

Role of public sector banks towards financial inclusion during pre and post introduction of PMJDY: a study on efficiency review

Role of public sector banks

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Abstract

Purpose – An inclusive financial system is essential to develop the country's economy. A massive shift in financial inclusion was observed by the initiative of government to include financially excluded into the formal financial system by launching Pradhan Mantri Jan Dhan Yojana (PMJDY) in 2014. This paper aims to attempt to examine the efficiency of public sector banks in financial inclusion during pre and post introduction of PMJDY.

Design/methodology/approach – The data envelopment analysis is used to measure the efficiency of the banks towards financial inclusion for the periods, 2010–2011 to 2013–2014 as pre-introduction and 2014–2015 to 2017–2018 as post-introduction phase. For this study, supply-side parameters of financial inclusion considered as input variables and demand-side parameters as output variables.

Findings – The study finds that overall average efficiency towards financial inclusion increases significantly during post-phase, though all the public sector banks are not performing equally. There is a significant variation in efficiency level between them and even between the two periods. Further, there is a huge opportunity to enhance technical efficiency with the same quantity of input which will help to achieve the target of financial inclusion.

Originality/value – A comparative study between the two phases has taken place to analyse the impact of the scheme on the technical efficiency of banks. One of the notable innovativeness of this study is that, unlike most of the previous studies which are mostly theoretical and conceptual, the present study may place itself as a unique inquiry in the domain of efficiency review of public sector banks during pre and post introduction of PMJDY.

Keywords Data envelopment analysis, Technical efficiency, Financial inclusion, Public sector banks

Paper type Research paper

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JEL classification – G21, G29



Introduction

The study on financial inclusion is extremely momentous for society, as outcomes of financial exclusion have quite a negative impact on the economic development of a country. People who are unable to obtain services from mainstream financial service providers are thus regarded as the financially excluded, not only because there are no branches of the bank or other financial institution in their community but also because they are excluded or unable to use services offered by different financial institutions. Financial inclusion implies bringing low income and disadvantaged groups under the coverage of banking by providing them access to banking services at an affordable cost. Banking industry plays an important role in the growth and development of an economy. It is very much essential in the Indian economy, which comprises rural, semi-urban and urban zones. Among these, villages dominate the nation geographically. Poverty, illiteracy, unemployment, poor health, etc., are the issues that influence our economy as well. Financial inclusion provides formal financial services with improved range, looks for availability and quality of financial services for those who are financially excluded not only in urban areas but also in rural areas. The banks or formal financial institutions provide a wide variety of financial services to their customers, like deposits, withdrawal, loans, payment services, remittance facilities and insurance products to low-income and poor households and their business entities.

The opening of bank accounts is not only essential for maintaining and improving their social and economic status of a person but also is essential for meeting all needs (Kodan and Chhikara, 2011; Kunt and Klapper, 2013). In developed countries and some developing countries like India, the government has used branch expansion policies (Panagariya, 2006; Chakravarty and Pal, 2013). The previous studies notice that even developed countries with well-developed financial systems like in USA and UK have not succeeded to provide formal financial services to all population. A major percentage of populations in these developed countries remains outside of financial systems. Across the globe, several countries look for financial inclusion to reach the unreached people to improve the future financial position and together contribute to the nation's progress. From the Indian perspective, the largest number of people to provide banking service has become a top priority for the government and Reserve Bank of India (RBI). To acquire the target of financial inclusion by extending financial services to massive yet un-served people the Pradhan Mantri Jan Dhan Yojana (PMJDY) has been initiated on 28 August 2014 to unlock its growth potential. To further strengthen financial inclusion endeavour and raise the penetration of banking. To enhance financial inclusion, the demand side initiatives of opening accounts under PMJDY scheme have got an excellent response from the rural and urban centre. As of June 2019, number of accounts under PMJDY has reached a magnificent level (360.0 million as of June 2019 with total ₹996.5bn deposits in the accounts). The present study is an initiative to review technical efficiency (TE) of public sector banks (PSBs) towards financial inclusion during pre and post introduction phases of PMJDY.

Literature review

Here, researchers have surveyed the literature of banks and other financial institutions' role in financial inclusion and DEA application to acknowledge that the DEA has been used as an efficiency measurement tool as well as to measure the efficiency of the banking sector with bank service provision.

This technique has been used widely to measure efficiency not only in the private sector but also in the public sector. Maity and Sahu (2018) have examined the role of Indian banks in financial inclusion and measure their efficiency through DEA in financial inclusion respect. Results indicate that scheduled commercial banks (SCBs) are using 94.87% of

resources to produce desired outputs concerning financial inclusion. The results further reveal that selected PSBs operate at 97.48% and private sector banks (PVBs) operate at 92.26% level of efficiency. Their input could be reduced by 2.52% for PSBs and 7.74% for PVBs. In a study, [Jain \(2015\)](#) has investigated financial inclusion progress and highlights the achievement of the banking sector in this area. The study reveals that the execution of financial inclusion will require an approach in totality on part of banks in creating awareness about financial products, education and advice on money management, debt counseling, savings and affordable credit. Further, [Feroze \(2012\)](#) has used DEA to assess the efficiency of District Cooperative Banks (DCBs) in Kerala during 2005–2009. The empirical results revealed that the level of efficiency in DCBs was 74% and the magnitude of inefficiency was 26%. Six DCBs obtained an efficiency score equal to 1 and formed an efficiency frontier. [Tyagarajan \(1975\)](#) and [Subrahmanyam \(1993\)](#) have examined various issues relating to the performance of Indian banks.

In a study, [Bhattacharyya et al. \(1997\)](#) have measured and endeavoured to explain the performance of commercial banks during the early phase of the government's liberalization program. They have found publicly owned banks are most efficient, in using resources to dispose of services. [Burgstaller \(2013\)](#) has considered total funds, fixed assets and total costs as inputs and outputs produced comprise total loans, other earning assets and non-interest income to measure efficiency in the regional banking market through DEA. Further, [Pathania et al. \(2016\)](#) have investigated the case of four commercial banks to deliberate upon the current quality parameters undertaken by these banks for financial inclusion of rural population thereby finding the gaps that need to be addressed as part of innovative financial inclusion. [Das and Ghosh \(2006\)](#) have examined the performance of banks during 1992–2002 in India. Medium-sized PSBs have found performing at a higher level of TE. To arrive at this, they chose inputs and output based on three approaches, namely, intermediation, value-added and production approach. Variation of efficiencies was then observed about ownership, bank size, CAR, NPA and quality of management.

According to [Raina \(2014\)](#), SCBs are enabling financial inclusion and promoting inclusive growth. When the banking system fails, the whole of a nations' payments system is in jeopardy. The only efficient bank can enlarge their business in the form of deposit and credit and reach the customer. [Kumar and Gulati \(2008\)](#) have evaluated the efficiency of Indian PSBs using cross-sectional data for 27 banks for the year 2004–2005. Besides this, an attempt has been made to explain the impact of environmental factors (like market share, asset quality, exposure to off-balance sheet activities, size and profitability) on the overall technical efficiency (OTE) of the PSBs. To realize the research objectives, a two-stage DEA framework has been applied in which estimates of OTE, pure technical efficiency (PTE) and scale efficiency (SE) for individual PSBs have been obtained by CCR and BCC models in the first stage; and in second stage, logistic regression analysis has been used to work out a relationship between OTE and environmental factors. [Saha and Ravisankar \(2000\)](#) in their analysis indicate that, except for few exceptions, PSBs have in general improved their efficiency scores over the years 1992 to 1995. Despite this, there are few banks continued to be at the lower end of relative efficiency scales. Among the variables, deposits and advances, etc., are output variables and branches and staffs, etc., are input variables.

[Valadkhani and Moffat \(2009\)](#) in their analysis have measured TE of ten major financial institutions in Botswana during 2001–2006 using DEA. [Angelidis and Lyroudi \(2006\)](#) have investigated the productivity of 100 large Italian banks during 2001–2002 by using DEA. They employed DEA to find Malmquist indices of total productivity change which is then put to use in examining productivity change of financial institutions of most recent members of European Union countries. [Yue \(1992\)](#) has demonstrated the use of DEA to find

out relative efficiencies of 60 commercial banks in Missouri for the period 1984 to 1990. Two alternative models of DEA have been used for evaluation: the CCR model and the additive DEA model followed by window analysis of the efficiencies obtained. Boufounou (1995) has built an appropriate example to support management decision-making in evaluating the branch performance of a bank. A representative sample of 62 branches of all sizes of the Commercial Bank of Greece network was chosen for this analysis. The study analyses volume of deposits attracted by each branch. Besides these, Dhar (2012) analyses the performance of few selected Indian Banks in the area of financial inclusion. In a recent study, Aruna *et al.* (2020) revealed that 20% of the respondents are having a PMJDY bank account in Indian Bank and other banks. This study covers a sample size of 60 from the Vellore District.

Research gap

The previous studies show that there have been widely used DEA applications to measure efficiency by considering different parameters as input and output. If we see the past literature, we found that earlier studies are based on the economic perspective to measure performance rather than based on deposit mobilization and credit disbursement. The literature reviews have not found much empirical study to measure banks' efficiency to fulfill a role in financial inclusion only. This research gap motivates us to work on our set of objectives.

The objective of the study

The main objective of this study is to examine TE of PSBs in fulfilling financial inclusion. Following objectives have been framed to accomplish the aim of the present study:

- to examine the technical efficiency of Indian PSBs in fulfilling financial inclusion; and
- to assess the comparative technical efficiency of PSBs during pre and post introduction phase of PMJDY.

Data and research methodology

Data

The entire research is exclusively based on secondary data collected from Database on Indian Economy (2020), RBI and the annual reports of the individual banks. The study covers for eight years from 2010–2011 to 2017–2018 with 2010–2011 to 2013–2014 as pre-introduction phase and 2014–2015 to 2017–2018 as post introduction phase of PMJDY scheme. This study covers all the PSBs as of March 2018. Based on the PSBs a conclusion has been drawn, as these banks hold the majority business share of the Indian banking industry.

Variables of the study

The present study considers two output and four input variables to analyse the data using DEA. After a careful review of earlier literature and considering present research objectives the study considered fixed assets, operating expenses, branch and automated teller machine (ATM) as input and deposit and credit which measure financial inclusion as output variables.

Input variables. The selection of inputs has been determined on the basis that the efficiency measurement is focused on the internal control and productivity of banks. In

practice, the banks use various levels of different inputs resources to serve the customers as deposits and credits. Accordingly, in Indian context, researchers have considered number of branches, ATMs, fixed assets size and operating expenses as input variables.

In this regard in Indian perspective branches and ATMs of a bank is playing a major role in financial inclusion (Kodan *et al.*, 2011; Das and Guha, 2015). The total asset of a bank is also depending upon branch size or number of branches. Based on the review of literature, in present analysis, number of branches, ATMs, the value of fixed assets (Saha and Ravisankar, 2000; Das *et al.*, 2004; Burgstaller, 2013), operating expenses are four input variables.

Output variables. The main function of any banking system is to mobilize money from saving and disbursement of credit. The output variables considered here are the deposits and credits of individually selected banks which measures financial inclusion. Here, we have measure efficiency level in terms of financial inclusion rather than profitability, so deposits and credit outstanding are our two output variables. To analyse efficiency, we need to find an optimum level of output with given input or optimum level of input to get the given output. As our objective is not to reduced branch and ATM rather the maximum level of deposit and credit to fulfill financial inclusion, researchers will consider the first option, i.e. the optimum level of output with the given input.

From the financial inclusion perspective as the banks, the main target is to collection of deposit by opening deposit accounts and disburses of credit or advance from the collected deposit by opening credit accounts. And that is the reason in most of the earlier studies these two variables have been selected as financial inclusion indicators (Mahadeva, 2008; Kodan and Chhikara, 2011; Shafi and Medabesh, 2012; Chakravarty and Pal, 2013; Kumar, 2013; Kunt and Klapper, 2013; Fungacova and Weill, 2015).

Research methodology

Efficiency is the ratio between an output and the factors that made it possible. It is very easy to compute this ratio if the decision-making unit (DMU) uses a single input to produce a single output, i.e. Efficiency = output/input. To measures, the efficiency with many inputs and many outputs, the researchers have applied DEA of the selected 21 banks. DEA is defined as a nonparametric method for efficiency measurement of a DMU by comparing it to other homogenous units with multiple inputs and multiple outputs. It has two models: CCR model under constant returns to scale (CRS) assumption and BCC model under variable returns to scale (VRS) assumption. The study intends to apply the technique of DEA for measures of OTE, PTE and SE for the individual PSBs. The measure of efficiency provided by CCR model is known as OTE under CRS assumptions and efficiency provided by BCC model is known as PTE under VRS assumptions. Also, the SE can be derived by the ratio of OTE to PTE. Lower scores less than 1 indicate low-efficiency level or inefficient and score equal to 1 indicate efficient. Technical efficiency has been measured under the output-oriented model (maximizing the output) for both the periods of pre and post introduction phase of PMJDY and a comparison has been done for the two periods. The output-oriented models object at maximizing the outputs by the DMUs with the same level of input consumed.

Analysis and findings

To increase validity, the researchers examine assumptions of “isotonicity” relationship with the correlation among all variables (Golany and Roll, 1989). The relationship expresses a rise in any input should not result in a loss in any output. Table 1 presents the descriptive statistics of all the parameters. The correlation matrix results as presented in Table 2 does

DMU	Fixed assets (₹)	Operating expenses (₹)	Branch	ATM	Deposit (₹)	Credit (₹)
Allahabad Bank	19865	33606	2895	825	2094455	2619884
Andhra Bank	8742	25399	2321	2363	1688780	2258322
Bank of Baroda	37604	73674	4715	6355	4202265	6110774
Bank of India	56252	71796	4523	4902	3956797	5560387
Bank of Maharashtra	12965	22649	1765	1361	1264784	1637015
Canara Bank	56051	66427	4946	6585	4531198	5717891
Central Bank of India	32768	52714	4423	3642	2794311	3227293
Corporation Bank	7395	24402	1993	2303	2030971	2471841
Dena Bank	10904	17526	1542	1158	1147819	1360686
IDBI Bank Ltd.	45740	36697	1479	2570	2712355	3647662
Indian Bank	26500	28409	2278	2219	1736343	2276676
Indian Overseas Bank	24502	40769	3064	2689	2305377	2838177
Oriental Bank of Commerce	17292	29503	2120	2046	2156855	2660340
Punjab and Sind Bank	9722	12963	1299	811	920237	1125373
Punjab National Bank	43061	92778	5908	7831	5093651	6720641
State Bank of India	187406	453316	21636	45922	21200342	28916562
Syndicate Bank	17368	39627	3336	2637	2217788	3120624
UCO Bank	16523	25201	2772	1885	1959526	2350518
Union Bank of India	30082	54464	3803	5816	3404899	4479463
United Bank of India	9978	19902	1856	1507	1233726	1286687
Vijaya Bank	8067	19034	1632	1361	1306966	1610723
Mean	32323	59088	3824	5085	3331402	4380835
Standard deviation	38777	92879	4291	9579	4260516	5859818
Minimum	7395	12963	1299	811	920237	1125373
Maximum	187406	453316	21636	45922	21200342	28916562

Table 1.
Descriptive statistics
of input and output
variables

Note: ₹ in million
Source: Calculated by researchers

Variables	Fixed assets	Operating expenses	Branch	ATM	Deposit	Credit
Fixed assets	1					
Operating expenses	0.9692	1				
Branch	0.9622	0.9933	1			
ATM	0.9615	0.9971	0.9886	1		
Deposit	0.9765	0.9974	0.9922	0.9954	1	
Credit	0.9764	0.9970	0.9907	0.9946	0.9993	1

Table 2.
Correlation among
the input and output
variables

Source: Calculated by researchers

not violate the isotonicity assumptions. The different selected PSBs represent here DMUs in DEA efficiency measurement. Further, as recommended by [Golany and Roll \(1989\)](#) and [Drake and Howcroft \(1994\)](#), DMUs number should be at least twice the total variables. Here, DMUs number is 21 (selected banks), i.e. more than twice the number (i.e. twelve) of variables in this analysis. Therefore, the proposed DEA model has high construct validity. In several studies, analysis has tended to select input-oriented models because many organizations or institutions have particular orders to fill and, hence, input appear to be primary decision variables, although this argument may not be as strong in all industries or institutions. In some cases, the firms may be given a fixed quantity of resources and asked

to produce as much output as possible. In this case, an output-oriented model would be more appropriate. Essentially, one should select according to which quantities (inputs or outputs) the managers have the most control over. Scores are 1 for efficient banks (on the frontier) and lower for relatively inefficient ones.

Tables 3 and 4 summarize DEA results. The entire period from 2010–2011 to 2013–2014 representing the pre-introduction phase and 2014–2015 to 2017–2018 representing the post-introduction phase. Output-oriented efficiency scores of the selected banks obtained from DEA models (CCR and BCC) for the two periods are presented in Tables 3 and 4 of the pre-introduction and post-introduction phase respectively. Efficiency scores for each selected bank are calculated over the two periods to check the trend in TE. Then average efficiency scores have been calculated for the two periods so that a conclusion can be drawn.

The results obtained by employing the two models on each year data reveal subtle fluctuations in efficiency scores during the two periods. The average score of OTE in 2010–2011 to 2013–2014 is at approximately 85.87% level. However, the efficiency level has enhanced from 85.87% in pre-introduction phase to 91.75% in post-introduction phase. This signifies that the efficiency of banks has been progressing during post-introduction period compare to pre-introduction period. Also, during the first phase, four banks are efficient with an average score of 0.8587 and in the second phase, five banks are efficient with an average score of 0.9175 under CCR model. Under BCC model, 12 banks are efficient in the first phase with average score 0.9270 and 11 banks are efficient in the second phase with an average score of 0.9638. The study concludes that the average score during the post-introduction phase compares to the pre-introduction phase growing positively at a higher rate. This signifies that due to the implementation of PMJDY scheme, a positive trend found

DMU	OTE (CCR)	PTE (BCC)	SE	Returns to scale
Allahabad Bank	1	1	1	Constant
Andhra Bank	0.9757	1	0.9757	Increasing
Bank of Baroda	0.9058	1	0.9058	Decreasing
Bank of India	0.8434	1	0.8434	Decreasing
Bank of Maharashtra	0.6959	0.7598	0.9159	Increasing
Canara Bank	0.8529	1	0.8529	Decreasing
Central Bank of India	0.6978	0.7511	0.9291	Decreasing
Corporation Bank	1	1	1	Constant
Dena Bank	0.9226	1	0.9226	Increasing
IDBI Bank Ltd.	1	1	1	Constant
Indian Bank	0.7052	0.7186	0.9812	Increasing
Indian Overseas Bank	0.7954	0.8062	0.9867	Decreasing
Oriental Bank of Commerce	0.9223	0.9228	0.9994	Increasing
Punjab and Sind Bank	0.9821	1	0.9821	Increasing
Punjab National Bank	0.6357	0.8858	0.7176	Decreasing
State Bank of India	0.7893	1	0.7893	Decreasing
Syndicate Bank	0.8468	0.8606	0.9840	Decreasing
UCO Bank	1	1	1	Constant
Union Bank of India	0.7051	0.8332	0.8462	Decreasing
United Bank of India	0.8595	0.9298	0.9243	Increasing
Vijaya Bank	0.8967	1	0.8967	Increasing
Average	0.8587	0.9270	0.9263	

Source: Calculated by researchers

Table 3.
Efficiency scores under CCR and BCC models during pre-introduction phase

Table 4.
Efficiency scores
under CCR and BCC
models during post-
introduction phase

DMU	OTE (CCR)	PTE (BCC)	SE	Returns to scale
Allahabad Bank	1	1	1	Constant
Andhra Bank	0.9343	0.9347	0.9996	Increasing
Bank of Baroda	0.9884	1	0.9884	Decreasing
Bank of India	0.8635	0.9849	0.8767	Decreasing
Bank of Maharashtra	0.8788	0.9723	0.9038	Increasing
Canara Bank	0.8889	1	0.8889	Decreasing
Central Bank of India	0.7075	0.8016	0.8826	Decreasing
Corporation Bank	1	1	1	Constant
Dena Bank	0.8453	0.9544	0.8857	Increasing
IDBI Bank Ltd.	1	1	1	Constant
Indian Bank	0.9022	0.9045	0.9975	Increasing
Indian Overseas Bank	0.7370	0.7496	0.9832	Decreasing
Oriental Bank of Commerce	1	1	1	Constant
Punjab and Sind Bank	0.9652	1	0.9652	Increasing
Punjab National Bank	0.9543	1	0.9543	Decreasing
State Bank of India	1	1	1	Constant
Syndicate Bank	0.8952	0.9969	0.8980	Decreasing
UCO Bank	0.9922	0.9954	0.9968	Increasing
Union Bank of India	0.9774	1	0.9774	Decreasing
United Bank of India	0.7674	0.9447	0.8124	Increasing
Vijaya Bank	0.9703	1	0.9703	Increasing
Average	0.9175	0.9638	0.9515	

Source: Calculated by researchers

in deposit accounts with a high volume of deposit and credit accounts with more volume of loan disbursement to new accounts.

This finding also implies that Indian PSBs can reduce inputs by at least 7.30% (BCC model) to 14.13% (CCR model) during pre-introduction phase and 3.62% (BCC model) to 8.25% (CCR model) during post-introduction phase and still generate the identical outputs or increase output to 1.079 (1/0.9270) times to 1.165 (1/0.8587) times during pre-introduction phase and 1.038 (1/0.9638) times to 1.090 (1/0.9175) times during post-introduction phase with identical inputs. During the pre and post introduction phase eight inefficient banks (CCR model) present increasing returns to scale (IRS) that can increase the scales to effectively improve efficiency.

Summary of the findings

While comparing their performance by applying DEA with the two financial parameters of deposit penetration and credit penetration with four input variables this study finds that, among the selected banks, four banks, i.e. Allahabad Bank, Corporation Bank, IDBI Bank Ltd. and UCO Bank are technically efficient during pre-introduction period and five banks, i.e. Allahabad Bank, Corporation Bank, IDBI Bank Ltd., OBC and SBI are technically efficient during the post-introduction period under CCR model. The result is something different under BCC model. Under BCC model during pre-introduction period in addition to four efficient banks under CCR model, eight more banks are technically efficient. During post-introduction period, in addition to five efficient banks under CCR model, six more banks are technically efficient. The analysis reveals, during pre-introduction period output can be increased to 1.165 times, whereas during post-introduction period output can be increased to 1.090 times. This result is consistent with [Bhattacharyya et al. \(1997\)](#) during the

study period 1986–1991; Kumar and Gulati (2008) during the study period 2004–2005. Further, Das and Ghosh (2006) have found medium size PSBs are performing at higher TE. Saha and Ravisankar (2000) in their study conclude that PSBs have improved their efficiency. Sathye (2003) shows Indian banks compares well with the world mean efficiency score.

Conclusion

The idea behind financial inclusion is not new since 2005 many new policies have been framed to make financial service base stronger for all the unbanked. We face several challenges in the implementation of financial inclusion policies. The initiative of opening PMJDY account got an excellent response all over India to bring banking within the reach of the masses of the Indian population. Average efficiency scores for the two periods also reflect the same results. The average OTE score during pre-introduction period of PMJDY is 0.8587 which increased to 0.9175 during post-introduction period. The results of higher growth of efficiency of PSBs during 2014–2015 to 2017–2018 may be due to the introduction of PMJDY scheme which leads to an opening of more accounts and more amounts of deposits and disbursement of loan to more accounts holders. According to Reynolds (2003), a measurement of financial exclusion is not having a bank account both deposit and credit. Hogarth *et al.* (2003), Leeladhar (2005), Thorat (2007), Bihari (2011), Shafi and Medabesh (2012), Kumar (2013) and Maity (2019) have proposed the number of bank accounts to population ratio as an indicator of penetration of banking system. Therefore, the opening of new accounts to excluded persons by way of any mode of banking either by branch-based or by non-branch based is the prime target of regulators. Further reaching the unbanked is a means to enhance the profits of banks (Singh and Singh, 2016). When banks are expanding their deposits and credit, their performance also improved due to business growth (Maity and Sahu, 2019). Finally, the results provide a useful lesson about bank efficiency and comparison among the PSBs. This study will help the banks to check their efficiency level and to consider various strategies for augmenting efficiency. Due to its importance and role in economic development this research can be used as the model by other researchers, government, financial regulators, banks and policymakers to proper utilization of resources and escalate the efficiency of banks. In the present market scenario, all the sectors worldwide are facing a new challenge of lockdown due to the COVID-19 pandemic which will impact every sector globally including the banking sector. Further study may be conducted after the COVID-19 pandemic over to measure how the pandemic impact on bank efficiency and a comparison with pre and post-pandemic situations.

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