks	No. of inefficient banks	PE
1992-93	6(22%)	21(78%)	<b>0.333</b>	7(29%)	17(71%)	<b>0.125</b>	17(89%)	2(11%)	<b>0.696</b>
1993-94	9(33%)	18(67%)	<b>0.071</b>	16(67%)	8(33%)	<b>0.087</b>	21(91%)	2(9%)	<b>0.536</b>
1994-95	14(52%)	13(48%)	<b>0.104</b>	18(75%)	6(25%)	<b>0.134</b>	20(95%)	1(5%)	<b>0.471</b>
1995-96	14(52%)	13(48%)	<b>0.122</b>	25(76%)	8(24%)	<b>0.180</b>	23(88%)	3(12%)	<b>0.515</b>
1996-97	18(67%)	9(33%)	<b>0.169</b>	26(81%)	6(19%)	<b>0.163</b>	23(70%)	10(30%)	<b>0.421</b>
1997-98	18(67%)	9(33%)	<b>0.308</b>	15(47%)	17(53%)	<b>0.254</b>	25(69%)	11(31%)	<b>0.539</b>
1998-99	15(56%)	12(44%)	<b>0.071</b>	13(41%)	19(59%)	<b>0.176</b>	22(59%)	15(41%)	<b>0.563</b>
1999-2000	13(48%)	14(52%)	<b>0.142</b>	18(56%)	14(44%)	<b>0.144</b>	22(56%)	17(44%)	<b>0.487</b>
2000-01	14(52%)	13(48%)	<b>0.109</b>	15(50%)	15(50%)	<b>0.239</b>	22(54%)	19(46%)	<b>0.511</b>
2001-02	20(74%)	7(26%)	<b>0.088</b>	13(43%)	17(57%)	<b>0.093</b>	19(53%)	17(47%)	<b>0.550</b>
2002-03	25(93%)	2(7%)	<b>0.276</b>	14(50%)	14(50%)	<b>0.101</b>	19(63%)	11(37%)	<b>0.638</b>
2003-04	25(93%)	2(7%)	<b>0.262</b>	21(78%)	6(22%)	<b>0.197</b>	20(67%)	10(33%)	<b>0.639</b>
2004-05	28(100%)	0(0%)	<b>0.258</b>	24(83%)	5(17%)	<b>0.182</b>	20(67%)	10(33%)	<b>0.602</b>
2005-06	28(100%)	0(0%)	<b>0.204</b>	24(86%)	4(14%)	<b>0.187</b>	19(66%)	10(34%)	<b>0.544</b>
2006-07	28(100%)	0(0%)	<b>0.250</b>	21(84%)	4(16%)	<b>0.205</b>	17(59%)	12(41%)	<b>0.599</b>
2007-08	28(100%)	0(0%)	<b>0.244</b>	21(91%)	2(9%)	<b>0.226</b>	18(67%)	9(33%)	<b>0.566</b>
2008-09	27(100%)	0(0%)	<b>0.175</b>	21(95%)	1(5%)	<b>0.156</b>	23(82%)	5(18%)	<b>0.527</b>

Year	Public sector banks			Private sector banks			Foreign banks		
	No. of Efficient banks	No. of inefficient banks	PE	No. of Efficient banks	No. of inefficient banks	PE	No. of Efficient banks	No. of inefficient banks	PE
2009-10	27(100%)	0(0%)	<b>0.186</b>	18(82%)	4(18%)	<b>0.201</b>	20(65%)	11(35%)	<b>0.594</b>
2010-11	26(100%)	0(0%)	<b>0.171</b>	20(95%)	1(5%)	<b>0.136</b>	23(72%)	9(28%)	<b>0.575</b>
2011-12	26(100%)	0(0%)	<b>0.139</b>	19(95%)	1(5%)	<b>0.117</b>	26(74%)	9(26%)	<b>0.546</b>
2012-13	26(100%)	0(0%)	<b>0.184</b>	20(100%)	0(0%)	<b>0.161</b>	28(74%)	10(26%)	<b>0.561</b>
2013-14	26(96%)	1(4%)	<b>0.169</b>	20(100%)	0(0%)	<b>0.157</b>	29(69%)	13(31%)	<b>0.647</b>
2014-15	26(96%)	1(4%)	<b>0.084</b>	17(85%)	3(15%)	<b>0.108</b>	33(79%)	9(21%)	<b>0.553</b>
2015-16	25(93%)	2(7%)	<b>0.093</b>	18(86%)	3(14%)	<b>0.187</b>	32(76%)	10(24%)	<b>0.625</b>
2016-17	26(96%)	1(4%)	<b>0.073</b>	19(90%)	2(10%)	<b>0.168</b>	33(80%)	8(20%)	<b>0.446</b>
2017-18	20(95%)	1(5%)	<b>0.086</b>	19(90%)	2(10%)	<b>0.204</b>	29(71%)	12(29%)	<b>0.545</b>
2018-19	18(90%)	2(10%)	<b>0.063</b>	19(86%)	3(14%)	<b>0.153</b>	32(76%)	10(24%)	<b>0.568</b>
2019-20	17(94%)	1(6%)	<b>0.108</b>	20(91%)	2(9%)	<b>0.247</b>	33(80%)	8(20%)	<b>0.554</b>
2020-21	12(100%)	0(0%)	<b>0.119</b>	20(95%)	1(5%)	<b>0.217</b>	31(76%)	10(24%)	<b>0.690</b>
<b>Average</b>			<b>0.161</b>			<b>0.169</b>			<b>0.562</b>
<b>Standard deviation</b>			<b>0.078</b>			<b>0.046</b>			<b>0.065</b>
<b>Minimum</b>			<b>0.063</b>			<b>0.087</b>			<b>0.421</b>
<b>Maximum</b>			<b>0.333</b>			<b>0.254</b>			<b>0.696</b>

Source: Researcher's Estimates, (Note: Figures in the parenthesis indicates the per centage of number of efficient and inefficient banks to total number of banks analysed in each year).

**Figure 6.5**

*Trends in mean profit efficiency of commercial banks during 1992-93 to 2020-21.*



As seen from the table 6.16, during the entire period of the study, the profit efficiency estimates of public sector banks varies from the minimum of 0.0630 in 2018-19 to a maximum of 0.3325 in 1992-93. The average profit efficiency calculated for the period is 0.1610. The profit efficiency of public sector banks was above average in 14 out of 29 years i.e in the years of 1992-93 (0.3325), 1996-97(0.1690), 1997-98 (0.3080), 2002-03(0.2757), 2003-04 (0.2616), 2004-05 (0.2583),2005-06 (0.2035), 2006-07(0.2498), 2007-08 (0.2435), 2008-09 (0.1753), 2009-10 (0.1860), 2010-11 (0.1707), 2012-13(0.1836) and 2013-14(0.1685). The profit efficiency estimates was below average in 15 times in the entire period. Although, the profit efficiency estimate is highest in 1992-93, the percentage of inefficient banks was also highest in the same year. Then, profit efficiency declined sharply in the next year (0.0711) but it started show an increasing trend from 1994-95 to 1997-98 and it reached to 0.3080 in 1997-98. During this period percentage of inefficient banks also exhibited a declining trend and therefore, percentage of efficient banks increased. From 2000-01, the percentage of number of inefficient banks become lower than 50 per cent and All public sector banks were found profit efficient from 2004-05 to 2012-13. During these years, profit efficiency was above average in all the years except 2011-12. It is also note that in any one of the year public sector banks could not able to achieve full profit efficiency score of one.

Profit efficiency of private sector banks ranges from the lowest value of 0.0866 in 1993-94 and highest value of 0.2540 in 1997-98 with the average value of 0.1657. Private sector also shows an inconsistent pattern in the profit efficiency during the study period. It was above average in the years of 1995-96 (0.1797), 1997-98 (0.2540), 1998-99 (0.1759), 2000-01(0.2393), 2003-04 (0.1967), 2004-05 (0.1822), 2005-06(0.1866), 2006-07 (0.2048), 2007-08 (0.2256), 2009-10 (0.2011), 2015-16 (0.1867), 2016-17 (0.1676), 2017-18 (0.2038), 2019-20 (0.2474) and 2020-21 (0.2173). During the entire period, profit efficiency of private sector banks found below average in 14 years. Similar to public sector banks, the percentage of inefficient banks was highest in the year 1992-93 and none of the banks found inefficient during 2012-13 and 2013-14. Consequently, all private sector banks were found efficient during 2012-13 and 2013-14. In the initial years of the study, i.e. from 1992-93 to 2002-03, the percentage of inefficient banks was more than 50 per

cent. Following this period, the percentage of number of private sector banks, become less than 50 per cent and it reduced to single digit and even zero in 2012-13 and 2013-14. Just like public sector banks, in any one of the year the profit efficiency of private sector banks could not achieve the full efficiency score of one.

The profit efficiency of foreign banks fluctuates from the low of 0.4205 in 1996-97 and high of 0.6961 in 1992-93 with the average of 0.5623. During the entire period of the study, the profit efficiency of foreign banks become below average in 16 years. It become above average in 1992-93 (0.6961), 1998-99 (0.5633), 2002-03 (0.6378), 2003-04 (0.6391), 2004-05(0.6020), 2006-07 (0.5985), 2007-08 (0.5660), 2009-10(0.5938), 2010-11(0.5748), 2013-14 (0.6468), 2015-15(0.6250), 2018-19(0.5676), and 2020-21(0.6902). Unlike domestic banks, the percentage of number of inefficient banks never becomes zero in any one of the year. However, it never becomes more than 50 per cent in any one of the study period. The highest percentage of inefficient banks (47%) is reported in 2001-02 and lowest percentage of 1% calculated in 1994-95. Similar to domestic banks, foreign banks never achieved profit efficiency score of one in any one of the year under study.

On comparing the three groups of banks, it is evident that all groups of banks never achieved the standard profit efficiency score of 1 in any one of the year. The average profit efficiency scores of foreign banks is found higher than that of private sector banks and public sector banks. While comparing the average efficiency of public and private sector banks, it is evident that there is only a slight difference between the profit efficiency of public and private sector banks. However, the profit efficiency of private sector banks are higher than the public sector banks in India. There are number reasons for the low profit efficiency of public sector commercial banks in India. Even though, liberalization process emphasized on the profit maximization objectives, certain socially relevant activities like opening new branches in rural areas, encouraging employment for low skilled workers etc have still strictly followed by public sector banks. As a part of social banking, public sector banks are directed to lent to priority sectors at a rate, which is below the market rate, may become unproductive and yield low return on advances. As on 31<sup>st</sup> March 2021, about 35.43% of total advances made by public sector banks are directed to priority sector. Another reason may be for the low profit efficiency of

the public sector banks is the heavy investment in risk free government securities. The banks can focus more on the credit extension and monitoring the risk associated with the credit. As on March 2021, about 83% of total investments of public sector banks have invested in government securities. Finally, public sector banks are not able to explore lending opportunities engendered by liberalization (Banjerjee, Cole & Duflo, 2004, Das & Ghosh, 2009).

Public sector banks and foreign banks have improved their profit efficiency during the last two years of the study. Foreign banks have recorded the highest improvement during this period. However, the profit efficiency of private sector banks has declined in the terminal year of the study.

### 6.3.3 Best performing banks in banking industry

The top 10 best-performing banks in the Indian banking sector are listed in Table 6.17. This ranking is based on the average values of profit efficiency of banks. However, in order to conduct this ranking, certain filters have been applied. These filters ensure that only financial institutions that are currently active are taken into consideration for the ranking. Financial institutions that have ceased their operations or merged with other financial institutions are omitted entirely from the ranking.

**Table 6.17**

*Best performing banks in terms of profit efficiency*

<b>Banks</b>	<b>PE</b>	<b>Rank</b>
Bank of Nova Scotia	0.743	1
Bank of America	0.698	2
Bank of Ceylon	0.639	3
Jp Morgan Chase Bank N.A.	0.551	4
Mizuho Corporate Bank	0.457	5
Deutsche Bank AG	0.429	6
Mashreq Bank	0.414	7
MUFG Bank, Ltd.	0.401	8
BNP Paribas	0.369	9
Barclays Bank	0.362	10

Source: Researcher's estimates based on DEA analysis

According to the estimation, the top 10 commercial banks that have outstanding performance in terms of profit efficiency are Bank of Nova Scotia, Bank of America, Bank of Ceylon, J.P. Morgan Chase Bank N.A., Mizuho Corporate Bank, Deutsche Bank AG, Mashreq Bank, MUFG Bank, Ltd., BNP Paribas, and Barclays Bank. This list contains no public or private sector banks. Das & Ghosh (2009) observed that Foreign banks are primarily located in metropolitan cities, and the majority of their customers are wealthy corporations and individuals. As opposed to the huge retail deposits of domestic banks, they generally depend more on wholesale deposits.

#### **6.3.4 Comparison of profit efficiency across different groups of banks**

In the light of the above discussion, the study further investigates the difference in profit efficiency across different ownership groups of banks by applying the non-parametric Kruskal-Wallis test separately for each individual year under study. Table 6.17 exhibits the mean ranks, chi square value, and p value estimated under the Kruskal-Wallis H test and standard test statistics and p value of each pair of commercial banks.

From table 6.18, it is clear that profit efficiency in all years is significantly different among different groups of commercial banks in India. That is, among the selected 29 years, the profit efficiency of different groups of commercial banks is statistically different. The pair-wise comparison shows which of the pairs shows a statistically significant difference. From the table, it is clear that profit efficiency among private sector banks and public sector banks is almost similar for the majority of the years. Only during 2003–04, 2015–16, 2016–17, 2017–18, 2018–19, and 2019–20 was the profit efficiency significantly different among the domestic banks.



**Table 6.18***Year wise comparison of profit efficiency of commercial banks in India*

Year	Kruskal Wallis H test					Pair wise comparison					
	Mean rank			Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB	
	PSB	PVB	FB			Std.Test statistic	P value	Std.Test statistic	P value	Std.Test statistic	P value
1992-93	12.42	5.71	20.62	15.249	0.000*	1.374	0.508	-1.969	0.147	-3.784	0.000*
1993-94	12.78	15.38	34.29	25.196	0.000*	-0.465	1.000	-4.024	0.000*	-4.248	0.000*
1994-95	17.93	19.83	38.50	20.511	0.000*	-0.353	1.000	-3.896	0.000*	-3.792	0.000*
1995-96	24.07	24.76	43.35	15.847	0.000*	-0.115	1.000	-3.159	0.005*	-3.573	0.001*
1996-97	31.64	26.06	44.83	11.723	0.000*	0.936	1.000	-2.154	0.094***	-3.371	0.002*
1997-98	25.72	22.87	36.20	7.214	0.027**	0.486	1.000	-2.016	0.131	-2.428	0.046**
1998-99	18.00	22.77	36.86	16.931	0.000*	-0.850	1.000	-3.850	0.000*	-2.613	0.027**
1999-2000	17.12	20.58	38.09	19.847	0.000*	-0.618	1.000	-3.889	0.000*	-3.573	0.001*
2000-01	13.18	24.73	35.03	18.767	0.000*	-2.099	0.107	-4.314	0.000*	-2.075	0.114
2001-02	16.95	20.00	41.00	27.751	0.000*	-0.565	1.000	-4.956	0.000*	-3.851	0.000*
2002-03	25.58	19.57	41.97	16.700	0.000*	1.071	0.853	-3.204	0.004*	-3.783	0.000*
2003-04	30.84	22.07	48.83	20.706	0.000*	-2.018	0.044**	-3.616	0.000*	-3.887	0.000*
2004-05	35.25	25.25	51.75	17.678	0.000*	1.719	0.257	-2.695	0.021**	4.185	0.000*
2005-06	32.86	26.65	52.39	17.577	0.000*	1.089	0.829	-4.065	0.000*	-3.181	0.004*
2006-07	29.93	25.00	49.88	17.481	0.000*	0.890	1.000	-3.382	0.002*	-3.974	0.000*
2007-08	28.89	26.67	50.50	17.809	0.000*	0.396	1.000	-3.671	0.001*	-3.808	0.000*
2008-09	29.11	25.90	53.30	24.207	0.000*	0.534	1.000	-4.132	0.000*	-4.399	0.000*

Year	Kruskal Wallis H test					Pair wise comparison					
	Mean rank			Chi Square	P value	PSB Vs PVS		PSB Vs FB		PVS Vs FB	
	PSB	PVB	FB			Std.Test statistic	P value	Std.Test statistic	P value	Std.Test statistic	P value
2009-10	23.48	27.44	50.85	26.242	0.000*	-0.689	1.000	-4.908	0.000*	-3.812	0.000*
2010-11	28.62	22.50	53.09	29.155	0.000*	1.026	0.951	-4.266	0.000*	-4.992	0.000*
2011-12	26.69	22.00	55.54	37.381	0.000*	0.754	1.000	-5.043	0.000*	-5.388	0.000*
2012-13	28.42	24.95	54.89	29.782	0.000*	0.543	1.000	-4.521	0.000*	-4.758	0.000*
2013-14	26.19	25.35	57.31	37.252	0.000*	0.130	1.000	-5.295	0.000*	-5.053	0.000*
2014-15	22.04	29.12	56.30	39.117	0.000*	-1.030	0.909	-5.929	0.000*	-3.160	0.005*
2015-16	17.40	35.33	55.59	43.594	0.000*	-2.666	0.023**	-6.576	0.000*	-4.165	0.000*
2016-17	18.73	40.58	55.24	37.851	0.000*	-3.196	0.004*	-6.148	0.000*	-2.248	0.074***
2017-18	14.70	34.11	48.41	34.528	0.000*	-3.068	0.006*	-5.875	0.000*	-2.456	0.042**
2018-19	12.72	30.53	50.19	41.603	0.000*	-2.702	0.021**	-6.348	0.000*	-3.389	0.002*
2019-20	14.88	33.65	47.24	28.683	0.000*	-2.800	0.015**	-5.334	0.000*	-2.360	0.055***
2020-21	14.00	23.20	44.65	31.206	0.000*	-1.381	0.502	-4.939	0.000*	-4.097	0.000*
<b>Overall</b>	<b>27.28</b>	<b>31.72</b>	<b>73.00</b>	<b>57.791</b>	<b>0.000*</b>	<b>-0.671</b>	<b>1.000</b>	<b>-6.893</b>	<b>0.000*</b>	<b>-6.223</b>	<b>0.000*</b>

Source: Researcher's estimates based on DEA analysis, \*, \*\*and \*\*\* indicates statistical significance at 1%, 5% and 10% respectively.

While comparing the efficiency among public sector banks and foreign banks, 27 out of 29 years show a significant difference. During 1992–93 and 1997–98, profit efficiency was not statistically significantly different between public sector banks and foreign banks. In the same way, there were statistically significant differences between private sector banks and foreign banks in all years except 2000–01.

The overall mean rank of the public sector, private sector, and foreign banks was calculated as 27.28, 31.72, and 73.00, respectively. The chi square value obtained from the Kruskal-Wallis H test is 57.791 with a p value of 0.000. Since the p value is less than 0.05, the null hypothesis formed in relation to the analysis is rejected, and thus there is a statistically significant difference in the profit efficiency of commercial banks during the study period. A multiple comparison test was conducted in order to see which pair of commercial banks were significantly different. The standard test statistic obtained from the pair of public sector banks and private sector banks is -0.671, and the p value is 1.000. Since the p value is higher than 0.05, it is inferred that there is no statistically significant difference in the profit efficiency among the public and private sector banks. Thus, during the study period, the profit efficiency among the domestic banks was statistically similar. The analysis between public sector banks and foreign banks obtained the standard test statistic value of -6.895 with a p value of 0.000. Since the p value is less than 0.05, it is clear that there is a statistically significant difference in the profit efficiency between public sector banks and foreign banks. Multiple comparison analysis among private sector banks and foreign banks obtained a p value of 0.000 with the standard test statistic of -6.223. Here also, the p value is lower than the significant value of 0.05. Hence, the profit efficiency among private sector banks and foreign banks is statistically different. From the analysis, it is understood that the profit efficiency of foreign banks is higher and statistically different than that of private sector banks and public sector banks.

### 6.3.5 Factors influencing revenue, cost and profit efficiencies

To carry out the factors influencing the revenue, cost and profit efficiency of commercial banks operating in India, the study used panel data tobit model.

**Table 6.19**

*Factors determining the revenue efficiency of commercial banks*

Independent variables	Model 1			Model 2		
	Coeff.	Robust Std. error	P value	Coeff.	Robust Std. error	P value
Size(log_size)	0.0064	0.0089	0.475	0.0049	0.0085	0.561
Liquidity	0.00014	0.0000	<b>0.021**</b>	0.0001	0.0000	<b>0.008*</b>
Off balance sheet	-0.0175	0.0128	0.172	-0.0191	0.0119	0.108
Profitability	0.0248	0.0066	<b>0.000*</b>	0.0289	0.0081	<b>0.000*</b>
GDP	0.0069	0.0019	<b>0.000*</b>	0.0069	0.0019	<b>0.000*</b>
Inflation	-0.0014	0.0019	0.452	-0.0041	0.0018	<b>0.021**</b>
Dummy Public	0.0373	0.0244	0.127	0.0364	0.0231	0.116
Dummy Foreign	0.1489	0.0259	<b>0.000*</b>	0.1644	0.0284	<b>0.000*</b>
Dummy Reform	0.0406	0.0158	<b>0.011**</b>	0.0176	0.0154	0.256
Dummy Crisis	0.0306	0.01149	<b>0.008*</b>	0.0396	0.0111	<b>0.000*</b>
Dummy Demonetisation	-0.1379	0.0119	<b>0.000*</b>	-0.1405	0.0117	<b>0.000*</b>
NPA	-	-	-	-0.0010	0.0008	0.222
Capital adequacy	-	-	-	-0.0010	0.0012	0.387
Constant	0.3931	0.0971	<b>0.000*</b>	0.4405	0.0939	<b>0.000*</b>
Log pseudolikelihood	805.04			781.55		
F statistics(p value)	21.16(0.000*)			18.97(0.000*)		
Period	<b>1992-93 to 2020-21</b>			<b>1995-96 to 2020-21</b>		

Source: Researcher's calculation, \* and \*\* indicates p value significant at 1% and 5% respectively

**Table 6.20***Factors determining the cost efficiency of commercial banks*

Independent variables	Model 1			Model 2		
	Coeff.	Robust Std. error	P value	Coeff.	Robust Std. error	P value
Size(log_size)	0.0176	0.0084	<b>0.037</b>	0.0117	0.0072	0.104
Liquidity	0.0000	0.0000	<b>0.049</b>	0.0016	0.0004	<b>0.000*</b>
Off balance sheet	-0.0365	0.0138	<b>0.008</b>	-0.0406	0.0108	<b>0.000*</b>
Profitability	0.0097	0.0070	0.163	0.0273	0.0088	<b>0.002*</b>
GDP	0.0018	0.0010	<b>0.079</b>	0.0006	0.0010	0.539
Inflation	0.0004	0.0015	0.812	-0.0041	0.0013	<b>0.002</b>
Dummy Public	-0.0125	0.0206	0.544	-0.0129	0.0169	0.448
Dummy Foreign	0.1901	0.0227	<b>0.000</b>	0.1868	0.0283	<b>0.000*</b>
Dummy Reform	0.0436	0.0124	<b>0.000</b>	-0.0011	0.0158	0.944
Dummy Crisis	0.1059	0.0106	<b>0.000</b>	0.1152	0.0109	<b>0.000*</b>
Dummy Demonetisation	-0.2049	0.0137	<b>0.000</b>	-0.2049	0.1049	<b>0.000*</b>
NPA	-	-	-	0.0018	0.0014	0.202
Capital adequacy	-	-	-	-0.0017	0.0012	0.147
Constant	0.2750	.0876	<b>0.002</b>	0.2748	0.0842	<b>0.001*</b>
Log pseudolikelihood		826.93			805.31	
F statistics(p value)		65.28(0.000)			62.27(0.000)	
Period		<b>1992-93 to 2020-21</b>			<b>1995-96 to 2020-21</b>	

Source: Researcher's calculation, \* and \*\* indicates p value significant at 1% and 5% respectively

**Table 6.21**

*Factors determining the profit efficiency of commercial banks*

Independent variables	Model 1			Model 2		
	Coeff.	Robust Std. error	P value	Coeff.	Robust Std. error	P value
Size(log_size)	0.0048	0.0085	0.571	0.0034	0.0081	0.679
Liquidity	0.0031	0.0007	<b>0.000*</b>	0.0014	0.0003	<b>0.000*</b>
Off balance sheet	-0.0151	0.0208	0.467	-0.0175	0.0054	<b>0.001*</b>
GDP	-0.0068	0.0037	<b>0.071***</b>	-0.0058	0.0022	<b>0.008*</b>
Inflation	-0.0009	0.0034	0.786	-0.0014	0.0022	0.535
Dummy Public	-0.0020	0.0261	0.938	-0.0021	0.0241	0.930
Dummy Foreign	0.2608	0.0468	<b>0.000*</b>	0.2825	0.0491	<b>0.000*</b>
Dummy Reform	-0.0227	0.0258	0.378	-0.0406	0.0255	0.112
Dummy Crisis	0.0080	0.0206	0.697	0.0152	0.0165	0.357
Dummy Demonetisation	-0.0480	0.0232	<b>0.039**</b>	-0.0292	0.0244	0.232
NPA	-	-	-	-0.0025	0.0014	<b>0.089*</b>
Capital adequacy	-	-	-	0.0000	0.0000	0.517
Constant	-0.0316	0.1183	0.789	.1168945	0.0963	0.225
Log pseudolikelihood		-324.57			-269.03	
F statistics (p value)		15.17 (0.00)			13.58 (0.00)	
Period		<b>1992-93 to 2020-21</b>			<b>1995-96 to 2020-21</b>	

Source: Researcher's calculation, \* and \*\* indicates p value significant at 1% and 5% respectively

The result of tobit regression where revenue and profit efficiency as dependent variable reveals that the size of the commercial banks are insignificant with the revenue and profit efficiency of commercial banks. This indicates that, the whether the bank is large or small it does not affect the revenue and profit efficiency of commercial banks in India. Even though, the size has no significant impact on RE and PE, the sign of the relation is positive i.e as per the null hypothesis formed. This result is consistent with the findings of Sufian & Noor (2015), Sufian et.al(2012), Tandon et.al(2014), Sufian et.al (2016) and inconsistent with the findings of

Megha(2016) who found that size of the banks are negatively and significantly impacts the revenue and profit efficiency of commercial banks in India. Sufian et.al (2012) found that bank size is positive and statistically significant with the revenue efficiency of commercial banks in Malaysia. Bhatia& Mahendru(2015) also observed that size of the banks has significant Table 6.20 also depicts the determinants of cost efficiency and it indicates that size of the commercial banks shows positive and significant relation with the cost efficiency. This means that, when the size of the banks increases, cost efficiency also increases and size of the banks decreases cost efficiency decreases. This result is in line with Gulati(2011), Singh & Thaker (2020) and contradicts with Megha(2016), Bhatia & Mahendru (2015) .

Independent variable liquidity has positive and significant (at 5% level of significance) relation with the revenue, cost and profit efficiencies of commercial banks in India. It implies that when the ratio increases, efficiency increases and if the ratio decreases efficiency decreases. As the higher ratio indicates lower liquidity, it is further implies that, liquidity decreases efficiency increases ad liquidity decreases efficiency increases. Hence, the efficiency and liquidity are inversely related. This result is consistent with the findings of Sufian & Habibullah (2012). On the contrary, Sufian & Noor (2016) observed a negative association between the revenue efficiency and liquidity of the South East Asian banks which means that high liquid banks tends to exhibits higher efficiency and vice versa.

Off balance sheet, activities are negatively and insignificantly related with the revenue efficiency of commercial banks where as it shows negative and significant relation with the cost and profit efficiency of the banks. It implies that, diversification of banking activities do not affect the revenue efficiency of banks. This is consistent with the findings of Sufian & Habibullah (2012), Sufian (2009) among others. Sufian & Habibullah (2012) found that ratio of non-interest to total assets is negatively and insignificantly associated with the technical efficiency of banks in Malaysia. Sufian (2009) and Sufian et.al (2016) observed that, the ratio representing diversification of banking activities is positive and insignificant with

the efficiency of commercial banks in Malaysia. Sharma & Sharma (2012), found that diversification negatively significantly affecting the output oriented technical efficiency of commercial banks in India. However, the finding in the present study is in contrary with the findings of Kumar & Gulati (2008), Tandon et al. (2014) among others.

Profitability is positively and significantly related with the revenue and cost efficiency of commercial banks. This result is inconsistent with the findings of Megha(2016) who observed that revenue efficiency is statistically negatively related with the return on asset of the banks. Tandon et.al(2014), Sufian & Habibullah (2012) observed negative and insignificant between the profitability and efficiency of banks in India.

The study included the Macroeconomic variable like GDP and inflation in the model. The results indicate that gross domestic product is positively and significantly (at 1% level of significance) related with the revenue and cost efficiency of commercial banks. This finding is in consistent with the findings of Sufian et.al, (2012), Sufian & Noor (2016) among others and it is inconsistent with the findings of Sufian & Habibullah (2012). Sufian et.al,(2012) found that GDP has a significant positive impact on the revenue efficiency of Islamic banks in Malaysia and Sufian & Noor (2016) observed the similar result among the South East Asian countries where as by Sufian et.al(2016) found that GDP was positively and insignificantly related with efficiency of the commercial banks. GDP has negative and significant relationship with the profit efficiency of the banks in India. During the period 1995-96 to 2020-21, the variable inflation is negatively significantly affects the revenue and cost efficiency of banks in India where as it is positive and insignificant with the profit efficiency of the banks. This implies that, lower inflation leads to lower revenue efficiency among the commercial banks in India and vice versa. The findings regarding the sign is consistent with the previous studies Sufian et.al,(2012), Sufian & Noor (2016), Sufian et.al(2016) among others. Kosmidou (2008) found that inflation has negative significant impact on the financial performance of the commercial banks in Greece and Sufian et.al,(2012) found the



similar result among Malaysian Islamic banks. Sufian & Noor (2016) observed the result among Islamic banks among South East Asian countries.

The model included *dummy\_public* to examine the impact of public sector banks on the revenue efficiency in the Indian banking sector. The empirical findings indicate that coefficient of the variable *dummy\_public* showed a positive and not statistically significant and it shows negative and insignificant relation with the cost and profit efficiency of the banks. Negative and insignificant relationship was obtained by Tandon et.al (2014) regarding the efficiency of nationalised banks in India. Similarly, *dummy\_foreign* is included in the model to study the impact of foreign banks on the revenue efficiency of Indian banks. The study observed that, coefficient of *dummy\_foreign* showed a positive and statistically significant (1% level of significance) with revenue, cost and profit efficiency of the banks. This could be attributed to the fact that, the revenue efficiency of public sector banks in India is significantly lower than that of foreign banks located in India.

*Dummy\_reform* positively significantly related with the revenue efficiency, cost efficiency of the commercial banks. This indicates that, the efficiency scores during the reformatory period has significant impact on the efficiency of commercial during the entire period under study. This is in line with the findings of Megha (2016) and Bhatia & Mahendru(2019) who found that reformatory period has significant relationship with the revenue and cost efficiency of commercial banks. Bhatia & Mahendru(2018) also found the cost efficiency is significantly higher during reformatory period than the post reformatory period. Table 6.21 shows that the reformatory period has negative and insignificant impact on the profit efficiency of commercial banks. This result contradicts the results of Megha(2016), Bhatia & Mahendru(2019) and among others.

*Dummy\_crisis* is positively significantly affects the revenue and cost efficiency of commercial banks but is not significant with the profit efficiency of the banks. *Dummy\_demonetisation* negatively significantly affects the revenue, cost and profit efficiency of commercial banks. Even though, the commercial banks were the biggest beneficiary of the demonetisation due to increase in deposit, which will

results in increase in liquidity with the banks, demonetisation reduces the revenue efficiency of banks during 2016-17 and 2017-18. Maity (2019) observed that when compared to the pre demonetisation period, the post-demonetization period has seen a decline in the efficiency of banks.

The second model includes the capital adequacy and NPA variables. The results indicate that, NPA are insignificantly related with revenue efficiency. Thus, it is clear that increase in the non-performing assets adversely affects the revenue efficiency of commercial banks. The sign of the variable NPA is as per the priori assumption i.e negatively related with RE. The findings is similar with the findings of Sufian et.al (2012), who observed that efficiency is insignificantly and negatively related with NPA of the bank in Malayisa. Tandon et.al (2014) also found that NPA is negatively and insignificant related with the efficiency of the banks in India. The analysis found that, there is statistically insignificant and positive relationship with the NPA and cost as well as profit efficiency of the commercial banks. Hence, following bad luck and bad management hypotheses, a hypothesis formulated that non-performing loans are negatively associated with cost efficiency. Here, a positive relationship was obtained and thus it is clear that, the data does not support bad luck and bad management hypothesis.

In the present study, the capital adequacy is negative and statistically insignificant with revenue and cost efficiency of banks and positive and insignificant relationship found between capital adequacy and profit efficiency. This result is in line with Ally & Patel (2014), Singh and Thaker (2020). Overall, the capital adequacy does not statistically impacts the efficiency of commercial banks. The negative sign indicates that, banks with higher capital adequacy tend to have lower efficiency score and vice versa. Tandon et.al (2014) observed negative and significant relationship between the efficiency and capital adequacy among the banks in India. CAR ensures that a bank has a layer of safety to manage its own risk-weighted assets prior to managing depositors' assets. Megha (2016) pointed out that Indian commercial banks are risk averse in nature and thus they invest in safer, low-yielding portfolios and they tend to maintain a CAR that is far higher than the usual

of 9%. As a result, there is an imbalance between inputs and outputs, which has a negative impact on efficiency. Hence, the null hypothesis framed earlier relating to capital adequacy is rejected. Negative and significant effect was also reported by Megha(2016).

#### **6.4 Analysis of Total Factor Productivity**

Productivity plays a decisive role in determining the profitability and reducing the cost and price of the firms and it leads to strengthening the competitiveness of firms as well as industry as whole (Mohammad, 2013). It is described in terms of inputs and outputs produced by the firm. It is the ratio of inputs and outputs. Larger value of this ratio indicates the better performance of the banks and vice versa (Kumar, 2013). It is measured by the quantity of outputs produced per unit of inputs (Mohan & Ray, 2004). There are two types of productivity measures; Partial productivity and Total Factor productivity (TFP). Partial productivity focuses on the separate productive inputs and total factor productivity or multi factor productivity considers the whole mix in production or value addition (Productivity Commission, 2013). TFP indicates the overall productivity of the firm in producing its outputs by using its resources in a best possible manner. It is an extensive measure of technical and economic efficiency, which reflects a number of other factors like managerial efficiency, human capital utilization and economies of scale (Kumar, 2013). In measuring the total factor productivity, different approaches have used in the existing literature i.e. Growth accounting approach, Econometric Estimation of Production and Cost Function Production Frontier approach and Non parametric approach (Bhattacharya, 2009). Unlike Econometric approach, non-parametric approach does not require the imposition of functional form of the structure of production technology (Sathye, 2002). Malmquist productivity index is the most widely used non-parametric method for measuring the productivity change occurred over a period. In measuring MPI, either can use input oriented approach or output oriented approach. Input orientation measures how much input quantities can be reduced proportionately keeping output quantities constant where as output orientation approach involves

keeping input quantities used constant, how much output quantities can be proportionately expanded. Under constant returns to scale assumptions, both input oriented approach and output oriented approach gives equal values, but gives different values under variable returns to scale assumption. The DEA based MPI is measured by exploiting the distance functions relationship with technical efficiency measures (Kumar, 2013). Following Sathye (2002), Krishnasami et.al (2003), Galagedera & Edirisuriya (2005), Das & Ghosh (2006), Sufian & Kamarudin (2014), Akthar (2010), Sufian (2011), Kumar (2013), Jayachitra (2015), Neupane (2013), Islam et.al (2019), Ghosh (2018), Ambarkhane (2018), Jahan (2019), Dar et.al (2021) among others the present study used the output oriented Malmquist Productivity index. Malmquist Productivity Index is used to estimate the Total Factor Productivity (TFP) change between two data. In Malmquist productivity index, the ratio of the distances of each data point is calculated in relation to a common technology in order to estimate the TFP change between two data points (Mohammad, 2013). Output oriented approach measures the change in total factor productivity in dealing with maximizing output by keeping input quantities as constant. MPI calculation requires the inputs and outputs of the firms. It does not require the data regarding input and output prices and specification of behavioral assumptions like minimization of cost or maximization of profit (Akthar, 2010). The change in the productivity is due to either change in efficiency (Catching up effect) or change in the production technology (Shift in production frontier or identification of innovation). This bifurcation allow us to determine what kind of policies are appropriate to enhance the growth prospects of the banking sector. The change in technical efficiency is attributed either by change in Pure efficiency or change scale efficiency.

#### **6.4.1 Productivity change of Indian banking industry**

As stated already, this section delineates total factor productivity change (TFPCH) of commercial banks in India and decomposing this change into Efficiency Change (EFFCH), Technical Efficiency Change (TECHCH), Pure Efficiency Change (PECH) and Scale Efficiency Change (SECH) using Malmquist productivity

index over the study period of 1992-93 to 2020-21. Commercial banks in India subsumed into four groups: all commercial banks, which represents the India banking industry as a whole, Public sector banks, private sector banks and foreign banks. Malmquist productivity index is applicable on panel data. In this analysis, balanced panel data has used. During the study period, an average of 85 commercial banks is functioning in India. However, owing to winding up, mergers and acquisitions many banks discontinued its operation during the study period. As the study using the balanced panel for Malmquist productivity index, only those banks, which are functioning throughout the study period have considered. Hence, total of 952 observations for 34 banks which are continuously working from 1992-93 to 2020-21 have included for the analysis. Out of these 34 banks, 12 belong to public sector banks, 11 banks are private sector banks and remaining 11 banks belongs to foreign banks. The productivity change index of Indian banking industry is obtained by calculating the geometric mean of TFPCH of public sector, private sector and foreign banks. The Malmquist productivity index greater than unity indicate the improvement in productivity or positive change in productivity and productivity index less than unity indicates the decline in productivity. The Malmquist productivity index of one reflects no change in productivity or stagnant productivity.

Table 6.22 shows the TFP change and decomposition of TFP change of Indian banking industry over the period 1992-93 to 2020-21. Since all indices are relative to the previous year, the year 1992-93 has no index. TFPCH of Indian banking sector shows up and downs during the study period. In 1993-94, the average TFPCH is 41.5 percent (i.e.  $1.415-1=0.415*100=41.5\%$ ) which means there is 41.5 percent growth in productivity of Indian banking industry. Similar to TFPCH, the components also showed an improvement during the year i.e. EFFCH and TECHCH indexes attained a value higher than unity. The EFFCH estimate 1.053 in 1993-94 indicates that as compared to previous year Indian banking industry has moved close to the frontier by 5.3 percent. TECHCH estimate 1.343 indicates that there is 34.3 percent change in technology as compared to the previous year. The decomposition of the TFPCH into EFFCH and TECHCH suggests that the dominant source of increase in TFPCH was mainly by shift in frontier or innovation than catching up

index. The MPI results depicts that Indian banking industry experienced a positive progress in the initial years of financial sector reforms and it continued till the second financial sector reforms. This is due to the frontier shift, which occurred following financial sector reforms. Thereafter, in 1997-98 productivity has declined and showed negative growth. However, a positive TFPCH reported in 1998-99, 1999-2000 but again it become negative in 2000-01. From 2001-02 to 2005-06 Indian banking industry exhibited the productivity index of more than unity. Among these years, except 2002-03, technological innovation has resulted in productivity growth. Again, from 2006-07 to 2015-16, the productivity of Indian banks showed negative growth. During the period 2016-17 productivity improved by 1.8 percent but it declined by 0.08 percent in 2017-18. Indian banking industry reported the TFPCH index of 1.074 in 2018-19 and 0.965 in 2019-20. However, as compared to the previous year, productivity has improved by 2.4 percent in 2020-21.

**Table 6.22**

*Decomposition of total factor productivity change (TFPCH) in Indian banking industry*

<b>Year</b>	<b>EFFCH</b>	<b>TECHCH</b>	<b>PECH</b>	<b>SECH</b>	<b>TFPCH</b>
1993-94	1.053	1.343	1.000	1.053	1.415
1994-95	0.988	1.168	1.000	0.988	1.153
1995-96	0.947	1.171	1.000	0.947	1.109
1996-97	1.052	1.030	1.000	1.052	1.084
1997-98	0.808	1.213	1.000	0.808	0.981
1998-99	1.130	0.906	1.000	1.130	1.023
1999-2000	1.001	1.001	1.000	1.001	1.002
2000-01	1.004	0.969	1.000	1.004	0.973
2001-02	0.849	1.178	1.000	0.849	1.001
2002-03	1.153	0.887	1.000	1.153	1.023
2003-04	0.708	1.421	1.000	0.708	1.006
2004-05	0.994	1.141	1.000	0.994	1.135
2005-06	0.201	5.410	1.000	0.201	1.088

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2006-07	0.679	1.412	1.000	0.679	0.958
2007-08	0.712	1.173	1.000	0.712	0.835
2008-09	1.439	0.654	1.000	1.439	0.941
2009-10	0.632	1.449	1.000	0.632	0.917
2010-11	0.829	1.169	1.000	0.829	0.969
2011-12	0.949	0.997	1.000	0.949	0.946
2012-13	1.010	0.951	1.000	1.010	0.960
2013-14	1.583	0.612	1.000	1.583	0.969
2014-15	1.330	0.720	1.000	1.330	0.957
2015-16	0.864	1.129	1.000	0.864	0.975
2016-17	1.145	0.890	1.000	1.145	1.018
2017-18	1.453	0.683	1.000	1.453	0.992
2018-19	0.877	1.224	1.000	0.877	1.074
2019-20	1.739	0.555	1.000	1.739	0.965
2020-21	0.696	1.471	1.000	0.696	1.024
<b>Overall Mean</b>	<b>0.934</b>	<b>1.084</b>	<b>1.000</b>	<b>0.934</b>	<b>1.013</b>

Source: Researcher's estimates

Malmquist results suggests that during the period 1992-93 to 2020-21, Indian commercial banks have on average showed TFPCH progress of 1.3 percent. The decomposition of TFPCH into efficiency change and technological change suggests that, since TECHCH is greater than EFFCH productivity gains in Indian banking industry are primarily the results of technological progress. In other words, average banks did not move closer to the frontier and the changes occurred in productivity due almost to shift in technology than change in efficiency. This is due to the increasing technology adoption by the banks like computerization, ATMs, internet banking, mobile banking, core banking solution, RTGS, NEFT etc during the study period. Akhtar (2010) observed among Saudi Arabian banks that adoption of new technology lead to improvement in productivity but the large adjustment outlays incurred in connection with the technology adoption resulted in deterioration of technical efficiency. Likewise, Indian banking industry also improved their productivity by the adoption of new technology as a part of financial sector reforms.

However, huge investment outlays incurred for the introduction of new technology could be the reason for decline in efficiency. Gulati & Kumar (2016) also pointed out that, the installed technology in the Indian banks was not completely making use of their customers in order start the process of efficiency change. Kumar et.al (2010), Gulati (2011), Jayachitra (2015), Gulati & Kumar (2016), Ghosh et.al (2018), Tamatam et.al (2019) analysed the productivity of commercial banks in India and found that productivity progress has mainly due to technological progress rather than efficiency change. Similar findings also emerged from the other countries like Saudi Arabia in which Akthar (2010) found that productivity change during 2000-2006 largely attributed by technological change. Krishnasami et.al (2003) also noted that overall increase in total factor productivity in Malaysian commercial banks was driven more by technological change and less by technical efficiency change. During the entire period under study, it is observed that the pure efficiency change is found stagnant i.e. there is neither progress nor regress. The geometric mean of scale efficiency change calculated for the study period is 0.936 i.e. 6.4 percent decline. Hence, the decomposition of efficiency change into PECH and SECH suggests that the major source of technical efficiency decline is scale efficiency change than the pure efficiency change. In other words, Indian banks are neither operating at the optimal scale of operations nor improving the managerial efficiency in maximizing their output.

Indian banking industry has experienced growth in TFPCH for 14 times., during 1993-94, 1994-95, 1995-96, 1996-97, 1998-99, 1999-2000, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2016-17, 2018-19 and in 2020-21 the Indian banking sector showed progress in terms of productivity. The decomposition of TFPCH into TECHCH (Innovation/ shift in frontier) and EFFCH (Catching up effect) suggest for the years of 1993-94, 1994-95, 1995-96, 2001-02, 2003-04, 2004-05, 2005-06, 2018-19 and in 2020-21 the improvement in TFPCH has exclusively come from the upward shift in the frontier and a consequent deceleration in the efficiency. During 1996-97, 1998-99, 2002-03 and 2016-17 the growth in productivity has contributed by catching up effect rather than innovation. In 1999-2000, both catching up effect and innovation has equally contributed towards the



productivity growth. For the years of 1997-98, 2000-01, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2017-18 and 2019-20 the TFPCH was found to be negative. Among these years, for the years of 2000-01, 2008-09, 2012-13, 2013-14, 2014-15, 2017-18, and 2019-20 the negative TFPCH was largely due to shift in frontier than the catch up effect. In contrast, for 1997-98, 2006-07, 2007-08, 2009-10, 2010-11, 2011-12 and 2015-16 the negative TFPCH mainly contributed by efficiency change.

#### **6.4.2 Productivity change across different ownership groups of banks**

Table 6.23 gives the results of Malmquist TFP growth for the public sector banks, private sector banks and foreign banks for each year. From the table it is apparent that there is noticeable variation in the TFPCH of public sector commercial banks over the study period. TFPCH varies from the minimum of 0.845 in 2020-21 and maximum of 1.510 in 1993-94. During the period under study, 14 times TFPCH calculated the value more than unity i.e. public sector banks showed a growth in productivity. From 1993-94 to 1998-99 and in 2004-05, 2005-06, 2006-07, 2011-12, 2014-15, 2015-16, 2016-17 and 2018-19 the productivity index found to be positive. In 1999-2000, 2000-01, 2001-02, 2003-04, 2007-08, 2008-09, 2009-10, 2010-11, 2012-13, 2013-14, 2017-18, 2019-20 and 2020-21 the public sector banks attained negative productivity change. Geometric mean of TFPCH for the entire period has turned out to be 1.018, which means that total factor productivity of public sector banks improved at an average annual rate of 1.8 percent over the study period. While examining the EFFCH and TECHCH, the study observed that efficiency regressed among the Indian public sector banks at an average annual rate of 1.3 percent, whereas technology improved at an annual rate of 3.1 percent over the study period. Therefore, it is clear that technological innovation is the major component, which contributes to the growth in productivity among Indian public sector banks. In other words, improvement in productivity among public sector banks is explained by the frontier shift effect alone. The result is in line with the findings of Tamatam et.al (2019) who evaluated the productivity change public sector banks over the period of 2008-2017. The productivity analysis by Chakarabarty (2013) using cost based

parameters also showed that public sector banks have exhibit significant progress on the productivity front.

Table 6.23 also shows productivity change of private sector commercial banks over the study period. TFPCH of private banks varies from the minimum of 0.638 in 2011-12 and maximum of 1.449 in 1993-94. 6 out of 29 years the TFPCH calculated the value more than unity, which indicates productivity growth. As noticed in the case of public sector banks, there exists noticeable variation in the TFPCH of private sector banks. From 1993-94 to 1995-96 and in 2004-05, 2006-07 and 2017-18 the productivity index found to be positive. From 1996-97 to 2003-04, 2005-06, 2007-08, 2008-09 to 2016-17, 2018-19, 2019-20 and 2020-21 the private sector banks secured negative productivity change. Geometric mean of TFPCH for the entire period has turned out to be 0.981, which means that total factor productivity of private sector banks regressed at an average annual rate of 1.9 percent over the study period. While examining the overall EFFCH and TECHCH, the study observed that efficiency regressed among the banks at an average annual rate of 0.7 percent, whereas technology declined at an annual rate of 1.2 percent over the study period. Therefore, it is clear that frontier shift effect is the major component, which cause to decline in productivity among Indian private sector banks. The reason for the negative EFFCH is investigated by analysing the PECH and SECH. Throughout the study period, there is no change in PECH i.e. it showed the index of 1.000. The stagnant PECH indicates that the technical efficiency change occurred in private sector banks are solely due to scale efficiency change. This observation is similar to the findings of Galagedera & Edirisuriya (2005), they evaluated the total factor productivity of private sector banks for the period of 1995-2002.

Table 6.23 also exhibits the TFP change of foreign banks in India. The geometric mean of TFPCH for entire period has turned out to be 0.984, which indicates that the total factor productivity of foreign banks regressed at an average annual rate of 1.6 percent over the study period. The average annual efficiency change found less than unity (0.946), i.e. 5.4 percent efficiency change has

calculated for the entire period. The technological change index calculated is 1.040, which means 4.0 percent change for the period 1992 to 2021. The study further noted that like public and private sector banks, the calculated productivity decline in foreign bank group is largely due to catching up effect. As noticed in the case of public sector banks and private sector banks, pure efficiency change of foreign banks found constant i.e. PECH index 1.000 throughout the study period. The scale efficiency index calculated is 0.946 i.e. scale efficiency regressed at rate of 5.4 percent over the study period. Hence, it is clear that any change occurred in efficiency is completely due to wrong scale of operation than managerial inefficiency.

**Table 6.23***Productivity change across different ownership groups of banks*

Year	Public Sector banks					Private sector banks					Foreign banks				
	Effch	Techch	Pech	Sech	Tfpch	Effch	Techch	Pech	Sech	Tfpch	Effch	Techch	Pech	Sech	Tfpch
1993-94	1.064	1.419	1.000	1.064	<b>1.510</b>	0.959	1.512	1.000	0.959	<b>1.449</b>	1.353	0.820	1.000	1.353	<b>1.110</b>
1994-95	1.074	1.139	1.000	1.074	<b>1.224</b>	0.918	1.229	1.000	0.918	<b>1.129</b>	1.011	1.022	1.000	1.011	<b>1.033</b>
1995-96	1.000	1.210	1.000	1.000	<b>1.210</b>	0.982	1.189	1.000	0.982	<b>1.167</b>	0.952	0.916	1.000	0.952	<b>0.872</b>
1996-97	1.043	1.097	1.000	1.043	<b>1.144</b>	0.964	1.017	1.000	0.964	<b>0.980</b>	0.772	1.438	1.000	0.772	<b>1.109</b>
1997-98	1.014	0.997	1.000	1.014	<b>1.011</b>	0.921	1.012	1.000	0.921	<b>0.932</b>	0.681	1.487	1.000	0.681	<b>1.013</b>
1998-99	1.009	1.020	1.000	1.009	<b>1.029</b>	1.072	0.893	1.000	1.072	<b>0.957</b>	1.138	0.914	1.000	1.138	<b>1.040</b>
1999-2000	0.975	0.994	1.000	0.975	<b>0.970</b>	1.034	0.89	1.000	1.034	<b>0.920</b>	1.029	1.021	1.000	1.029	<b>1.050</b>
2000-01	0.967	1.005	1.000	0.967	<b>0.972</b>	1.044	0.933	1.000	1.044	<b>0.974</b>	0.888	1.054	1.000	0.888	<b>0.936</b>
2001-02	0.913	1.058	1.000	0.913	<b>0.966</b>	0.954	0.998	1.000	0.954	<b>0.952</b>	0.820	1.259	1.000	0.820	<b>1.031</b>
2002-03	0.918	1.034	1.000	0.918	<b>0.949</b>	0.928	1.028	1.000	0.928	<b>0.954</b>	1.281	0.885	1.000	1.281	<b>1.134</b>
2003-04	0.927	1.044	1.000	0.927	<b>0.968</b>	0.927	1.015	1.000	0.927	<b>0.941</b>	0.824	1.305	1.000	0.824	<b>1.074</b>
2004-05	0.964	1.072	1.000	0.964	<b>1.034</b>	1.015	0.992	1.000	1.015	<b>1.008</b>	1.062	1.062	1.000	1.062	<b>1.127</b>
2005-06	1.034	1.041	1.000	1.034	<b>1.076</b>	0.989	1.008	1.000	0.989	<b>0.997</b>	0.222	4.481	1.000	0.222	<b>0.995</b>
2006-07	0.918	1.112	1.000	0.918	<b>1.021</b>	0.962	1.044	1.000	0.962	<b>1.004</b>	0.624	1.183	1.000	0.624	<b>0.738</b>
2007-08	1.085	0.841	1.000	1.085	<b>0.912</b>	0.946	0.962	1.000	0.946	<b>0.910</b>	0.599	1.083	1.000	0.599	<b>0.648</b>
2008-09	1.154	0.787	1.000	1.154	<b>0.908</b>	0.927	0.98	1.000	0.927	<b>0.908</b>	1.164	0.851	1.000	1.164	<b>0.990</b>
2009-10	1.140	0.793	1.000	1.140	<b>0.904</b>	1.099	0.823	1.000	1.099	<b>0.905</b>	0.930	0.968	1.000	0.930	<b>0.900</b>
2010-11	0.935	1.050	1.000	0.935	<b>0.982</b>	1.199	0.746	1.000	1.199	<b>0.895</b>	0.727	1.296	1.000	0.727	<b>0.942</b>

Year	Public Sector banks					Private sector banks					Foreign banks				
	Effch	Techch	Pech	Sech	Tfpch	Effch	Techch	Pech	Sech	Tfpch	Effch	Techch	Pech	Sech	Tfpch
2011-12	0.956	1.048	1.000	0.956	<b>1.002</b>	1.068	0.813	1.000	1.068	<b>0.868</b>	0.986	0.945	1.000	0.986	<b>0.931</b>
2012-13	0.963	0.996	1.000	0.963	<b>0.959</b>	0.845	1.112	1.000	0.845	<b>0.940</b>	1.054	0.909	1.000	1.054	<b>0.958</b>
2013-14	1.084	0.888	1.000	1.084	<b>0.962</b>	1.080	0.895	1.000	1.080	<b>0.966</b>	1.892	0.508	1.000	1.892	<b>0.961</b>
2014-15	0.898	1.157	1.000	0.898	<b>1.039</b>	1.051	0.926	1.000	1.051	<b>0.974</b>	1.210	0.724	1.000	1.210	<b>0.876</b>
2015-16	1.057	0.973	1.000	1.057	<b>1.028</b>	0.909	1.056	1.000	0.909	<b>0.959</b>	0.742	1.241	1.000	0.742	<b>0.921</b>
2016-17	0.934	1.094	1.000	0.934	<b>1.022</b>	1.226	0.777	1.000	1.226	<b>0.952</b>	1.315	0.863	1.000	1.315	<b>1.135</b>
2017-18	1.073	0.917	1.000	1.073	<b>0.983</b>	0.923	1.117	1.000	0.923	<b>1.031</b>	1.525	0.601	1.000	1.525	<b>0.916</b>
2018-19	0.929	1.143	1.000	0.929	<b>1.062</b>	0.913	1.085	1.000	0.913	<b>0.990</b>	0.803	1.369	1.000	0.803	<b>1.099</b>
2019-20	0.815	1.223	1.000	0.815	<b>0.996</b>	0.987	1.003	1.000	0.987	<b>0.990</b>	1.576	0.605	1.000	1.576	<b>0.954</b>
2020-21	0.885	0.955	1.000	0.885	<b>0.845</b>	1.060	0.910	1.000	1.060	<b>0.965</b>	1.122	1.171	1.000	1.122	<b>1.313</b>
<b>Mean</b>	<b>0.987</b>	<b>1.031</b>	<b>1.000</b>	<b>0.987</b>	<b>1.018</b>	<b>0.993</b>	<b>0.988</b>	<b>1.000</b>	<b>0.993</b>	<b>0.981</b>	<b>0.946</b>	<b>1.040</b>	<b>1.000</b>	<b>0.946</b>	<b>0.984</b>

Source: Researcher's estimates

### 6.4.3 Testing of hypotheses for productivity differences across bank groups

In the previous section, it was seen that the geometric mean of different groups of banks are different. In order to see whether there is any significant difference in the annual average productivity change and its components of public, private and foreign banks in India during the study period, Kruskal wallis H test has conducted. Since there is no change in the pure efficiency of each group of banks, efficiency change and scale efficiency change are the same. Therefore, pure efficiency and scale efficiency has excluded from this test.

**Table 6.24**

#### Results of Kruskal Wallis H test

Measures	No.of observations	Test statistics	P value	Inference
TFPCH	84	3.502	0.174	Failed to reject H <sub>0</sub>
EFFCH	84	0.007	0.996	Failed to reject H <sub>0</sub>
TECHCH	84	1.676	0.433	Failed to reject H <sub>0</sub>

Source: Researcher's estimates

The table 6.24 shows results of Kruskal Wallis test of EFFCH, TECHCH and TFPCH of public sector banks, private sector banks and foreign banks at 5% level of significance. The p value corresponding to TFPCH IS 0.174, which means the distribution of TFPCH, is same across three categories of banks. The p value relating to TECHCH is 0.433 that indicates that there is no change in distribution of TECHCH of among public sector, private sector and foreign banks. The test statistic of EFFCH is 0.007 with p value of 0.996. Hence, it is inferred that there is significant change in the efficiency change of different groups of banks. The above analysis shows whether there is any difference in the annual productivity index of three groups of banks. However, there may be bank group wise difference in the productivity and its components in each year of the study.

In following Gulati (2011), in order to check the robustness of the above result, the present study also tested hypotheses relating to annual difference in the

total factor productivity and its components across different ownership groups of banks. The year wise result of Kruskal Wallis test result is displayed in the table 6.25

**Table 6.25**

*Result of productivity difference across different groups of banks*

Year	No. of Observations	TFPCH	EFFCH	TECHCH
1993-94	34	24.569(0.000)*	5.259(0.072)	28.690(0.000)*
1994-95	34	21.246(0.000)*	6.411(0.041)*	23.867(0.000)*
1995-96	34	21.251(0.000)*	1.454(0.483)	27.052(0.000)*
1996-97	34	14.949(0.001)*	11.769(0.003)*	21.476(0.000)*
1997-98	34	8.793(0.012)*	9.007(0.011)*	1.337(0.513)
1998-99	34	3.919(0.141)	1.342(0.511)	9.933(0.007)*
1999-2000	34	3.603(0.165)	0.928(0.629)	2.053(0.358)
2000-01	34	1.221(0.543)	2.900(0.235)	1.035(0.596)
2001-02	34	1.581(0.454)	1.081(0.582)	4.253(0.119)
2002-03	34	1.799(0.407)	1.047(0.593)	1.957(0.376)
2003-04	34	2.016(0.365)	4.148(0.126)	7.389(0.025)*
2004-05	34	5.662(0.059)	3.514(0.173)	14.244(0.001)*
2005-06	34	6.404(0.041)*	1.212(0.546)	3.218(0.200)
2006-07	34	5.597(0.061)	1.061(0.588)	17.582(0.000)*
2007-08	34	1.911(0.385)	1.069(0.586)	18.527(0.000)*
2008-09	34	2.438(0.296)	6.129(0.047)*	10.098(0.006)*
2009-10	34	0.088(0.957)	10.927(0.004)*	19.928(0.000)*
2010-11	34	2.467(0.291)	6.299(0.043)*	14.016(0.001)*
2011-12	34	5.125(0.077)	4.777(0.092)	24.091(0.000)*
2012-13	34	0.240(0.887)	2.479(0.290)	20.781(0.000)*
2013-14	34	0.874(0.646)	6.013(0.049)	12.751(0.002)*
2014-15	34	8.611(0.013)*	8.261(0.016)*	6.542(0.038)*
2015-16	34	5.303(0.071)	7.173(0.028)*	3.088(0.214)
2016-17	34	6.437(0.040)*	6.222(0.045)*	8.696(0.013)*
2017-18	34	6.711(0.035)*	1.025(0.599)	7.449(0.024)*
2018-19	34	1.503(0.472)	4.983(0.083)	12.338(0.002)*
2019-20	34	0.724(0.696)	8.129(0.017)*	9.457(0.009)*
2020-21	34	18.950(0.000)*	20.682(0.000)*	18.842(0.000)*

Source: Researcher's estimates, \* indicates the significance at 5% level of significance, Figures in the parentheses are the p value relating the test statistic.

From the table 6.21, it is clear that in majority of years the productivity and its components do not exhibit significant difference across public sector, private sector and foreign banks. Hence, the present study also confirms the observation of Gulati(2011) that there is a convergence in the productivity and its components across the different ownership bank groups.

#### **6.4.4 Ranking of banks based on total factor productivity**

In this section, the study analyses the productivity of individual banks from 1992-93 to 2020-21. The comparison of the annual changes in the productivity of individual banks enables to identify the pattern of change in the productivity of individual banks that differ from the rest of the industry and to identify the general trends in productivity of the banking industry as a whole (Sathye,2002). Table 6.26 shows the average annual productivity and its components of all banks under study and the ranking of the commercial banks in terms of productivity change.

**Table 6.26**

*Annual summary of productivity change and its components of selected banks in India*

<b>BANKS</b>	<b>EFFCH</b>	<b>TECHCH</b>	<b>PECH</b>	<b>SECH</b>	<b>TFPCH</b>	<b>Ranking</b>
State Bank Of India	0.934	1.131	1.000	0.934	1.057	9
Bank Of Baroda	0.932	1.125	1.000	0.932	1.049	12
Bank Of India	0.951	1.119	1.000	0.951	1.065	5.5
Bank Of Maharashtra	0.939	1.134	1.000	0.939	1.065	5.5
Canara Bank	0.927	1.133	1.000	0.927	1.050	11
Central Bank Of India	0.968	1.131	1.000	0.968	1.095	2
Indian Bank	0.938	1.121	1.000	0.938	1.052	10
Indian Overseas Bank	0.963	1.126	1.000	0.963	1.084	3
Punjab And Sind Bank	0.950	1.125	1.000	0.950	1.070	4
Punjab National Bank	0.930	1.123	1.000	0.930	1.044	13



<b>BANKS</b>	<b>EFFCH</b>	<b>TECHCH</b>	<b>PECH</b>	<b>SECH</b>	<b>TFPCH</b>	<b>Ranking</b>
UCO Bank	0.972	1.128	1.000	0.972	1.096	1
Union Bank Of India	0.910	1.118	1.000	0.910	1.017	18
Catholic Syrian Bank Ltd	0.950	1.117	1.000	0.950	1.061	7
City Union Bank Limited	0.893	1.126	1.000	0.893	1.005	22
Dhanalaxmi Bank	0.933	1.097	1.000	0.933	1.024	17
Federal Bank	0.910	1.116	1.000	0.910	1.015	19.5
Jammu & Kashmir Bank Ltd	0.929	1.106	1.000	0.929	1.028	16
Karnataka Bank Ltd	0.915	1.105	1.000	0.915	1.011	21
Karur Vysya Bank	0.895	1.110	1.000	0.895	0.993	27
Nainital Bank	0.932	1.105	1.000	0.932	1.030	15
Ratnakar Bank	0.844	1.096	1.000	0.844	0.925	32
South Indian Bank	0.913	1.095	1.000	0.913	0.999	24
Tamilnad Mercantile Bank Ltd	0.911	1.101	1.000	0.911	1.003	23
Bank Of America	0.948	1.049	1.000	0.948	0.994	26
Bank Of Bahrain & Kuwait B.S.C.	0.972	1.090	1.000	0.972	1.060	8
Bank Of Nova Scotia	1.003	1.040	1.000	1.003	1.043	14
Barclays Bank	0.906	0.970	1.000	0.906	0.879	34
Citibank	0.949	1.048	1.000	0.949	0.995	25
Deutsche Bank Ag	0.895	1.027	1.000	0.895	0.920	33
Mashreq Bank	1.009	1.006	1.000	1.009	1.015	19
Banque Nationale De Paris (BNP Paribas)	0.925	1.018	1.000	0.925	0.941	29
Hongkong And Shanghai Bank	0.922	1.004	1.000	0.922	0.926	31
Societe Generale	0.974	0.970	1.000	0.974	0.944	28
Standard Chartered Bank	0.934	1.002	1.000	0.934	0.936	30

Source: Researcher's estimates

Analysis of productivity change of individual banks indicates that the mean TFPCH has been more than unity in respect of 23 banks i.e. State Bank of India, Bank of Baroda, Bank Of India, Bank of Maharashtra, Canara Bank, Central Bank of India, Indian Bank, Indian Overseas Bank, Punjab and Sind Bank, Punjab National Bank, UCO Bank, Union Bank of India, Catholic Syrian Bank Ltd, City Union Bank Ltd, Dhanalakshmi Bank, Federal bank, Jammu and Kashmir Bank Ltd, Karnataka Bank, Nainital Bank, Tamilnad Mercantile Bank, Bank Of Bahrain & Kuwait B.S.C., Bank Of Nova Scotia and Mashreq Bank. On the other hand, 11 out of 34 Indian banks in the panel do not exhibit increase in productivity. All public sector banks considered in this study shows positive change in productivity. That is 100 percent of sample public sector banks exhibited increase in average annual productivity. The highest productivity change of 9.6 percent has attained by UCO bank followed by Central bank of India with 9.5 percent change in productivity. Barring the Karur Vysya Bank, Ratnakar Bank and South Indian Bank, rest of the private sector banks experienced average productivity index more than unity. Out of 11 foreign banks included in the analysis only three banks such as Bank of Bahrain & Kuwait B.S.C., Bank of Nova Scotia and Mashreq Bank attained positive productivity change index. Among these banks, 6.0 percent and 4.3 percent change has scored by Bank of Bahrain & Kuwait and Bank of Nova Scotia respectively where as Mashreq bank experienced a positive change of 1.5 percent.

All banks except Mashreq Bank, which showed positive annual mean TFPCH, are exclusively a product of upward shift in the frontier i.e. due technological innovation. In the case of Mashreq Bank, 0.9 percent change has reported in technical efficiency and 0.6 percent change has reported in frontier shift. That is 0.9 percent efficiency change and 0.6 percent technological change contributing to the TFPCH of 1.5 percent. Hence, it is clear that, the major source contributing the productivity change of Mashreq bank is catching up effect.

As in the group wise productivity change analysis, the analysis of individual banks also reveals that public sector banks outperform private sector banks and foreign banks. Similarly, private sector banks are better performing than foreign banks during the study period.

### 6.4.5 Determinants of productivity and its components

In this section, panel data regression analysis has carried out in order to identify the factors explaining the total factor productivity change across Indian commercial banks. Fixed and random effect models are utilized and the selection of appropriate model is done on the basis of the Hausman specification test. This panel data models and test have been used by Kumar et.al (2010), Gulati (2011), Narwal & Pathneja (2015) to explain the factors influencing total factor productivity and its components. In this study, TFPCH, TECHCH, EFFCH indices are regressed on the bank specific variables, macroeconomic variables and dummy variables. Two models were estimates on each dependent variable based on the availability of the data. The following regression equations have been estimated with respect to the TFPCH of commercial banks in India.

1.  $TFPCH = f(\text{Log\_size}, \text{Log\_ROA}, \text{Liquidity}, \text{Offbalancesheet}, \text{Log\_GDP}, \text{Inflation}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation})$
2.  $TFPCH = f(\text{Log\_size}, \text{Log\_ROA}, \text{Liquidity}, \text{Offbalancesheet}, \text{Log\_GDP}, \text{Inflation}, \text{NPA}, \text{Capital adequacy}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation})$

Table 6.27 shows the results of panel data regression. Before conducting regression analysis, stationarity of the all the variables have checked and found stationarity. Multicollinearity have checked and found that the VIF values of the variables included in the model are less than 5. Heteroscedasticity of the model have checked using White test and the p value obtained in the test was 0.000. Hence, the null hypothesis relating to the test have rejected and found that there is heteroscedasticity. Autocorrelation of the model have checked using Wooldridge test for autocorrelation in panel data and obtained the p value of 0.0365 and 0.0223 respectively in model 1 and model 2, which is less than 0.05. Hence, the residuals of the model are auto correlated. Joint significance of the dummy variables have tested and found that there is joint significance of the dummy variables such as dummy variable for reforms, global crisis and demonetisation. Thus, from the above tests, it is inferred that the models have the problem of both heteroscedasticity and autocorrelation. Hence, clustered robust standard error has applied in the model 1

and 2 in following Hoechle, D. (2007). The Hausman test was conducted in order to find whether fixed and or random effect model is appropriate. The result of Hausman test has found the p value of 0.001 in model 1 and 2, hence fixed effect model is more appropriate in both cases. The overall F value calculated is 23.01 and 17.61 with the p value of 0.000 for model 1 and model 2 respectively. Hence, all the coefficients in the models are different than zero and the explanatory power of all independent variables are reasonably high.

**Table 6.27**

*Factors determining total factor productivity change among the commercial banks in India*

Independent variables	Model 1(Fixed effect model)			Model 2(Fixed effect model)		
	Coefficient	Cluster robust std.error	P value	Coefficient	Cluster robust std.error	P value
Log_size	-0.1146	0.0240	<b>0.000*</b>	-0.0559	0.0113	<b>0.000*</b>
Log_ROA	-0.0739	0.0230	<b>0.003*</b>	0.0056	0.0090	0.540
Liquidity	-0.0013	0.0009	0.187	-0.0004	0.0004	0.357
Off balancesheet	-0.0580	0.0277	<b>0.044**</b>	-0.0279	0.0067	<b>0.000*</b>
NPA	-	-	-	0.0060	0.0007	<b>0.000*</b>
Capital adequacy	-	-	-	-0.0002	0.0022	0.922
Log_GDP	-0.0127	0.0298	0.672	0.0226	0.0199	0.256
Inflation	0.0039	0.0042	0.343	-0.0001	0.0021	0.960
Dummy_Reform	-0.0619	0.0316	0.059	-0.0699	0.0166	<b>0.000*</b>
Dummy_Crisis	-0.0807	0.0323	<b>0.018**</b>	-0.0398	0.0206	0.062
Dummy_Demonetisation	0.0389	0.0194	0.053	0.0082	0.0159	0.610
Constant	2.3488	0.2955	<b>0.000*</b>	1.5954	0.1329	<b>0.000*</b>
R <sup>2</sup>	0.0102			0.0408		
F statistics (P value)	23.01 (0.000*)			17.61(0.000*)		
No.of observations	918			882		

Source: Researcher's estimates, \* and \*\* indicates significance at 1% and 5% respectively.

Regression results shows that size of the banks have a negative significant impact on the total factor productivity change of commercial banks in India. This

means that, small banks could be more productive than the larger banks. In other words, large banks do not have any advantage over the TFP change. This result is in line with the findings of Isik (2007), Kumar et.al (2010), Gulati (2011), Sufian (2011), and Narwal & Pathneja (2015) and among others. However, there are studies that found results different than the findings of the present study. Huang et.al (2008) observed an insignificant negative relation between the size and the productivity change among the banks in Taiwan. Zhang & Wang (2014) found an insignificant negative relation between the size and the TFP among the banks in China where as Kamarudin (2017) found positive and insignificant relationship among the domestic Islamic banks in Malaysia, positive insignificant relationship among the Brunei Islamic banks as well as Malaysian Islamic banks and positive significant relationship among the banks in Indonesia. Sufian (2011) found negative insignificant relation between TFPCH and size of the banks in Malaysia both in models that controlled ownership control and origin.

While analysing the effect of Log\_ROA on the TFP change of commercial banks, it is observed that there is negative relationship between profitability and TFP change. Contrary to the expected sign, profitability (ROA) of the banks negatively significantly associated with the productivity change of commercial banks. Similar relationship was also found by Sufian (2011) among the Malaysian commercial banks. However, positive and insignificant relationship was found by Narwal & Pathneja (2015) among the commercial banks in India and positive and significant relationship was observed among the banks in China by Zhang & Wang (2014) and Gulati (2011) among the Indian banks.

Liquidity of the banks is represented by the ratio of total loans to total deposits. The regression results shows an insignificant negative relationship with the productivity change of the commercial banks. This means that when the ratio representing liquidity increases productivity decreases and vice versa. Increase in the ratio means reduction in the liquidity. Thus, productivity increases when the liquidity also increases. However, that increase or decrease is not statistically significant according to the analysis. Kamarudin et.al (2017) found negative and

significant impact of liquidity on the TFPCH of the domestic Islamic banks in South East Asian countries, Brunei Islamic bank, Indonesian Islamic banks and Malaysian Islamic banks.

Likewise, Capital Adequacy (CAR) showed a negative insignificant relationship with the productivity change of commercial banks in India. The greater a bank's CAR, the more likely it is to withstand a financial downturn or other unanticipated losses. From the regression analysis it is found that, productivity increases when the capital adequacy decreases and vice versa. However, this change in TFPCH in relation to capital adequacy ratio is not statistically significant. Huang et.al (2008) also found an insignificant negative relation between the capital adequacy and the productivity change among the banks in Taiwan.

Off balance sheet activities represents the diversification of the business of the banks. In the present study, it is found that there is significant negative relationship between the off balance sheet activities and the total factor productivity change of the commercial banks in India. It indicates that, banks having less involvement in the non-traditional activities experiencing larger productivity gain and vice versa. This finding is in contrary with the findings of Gulati (2011) and Narwal & Pathneja (2015) among the Indian banks. This may be because the present study focused exclusively on traditional activities as inputs and outputs, whereas Gulati (2011) and Narwal & Pathneja (2015) have included non-interest income as an output in his analysis. Positive and insignificant relationship was obtained by Sufian (2011) among the commercial banks in Malaysia.

As against the expectation, positive significant relationship has found between the non performing asset ratio and productivity of commercial banks, which means that productivity decreases when the NPA decreases and vice versa. A positive insignificant relationship was obtained by Gulati (2011) between the NPA and productivity in model 5 & 6 of her analysis whereas Huang et.al (2008) observed negative and significant relationship with TFP change among commercial banks in Taiwan.

Macro economic variables such as Log\_GDP and inflation shows an insignificant relationship with the productivity of the banks. This means that, any change in GDP and inflation does not affect significantly the productivity of the commercial banks in India. However, the sign of both variables shows difference in model 1 and 2. Sufian (2011) observed an insignificant negative relationship with GDP and TFPCH where as significant negative sign was found between the inflation and productivity change. Kamarudin (2017) found that GDP insignificantly and negatively affects TFPCH of domestic Islamic banks in South East Asian countries and Malaysian Islamic banks and positive and insignificant relationship among the Indonesian Islamic banks, negative and significant among Brunei Islamic banks. Kamarudin (2017) also analysed the impact of inflation on TFPCH and found that negative and insignificant among domestic Islamic banks and Malaysian Islamic banks and positive and insignificant relationship among Brunei Islamic banks and Indonesian Islamic banks.

Time dummy variables are also included in the model to identify the financial sector reforms, global crisis and demonetisation on the TFP change. Reformatory period shows significant negative relationship with TFP change among the banks. This means that, during the reformatory period productivity regressed considerably. Likewise, global crisis exhibits significant negative relationship with the productivity change of commercial banks in India, which means that during the crisis period productivity of the commercial banks decreased significantly or global crisis affects the productivity adversely. Positive significant impact was found on the part of demonetisation. This means that, demonetisation affects the productivity of the banks favorably.

Similar to TFP change, determinants of EFFCH change of commercial banks are presented in the table 6.28. The following two equations were formulated and estimated.

1.  $EFFCH = f(\text{Log\_size}, \text{Log\_ROA}, \text{Liquidity}, \text{Off balance sheet}, \text{Log\_GDP}, \text{Inflation}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation}, \text{Dummy\_Public}, \text{Dummy\_Foreign})$

2.  $EFFCH = f(\text{Log\_size}, \text{Log\_ROA}, \text{Liquidity}, \text{Off balance sheet}, \text{NPA}, \text{Capital adequacy}, \text{GDP}, \text{Inflation}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation}, \text{Dummy\_Public}, \text{Dummy\_Foreign})$

In the model 1 and 2, stationarity was checked by Levin, Lin Chu and found stationary for all variables. Multicollinearity was tested and found that VIF values of all the variables are less than 5. Thus, there is no multicollinearity among the independent variables. Heteroscedasticity was tested using White test and obtained the p value less than 0.05. In model 1 Autocorrelation was checked by adopting Wooldridge test for autocorrelation in panel data and found a p value (0.1185) less than 0.05 and thus there is no first order autocorrelation in the model. Since there is heteroscedasticity, robust standard error was adopted in the model. In model 2 the obtained p value of Wooldridge test for autocorrelation is 0.0039, which is less than 0.05. Hence, there is first order autocorrelation in model. Since there is both heteroscedasticity and autocorrelation, cluster robust standard error was adopted in the model 2. In model 1 and 2, the p value obtained in the Hausman test is 0.2262 and 0.4799 respectively, which suggests that the random effect model is appropriate (since the p value is more than 0.05) than fixed effect model. Since the random effect model was appropriate, it is possible to add cross sectional dummies into model. Hence, in the model 1 and 2, dummy for public sector banks (dummy\_public) and dummy for foreign banks (dummy\_foreign) has added. The regression result of both model 1 and 2 are presented in the table 6.28

**Table 6.28**

*Factors determining efficiency change among the commercial banks in India*

Independent variables	Model 1(Random effect)			Model 2(Random effect)		
	Coefficient	Robust Std. error	P value	Coefficient	Cluster robust std.error	P value
log_size	0.0115	0.0087	0.189	-0.0019	0.0076	0.806
log_ROA	-0.0856	0.0293	<b>0.004*</b>	0.0005	0.0206	0.981
liquidity	0.0011	0.0009	0.280	0.00089	0.0007	0.247
off balance sheet	-0.0690	0.0227	<b>0.002*</b>	-0.0285	0.0113	<b>0.012**</b>



Independent variables	Model 1(Random effect)			Model 2(Random effect)		
	Coefficient	Robust Std. error	P value	Coefficient	Cluster robust std.error	P value
NPA	-	-	-	0.0041	0.0015	<b>0.007*</b>
Capitaladequacy	-	-	-	-0.0021	0.0029	0.465
Log_Gdp	-0.5551	0.0394	<b>0.000*</b>	-0.3266	0.0238	<b>0.000*</b>
Inflation	-0.0222	0.0027	<b>0.000*</b>	-0.0168	0.0022	<b>0.000*</b>
Dummy_Reform	-0.0278	0.0235	0.237	-0.0325	0.0249	0.191
Dummy_Crisis	0.1134	0.0431	<b>0.008*</b>	0.1733	0.0329	<b>0.000*</b>
Dummy_Demonetisation	0.2956	0.0465	<b>0.000*</b>	0.3313	0.0382	<b>0.000*</b>
Dummy_Public	-0.0532	0.0307	0.083	0.0046	0.0188	0.808
Dummy_Foreign	0.1296	0.0292	<b>0.000*</b>	0.0870	0.0214	<b>0.000*</b>
Constant	2.0527	0.1375	<b>0.000*</b>	1.6705	0.1517	<b>0.000*</b>
R <sup>2</sup>	0.2960			0.1948		
Wald Chi2(p value)	63.76(0.000)			737.32(0.000)		
No.of observations	918			882		

Source: Researcher's estimates, \* and \*\* indicates significance at 1% and 5% respectively.

Table 6.28 shows that in the variable Log\_size has no significant impact on the EFFCH of the commercial banks during the study period. This implies that size of the banks do not affects change in the ability of the commercial banks in maximizing outputs with the same level of input. This is similar to the finding of Gulati(2011), who found that size of the commercial banks does not impacts the efficiency change of commercial banks in India. Narwal & Pathneja (2015) also found negative and insignificant relationship with the EFFCH and size of the banks in India. Similarly Huang et.al (2008) observed positive and insignificant relationship among commercial banks in Taiwan. However, Isik(2008) found negative significant relation between the efficiency change and size of the banks in Turkey.

Coefficient of Log\_ROA is negative and statistically significant with the EFFCH f commercial banks. This implies that when the ROA increases EFFCH decreases and vice versa. Contrary to this result, Gulati (2011) and Narwal &

Pathneja (2015) found that the coefficient of ROA is positively and significantly related with efficiency change. Similarly, negative and insignificant relationship was reported by Sufian (2011) among the commercial banks in Malaysia. The coefficient of liquidity is negative and statistically significant at 10% level of significance. Higher Liquidity ratio implies the low Liquidity and lower ratio implies the high Liquidity. Hence, if the Liquidity increases, efficiency increases and vice versa. The impact of liquidity and EFFCH is similar to that of impact of TFPCH and productivity. Similar to Liquidity, independent variable off balance sheet shows negative and statistically significant on the EFFCH of the commercial banks. This finding is inconsistent with the findings of Gulati (2011) and Narwal & Pathneja (2015) who found that off balance is positively significantly related with EFFCH.

The coefficient of Log\_GDP and inflation is negative and statistically significant at 1%. This means that any change in macro economic impact will have a change in efficiency of commercial banks in India. Since the sign is negative, increase in the GDP and or inflation leads to decrease in the efficiency and vice versa. Independent variable Dummy\_Reform is found to be negative and statistically insignificant with the EFFCH of the commercial banks where as Dummy\_Crisis and Dummy\_Demonetisation, shows statistically significant with the EFFCH of commercial banks in India. The sign of the Dummy\_Crisis and Dummy\_Demonetisation is found positive which implies that both crisis and demonetisation favourably contributed to the EFFCH of the commercial banks in India.

In model 2, NPA and capital adequacy have incorporated and it is found that independent variable NPA has statistically significant and positive impact on the EFFCH of commercial banks. Gulati (2011) observed that EFFCH is not significantly depends upon the asset quality of the commercial banks. However, Huang et.al (2008) found that non performing ratio is negatively significantly related with efficiency change in Taiwan. The study has found that the coefficient of capital adequacy has no statistically significant impact on the EFFCH of commercial banks.

This indicates that any change in capital adequacy ratio of banks do not affect the EFFCH of the commercial banks in India. This finding is inconsistent with the findings of Huang et.al (2008), who found that capital adequacy is significantly positively impacts the efficiency change of banks in Taiwan.

Dummy for public sector banks shows negative and significant impact on the dependent variable. Gulati (2011) reported that Dummy\_Public is insignificant and negative on the EFFCH of the commercial banks. Dummy\_Foreign is found to be positive and significant at 1% level of significance. Thus, in the above model, the coefficients of Log\_ROA, NPA, log\_GDP, Inflation, Dummy\_Demonetisation, Dummy\_Crisis, Dummy\_Public and Dummy\_Foreign are found to be statistically significant and coefficients of off balances sheet, Log\_Size, capital adequacy, liquidity and Dummy\_Reform are statistically insignificant on the EFFCH of the commercial banks in India.

Similar to TFP change and EFFCH, determinants of TECH change of commercial banks are presented in the table 6.29. The following two equations were formulated and estimated.

1.  $TECHCH = f(\text{Log\_Size}, \text{Log\_ROA}, \text{Liquidity}, \text{Off balance sheet}, \text{Log\_GDP}, \text{Inflation}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation})$
2.  $TECHCH = f(\text{log\_Size}, \text{log\_ROA}, \text{Liquidity}, \text{Off balance sheet}, \text{NPA}, \text{Capitaladequacy}, \text{Log\_GDP}, \text{Inflation}, \text{Dummy\_Reforms}, \text{Dummy\_Crisis}, \text{Dummy\_Demonetisation})$

In the model 1 and 2, stationarity was checked by Levin, Lin Chu and found stationary. Multicollinearity was tested and found that VIF values of all the variables are less than 5. Thus, there is no multicollinearity among the independent variables. Heteroscedasticity was tested using White test and obtained the p value less than 0.05. Therefore, null hypothesis is rejected and hence, there is a problem of heteroscedasticity. In model 1, autocorrelation was checked using Wooldridge test for autocorrelation and found that the p value is higher than 0.05 and thus there is no first autocorrelation in the model. Since there is heteroscedasticity and no

autocorrelation in the model 1, cluster standard error was computed. In model 2, autocorrelation was checked found that the p value (0.000) is less than 0.05 and thus there is first autocorrelation in the model. Therefore, cluster robust standard error was adopted in the model. The Hausman test was conducted and obtained the p value of 0.000 and 0.046 respectively in model 1 and 2. Hence, it is suggested that the fixed effect model is appropriate (since the p value is less than 0.05) than the random effect model. The regression result of both model 1 and 2 are presented in the table 6.29.

**Table 6.29**

*Factors determining technological change among the commercial banks in India*

Independent variables	Model 1(Fixed effect model)			Model 2(Fixed effect model)		
	Coefficient	Robust Std. error	P value	Coefficient	Cluster Robust Std. error	P value
Log_size	-0.3571	0.0774	<b>0.000*</b>	-0.0844	0.0288	<b>0.006*</b>
Log_ROA	-0.0046	0.0474	0.923	-0.0054	0.0155	0.729
Liquidity	-0.0043	0.0032	0.185	-0.0017	0.0011	0.114
Off balance sheet	-0.0487	0.0644	0.455	0.0002	0.0217	0.992
NPA	-	-	-	0.0040	0.0019	<b>0.040**</b>
Capital adequacy	-	-	-	0.0040	0.0038	0.228
Log_GDP	0.7483	0.0429	<b>0.000*</b>	0.2969	0.0279	<b>0.000*</b>
Inflation	0.0363	0.0044	<b>0.000*</b>	0.0208	0.0028	<b>0.000*</b>
Dummy_Reform	-0.6678	0.0931	<b>0.000*</b>	-0.1853	0.0270	<b>0.000*</b>
Dummy_Crisis	-0.4091	0.0651	<b>0.000*</b>	-0.2410	0.0342	<b>0.000*</b>
Dummy_Demonetisation	-0.4334	0.0448	<b>0.000*</b>	-0.3198	0.0233	<b>0.000*</b>
Constant	3.8017	0.7703	<b>0.000*</b>	1.3856	0.3189	<b>0.000*</b>
R <sup>2</sup>	0.0225			0.0930		
F statistics (P value)	136.78 ( <b>0.000*</b> )			105.85( <b>0.000*</b> )		
No. of observations	918			882		

Source: Researcher's estimates, \* and \*\* indicates significance at 1% and 5% respectively.

Log\_Size is negatively and significantly impacts the TECH change of commercial banks in India. This result is similar with the findings of Narwal &

Pathneja (2015), Isik (2007) and it is inconsistent with the findings of Gulati (2011) who observed that size of the banks is negatively and insignificantly related with TECH change of the banks and positive and insignificant impact on TECHCH in model 1. Huang et.al (2008) also found negative and insignificant relationship among the banks in Taiwan.

From the above table it is found that Log\_ROA and TECHCH is negatively and insignificantly related among the banks in India. Gulati (2011) also found that ROA is insignificantly negatively impacts the TECH change of the commercial banks where as positive and insignificant relationship was found by Narwal & Pathneja (2015). In this study, the coefficient of off balance sheet is found positive and insignificant. This result is in inconsistent with the findings of Gulati (2011), who found that off balance sheet activities are significantly and positively related with technological change of commercial banks. The coefficient of Liquidity is negative and significant at 10% level of significance. It indicates that when liquidity increases, productivity also increases and vice versa.

NPA is found positive and significant relationship with the TECH change of the commercial banks. This finding is inconsistent with the Gulati (2011) found that NPA is negatively affects the TECH change of the commercial banks in India and Huang et.al (2008) observed negative and significant relation between TECH change and non performing asset ratio in Taiwan. Log\_GDP and inflation are found significant at 1% and positively affects the dependent variable. Similarly, Dummy\_Reform, Dummy\_Crisis and Dummy\_Demonetisation have negative and significant impact on the TECHCH of commercial banks in India.

Capital adequacy is found statistically insignificant with the TECH change of commercial banks in India. In the case of capital adequacy, similar result was obtained by Huang et.al (2008) among the commercial banks in Taiwan. Log\_Size, Asset quality, Log\_GDP, Inflation, Dummy\_Crisis and Dummy\_Demonetisation are found statistically significant relationship with the dependent variable. Among these variables, Asset quality, Log\_GDP and Inflation are positively affecting the TECH

change and Dummy\_Crisis and Dummy\_Demonetisation are negatively affecting TECHCH.

## **6.5 Conclusion**

The study used the growth, profitability, efficiency and productivity of commercial banks in India over the period 1992-93 to 2020-21. The present chapter deal with the efficiency and profitability of commercial banks. As done in the previous chapter, the entire commercial banks have been categorized into 3 categories such as public sector banks, private sector banks and foreign banks. The efficiency of the commercial banks are analysed using revenue, cost and profit efficiency. For that purpose, physical capital, labour and deposits are used as inputs and investment and advances are used as outputs. The price data relating to inputs and outputs are also used for the calculating efficiency scores. The mean, standard deviation, minimum maximum values are used to analyse the efficiency scores and in order to test whether there is any significant difference in the efficiency of different groups of commercial banks in India, Kruskal Wallis H test was conducted. Further, for identifying the factors influencing the efficiency of commercial banks, panel tobit regression was used and a number of bank specific variables, macro economic variables and dummy variables were incorporated in the study.

The productivity of the commercial banks are analysed using Malmquist productivity index. The same set of inputs and outputs used in the computation of efficiency analysis were used for calculating the total factor productivity change of the commercial banks in India. Kruskal Wallis H test was used to test the significance difference in the productivity and its components over the study period. Panel fixed and random effect model was used to identifying the factors influencing the productivity of commercial banks in India.

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CHAPTER VII

**SUMMARY, FINDINGS AND CONCLUSIONS**

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## **7.1 Introduction**

The previous part of the research work discussed the introduction, review of literature, banking sector overview, methodology, growth and profitability of the banks and efficiency and productivity of the banks. This chapter portrays the summary, findings and conclusion derived from the study.

## **7.2 Summary**

India has a well-structured financial system. It has an amazing network of banks, other financial and investment institutions, and different financial instruments that all work in a well-developed capital and money market. The Indian financial system consists of financial institutions, financial instruments and financial markets (Desai, 2019). The financial markets are a crucial part of the Indian financial system. They are not just a source of funds but instead operate as a facilitator by connecting individual and institutional savers and investors. The financial market includes the capital or securities market as well as the money market. The capital or securities market represents institutional sources of long-term capital, whereas the money market component permits the adjustment of liquidity among market participants. The capital or securities market consists of the primary or new issue market and the secondary or stock market (Khan, 2016). Institutions in the financial markets, such as commercial banks and non-bank intermediaries, engage in the process of financial intermediation, in which surplus funds or savings are directed to deficit sectors. The financial institutions distribute surplus economic units' funds to people desiring to invest in real capital. Using their informational advantage in the loan market, financial intermediaries can boost economic growth by combining the funds of



small, dispersed savers and allocating them for investment in an efficient manner. They are the primary agents responsible for the mobilization of surplus funds to finance productive activity, and to the extent that they do so, they promote capital accumulation and, consequently promote growth (Machiraju, 2013).

The Indian financial system is dominated by banks. Over sixty per cent of the entire assets of the financial system, consisting of banks, insurance firms, non-banking financial companies, cooperatives, mutual funds, and other smaller banking institutions, are held by commercial banks (Mohanty,2013). Commercial banks are the heart of our financial system. They keep the deposits of millions of individuals, governments, and companies. Through their lending and investing activities, they make funds available to borrowers, such as individuals, businesses, and the government. In doing so, they enable the movement of goods and services from producers to consumers as well as the government's financial operations. They constitute a substantial component of our medium of exchange and are the means by which monetary policy is implemented. These facts naturally lead to the conclusion that the nation's commercial banking system is essential to the running of the economy. Commercial banks play an extremely significant role in our economy; in fact, it is difficult to imagine how our economic system might operate effectively in the absence of many of the services that commercial banks provide. They are the core of our financial structure because, in conjunction with the Reserve Bank of India, they may increase the nation's money supply and create additional purchasing power. The lending, investment, and related activities of banks help the production, distribution, and consumption processes of the economy. The growth of commercial banking activity has occurred in multiple directions and dimensions. Banks have played a catalytic role in area development, backward area development, and rural development assistance, while also significantly assisting agriculture, industry, and international trade. In this manner, commercial banks have emerged as the most important financial institutions for rapid economic growth (Desai, 2019).

The specific objectives of the study:

1. To study the trend and progress made on the assets, liabilities, income, and expenses of commercial banks as a whole and across different groups of commercial banks.
2. To measure and compare the profitability among different ownership groups of banks during the post-liberalization period.
3. To examine the trends in cost, revenue, and profit efficiencies among the commercial banks as a whole and across distinct ownership groups of banks during the post-liberalization period.
4. To analyze the Total Factor Productivity (TFP) growth of commercial banks in India.

The present study is designed as both descriptive and analytical in nature to systematically review the performance of commercial banks in India in terms of growth, profitability, efficiency, and productivity. The study encompasses the entire post-deregulatory period. A longer sample period of 29 years, ranging from the time span of 1992–1993 to 2020–21, has been used for this study. This study aims to assess the performance of Indian commercial banks based on its ownership. Commercial banks are divided into three categories based on their ownership: public sector banks, private sector banks, and foreign banks. All commercial banks operating in each year are included for assessing the growth profitability and efficiency. Since the balanced panel data is required for calculating the productivity change, banks that are operational during the entire period of the study are selected.

The whole analysis of data in the current study is based purely on secondary sources. The relevant secondary data were obtained mostly from the RBI's yearly publication titled "Statistical tables relating to banks in India." In addition, the study relies on "Trends and Progress of Banks in India," the Reserve Bank of India Bulletin, and the Reserve Bank of India Annual Report. Compound Annual Growth Rate, Average Annual Growth rate and mean was used to study the growth of the commercial banks over the study period. Spread, burden and profitability ratios

employed to evaluate the profitability of the banks. Data Envelopment analysis was used to examine the revenue, cost and profitability of the commercial banks and Malmquist Productivity Index was used for analysing the total factor productivity change of the commercial banks over the study period. Besides, ANOVA, Kruskal-Wallis H test, Tukey's multiple comparison test and Dunn multiple comparison test was used to test whether significant difference exists in among different groups of banks.

### **7.3 Major findings of the study**

#### **7.3.1 Growth**

##### **1. Advances**

1. The mean value of advances of public sector banks is higher than other groups of banks followed by private sector and foreign banks. Even though Indian banking sector has opened up for the new private sector banks and foreign banks as a part of introduction of new economic reforms, Indian banking industry has been still dominated by the public sector banks in terms of value of advances.
2. The average annual growth rate of advances of public sector banks was 8.57%. In the case of private sector banks, annual average growth rate was calculated as 18.34%. The advance of foreign banks was increased by the annual average growth rate of 9.19%. It is important to mention that, unlike public sector banks and foreign banks the annual growth rate of private sector banks never become negative during the period of the study.
3. The calculated CAGR of private sector banks, public sector banks, foreign banks and all commercial banks are 10.51, 17.86, 8.46 and 11.63 respectively. The compound growth rate of private sector banks is higher than the other group of banks. The compound growth rates of foreign banks are found better than public sector banks.

4. An average of 71% of advances of the all commercial banks is disbursed by the public sector banks where as private sector banks could able to lend only 24% of entire advances and 5% by foreign banks. However, while analysing the trend of share of advances of each groups of banks over the study period, the share of public sector banks is declining gradually and the share of private sector banks improving substantially over the period. The share of foreign banks exhibited declining trend over the period. During the period, foreign banks reported an average share of 5% of advances of all commercial banks and it is important to note that, foreign banks were not able to lend even more than 10 per cent of the total advances of all commercial banks in any one of the year under study.
5. Kruskal Wallis H test result shows that the observed Chi square statistic is 13.381 with the p value of 0.001. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the advances of different groups of commercial banks.
6. Pair-wise comparison shows which pairs of bank groups indicates the significant difference. The growth rate distribution of public sector banks and foreign banks do not have any statistically significant difference. However, growth rate in between public sector banks and private sector banks and private sector banks and foreign banks exhibits statistically significant difference.

## **2. Investment**

1. The mean investment calculated for public sector banks over the study period is higher than the mean value of private sector banks and foreign banks. The mean of investment of private sector banks is higher than the foreign banks.
2. The annual average growth rate was calculated for public sector banks 7.25%, which is lower than the average annual growth rate of private sector banks and foreign banks. The average annual growth rate of investment of the private sector banks are calculated as 16.36% whereas the average annual

growth rate of investment of foreign banks was calculated as 9.88%. The average annual growth rate calculated for all commercial banks was 8.47%.

3. The CAGRs for all commercial banks, foreign banks, private sector banks, and public sector banks were calculated to be 8.09%, 9.23%, 14.64%, and 6.78%, respectively. The compound growth rate of private sector banks is higher than that of other groups of banks. Foreign banks' compound growth rates are found to be higher than those of public sector banks.
4. When analysing the share of investments of different groups of banks, it was observed that the public sector banks are still holding the lion's share of investment in entire commercial banks. An average of 70 per cent of the investment of all commercial banks is held by public sector banks, 22 per cent is held by private sector banks, and 8 per cent is held by foreign banks. However, while analysing the trend of share of investment for each group of banks over the study period, it is observed that the share of public sector banks is declining gradually and the share of private sector banks is increasing substantially over the period. The share of foreign banks did not exhibit considerable change over the study period. On the asset side of all commercial banks, advances and investment together constitute almost 84% of the total assets of the banks. As a result, because the trend of shares of advances and investments exhibits a similar pattern, it can be attributed to the banks' total assets.
5. According to the ANOVA result, the observed F statistic is 3.744, with a p value of 0.028. Since the p value is less than 0.05, the null hypothesis is rejected, which indicates that there is a significant difference in the growth rate of investment among different groups of commercial banks in India.
6. Pair-wise comparison shows that the growth rate distributions of public sector banks and private sector banks have a statistically significant difference. This means that the distributions of investment growth rates differ across domestic banking groups. However, the growth rates between public

sector banks and foreign banks and between private sector banks and foreign banks do not exhibit a statistically significant difference.

### 3. Deposits

1. The mean advances of public sector banks are higher than the private sector banks and foreign banks whereas the mean of private sector banks was found higher than the foreign banks.
2. The deposit of public sector banks has increased with an annual average growth rate of 7.45%. During the study period, the deposits of private sector banks improved with an annual average growth rate of 16.06%. The average annual growth rate of foreign banks is calculated as 8.82%.
3. The calculated CAGRs of private sector banks, public sector banks, foreign banks, and all commercial banks are 15.17%, 8.50%, 7.72%, and 9.46%, respectively. The compound growth rate of private sector banks is higher than that of other groups of banks, followed by foreign banks and public sector banks.
4. When the share of deposits of each category of banks is examined, it is obvious that public sector banks continue to dominate the banking sector in terms of deposits. The public sector banks collect an average of 74% of the deposits of the entire banking industry, whereas the private sector banks could only accept 21% of the total deposits and 5% from foreign banks. Surprisingly, when analysing the trend of the proportion of deposits in each group of banks during the research period, the proportion of public sector banks is progressively declining, whereas the proportion of private sector banks is significantly increasing over the period. It is significant to note that foreign banks were not able to gather even more than 10% of the total deposits of the banking industry in any one of the years under consideration. Foreign banks reported an average share of 5% of deposits during the period.
5. The Kruskal-Wallis H test shows that the observed Chi-square statistic is 17.873 with a 0.001 p-value. As the p value is less than 0.05, the null

hypothesis that there is no significant difference between the deposit growth rates of different groups of commercial banks is rejected. This indicates that at least one pair of banks differ significantly.

6. The pair wise comparison result shows that the growth rate distribution of public sector banks and foreign banks does not have any statistically significant difference. However, the growth rates between public sector banks and private sector banks and between private sector banks and foreign banks exhibit a statistically significant difference.

#### **4. Borrowings**

1. During the study period, mean borrowings of public sector banks was higher than the private sector banks and the mean of foreign banks is lower than the other groups of banks.
2. The borrowings of all commercial banks improved with an average annual growth rate of 13.06 per cent whereas the borrowings of public sector banks increased with an average annual growth rate of 12.84%. The average annual growth rate of private sector banks was 39.87 per cent and the average annual growth rate of foreign banks was 10.82 per cent.
3. Private-sector banks have a greater CAGR than both foreign and public-sector banks. The calculated compound growth rate for public sector banks is 6.51 per cent, while that for private sector banks is 19.04 per cent. The foreign bank's CAGR is 4.57 per cent, which is lower than both private and public sector banks. Along with the substantial growth of advances, investments, and deposits, the private sector banks are more active in borrowing funds from a variety of sources for expanding their operations.
4. Analysis of proportion of borrowings held by each category of bank reveals that public sector banks still own half of the proportion of borrowings held by all commercial banks. Public-sector banks account for an average of 52 per cent of total industrial borrowings, compared to 35 per cent for private-sector banks and 13 per cent for foreign banks. Yet, when analysing the

pattern of share of borrowings for each category of banks over the study period, the share of public sector banks declines gradually while the percentage of private sector banks rises significantly. The same pattern was seen in the case of these banks' advances and investments, since deposits and borrowings were utilized for lending advances and investment operations. Over the first few years of the study, the proportion of foreign banks grew but then declined.

5. The result of the Kruskal-Wallis H test shows that the mean rank calculated for public sector banks, private sector banks, and foreign banks is 40.48, 45.37, and 41.68, respectively. The test statistic calculated is 0.603, and the p value associated with the test statistic is 0.740. As the p value is greater than 0.05, the null hypothesis that there is no significant difference in the growth rate of borrowings among different groups of banks was failed to rejected. It indicates that growth rate of borrowing by public sector banks, private sector banks, and foreign banks are the same.

### **5. Interest income**

1. The mean interest income of public sector banks was found higher than the mean of private sector banks and foreign banks. The mean of foreign banks was lower than the private sector banks and public sector banks.
2. The annual average growth rate for public sector banks, private sector banks, foreign banks and all commercial banks are 5.62%, 16.21%, 6.51% and 7.18% respectively.
3. The compound annual growth rate of private sector banks is higher than that of the other group of banks. The calculated CAGRs of private sector banks, public sector banks, foreign banks, and all commercial banks are 14.93%, 6.99%, 5.85%, and 8.25%, respectively. The compound growth rates of foreign banks are found slightly higher than public sector banks.
4. With respect to the share of interest income of the banks, it was found that that public sector banks are still leading the banking industry in respect of



interest income. An average of 70 per cent of the interest income of the entire banking industry is earned by the public sector banks, while 24 per cent is contributed by private sector banks and 6 per cent by foreign banks. However, while analysing the trend of the share of interest income of each group of banks over the study period, the share of public sector banks is deteriorating gradually, while the share of private sector banks is improving substantially over the period. The same trend was evident in the cases of advances and investments made by these banks. It may have an impact on the trend of the share of interest income of public and private sector banks, as interest income from advances and investments is the primary source of interest income for commercial banks. The share of foreign banks did not exhibit substantial improvement over the period. An average share of 6 per cent of interest income is reported by foreign banks during the period, and it is important to note that foreign banks were not able to earn even more than 10 per cent of the total interest income of the banking industry in any one of the years under study.

5. The Kruskal-Wallis H test result shows that the observed Chi-square statistic is 9.344 with a p value of 0.009. Since the p value is lower than 0.05, the null hypothesis that there is no significant difference in the growth rate of interest income among different groups of commercial banks is rejected.
6. The pair-wise comparison results show that no significant difference between the growth rates of public sector banks and foreign banks. Comparing public sector banks and private sector banks, however, yields a p value of 0.017 and a p value of 0.036 for private sector banks and foreign banks, respectively. Therefore, it is clear that the growth of interest income for private sector banks is different from that of other types of banks.

## **6. Non-interest income**

1. The average non-interest income of the public sector banks was found higher than the private sector banks and foreign bank. The analysis of both average annual growth rate and compound annual growth rate indicates that the rate

of growth of private sector banks are found higher than the other groups of banks and growth rate of public sector banks are found lower than the followed by the foreign banks and public sector banks.

2. During the study period, the proportion of non-interest income of public sector banks is higher than the other groups of banks. The percentage of proportion of public sector banks decreased from 89 per cent in 1992–93 to 51 percent in 2020–21. In contrast, the share of non-interest income earned by private sector banks increased from 4% in 1992–1993 to 42% in 2020–21. The contribution of foreign banks to the banking industry's non-interest income is not negligible. Foreign banks earned an average of 11% of their non-interest income.
3. The mean rank calculated for public sector banks, private sector banks and foreign banks are 37.96, 49.34 and 40.20 respectively. The test statistic calculated is 3.420 and the p value associated with the test statistic is 0.181. As the p value is more than 0.05, the null hypothesis that there is no significant difference in the growth rate of non-interest income of different groups of banks was not rejected. That is there is no significant difference in the growth rate of non-interest income among the different groups of banks.

### **7. Interest expenses**

1. The mean interest expense of the public sector banks was found higher than the other groups of banks. The mean of private sector banks was higher than the foreign bank and less than the public sector banks.
2. The average annual growth rate of private sector banks (15.38%) is found higher than the public sector banks (5.16%) and foreign banks (4.44%). The average annual growth rate of foreign banks is lower than the both public sector banks and private sector banks.
3. The compound annual growth rate indicates that the rate of growth of private sector banks was calculated as 13.98%, which is higher than the CAGR of

public sector banks and foreign banks. The CAGR of foreign banks is 3.85 which is lower than the public sector banks (5.16%)

4. About 73% of the average interest expense of the whole banking industry have been incurred by public sector banks, while 22% is incurred by private sector banks, and 5% is incurred by foreign banks. As in the previous variables, the share of public sector banks is progressively declining and the percentage of private sector banks is significantly increasing over the period. The proportion of foreign banks did not vary significantly during the period.
5. ANOVA test has been applied to test whether the distribution is the same across different groups of banks. ANOVA result shows that the observed F statistic is 3.723 with a p value of 0.028. Since the p value is lower than 0.05, the null hypothesis that there is no significant difference in the growth rate of interest expenses among different groups of commercial banks in India is rejected.
6. Pair wise comparison results showed that growth rate distributions between public sector banks and private sector banks have a statistically significant difference at the 10% level of significance, and the growth rate of interest expenses between private sector banks and foreign banks exhibits a statistically significant difference at the 5% level of significance. However, no statistically significant difference is found between public sector banks and foreign banks.

## **8. Operating expenses**

1. The mean operating expenses of the public sector banks was higher than the private sector banks and foreign bank and the average of private sector banks was higher than foreign banks and lower than public sector banks.
2. The analysis of both average annual growth rate and compound annual growth rate indicates that the rate of growth of private sector banks are found higher than the other groups of banks, followed by foreign banks and public sector banks.

3. Similar to all other variables, the share of operating expenses of public sector banks are higher than the public sector banks and foreign banks. However, over the study period, percentage of their share decreased from 89 per cent in 1992–93 to 57 per cent in 2020–21. On the contrary, the share of operating expenses of the private sector banks increased from 5 per cent in 1992–93 to 37 per cent in 2020–21 in accordance with the expansion of business. The share of foreign banks in the operating expenses of the banking industry is not as high as that of public and private sector banks.
4. The Kruskal-Wallis H test result shows that the observed Chi-square statistic is 14.970 with a p value of 0.001. Since the p value is lower than 0.05, the null hypothesis that there is no significant difference in the growth rate of operating expenses among different groups of commercial banks is thus rejected. That is there is significant difference in the growth rate of operating expenses among the different groups of banks.
5. A pair-wise comparison test shows that there is no significant difference in the growth rates of public and foreign banks. However, the p value obtained in comparing public sector banks and private sector banks is 0.017 and 0.036 for private sector banks and foreign banks, respectively. Hence, it is obvious that there is a significant difference in the growth of interest income of private sector banks from the other groups of banks.

### **7.3.2 Profitability**

#### **A. Spread ratios**

##### **1. Ratio of interest income to total assets**

1. The average ratio of public sector banks calculated was 8.07% and private sector banks 8.34%. The mean ratio of foreign banks obtained was 7.80%. The average ratio of private sector banks is higher than the public sector banks and foreign banks and the average ratio of interest income total assets of foreign banks is lower than both public sector banks and private sector banks.

2. The CAGR and average annual growth rate of the ratio is found negative during the study period. This is because, the profitability was higher in initial years and it declined in majority of years. However, the CAGR of the private sector banks (-0.429) are higher than the public sector banks (-1.401) and foreign banks (-2.50). The CAGR of the foreign banks was found lower than the domestic bank groups.
3. ANOVA results show that F statistic is 1.148 with the p value of 0.322. Since the p value is higher than 0.05, it is failed to reject the null hypothesis that there is no significant difference in the ratio of interest income to total assets in respect of different groups of commercial banks.

## **2. Ratio of interest expenses to total assets**

1. The average ratio of interest expenses to total assets of public sector banks, private sector banks, foreign banks and all commercial banks are 5.44%, 5.72%, 4.14% and 5.10% respectively. It is clear that the average ratio of interest expenses to total assets of private sector banks was higher than the other groups of banks and average ratio of foreign banks are lower than both public sector banks and private sector banks. Therefore, foreign banks are more profitable than the domestic banks while considering the ratio of interest expenses to total assets.
2. Since the ratio of all groups of banks shows a decreasing trend over the study period, the average annual growth rate and compound annual growth are negative. The average growth rate and CAGR of foreign banks is less than the other groups of banks.
3. ANOVA result shows that the observed F statistic is 9.469 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of interest expenses to total assets in respect of different groups of commercial banks.
4. Multiple comparison test shows that there is statistically significant difference in the ratio of interest expenses to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign

banks. No significant difference was found in between the private sector banks and public sector banks. This means that the distribution of interest expenses to total assets of domestic banks is almost same.

### **3. Spread (Net Interest Margin) to total assets**

1. The average ratio of spread to total asset ratio of foreign banks (3.73%) are higher than the public sector banks (2.63%) and private sector banks (2.83%). Hence, foreign banks are more profitable than the domestic banks. The average ratio of private sector banks is higher than the public sector banks and therefore, as compared to public sector banks, the profitability of private sector banks are higher.
2. The CAGR and average annual growth rate of private sector banks is more than the foreign banks and public sector banks. The growth rate of public sector banks are lower than the foreign banks.
3. ANOVA result shows that the observed F statistic is 61.130 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected that there is significant difference in the ratio of spread as percentage of total assets in respect of different groups of commercial banks.
4. Multiple comparison test indicates that there is statistically significant difference in the ratio of spread to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign banks. No significant difference was found between the private sector banks and public sector banks. This means that the distribution of spread ratio of domestic banks are almost same.

### **B. Burden ratios**

#### **1. Ratio of non-interest income to total assets**

1. The mean ratio of non-interest income to total assets of public sector banks, private sector banks, foreign banks and all commercial banks are 1.22%, 1.75%, 2.36% and 1.78% respectively. Since the average ratio of foreign

banks are higher than the private sector banks and public sector banks, foreign banks are more profitable during the study period. Among domestic banks, the average ratio of private sector banks are higher than the public sector banks and therefore, profitability of private sector banks are better.

2. The CAGR and average annual growth rate of foreign banks are higher than the other bank groups followed by private sector banks and foreign banks.
3. Kruskal wallis H test result shows that the observed Chi square statistic is 52.381 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected and it is clear that there is significant difference in the ratio of spread as percentage of total assets in respect of different groups of commercial banks.
4. Multiple comparison tests show that there is statistically significant difference in the ratio of non- interest income to total assets for the all pairs of banks. The p value obtained in comparing all pairs of banks are less than 0.05. As the p value is lower than 0.05 the null hypothesis relating to the test is rejected and it indicates that there is significant difference between each pairs of banks.

## **2. Ratio of operating expenses to total assets**

1. Over the study period, the average ratio of operating expenses to total assets of public sector banks are lower than other bank groups. Hence, the profitability of public sector banks are higher in terms of operating expenses to total assets. Similarly, average ratio calculated for foreign banks are higher than other bank groups which indicates that profitability of foreign banks in by controlling operating expenses is lower than the other bank groups.
2. The CAGR and average annual growth rate of private sector banks is higher than public sector banks and foreign banks and the growth rate are lower for foreign banks over the study period.

3. ANOVA result shows that the observed F statistic is 15.274 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected and there is significant difference in the ratio of operating expenses to total assets in respect of different groups of commercial banks.
4. Multiple comparison tests indicate that there is statistically significant difference in the ratio of operating expense to total assets for the pairs of public sector banks and foreign banks and private sector banks and foreign banks. No significant difference was found between the private sector banks and public sector banks. It shows that the distribution of operating expenses to total assets ratio of domestic bank groups are almost same.

### **3. Ratio of burden to total assets**

1. In this ratio, the average of foreign banks (0.33) is less than the other groups of banks, followed by private sector banks (0.53) and public sector banks (0.93). Hence, the profitability of the foreign banks is higher than the domestic banks. Among domestic banks, the profitability of the private sector banks is better than the public sector banks.
2. The CAGR of all groups of banks including all commercial banks are negative. It means that the ratio of burden to total assets of the commercial banks in India have decreased over the period.
3. Kruskal wallis H test result shows that the observed Chi square statistic is 28.290 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected and hence there is significant difference in the ratio of burden to total assets in respect of different groups of commercial banks.
4. Multiple comparison tests indicate that there is statistically significant difference in the ratio of burden to total assets for the all pairs of banks. The p value obtained in comparing all pairs of banks are less than 0.005. As the p value is lower than 0.05 the null hypothesis that there is no significant difference in the ratio between the different groups of banks is thus rejected.



Hence, there is statistically significant difference in the ratio of public sector banks and private sector banks as well as private sector banks and foreign banks.

### **C. Profitability ratios**

#### **1. Ratio of net profit to total assets**

1. The average ratio of net profit to total assets of public sector banks, private sector banks, foreign banks and all commercial banks are 0.42%, 1.07%, 1.47% and 0.99% respectively. The average ratio of net profit to total assets of foreign banks are higher than the other groups of banks. Hence, the profitability of foreign banks are higher than the domestic banks. As compared to other groups of banks, profitability of public sector banks is lower than both private sector banks and foreign banks.
2. The CAGR of the private sector banks are higher than the other groups of banks and lower for the public sector banks and the CAGR of the public sector banks are lower than private sector banks and foreign banks.
3. Kruskal wallis H test result shows that the observed Chi square statistic is 45.244 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected and shows that there is significant difference in the ratio of net profit to total assets in respect of different groups of commercial banks.
4. It is observed that there is statistically significant difference in the ratio of net profit to total assets for the all pairs of banks. The p value obtained in comparing the different pairs of banks are less than 0.05. As the p value is lower than 0.05 the null hypothesis relating to the test is rejected and hence, there is statistically significant difference in the ratio of public sector banks and private sector banks, private sector banks and foreign banks and public sector banks and foreign banks.

## 2. Ratio of operating profit to total assets

1. Similar to the ratio of net profit to total assets, the average ratio of operating profit to total assets of foreign banks are higher than the domestic banks over the study period. Likewise, average ratio of public sector banks are lower than both foreign banks and private sector banks. Therefore, during the study period, foreign banks are more profitable followed by private sector banks and public sector banks.
2. The CAGR of the private sector banks are higher than the other bank groups and the growth rate of foreign banks are lower than the private sector banks and public sector banks.
3. Kruskal wallis H test result shows that the observed Chi square statistic is 58.270 with the p value of 0.000. Since the p value is lower than 0.05, the null hypothesis is rejected and indicates that there is significant difference in the ratio of operating profit to total assets in respect of different groups of commercial banks.
4. The multiple comparison test shows that the p value of all pairs of banks are less than 0.05 and hence there is significant different in ratio of operating profit to total assets among all pairs of banks.

### 7.3.3 Efficiency

#### 1. Revenue efficiency

- The average revenue efficiency of all commercial banks in India during the study period is 0.575 (the inefficiency is 0.425). Throughout the period of the study, the revenue efficiency score ranges from its lowest score of 0.394 in 2016–17 to its highest score of 0.742 in the year 1993–94 and during the period, a pattern of inconsistency was observed regarding the revenue efficiency and its components of all commercial banks in India.
- All commercial banks in India scored an average allocative efficiency of 0.875 (inefficiency 0.125) and an average technical efficiency of

0.659(inefficiency of 0.341) Except for the year 1992–1993, the technical inefficiency is higher than the allocative inefficiency. Therefore, it is very clear that the primary source of revenue inefficiency among the commercial banks during the period was technical inefficiency rather than allocative inefficiency.

- During the period, the average pure technical efficiency was 0.891 (the level of inefficiency was 0.109). In terms of the scale efficiency, the estimated average is 0.744 (the value for inefficiency is 0.256). The examination of the components of technical efficiency reveals that, with the exception of 1992–1993, the scale inefficiency is greater than the pure technical inefficiency. Because of this, it is evident that the primary reason for the technical inefficiency is not pure technical inefficiency but the inefficiency of scale.
- The average revenue efficiency of public sector banks ranges from a minimum of 0.273 in 2016–17 to a maximum of 0.806 in 1992–93. The grand mean of revenue efficiency (or inefficiency) over the entire study period is 0.534 (0.466). This means that a commercial public sector bank in India could generate only 53.4 per cent of its output from the given level of input, wasting 46.6 per cent of its input.
- The grand mean of allocative efficiency (or inefficiency) is found to be 0.878 (0.122). The grand mean of technical efficiency (or inefficiency) for the study period is estimated at 0.615 (0.385). The mean allocative efficiency is higher than the average technical efficiency. Hence, it is clear that the dominant source of revenue efficiency among public sector banks is technical efficiency rather than allocative efficiency. It also indicates that Indian public sector banks are not relatively good at maximising the level of output from a given level of input.
- The grand mean score of PTE (or inefficiency) over the entire period is 0.942 (0.058), whereas the grand mean score of SE (or inefficiency) is 0.650 (0.350). Hence, it is evident that as scale inefficiency is superior to pure

technical inefficiency, the dominant source of technical inefficiency is scale inefficiency rather than pure technical inefficiency.

- The grand mean of RE (or inefficiency) in private sector commercial banks is 0.494 (0.506). During the entire period of the study, the RE score ranges from a minimum of 0.261 in 2016–17 to a maximum of 0.70 in 1992–93.
- The grand mean of allocative efficiency (inefficiency) in private sector banks is 0.880 (0.120), whereas the grand mean of technical efficiency (inefficiency) over the entire study period is 0.563 (0.437). Thus, both allocative inefficiency and technical inefficiency result in revenue inefficiency. However, as the technical inefficiency is higher than the allocative inefficiency, the major reason for the revenue inefficiency is the technical inefficiency rather than the allocative inefficiency.
- The grand mean score of the pure technical efficiency (or inefficiency) of the banks over the study period is 0.845 (0.155). Likewise, the grand mean scale efficiency of banks for the study period is 0.673 (0.327). From this, it is clear that the major reason for the technical inefficiency among private sector commercial banks in India is scale efficiency rather than pure technical efficiency.
- The grand mean score of the RE (inefficiency) of foreign banks calculated for the entire period of the study is 0.655 (0.345). The mean score ranges from a minimum of 0.542 in 2016–17 to a maximum of 0.745 in 1998–99.
- The grand mean of AE (inefficiency) over the study period is 0.871 (0.129). The grand mean TE (inefficiency) score estimated for the study period is 0.751 (0.249). As the technical inefficiency of foreign banks is higher than the allocative inefficiency, the major source of revenue inefficiency among foreign banks operating in India is technical inefficiency, i.e., due to managerial inefficiency.

- Regarding the components of TE, the grand means of PTE (inefficiency) and SE (inefficiency) are 0.887 (0.113) and 0.851 (0.149), respectively. As the scale inefficiency is higher than the pure technical inefficiency, the technical inefficiency among foreign banks is mainly due to scale inefficiency.
- As seen in the case of all commercial banks, the public sector banks, private sector banks and foreign banks never achieved a full efficiency score of 1 in the case of revenue efficiency and its components during the entire study period.
- The top 10 commercial banks that have outstanding performance in terms of revenue efficiency are Credit Suisse AG, Sberbank, JP Morgan Chase Bank N.A., Bank of Nova Scotia, United Overseas Bank Ltd., Qatar National Bank (Q.P.S.C.), Cooperative Rabobank U.A., Bank of America, and Bank of Ceylon. There are no public or private sector banks on this list. Only Credit Suisse AG banks achieved 100% efficiency during the research period. In the case of these top 10 banks, the most significant factor contributing to the revenue inefficiency is the allocative inefficiency, with a few notable exceptions including Sberbank, Mizuho Corporate Bank, and Bank of Ceylon.
- Kruskal Wallis H test result shows that the calculated chi-square value for revenue efficiency is 33.93 with a p value of 0.001. The p-value is less than 0.05, so the null hypothesis that there is no significant difference in the revenue efficiency of different commercial bank groups is rejected. Regarding allocative efficiency, the obtained chi square value is 4.05 and the p value is 0.132. Since the p value is greater than 0.05, the null hypothesis that there is no significant difference in the allocative efficiency of public sector banks, private banks, and foreign banks cannot be rejected.
- Since the p value of Kruskal Wallis H test relating to technical efficiency, pure technical efficiency and scale efficiency are less than 0.05, the null hypotheses are rejected and it indicates that there is significant difference

among the different groups of commercial banks regarding technical efficiency, pure technical efficiency and scale efficiency.

- The pair-wise comparison test also shows that there is significant difference between private sector banks and foreign banks in the case of revenue efficiency, technical efficiency, pure technical efficiency and scale efficiency. Likewise, significant difference was found between public sector banks and foreign banks with respect to revenue efficiency, technical efficiency, scale efficiency and pure technical efficiency. Except pure technical efficiency, no significant difference was found between public sector banks and foreign banks.
- In terms of revenue efficiency, foreign banks (0.599) outperform other groups of banks. Following foreign banks, public sector banks (0.456) do better in terms of revenue efficiency, whereas private sector banks underperform relative to other groups of banks. According to the result, the order of the various categories of banks according to their revenue efficiency is as follows: Foreign banks > Public sector banks > Private sector banks.
- In terms of both allocative efficiency and scale efficiency, the performance of foreign banks is superior to that of domestic banks; nevertheless, private sector banks are outperforming public sector banks when compared within the context of domestic banks. Therefore, in terms of allocative efficiency and scale efficiency, foreign banks rank higher than private sector banks and public sector banks.
- In addition, in terms of technical efficiency, foreign banks do better than those in the public and private sector banks. Public-sector banks outperform private-sector banks among domestic banks. Hence, the ranking of different bank groups in terms of technical efficiency is: foreign banks > public sector banks > private sector banks. In the case of pure technical efficiency, public sector banks performed better than private sector banks and foreign banks. Following public sector banks, foreign banks are outperforming private

sector banks. Therefore, the ranking of different bank groups in terms of pure technical efficiency is: public sector banks > foreign banks > private sector banks.

- The analysis of returns to scale indicates that, in the case of all commercial banks, an average of 85 banks were analyzed, and among this total, an average of 11 banks are operating below their optimal scale size and experiencing IRS. An average of 65 banks have been observed to be operating in the DRS zone. It means that these banks are not able to generate proportionate outputs from the inputs at the present scale. An average of nine banks are operating at their most productive scale and experiencing CRS. That is, the majority of banks operating in the India are operating in the DRS zone, followed by the IRS zone and the CRS zone. Since the number of banks experiencing DRS is higher than the number of banks experiencing IRS and CRS, decreasing returns to scale are observed to be the predominant form of scale inefficiency in the Indian banking industry.
- Among the different groups of commercial banks, the largest are the public sector banks, which operate in the DRS zone, followed by private sector banks and foreign banks. The maximum number of banks operating in the CRS zone belongs to foreign banks, followed by private sector banks and public sector banks.

## **2. Cost efficiency**

- The average cost efficiency (inefficiency) of all banks during the entire study period is 0.503 (0.497), indicating that, on average, banks in the Indian banking industry during the study period could have produced the same level of output using only 50.3% of the resources employed if they were producing at the efficient frontier rather than their current position. To put it another way, the Indian banking industry is only 50.34 per cent efficient in terms of making optimal use of input costs when compared to the most best practicing banks that are operating in the same environment.

- The mean AE scores of all commercial banks is 0.756. This shows that all commercial banks, or the Indian banking industry, have suffered 24.4 per cent greater production costs than necessary as a consequence of selecting an improper combination of inputs based on their prices. The TE score ranges from a low of 0.430 in 2016–17 to a high of 0.873 in 1992–93, with an overall mean of 0.659. This indicates that all commercial banks in the Indian banking industry are, on average, 65.9% efficient at minimizing inputs in order to achieve a given output. With the existing technology, an average Indian bank wastes approximately 34.1% of its inputs when producing output.
- Indian banking industry's cost inefficiency (49.7) is the result of both allocative inefficiency (24.4) and technical inefficiency (34.1). However, technical inefficiency rather than allocative inefficiency is the primary source of cost inefficiency. In other words, the Indian banking industry's cost inefficiency is caused more by management functional inefficiencies than by an inefficient combination of input mix given their costs.
- The mean PTE (inefficiency) of 0.890 (0.110). The grand mean scale efficiency (inefficiency) for the entire study period is 0.742 (0.258). The average scale efficiency for the entire period ranges from a low of 0.516 in 2016–17 to a high of 0.954 in 1992–93. It is evident that 34.1% of technical inefficiency is due to both technical inefficiency and scale inefficiency. Thus, technological inefficiency in the Indian banking sector is emerging due to managerial incompetence in regulating the inputs in the production process and the inability of banks to operate at the optimal size or scale. Secondly, scale inefficiency is greater than pure technical inefficiency, indicating that the primary cause of technical inefficiency in the Indian banking sector is scale inefficiency rather than pure technical inefficiency, i.e., an inappropriate choice of scale of operation.
- The average cost efficiency of public sector banks ranges from 0.116 in 2016–17 to 0.737 in 1992–93, with a standard deviation of 0.153. The



overall mean of cost efficiency (inefficiency) throughout the duration of the study is 0.444 (0.556). This means that, on average, commercial banks in India's public sector use 44.4% of their inputs to produce the same result, while wasting 55.6%. More than half of the inputs used by commercial banks in India's public sector are not properly used. It also emphasizes that there is significant potential for cost savings by limiting inputs and selecting the optimal mix of inputs at given pricing.

- Allocative efficiency (or inefficiency) is determined to have a grand mean of 0.733 (0.267). Given the prices of inputs, it is obvious that India's public sector banks experienced an additional 26.7% in manufacturing costs due to a poor choice of input combinations.
- The estimated grand mean of technical efficiency (inefficiency) for the study period is 0.624 (0.376). The grand mean of allocative efficiency exceeds the mean of technical efficiency. Thus, it is evident that technical efficiency, rather than allocative efficiency, is the primary source of cost inefficiency in public-sector commercial banks. It also implies that Indian public sector banks are relatively good at selecting an optimal combination of inputs at their given pricing but not so good at limiting the number of inputs required to produce a specific output.
- The grand mean score of PTE (Inefficiency) over the entire period is 0.936 (0.064) where as the grand mean score of SE (Inefficiency) is 0.662 (0.338). Hence, it is evident that scale inefficiency causing almost 33.8 per cent to the overall technical efficiency of public sector commercial banks in India.
- The grand mean of CE (inefficiency) for commercial banks in the private sector is 0.432 (0.568), indicating that, on average, commercial banks in the private sector waste 56.8% of the cost incurred to produce the same level of production. This cost inefficiency may be the result of poor input mix selection or management's inability to reduce input costs. Throughout the

study period, the CE score ranges from a low of 0.125 in 2016–17 to a high of 0.64 in 1991–92.

- The grand mean of allocative efficiency (inefficiency) for private sector banks is 0.751 (0.249), but the grand mean of technical efficiency (inefficiency) over the entire study period is 0.562 (0.438). Therefore, both allocative and technical inefficiencies contribute to cost inefficiency. Since the technical inefficiency is greater than the allocative inefficiency, it may be inferred that the primary cause of the cost inefficiency is the technical inefficiency rather than the allocative inefficiency.
- During the study period, the mean score for the pure technical efficiency (inefficiency) of the banks was 0.832 (0.168). Similarly, the overall scale efficiency of banks over the study period is 0.685 (0.315). It is evident that scale efficiency, rather than pure technical inefficiency, is the primary cause of private sector commercial banks' technical inefficiency in India.
- The grand mean score of the CE (inefficiency) of foreign banks calculated for the entire study period is 0.599 (0.401), indicating that the average foreign bank operating in India could only utilize 59.9% of its inputs to achieve the same level of output while wasting 39.3% of its inputs. The average cost efficiency scores ranges from a minimum of 0.360 in 1996–97 to a high of 0.821 in 1992–93.
- During the study period, the overall mean of AE (inefficiency) was 0.785 (0.215). The estimated grand mean TE (inefficiency) score for the study period is 0.757 (0.243). As the technical inefficiency of foreign banks is greater than their allocative inefficiency, the most significant cause of cost inefficiency among foreign banks operating in India is technical inefficiency, i.e., managerial inefficiency.
- Regarding the components of TE, the grand mean values for PTE (inefficiency) and SE (inefficiency) are 0.897 (0.103) and 0.836 (0.164), respectively. As scale inefficiency is greater than pure technical inefficiency,

foreign banks' technical inefficiency is mostly attributable to scale inefficiency.

- The top 10 commercial banks that have remarkable performance in terms of cost efficiency are Credit Suisse AG, United Overseas Bank Ltd., Industrial and Commercial Bank of China, Credit Agricole Corporate and Investment Bank, Barclays Bank, Mizuho Corporate Bank, Bank of America, Mufg Bank, Ltd., Sumitomo Mitsui Banking Corporation, and Cooperative Rabobank U.A. These banks are suitable benchmarks for other banks in the Indian banking sector and can serve as models for other banks. An interesting fact is that all of the banks on this list are foreign, just like all of the banks on the list for revenue efficiency. This list contains neither public sector banks nor private sector banks.
- Comparison of the cost efficiency among different groups of commercial banks was conducted using Kruskal-Wallis H test and it was found that in the case of cost efficiency, technical efficiency, pure technical efficiency and scale efficiency, significant difference was found among the different groups of commercial banks. Further, multiple comparison test shows that no significant difference exists between the public and private sector banks in the case of cost efficiency, technical efficiency and scale efficiency. Significant difference was found between the private sector banks -foreign banks and public sector banks and foreign banks with respect to cost, technical, pure technical and scale efficiencies.
- In terms of cost efficiency, foreign banks (0.607) outperform other groups of banks. Following foreign banks, public sector banks (0.456) do better in terms of cost efficiency, whereas private sector banks underperform relative to other groups of banks. As a result, the order of the various categories of banks according to their cost efficiency is as follows: Foreign banks > Public sector banks > Private sector banks.

- In terms of both allocative efficiency and scale efficiency, the performance of foreign banks is superior to that of domestic banks; nevertheless, private sector banks are outperforming public sector banks when compared within the context of domestic banks. Therefore, in terms of allocative efficiency and scale efficiency, foreign banks rank higher than private sector banks and public sector banks. In addition, in terms of technical and pure technical efficiency, foreign banks do better than those in the public and private sectors. Public-sector banks outperform private-sector banks among domestic banks. As a result, the ranking of different bank groups in terms of both technical and pure technical efficiency Foreign banks > Public sector > Private sector.
- In the case of all commercial banks, an average of 85 banks were analysed and among this total, average of 11 banks are operating below their optimal scale size and experiencing IRS. The policy implication of these findings is that, these banks can enhance technical efficiency by increasing their size. An average of 65 banks have been observed to be operating on the zone of DRS. The policy implication of these banks is that downsizing seems to be an appropriate strategic option for these banks in their pursuits to reduce the cost. Only 9 banks are operating on the most productive scale size and experiencing CRS. Since the number of banks, experiencing CRS is lower than the number of banks on IRS and CRS, decreasing returns to scale is observed to be the predominant form of scale inefficiency in the Indian banking industry.
- In the case of public sector banks, an average of 25 banks were analysed and these 25 banks are operating on the DRS. Since majority of the public sector banks are operating on the zone of decreasing returns of scale, decreasing returns to scale is observed to be the predominant form of scale inefficiency among the Indian public sector banking Industry. 91% of private sector commercial banks are operating on the DRS and 7% of commercial banks are operating on the IRS. Only 2% of commercial banks are operating at

CRS. Hence, it is clear that the predominant form of scale inefficiency among Indian private sector banks is decreasing returns to scale.

- Like domestic banks, majority of foreign banks operating in India are operating on the zone of DRS. However, the percentage of commercial banks operating on DRS is less than the percentage of public and private sector commercial banks operating on DRS. 27 percentage of foreign banks are operating on IRS and 47 percentage of banks are operating on DRS (99% and 91% respectively for public sector banks and private sector banks). 26% of foreign banks operating during the study period are operating on the constant returns to scale. As compared to public and private sector banks, the banks operating on the CRS are higher in the case of foreign banks. However, as the majority of the foreign banks operating on the zone of DRS, the prominent form of scale inefficiency among foreign banks is decreasing returns to scale.

### **3. Profit efficiency**

- The grand mean of profit efficiency for commercial banks in India during the period is 0.3202. This means that the banks in India can increase their profit efficiency on average by 60% to 70% merely by adopting the best practices within their peer group. There appears to be substantial room for growth in potential profitability if Indian banks are able to utilize factor inputs effectively and select an optimal loan and investment portfolio mix. The average profit efficiency score varies from a minimum of 0.253 in 1996–97 to a maximum of 0.4901 in 1992–93.
- The profit efficiency of all commercial banks, public sector banks, private sector banks and foreign banks in the Indian banking industry never achieved a full efficiency score of 1 during any one of the years under study.
- During the entire period of the study, the profit efficiency estimates of public sector banks varies from the minimum of 0.0630 in 2018-19 to a maximum of 0.3325 in 1992-93. The average profit efficiency calculated for the period

is 0.1610. Profit efficiency of private sector banks ranges from the lowest value of 0.0866 in 1993-94 and highest value of 0.2540 in 1997-98 with the average value of 0.1657 whereas the profit efficiency of foreign banks fluctuates from the low of 0.4205 in 1996-97 and high of 0.6961 in 1992-93 with the average of 0.5623.

- The average profit efficiency scores of foreign banks is found higher than that of private sector banks and public sector banks. While comparing the average efficiency of public and private sector banks, it is evident that there is only a slight difference between the profit efficiency of public and private sector banks. However, the profit efficiency of private sector banks are higher than the public sector banks in India.
- On comparing the three groups of banks, it is revealed that all groups of banks never achieved the standard profit efficiency score of 1 in any one of the year.
- The top 10 commercial banks that have outstanding performance in terms of profit efficiency are Bank of Nova Scotia, Bank of America, Bank of Ceylon, J.P. Morgan Chase Bank N.A., Mizuho Corporate Bank, Deutsche Bank AG, Mashreq Bank, MUFG Bank, Ltd., BNP Paribas, and Barclays Bank. This list contains no public or private sector banks. Das & Ghosh (2009) observed that Foreign banks are primarily located in metropolitan cities, and the majority of their customers are wealthy corporations and individuals. As opposed to the huge retail deposits of domestic banks, they generally depend more on wholesale deposits.
- The overall mean rank of the public sector, private sector, and foreign banks was calculated as 27.28, 31.72, and 73.00, respectively. The chi square value obtained from the Kruskal-Wallis H test is 57.791 with a p value of 0.000. Since the p value is less than 0.05, the null hypothesis formed in relation to the analysis is rejected, and thus there is a statistically significant difference in the profit efficiency of commercial banks during the study period.

- Multiple comparison tests indicate that there is no significant difference in the profit efficiency between public sector banks and private sector banks. This means that profit efficiency is same across the domestic banks. However, there is significant difference in the profit efficiency between domestic banks and foreign banks.

#### **7.3.4. Findings relating to productivity change**

- Analysis of productivity change suggests that during the period 1992-93 to 2020-21, Indian commercial banks have showed TFPCH progress of 1.3%. The decomposition of TFPCH into efficiency change and technological change suggests that, since TECHCH is greater than EFFCH productivity gains in Indian banking industry are primarily the results of technological progress. In other words, average banks did not move closer to the frontier and the changes occurred in productivity due almost to shift in technology than change in efficiency.
- TFPCH of public sector banks varies from the minimum of 0.845 in 2020-21 and maximum of 1.510 in 1993-94. Geometric mean of TFPCH for the entire period has turned out to be 1.018, which means that total factor productivity of public sector banks improved at an average annual rate of 1.8% over the study period. While examining the EFFCH and TECHCH, the study observed that efficiency regressed among the Indian public sector banks at an average annual rate of 1.3 percent, whereas technology improved at an annual rate of 3.1% over the study period. In other words, improvement in productivity among public sector banks is explained by the frontier shift effect alone.
- TFPCH of private banks varies from the minimum of 0.638 in 2011-12 and maximum of 1.449 in 1993-94. Geometric mean of TFPCH for the entire period has turned out to be 0.981, which means that total factor productivity of private sector banks regressed at an average annual rate of 1.9% over the study period. While examining the overall EFFCH and TECHCH, the study

observed that efficiency regressed among the banks at an average annual rate of 0.7%, whereas technology declined at an annual rate of 1.2 per cent over the study period. Therefore, it is clear that frontier shift effect is the major component, which cause to decline in productivity among Indian private sector banks. The reason for the negative EFFCH is investigated by analysing the PECH and SECH. Throughout the study period, there is no change in PECH i.e. it showed the index of 1.000. The stagnant PECH indicates that the technical efficiency change occurred in private sector banks are solely due to scale efficiency change.

- The geometric mean of TFPCH of foreign banks for entire period has turned out to be 0.984, which indicates that the total factor productivity of foreign banks regressed at an average annual rate of 1.6% over the study period. The average annual efficiency change found less than unity (0.946), i.e. 5.4% efficiency change has calculated for the entire period. The technological change index calculated is 1.040, which means 4.0% change for the period 1992 to 2021. As noticed in the case of public sector banks and private sector banks, pure efficiency change of foreign banks found constant i.e. PECH index 1.000 the throughout the study period. The scale efficiency index calculated is 0.946 i.e. scale efficiency regressed at rate of 5.4% over the study period. Hence, it is clear that any change occurred in efficiency is completely due to wrong scale of operation than managerial inefficiency.
- Kruskal-Wallis H test results shows that p value obtained for TFPCH, EFFCH and TECHCH are higher than 0.05, which means that, there is no significant change in TFPCH, EFFCH ad TECHCH among the different groups of commercial banks in India.
- Analysis of productivity change of individual banks indicates that the mean TFPCH has been more than unity in respect of 23 banks i.e. State Bank of India, Bank of Baroda, Bank Of India, Bank of Maharashtra, Canara Bank, Central Bank of India, Indian Bank, Indian Overseas Bank, Punjab and Sind Bank, Punjab National Bank, UCO Bank, Union Bank of India, Catholic



Syrian Bank Ltd, City Union Bank Ltd, Dhanalakshmi Bank, Federal bank, Jammu and Kashmir Bank Ltd, Karnataka Bank, Nainital Bank, Tamilnad Mercantile Bank, Bank Of Bahrain & Kuwait B.S.C., Bank Of Nova Scotia and Mashreq Bank. On the other hand, 11 out of 34 Indian banks in the panel do not exhibit increase in productivity.

### **7.3.5 Factors influencing efficiency and productivity**

#### **1. Efficiency**

- The result of tobit regression where revenue and profit efficiency as dependent variable reveals that the size of the commercial banks are insignificant with the revenue and profit efficiency of commercial banks. The size of the commercial banks shows positive and significant relation with the cost efficiency.
- Liquidity has positive and significant relation with the revenue, cost and profit efficiencies of commercial banks in India.
- Off balance sheet, activities are negatively and insignificantly related with the revenue efficiency of commercial banks whereas it shows negative and significant relation with the cost and profit efficiency of the banks.
- ROA is positively and significantly related with the revenue and cost efficiency of commercial banks.
- Gross domestic product is positively and significantly (at 1% level of significance) related with the revenue and cost efficiency of commercial banks. GDP has negative and significant relationship with the profit efficiency of the banks in India.
- The variable inflation is negatively significantly affects the revenue and cost efficiency of banks in India whereas it is positive and insignificant with the profit efficiency of the banks.

- The empirical findings indicate that coefficient of the variable *dummy\_public* showed a positive and not statistically significant and it shows negative and insignificant relation with the cost and profit efficiency of the banks. The coefficient of *dummy\_foreign* showed a positive and statistically significant (1% level of significance) with revenue, cost and profit efficiency of the banks.
- *Dummy\_reform* positively significantly related with the revenue efficiency and cost efficiency of the commercial banks whereas reformatory period has negative and insignificant impact on the profit efficiency of commercial banks.
- *Dummy\_crisis* is positively significantly affects the revenue and cost efficiency of commercial banks but is not significant with the profit efficiency of the banks. *Dummy\_demonetisation* negatively significantly affects the revenue, cost and profit efficiency of commercial banks.
- NPAs are significantly related with revenue efficiency. Thus, it is clear that increase in the non-performing assets adversely affects the revenue efficiency of commercial banks. The analysis revealed that, there is statistically insignificant and positive relationship with the NPA and cost as well as profit efficiency of the commercial banks.
- The capital adequacy is negative and statistically insignificant with revenue and cost efficiency of banks and positive and insignificant relationship found between capital adequacy and profit efficiency.

## 2. Productivity

- Regression results show that size of the banks have a negative significant impact on the total factor productivity change and technological change of commercial banks in India whereas efficiency change is insignificantly related size of the banks.

- As against the expectation, ROA is negatively and significantly related with the total factor productivity change and efficiency change of the banks. While, the ROA is insignificantly and negatively related with technological change of the commercial banks.
- Independent variable liquidity is negatively and insignificantly associated with technological change and total factor productivity change. However, it is positively and insignificantly related with efficiency change of the commercial banks.
- As against the expected sign, off balancesheet is negatively and significantly related with the total factor productivity change and efficiency change whereas no significant impact between the technological change and offbalancesheet.
- NPA is positively and significantly related with the total factor productivity change, efficiency change and technological change of the banks.
- Capital adequacy is negatively and insignificantly related with total factor productivity change and efficiency change and it is positively insignificantly related with technological change of the commercial banks.
- GDP and inflation negatively and significantly related with efficiency change and positively and significantly related with technological change of the commercial banks. However, GDP and inflation do not significantly affect the total factor productivity of the banks.
- Dummy reform and dummy crisis are negatively significantly affects the productivity change of the banks whereas dummy demonetisation is positively and insignificantly related with TFPCH.
- Dummy reform is negatively insignificantly related with the efficiency change of the commercial banks. Dummy crisis and dummy demonetisation is positively and significantly related with efficiency change of the banks.

- Dummy reform, dummy crisis and dummy demonetisation is negatively and significantly affects the technological change of the banks.
- Dummy public is negatively significantly related with the efficiency change of the banks and dummy foreign is positively and significantly related with the commercial banks in India.

#### **7.4 Conclusions**

The present research mainly investigates the performance of commercial banks in the post-liberalization period. The performance in terms of growth, profitability, efficiency, and productivity of public sector banks, private sector banks, and foreign banks was examined. The analysis carried out reveals that none of the groups of banks exhibits consistent performance in the performance indicators selected in the study. In the growth analysis, the growth rate of private sector banks is higher than that of other groups of banks. In testing the hypotheses, the growth rate of deposits and borrowings did not exhibit any statistically significant difference among the different groups of commercial banks. In the case of variables that show statistical significance, a statistically significant difference was found between private sector banks, public sector banks, and foreign banks. The share of each bank group for each variable on the total of the variables indicates that public sector banks are still holding the major portion of the business; however, the trend of the percentage share of private sector banks has improved over the study period, while the share of public sector banks has decreased. Hence, from the growth analysis, it is concluded that over the last 29 years, the growth of private sector banks has been significantly greater than that of public sector banks and foreign banks. The profitability and efficiency analysis found that the performance of foreign banks was better than that of domestic banks. In the case of profitability analysis, except for the ratio of interest income to total assets, a statistically significant difference exists among the commercial banks, and there is a significant difference especially between foreign banks and private sector banks and foreign banks and public sector banks.

The efficiency analysis reveals that foreign banks had higher revenue, cost, and profit efficiency scores during the study period. This may be because these banks are operating with a smaller number of branches and fewer employees. Further, they are operating on a class banking concept rather than mass banking. They are located mainly in major cities and cater to the needs of big enterprises. On the contrary, public and private sector banks are operating in every nook and corner of the country, and they are required to follow the policy of social objectives. This could be the reason for the inefficiency among the public and private sector banks. The major source of inefficiency was technical inefficiency rather than allocative inefficiency, and the major source of technical inefficiency was scale efficiency rather than pure technical inefficiency. The revenue, cost, and profit efficiency scores of commercial banks did not achieve the standard efficiency score. Hence, there is still room for the Indian commercial banks to improve their efficiency by maximizing their outputs as well as minimizing their costs. Productivity analysis indicates that there is productivity progress among all commercial banks and public-sector commercial banks, whereas private-sector banks and foreign banks have experienced a decline in productivity. Among the different groups of banks, productivity growth was higher for the public sector commercial banks. The analysis also indicates that innovations in banking technology contributed to productivity growth of 1.3% per annum during the study period. It means that technological improvement is the major reason for the productivity improvement in the Indian banking industry. To sum up, each group of commercial banks is performing better as per one performance indicator or another. None of the bank groups is performing better according to all the selected performance indicators.

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CHAPTER VIII

**RECOMMENDATIONS AND POLICY  
IMPLICATIONS**

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## **8.1 Recommendations**

Based on the findings of the research work the following recommendations are suggested:

1. The present study revealed that the efficiency of the commercial banks did not reach the standard score, and efficiency change became the major reason for the reduction in the total factor productivity change of the banks. The banks should pay more attention to the right way to manage their assets and liabilities, with loanable funds, employees, and fixed assets as inputs and advances and investments as outputs. Hence, it will help to improve the revenue, cost, and profit efficiency scores of the commercial banks.
2. From the studies relating to banking literature, it has been understood that efficiency scores may change as per different input/output mixes. Hence, different combinations of the input-output mix should be fixed by the RBI, and an efficiency score should be calculated periodically to review the efficiency performance and, thereby, formulate policies to improve the efficiency.
3. Efficiency analysis revealed that scale inefficiency is the major cause of technical inefficiency. When analyzing the returns to scale of the commercial banks, it was found that most of the banks are operating on decreasing returns to scale and increasing returns to scale. Hence, policymakers should take all the necessary action to rectify the diseconomies of scale of operation.

4. Foreign banks are encouraged to open more branches in the country because their value of business is worth less than that of public sector banks and private sector banks. When looking at the number of branches of the foreign banks, it is not enough to cater to the needs of the Indian economy. Hence, policymakers should also ensure a minimum number of bank branches in rural as well as urban areas before allowing them to operate in the Indian economy.
5. In the case of profitability analysis, it was found that the profitability of domestic banks is lower as compared to foreign banks. Profitability is the major criterion for measuring the success or failure of any organization. When analyzing the ratio of interest income to total assets, domestic banks are performing better than foreign banks. Likewise, the ratio of interest expenses to total assets of the public and private sector banks is high. Hence, the spread of these banks need to be improved to enhance their profitability. The ratio of non-interest income to total assets of public sector banks and private sector banks is lower than that of foreign banks. Even though the ratio of operating expenses to total assets of the foreign banks is also higher, the burden ratio of the foreign banks is comparatively lower than that of the domestic banks. Hence, both public sector banks and private sector banks should try to reduce the burden in order to improve profitability.

## **8.2 Policy Implications**

The findings of the current study give directions for improving the performance of commercial banks in India. The empirical findings highlight that the major share of business in the Indian banking industry is still in the hands of the public sector banks. Even though more private sector banks were given licenses and foreign banks were allowed to enter the Indian banking industry as a part of banking sector reforms, the public sector banks still hold most of the assets, liabilities, income, and expenses. However, when we analyze the trend of the share of each group of banks, it is clear that in all the variables considered in the present study, the share of public sector banks is decreasing and the share of private sector banks is



gradually increasing. If the trend continues, private sector banks would expand their business as much as public sector banks. This should be considered by policymakers while framing future policies. In addition to that, the study also found that foreign banks are not able to achieve significant growth in the business. Suitable actions that result in the expansion of business need to be taken by the authorities. Moreover, the growth rate of private sector banks is higher than that of public sector banks and foreign banks. This result indicates that the dominance of the public sector banks is not a hindrance to the growth of the private sector banks.

The profitability and efficiency analysis indicates that foreign banks are more profitable and efficient than the domestic Indian banks. So, this finding proves that foreign banks are important to the growth of the Indian banking industry and justifies the presence of foreign banks in India. Because it compels the domestic banks to follow international best practices and adopt them, which enables them to improve their performance. Also, none of the bank groups can reach the standard efficiency value of 1 in any given year, so policymakers will take the steps to make commercial banks in India more efficient. Analysis of the returns to scale of the banks highlights that the majority of the commercial banks are operating on the wrong scale, mainly decreasing returns to scale, which means that a percentage increase in inputs produces less than a proportional increase in output. Hence, classification of the banks based on returns to scale and proper action, i.e., either downsizing or expanding the scale of operations, is necessary to achieve the optimum scale of operations, which helps to improve efficiency and productivity.

Productivity analysis pointed out that the major reason for the reduction in productivity is efficiency change. From the efficiency analysis, it was seen that the efficiency of commercial banks did not attain the standard efficiency score of 1. Again, this indicates the need for actions that will improve the efficiency of the commercial banks in India. Technological change is a major factor contributing to the progress of the banks in India in terms of productivity. All the technologies adopted by the RBI so far have contributed to the increased productivity of the commercial banks.

### **8.3 Limitations of the study**

None of the research is free from limitations. The following are the limitations of the present study:

1. The number of banks in each of the groups is changing over the study period. Since the growth of the commercial banks is measured based on the absolute values of the variables, changes in the number of banks may affect the growth rate of the different groups of commercial banks.
2. The study considered only the quantitative aspects of the performance of commercial banks. Performance in terms of qualitative aspects is completely ignored in the present study. Likewise, only quantitative factors influencing the performance of commercial banks are considered in the study.
3. Due to the lack of uniformity in the data during the pre- and post-reform periods, the scope of the study has been limited to the post-reform period only.

### **8.4 Scope for further research**

- Studies employing parametric approaches like Stochastic Frontier Approach and Thick Frontier Approaches are less in existing literature as compared to the studies employing parametric approaches mainly DEA. Hence, a study employing parametric approaches and comparing the efficiency of using both parametric and non-parametric approaches in analysing the efficiency of banks is one of the interesting directions for future research.
- Small finance banks and payment banks are the differentiated banks functioning in the Indian banking sector. Analysis of these banks would give an insight into the performance of the banks at the early stages of its introduction.
- The selection of inputs and outputs would influence the efficiency of the banks. Hence, the studies employing different inputs and outputs and

comparing the efficiency scores calculated using different combination of the inputs and outputs are worth relevant.

- Studying the performance of commercial banks using both quantitative as well as qualitative would give a complete picture about the performance of the banks.
- Comparative study on the performance of the banks of the different countries would give an idea about the performance of the banks globally.

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