



Mergers and Bank Performance: Evidence from The Indian Public Sector Banks

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Abstract

The existing literature on bank mergers reveals mixed and inconclusive evidence on merger outcomes, particularly in developing economies. This study examines the impact of the 2020 merger of Indian Public Sector Banks (PSBs), which remained largely underexplored. The study employs a quantitative design with causal-comparative elements, utilising eight years (2016–2024). It applies the "Profit = Spread – Burden" framework to explore the drivers of bank profitability after the mergers. CAMEL-based key performance ratios are also analysed using paired and independent-samples t-tests, and a difference-in-differences regression is employed to isolate merger effects. Findings indicate improved profitability primarily due to increased spreads, alongside gains in capital adequacy and asset quality. Employee productivity rose without significant downsizing, though rising intermediation costs highlight operational challenges. A significant decline in the cost of funds (CF) highlights stronger bargaining power and an improved ability of merged banks to mobilise funds at lower costs. Compared to non-merged banks, merger benefits appear moderate, questioning guaranteed scale efficiencies. Thus, with a multi-layered analytical approach, this study provides insights into merger outcomes for policymakers in evaluating the effectiveness of mergers as a reform tool, especially in the Indian banking context.

Keywords: Bank Merger; Difference-in-Difference Regression; Financial Performance; India; Ratio Analysis.

1. Introduction

The policy changes as part of economic reforms have been the primary drivers of corporate restructuring activity in India. (Chauhan, 2011). Merger has become one of the favourite growth strategies for Indian corporates post-1991 reforms. (Basant, 2000; Pawaskar, 2001; Ramakrishnan, 2008; Sinha & Gupta, 2011). Similar to other developing economies, mergers in India are often pushed by the Government's policy and strategy, rather than market forces. (Jayaraman et al., 2014; Ravichandran et al., 2010).

In an era marked by rapid globalization, evolving regulatory landscapes, and dynamic shifts in economic paradigms, the banking sector in India plays a pivotal role in maintaining financial stability and driving growth. One significant phenomenon that has gained prominence in recent years is the consolidation of banks through mergers and acquisitions. Banks are expected to derive benefit from a merger either by reducing expenses or augmenting revenues. (Kumar & Suhas, 2010). In 1998, the second Narasimhan Committee on Banking Reforms proposed consolidating Indian banks to create a few large banks rather than many small banks. Over the years, the Indian banking system has seen several mergers. The year 2020 witnessed a watershed moment in the Indian banking landscape, characterised by a series of Public Sector Banks (PSBs) mergers that reshaped the sector's dynamics. The government consolidated ten PSBs into four to build a stronger and more competitive banking sector, aiming at economies of scale, global reach, cost efficiency, and enhanced competitiveness. (Sadani, 2024).

With these mergers, banks are now 'too-big-to-fail', whose failure could impact the financial system as a whole because of their size and interconnectedness. Banking, being the most vital instrument for the economic growth of a country, is crucial to constantly examine the effect of such changes on the performance of the sector. As the dust settles on these transformative mergers, a crucial question looms: what has been the impact of these mergers on the performance of the banks involved? Against this backdrop, the present study seeks to provide an empirical assessment of the 2020 PSB mergers. Specifically, it examines shifts in key performance indicators, evaluates the causal effect of the merger through a difference-in-differences framework, and explores the drivers of post-merger profitability or loss. By doing so, the study aims to generate evidence-based insights into whether these large-scale mergers have truly delivered on their intended objectives.

2. Review of Literature and Research Objectives

A substantial body of research has examined mergers and acquisitions (M&A) in the banking sector across different contexts, both in India and abroad. However, systematic reviews such as Mehrotra & Sahay (2018) highlight that the majority of these studies are concentrated in

developed economies, with relatively fewer focusing on emerging markets like India. Research on banking mergers and acquisitions highlights diverse motives behind such consolidations. Rani et al. (2020) noted that managers pursue mergers only when they expect synergy, and such synergy may stem from operational gains, financial advantages, or improved managerial effectiveness. In advanced economies, mergers and acquisitions are largely driven by competitive market dynamics. However, in developing countries, such consolidation often happens under the intervention of financial regulators and monetary authorities (Awdeh & EL-Moussawi, 2011). In the Indian context, Agarwal & Bhattacharjee (2006) showed that mergers tend to cluster in response to industry and regulatory shocks, suggesting an external push rather than internal choice. Sharma & Rai (2012) claim that mergers in the twenty-first century included both forced restructuring of weak banks by the RBI and voluntary mergers with the primary goals being development, diversification, and general growth. Ray & Sethia (2022) argued that the motives behind bank mergers have evolved: earlier mergers were rescue measures to stabilise weak banks, while current ones pursue strategic objectives like market expansion, branch growth, capital optimisation, and faster decision-making. Therefore, examining bank mergers in emerging markets becomes essential, as the motivations and processes differ significantly from those seen in developed economies. The review is divided into three categories based on the impact of mergers on bank performance.

2.1. Positive effects of bank mergers on performance

Several studies report positive outcomes of mergers and acquisitions, highlighting improvements in efficiency, profitability, and overall performance. Srinivas (2010) Found that Punjab National Bank improved in terms of spreads, asset quality, and profitability after its merger, while HDFC Bank achieved notable gains in profitability despite higher burden ratios. Chaudhary & Kaur (2021) Reported that the profitability of regional rural banks improved modestly after mergers, with return on equity increasing significantly in the post-merger phase. Senger et al. (2021) Employing trend analysis and paired t-tests found that the financial health of acquiring banks strengthened after consolidation. Herwadkar et al. (2022) Studied Indian bank M&As between 1997 and 2020 and confirmed that the technical efficiency of acquiring banks improved significantly post-merger, with the results remaining consistent after controlling for industry-wide dynamics. Maani et al. (2025) Showed that the wave of mergers among major Indian PSBs between 2015 and 2020 led to substantial improvements in overall technical efficiency. Their findings highlight that larger banks benefited from economies of scale, while better asset quality supported sustained performance improvements. Kumar & Verma (2024) Examined the financial performance of six merged Indian PSBs in the post-COVID era, revealing improvements in profitability, efficiency, and asset utilisation. The results suggest that consolidation has enabled economies of scale and cost efficiencies, strengthening the overall performance of merged banks.

2.2. Negative effects of bank mergers on financial outcomes

While many studies highlight the benefits of mergers, a substantial body of research questions their effectiveness. Pawaskar (2001), studying 36 Indian mergers from 1992–1995, found no post-merger improvement in profitability. Similar scepticism appears in Mantravadi & Reddy (2008), who reported that profitability ratios and returns on invested capital declined after mergers. Likewise, Kumar & Suhas (2010) Observed that merged banks experienced lower return on assets and weaker fund-based income to cash flow ratios compared to a control group, with asset growth lagging behind non-merged banks. Kalaichelvan (2011) Found that mergers may adversely affect liquidity and operational efficiency without offering clear improvements in profitability over time. Kalra et al. (2013) Found no significant improvement in the financial performance of 10 Indian banks, aside from marginal gains in EPS and market value. Ravichandran et al. (2010) also reported that mergers failed to improve production efficiency or profitability in Indian banks, while Abbas et al. (2014), analysing Pakistani banks, concluded that mergers did not generate cost synergies or enhance liquidity, leverage, or profitability. Jayaraman et al. (2014) found that the technical efficiency of merged banks declined immediately after the merger, primarily due to scale inefficiency. Banerjee (2017) Reported that larger merged banks displayed weaker efficiency, with total assets negatively associated with advance-deposit ratios, investment-deposit ratios, and profit rates. It, thus, challenged the assumption of scale economies in the Indian context. More recently, Das & Kumbhakar (2022) Found that cost efficiency actually declined after India's consolidation drive. The study argues that consolidation decisions were not primarily driven by efficiency concerns and that post-merger benefits have been minimal. In several instances, the mergers have led to a decline in the performance of the stronger bank, potentially weakening the overall public sector banking system. Arshi & Vaishali (2024) Analysed PSB mergers from 2016–2022 and observed that post-merger financial performance did not show noticeable change. Chakraborty (2025) Analysed the post-merger financial performance of PSBs merged in 2020 using the Altman Z-score model. Except for Canara Bank, all merged PSBs recorded Z-scores below the threshold, indicating a high risk of financial distress. This suggests that the mergers largely served to rescue weak banks rather than generating significant synergistic gains in financial health. Cross-country evidence also tempers optimism. Du & Sim (2016), analysing six emerging economies, including India, concluded that efficiency gains from bank mergers are generally weak. These findings suggest that the strategic and policy rationale for mergers—particularly in developing countries—may be overstated, as post-merger benefits are often minimal or absent.

2.3. Mixed results in bank merger performance studies

Several studies on bank mergers have reported mixed outcomes, where improvements in some indicators were offset by declines in others. Sinha et al. (2010) Found improvements in EPS, D/E ratio, and PBT, but no gains in liquidity. Sinha & Gupta (2011), analysing 80 financial sector mergers, observed improved profitability and reduced liquidity, with mixed results for cost efficiency and interest coverage. Patel (2018) Found that mergers have a detrimental effect on ROE, ROA, net profit margin, yield on advances, and yield on investment. However, there has been a favourable trend in Profit per Employee and Business per Employee. Gandhi et al. (2020) Found that private sector banks showed statistically significant progress only in capital adequacy, while public sector banks improved in asset quality and management efficiency. Kumar (2011), using 23 ratios, concluded that only five ratios improved significantly, with profitability indicators such as ROE, interest income, and profit margin benefiting most. Sadani (2024), analysing anchor banks from the 2020 Indian bank merger, reported improvements in asset quality, management efficiency, and earnings ability, while liquidity measures gave mixed signals. Pathak et al., (2024) Examined the 2020 mega merger and reported varied outcomes: Union Bank of India struggled with liquidity and ROA, Canara Bank showed better profitability and lower debt, while Indian Bank improved profitability but lacked liquidity and leverage. Similarly, Mishra & Mohanty (2024) Assessed six recent PSB mergers and found mixed results—some banks recorded gains in profitability and solvency, whereas others showed limited improvement, and efficiency measures remained largely insignificant for all entities after amalgamation.

Cross-country evidence also reflects this dual trend. Adhikari et al. (2023), studying Nepalese banks, reported that one bank showed notable improvements in profitability indicators, while the other remained largely unaffected. Alsharif (2023) observed that Saudi banks became

better capitalised post-merger, but suffered declines in profitability and liquidity. Akhtar & Nosheen (2022) found that mergers between banks and fintech firms boosted operating performance, liquidity, and ROA, but reduced profit margins.

2.4. Research gap

The literature shows that bank mergers are often motivated by efficiency gains, market expansion, and regulatory considerations, yet their outcomes remain far from uniform. While several studies report improvements, others highlight adverse or negligible effects. This inconsistency underscores the mixed and inconclusive nature of existing evidence. Furthermore, a noticeable gap persists in research on developing countries, where banking sector dynamics differ significantly from those of developed economies. The large-scale consolidation of Indian PSBs in 2020 represents a recent and unique development that has not been studied in depth, limiting insights into its long-term implications. The limited studies that have been done relied primarily on pre- and post-merger comparisons (Chakraborty, 2025; Kumar & Verma, 2024; Sadani, 2024), often neglecting suitable non-merged bank benchmarks. Addressing these gaps is crucial to building a more nuanced understanding of merger outcomes.

2.5. Research objectives

To bridge these gaps, this study undertakes the following objectives:

- 1) To explore the underlying drivers influencing profit or loss in the post-merger period for the merged banks.
- 2) To analyse the shifts in key performance indicators of Indian PSBs after the 2020 merger.
- 3) To evaluate the mergers' causal effect on performance indicators by comparing merged banks with the non-merged banks.

3. Research Methodology

The study used an analytical and explanatory research design with causal-comparative elements, employing quantitative methods. To achieve the first objective, the study adopts the following analytical framework:

$\text{Profit} = \text{Spread} - \text{Burden}$,

where spread refers to the difference between interest income and interest cost, while burden is measured as the difference between non-interest cost and non-interest income (Mahapatra, 2010). As depicted in Table 1, the spread captures the core banking function of financial intermediation, while the burden accounts for all non-core operational elements that affect profitability. This framework allows profitability to be broken down into components that can be independently influenced and managed by the banks. It is relevant especially in the context of bank mergers, as mergers aim to enhance profitability either through improved intermediation (wider spread) or operational synergy (reduced burden).

Table 1: Analytical Framework for Profitability Analysis

Particulars	Income Structure	Expense Structure	Difference
Core banking activities	A. Interest Income	B. Interest Expenses	E. Spread (A-B)
Non-core operational factors	C. Non-interest Income	D. Non-interest Expenses	F. Burden (D-C)
Total	G. Total Income	H. Total Expenses	I. Profit (E-F) or (G-H)

Source: Mahapatra, 2010.

To achieve the second and third objectives, this study employs a ratio analysis approach, utilising the CAMEL framework as its analytical foundation. CAMEL is essentially a diagnostic model that gauges the financial condition of banks using a structured set of performance ratios (Agarwal et al., 2019). The CAMEL framework centres on five core dimensions: Capital Adequacy, Asset Quality, Management Efficiency, Earnings, and Liquidity. This accounting-based evaluation approach using financial ratios is one of the most fundamental and extensively practised techniques in merger literature. (Adhikari et al., 2023; Aggarwal & Garg, 2022; Gupta et al., 2023; Herwadkar et al., 2022; Mantravadi & Reddy, 2008; Patel, 2018; Sadani, 2024). The performance of the merged entities is measured using the ratios depicted in Table 2 that reflect these key components of financial health.

Table 2: List of Ratios Based on CAMEL Framework

Sl. No.	Parameter	Ratio	Formula	Acronym
1	Capital Adequacy	Capital Adequacy Ratio	$100 \times (\text{Tier 1 Capital} + \text{Tier 2 Capital}) / \text{Risk-Weighted Assets}$	CAR
		Total Advances to Total Assets Ratio	$100 \times (\text{Total Advances} / \text{Total Assets})$	TATAR
		Debt Equity Ratio	$(\text{Deposits} + \text{Borrowings} + \text{Other Liabilities and Provisions}) / (\text{Equity Capital} + \text{Reserves and Surplus})$	DER
		Ratio of Net NPA to Net Advances	$100 \times \text{Net Non-performing Assets (NPAs)} / \text{Net Loans \& Advances}$	NNPANA
2	Asset Quality	Gross NPAs to Gross Advances Ratio	$100 \times \text{Gross Non-performing Assets (NPAs)} / \text{Gross Loans \& Advances}$	GNPAGA
		Ratio of Secured Advances to Total Advances	$100 \times (\text{Advances secured by tangible assets} + \text{Covered by Bank/ Government Guarantees}) / (\text{Total Advances})$	SATA
		Ratio of investments in non-approved securities to total investments	$100 \times (\text{Shares} + \text{Debentures and Bonds} + \text{Subsidiaries and/or joint ventures} + \text{Others} + \text{Foreign Government securities} + \text{Subsidiaries and/or joint ventures} + \text{Others}) / (\text{Total Investments})$	INASTI
3	Management Efficiency	Business Per Employee (in Rs. Lakh)	$(\text{Deposits} + \text{advances}) / \text{Total number of Employees}$	BPE
		Profit Per Employee (in Rs. Lakh)	$\text{Net Profit} / \text{Total Number of Employees}$	PPE
		Cost of Funds	$100 \times (\text{Interest Expended}) / \text{average (Deposits} + \text{Borrowings) for Current and Previous Years.}$	CF

4	Earnings Ratios	Ratio of Wage Bills to Total Expenses	$100 \times (\text{Payments to and provisions for employees}) / (\text{Interest Expended} + \text{Operating Expenses})$	WBTE
		Ratio of Wage Bills to Intermediation Cost	$100 \times (\text{Payments to and provisions for employees}) / (\text{Intermediation Cost})$	WBIC
		Ratio of Other Intermediation Cost to Intermediation Cost	$100 \times (\text{Intermediation Cost other than Payments to and provisions for employees}) / (\text{Intermediation Cost})$	OICIC
		Ratio of Intermediation Cost to Total Assets	$100 \times (\text{Operating Expenses}) / \text{average (Total Assets) for Current and Previous Years}$	ICTA
		Ratio of Burden to Total Assets	$100 \times (\text{Operating Expenses} - \text{Other Income}) / \text{average (Total Assets) for Current and Previous Years}$	BTA
		Ratio of Interest Income to Total Assets	$100 \times (\text{Interest Earned}) / \text{average (Total Assets) for Current and Previous Years}$	IITA
		Ratio of Non-interest Income to Total Assets	$100 \times (\text{Other Income}) / \text{average (Total Assets) for Current and Previous Years}$	NIITA
		Ratio of Operating Profit to Total Assets	$100 \times (\text{Interest Earned} + \text{Other Income} - \text{Interest Expended} - \text{Operating Expenses}) / \text{average (Total Assets) for Current and Previous Years}$	OPTA
		Return on Assets	$100 \times (\text{Profit after tax} / \text{Av. Total assets})$	ROA
		Return on Equity	$100 \times (\text{Net Profit for the year}) / \text{average (Capital} + \text{Reserves and Surplus) for Current and Previous Years}$	ROE
5	Li- quid- ity Ra- tio	Net Interest Margin	$100 \times (\text{Interest Earned} - \text{Interest Expended}) / \text{average (Total Assets) for Current and Previous Years}$	NIM
		Cash Deposit Ratio	$(\text{Cash in Hand} + \text{Balances with RBI}) / (\text{Deposits}) \times 100$	CDR
		Liquid Assets to Total Assets	$100 \times (\text{Liquid Assets} / \text{Total Assets})$	LATAR
		Liquid Assets to Total Deposits	$100 \times (\text{Liquid Assets} / \text{Total Deposits})$	LATDR
		Ratio		

Source: compiled by the authors from DBIE, RBI.

3.1. Data and study period

The study focuses on the four major PSBs in India that underwent the merger process in 2020, i.e., Canara Bank, Indian Bank, Punjab National Bank, and Union Bank of India. The data utilised for this study are derived from the Database of Indian Economy (DBIE) maintained by the Reserve Bank of India (RBI).

The study covers a period of 8 years, with 4 years of pre-merger (2016-17 to 2019-20) and 4 years of post-merger (2020-21 to 2023-24). The selection of this time frame is based on the need to balance two perspectives in merger analysis. According to Mehrotra & Sahay (2018) It is essential to allow a reasonable time period after the merger to accurately examine its operational and financial implications. At least three years of financial data are needed to evaluate a company's long-term financial performance. (Akhtar & Nosheen, 2022; DeYoung et al., 2009; S. Kumar & Bansal, 2008). On the other hand, Bernad et al. (2013) Suggest that it becomes difficult to establish a direct causal relationship between the merger and its outcomes as time progresses. A longer period can have adverse effects because of all the other external economic conditions. (Abbas et al., 2014; Herwadkar et al., 2022). Therefore, this study ensures that the data reflects both the immediate and longer-term effects of the merger. The pre-merger period covers four fiscal years from 2016-17 to 2019-20, while the post-merger period extends over four fiscal years from 2020-21 to 2023-24.

3.2. Statistical tools and techniques

To evaluate the effect of the merger, paired sample t-tests are used to compare pre-merger and post-merger outcomes. The paired sample t-test is used to determine the significance of differences in financial performance before and after the merger activity. (Adhikari et al., 2023; Gupta et al., 2023; Kalra et al., 2013; Rani et al., 2015). In addition, independent sample t-tests are conducted to evaluate the changes in individual banks before and after the merger. (Sadani, 2024; Srinivas, 2010).

One disadvantage of comparing the post-merger financial ratios with pre-merger ratios is that it fails to account for evolving macroeconomic conditions. (Herwadkar et al., 2022). The difference-in-differences (DiD) approach overcomes this limitation by incorporating a comparison group that follows the same trends but remains unaffected by the policy change, ensuring a more accurate evaluation of its impact. (Audretsch et al., 2019).

Several authors utilised DiD regression to study ex-post effect assessment of various dimensions of a merger decision. (Ashenfelter & Hosken, 2010; Audretsch et al., 2019; Gugler & Szücs, 2016; Jiménez & Perdiguero, 2018; Kwan & Wilcox, 1999; Liu et al., 2019; Wang et al., 2021). This study employed the difference-in-differences (DiD) regression that established causal relationships and determined whether the merger resulted in statistically significant improvements (or deteriorations) in the financial performance of the merged banks compared to their non-merged counterparts. This study applies cluster-robust standard errors to address heteroskedasticity and autocorrelation. (Audretsch et al., 2019). Furthermore, the fixed effects model is not suitable in this context because it cannot accommodate time-invariant explanatory variables. Since the primary focus of this study is to assess the impact of mergers—a constant factor over time—the panel random effects model is applied for analysis (Ghose et al., 2018). The treatment and control groups are listed in Table 3. Two PSBs, namely State Bank of India and Bank of Baroda, are excluded from the control group as they underwent separate mergers within the study period.

Table 3: Treatment & Control Group for DiD Analysis

Treatment Group	Control Group
Punjab National Bank	Indian Overseas Bank
Canara Bank	Punjab and Sind Bank
Union Bank India	UCO Bank
	Bank of India
Indian Bank	Bank of Maharashtra
	Central Bank of India

Source: Authors' own

The following DiD regression model is formulated for DiD analysis:

$$Y_{i,t} = \alpha + \beta_1 \cdot Dm_i + \beta_2 \cdot Dt_t + \beta_3 Dm_i * Dt_t + \varepsilon_{i,t}$$

Where, Y is the performance ratio, i represents the merger status, t is the period, Dm is a dummy variable whose value is 1 if the bank is merged, 0 otherwise, Dt is a dummy variable whose value is 1 for the post-merger period, 0 otherwise, Dm*Dt represents the interaction between the two dummy variables, thus taking value 1 if the data corresponds to a merged bank in the post-merger period, 0 otherwise, ε is the error term, and α and β_1 to β_3 are the coefficients of determination. α represents the baseline performance of non-merged banks in the pre-merger period, β_1 captures the difference in performance between merged and non-merged banks before the merger, β_2 Captures the change in performance of non-merged banks in the post-merger period, and β_3 measures the causal impact of the merger on the merged banks by capturing the differential change in performance between merged and non-merged banks after the merger.

4. Results and Discussion

Based on the stated objectives, this section presents the results of the empirical analysis. It begins by exploring the drivers of profitability or loss in the post-merger period. Secondly, it examined the shifts in key performance indicators of Indian PSBs following the 2020 merger, followed by a comparison of the performance of merged banks with that of non-merged PSBs over the same period to establish the causal effect of the merger.

4.1. Profitability analysis

A fundamental measure of banking performance lies in the generation of operating profit. The profitability dynamics of the merged banks are best understood through the analytical framework “Operating Profit = Spread – Burden”.

4.1.1. Results of the paired t-test and the independent sample t-test

Table 4 presents the results of the paired t-test, and Table 5 presents the results of the independent-samples t-test.

Table 4: Paired Sample t-test for Profitability Analysis

Parameter (in Rupees Lakh)	Mean After Merger	Mean Before Merger	Mean Change	t-value	p-value
Operating Profit	21331.17	14076.86	7254.31	4.6304	0.0190*
Spread	28125.38	18885.20	9240.18	12.4946	0.0011**
Interest Earned	73456.17	62369.56	11086.61	6.4329	0.0076**
Interest Expended	45330.79	43484.36	1846.43	1.3288	0.2760
Burden	6794.21	4808.34	1985.88	1.4861	0.2339
Operating Cost	19386.48	14508.25	4878.23	7.9625	0.0041**
Non-interest Income	12592.27	9699.91	2892.35	1.6254	0.2025

Source: Data compiled by the authors.

**, Significant at the 0.01 level.

*, Significant at the 0.05 level.

Table 4 indicates a significant increase in operating profit, primarily attributable to rising spread. The improvement in spread was driven by rising interest income, supported by a stable interest expenditure. The rise in operating cost is mainly driven by higher employee wages, rather than increases in routine expenses such as printing, advertising, fees, legal charges, communication costs, or maintenance.

Table 5: Results of Independent Sample t-test

Parameter (in Rupees Lakh)	Canara Bank	Indian Bank	Punjab National Bank	Union Bank of India
Operating Profit	5.3140 (0.0128) *	4.0383 (0.0068) **	3.4736 (0.0132) *	3.5481 (0.0121) *
Spread	3.5359 (0.0123) *	3.9223 (0.0078) **	3.6235 (0.0111) *	3.2069 (0.0184) *
Interest Earned	1.7175 (0.1779)	2.2625 (0.0643)	1.3276 (0.2326)	1.2295 (0.3031)
Interest Expended	0.8449 (0.4562)	0.8552 (0.4253)	-0.1020 (0.9248)	0.0268 (0.9801)
Burden	-0.8751 (0.4152)	2.2123 (0.0689)	2.3985 (0.0534)	2.0265 (0.0891)
Operating Cost	3.2772 (0.0169) *	3.8534 (0.0084) **	1.5485 (0.1725)	2.9675 (0.0250) *
Non-interest Income	6.5501 (0.0006) **	3.1819 (0.0190) *	-2.1921 (0.0709)	3.0532 (0.0224) *

Source: Data compiled by the authors.

**, Significant at the 0.01 level.

*, Significant at the 0.05 level.

The independent t-test also validates the trends at the bank level (as depicted in Table 5). All four banks demonstrated notable gains in both operating profit and spread, underscoring the robustness of revenue-side improvements. The simultaneous and significant rise in both operating costs and non-interest income resulted in no net change in the burden.

4.1.2. Results of the difference-in-difference regression

Table 6 compares the profitability parameters of the merged banks with those of the non-merged banks.

Table 6: Difference-in-Difference Regression for Profitability Analysis

Parameter (in Rupees Lakh)	Dm Coeff. (p-value)	Dt Coeff. (p-value)	Size Coeff. (p-value)	DmDt Coeff. (p-value)	R ² within
Operating Profit	127.966 (.956)	150.859 (.742)	7982.789 (.000) **	5080.395 (.000) **	0.750
Spread	-1560.616 (.564)	172.732 (.811)	11516.228 (.000) **	6148.93 (.000) **	0.770
Interest Earned	274.252 (.977)	-5577.884 (.006) **	33600.899 (.000) **	8149.126 (.000) **	0.546
Interest Expended	3380.664 (.612)	-5455.078 (.000) **	20867.693 (.000) **	2013.072 (.081)	0.326
Burden	-983.16 (.214)	156.741 (.700)	2978.074 (.000) **	1074.411 (.437)	0.262
Operating Cost	-1021.893 (.690)	-211.306 (.735)	8452.987 (.000) **	2947.321 (.000) **	0.680
Non-interest Income	1249.596 (.499)	-121.733 (.685)	4460.635 (.000) **	1883.642 (.236)	0.445

Source: Data compiled by the authors.

** . Significant at the 0.01 level.

* . Significant at the 0.05 level.

Table 6 shows the Difference-in-Differences (DiD) regression outcomes. The estimates reveal that post-merger operating profits of the merged banks improved not only relative to their own pre-merger performance but also when compared with non-merged counterparts. The superior performance of the merged banks was primarily driven by an expansion in spreads through a steeper increase in interest income. Nevertheless, operating costs also rose with the scale of operations, exceeding those of non-merged banks. Together, merged banks achieved better financial performance through stronger core operations, while managing to contain cost pressures at a level that did not erode the overall gains.

Thus, the spread–burden framework confirmed that the merger enhanced operating profit primarily via expansion in spread. Burden also increased, but the change was statistically insignificant as non-interest income offset the operating cost pressures.

4.2. Shifts in key performance indicators of merged PSBs

Table 7 highlights the significant shifts in the performance of merged banks based on the paired sample t-test.

Table 7: Results of Paired Sample t-test

Parameter	Ratio	Mean After Merger	Mean Before Merger	Mean Change	t-value	p-value
Capital Adequacy	CAR	15.41	12.36	3.05	9.6291	0.0024**
	TATAR	58.72	60.10	-1.37	-10.765	0.0017**
	DER	14.92	15.67	-0.76	-0.8200	0.4723
Asset Quality	NNPANA	2.59	6.08	-3.48	-6.7213	0.0067**
	GNPAGA	8.22	11.49	-3.26	-2.9085	0.0621
	SATA	83.53	85.36	-1.83	-0.5106	0.6448
	INASTI	13.23	18.13	-4.89	-3.3558	0.0439*
	BPE	2264.13	1754.31	509.81	10.4149	0.0019**
	PPE	9.26	-2.88	12.13	6.4222	0.0077**
	No. of Employees	75,281 (2023-24)	76,120 (2019-20)	-839	-0.3517	0.7483
Management Efficiency	CF	4.40	5.31	-0.91	-9.0451	0.0029**
	WBTE	18.45	13.48	4.97	6.8892	0.0063**
	WBIC	60.87	55.96	4.91	2.6772	0.0752
	OICIC	39.13	44.04	-4.91	-2.6772	0.0752
	ICTA	1.73	1.53	0.21	9.1818	0.0027**
	BTA	0.61	0.45	0.16	1.7132	0.1852
	IITA	6.55	7.05	-0.50	-5.7559	0.0104*
	NIITA	1.12	1.08	0.04	0.4313	0.6954
Earnings	OPTA	1.93	1.74	0.19	1.4921	0.2325
	ROA	0.57	-0.24	0.81	4.8762	0.0165*
	ROE	9.21	-5.11	14.33	4.8214	0.0170*
	NIM	2.54	2.19	0.35	6.7150	0.0067**
	CDR	5.24	4.36	0.88	1.4757	0.2365
Liquidity	LATAR	9.78	8.64	1.14	0.9734	0.4022
	LATDR	11.17	10.19	0.98	0.7153	0.5261

Source: Data compiled by the authors.

** . Significant at the 0.01 level.

* . Significant at the 0.05 level.

Table 7 showed that the CAR improved significantly, indicating stronger capital buffers post-merger. It is well above the standard norms as per BASEL Norms and RBI guidelines. TATAR suggested a lower share of advances in overall assets, while the DER implied stable leverage.

Asset quality in terms of NNPANA showed marked improvement. Other ratios also pointed towards overall improvement in asset quality. Improvements were observed in management efficiency. Both BPE and PPE increased significantly without significant downsizing, underscoring better human resource utilisation. The merged entities appear to have gained stronger bargaining leverage and enhanced capacity to raise funds at reduced costs. The overall rise in ICTA is primarily driven by an increase in wage costs. In contrast, other operating expenses have declined significantly at the 10% level, which reflects integration gains and scale efficiencies following consolidation.

Post-merger profitability, measured in terms of ROA, ROE, and NIM, improved significantly. The improvement in NIM is primarily from a reduction in the cost of funds, rather than from the interest income. Even though the banks are earning more interest in absolute terms, the proportion of interest income generated per unit of asset is falling. This could indicate that new assets being added may be less profitable

or earn lower yields. Revenue from alternative sources improved only marginally, signalling no significant income diversification. This points to a pattern where overall profitability has improved, but the growth is not strongly underpinned by diversified or asset-efficient revenue generation, suggesting potential vulnerabilities if cost advantages diminish.

4.3. Robustness test: excluding pandemic years

To address the concern that the observed results might be influenced by the COVID-19 pandemic rather than the merger itself, a paired sample t-test was conducted again by excluding the years 2019–20, 2020–21, and 2021–22. Therefore, the revised dataset considered three pre-merger years and two post-merger years. The findings show that the core results remain largely consistent with the baseline analysis.

Table 8: Robustness Test: Results of Paired Sample t-test Excluding Pandemic Years

Parameter	Ratio	Mean After Merger	Mean Before Merger	Mean Change	t-value	p-value
Capital Adequacy	CAR	16.30	11.92	4.38	8.8251	0.0031**
	TATAR	61.39	60.32	1.06	2.0575	0.1318
	DER	14.48	16.06	-1.58	-1.5328	0.2229
	NNPANA	2.59	6.08	-3.48	-6.7213	0.0067**
Asset Quality	GNPAGA	5.78	11.71	-5.93	-4.3823	0.0220*
	SATA	82.68	86.08	-3.40	-0.9382	0.4173
	INASTI	12.45	18.20	-5.75	-3.0006	0.0576
	BPE	2485.88	1668.68	817.20	11.4203	0.0014**
Management Efficiency	PPE	13.00	-3.25	16.25	8.2184	0.0038**
	CF	4.64	5.33	-0.69	-6.4237	0.0076**
	WBTE	18.57	13.55	5.02	7.0505	0.0059**
	WBIC	61.57	56.25	5.32	3.0744	0.0544
	OICIC	38.43	43.75	-5.32	-3.0744	0.0544
	ICTA	1.81	1.53	0.28	11.5409	0.0014**
	BTA	0.68	0.46	0.22	1.9792	0.1422
	IITA	6.92	7.07	-0.15	-1.6297	0.2017
Earnings	NIITA	1.13	1.07	0.06	0.5208	0.6385
	OPTA	2.02	1.72	0.30	2.1291	0.1231
	ROA	0.76	-0.28	1.04	5.2885	0.0132*
	ROE	12.18	-5.88	18.06	5.0248	0.0152*
	NIM	2.70	2.19	0.51	10.0417	0.0021**
Liquidity	CDR	4.97	4.50	0.47	1.5121	0.2277
	LATAR	8.65	8.76	-0.11	-0.1617	0.8818
	LATDR	9.88	10.32	-0.44	-0.5594	0.6150

Source: Data compiled by the authors.

**, Significant at the 0.01 level.

*, Significant at the 0.05 level.

According to Table 8, the earlier decline in credit allocation relative to assets was largely a result of pandemic-driven risk aversion and lending disruptions rather than the merger itself. With respect to asset quality, NNPANA and GNPAGA both showed a significant reduction, suggesting that asset quality improvements are merger-driven rather than pandemic-induced. The ratio of investments in non-approved securities to total investments also declined, but the change was marginally insignificant. In terms of Management and cost efficiency, the ratios mirror the baseline test, indicating improved productivity and structural shifts in cost dynamics associated with the merger. In earnings quality, IITA lost its significance once the pandemic years were excluded. The earlier observed decline was therefore more a reflection of crisis-era interest rate cuts and subdued loan demand than a structural merger effect. The liquidity ratios did not show significant differences between pre- and post-merger periods, consistent with the baseline findings.

Overall, these results strengthen the argument that the shifts are primarily merger-driven, while some observed deteriorations in credit deployment and income generation were more directly linked to pandemic disruptions.

4.4. Bank-wise shifts in key performance indicators

Table 9 highlights the changes in various ratios of individual banks before and after the merger.

Table 9: Results of Independent Sample t-test

Parameter	Ratio	Canara Bank	Indian Bank	Punjab National Bank	Union Bank of India
Capital Adequacy	CAR	2.6898 (0.0361) *	7.5421 (0.0003) **	3.2704 (0.0170) *	3.0400 (0.0228) *
	TATAR	-0.6499 (0.5398)	-0.5346 (0.6122)	-0.8999 (0.4028)	-0.8129 (0.4473)
	DER	0.4886 (0.6424)	1.9177 (0.1036)	-2.0190 (0.1292)	-2.5418 (0.0440) *
	NNPANA	-3.8986 (0.0080) **	-2.8309 (0.0299) *	-2.6494 (0.0381) *	-3.9434 (0.0076) **
Asset Quality	GNPAGA	-2.3512 (0.0570)	-0.1107 (0.9187)	-2.3001 (0.0611)	-2.1335 (0.0768)
	SATA	-4.7941 (0.0154) *	6.4824 (0.0006) **	-1.5793 (0.1653)	-3.3065 (0.0163) *
	INASTI	-4.0347 (0.0068) **	-3.4645 (0.0134) *	-4.3340 (0.0049) **	-0.4458 (0.6714)
	BPE	2.9997 (0.0240) *	2.2826 (0.0626)	3.3939 (0.0146) *	2.4019 (0.0532)
Management Efficiency	PPE	3.0984 (0.0212) *	2.6139 (0.0399) *	2.2148 (0.0687)	3.7856 (0.0091) **
	CF	-2.5223	-3.8210	-2.8419	-2.9463

		(0.0451) *	(0.0088) **	(0.0295) *	(0.0257) *
	WBTE	4.9440	14.7953	1.9049	9.9390
		(0.0026) **	(0.0000) **	(0.1055)	(0.0001) **
	WBIC	3.4874	4.6323	0.0448	3.9174
		(0.0130) *	(0.0036) **	(0.9657)	(0.0078) **
	OICIC	-3.4874	-4.6323	-0.0448	-3.9174
		(0.0130) *	(0.0036) **	(0.9657)	(0.0078) **
	ICTA	3.6958	4.5036	1.3472	4.3786
		(0.0101) *	(0.0041) **	(0.2266)	(0.0047) **
	BTA	-0.5984	1.7790	2.5849	2.3418
		(0.5715)	(0.1256)	(0.0415) *	(0.0577)
	IITA	-1.1553	-2.3560	-1.0647	-1.5230
		(0.3230)	(0.0566)	(0.3280)	(0.1786)
	NIITA	3.2089	0.5145	-3.1895	2.1225
		(0.0184) *	(0.6253)	(0.0188) *	(0.0780)
	OPTA	4.3875	0.3796	-0.5869	4.4543
		(0.0046) **	(0.7173)	(0.5787)	(0.0043) **
Earnings	ROA	3.0427	1.9866	2.0381	3.8241
		(0.0227) *	(0.0942)	(0.1277)	(0.0087) **
	ROE	3.2629	2.7478	1.9452	3.6700
		(0.0172) *	(0.0334) *	(0.1425)	(0.0105) *
	NIM	2.8773	1.7517	3.0987	4.8290
		(0.0282) *	(0.1304)	(0.0212) *	(0.0029) **
	CDR	1.5003	1.7703	1.0764	-1.9268
		(0.1842)	(0.1271)	(0.3231)	(0.1023)
Liquidity	LATAR	2.3491	1.8300	-1.4296	-0.2604
		(0.0571)	(0.1170)	(0.2028)	(0.8033)
	LATDR	2.1832	1.7544	-1.6109	-0.7430
		(0.0717)	(0.1299)	(0.1583)	(0.4856)

Source: Data compiled by the authors

**, Significant at the 0.01 level.

*, Significant at the 0.05 level.

Table 9 depicts an overall stronger capital buffer post-merger. Lending activities relative to total assets and leverage patterns largely remained stable except for Union Bank of India, where a decline in leverage was observed.

Asset quality improved as NNPA declined significantly across all four banks. GNPAGA also declined for most banks, though the results were not significant. In terms of secured lending, the approach varied across banks. While Canara Bank and Union Bank of India showed a significant decline, Indian Bank showed a sharp increase. INASTI suggested a more cautious, prudent investment approach post-merger. There was a marked gain in employee productivity and cost efficiency overall. Increased ICTA and wage bills suggest that labour-related expenses rose more sharply in most cases. At the same time, three banks recorded a notable decline in their other operating costs. This pattern points towards possible efficiency gains or cost-rationalisation effects arising from the mergers.

There was limited improvement in interest income generation relative to the enlarged post-merger asset base. Apart from Canara Bank, none of the merged banks achieved meaningful income diversification, as non-interest income either declined or stayed insignificant. Other earnings ratios increased significantly for Canara Bank and Union Bank of India, indicating efficiency in asset utilisation. The improvement in earnings is relatively modest for Indian Bank and Punjab National Bank. Liquidity showed neither improvement nor deterioration across the merged banks.

4.5. Difference-in-differences regression analysis

The t-tests could not fully isolate the causal effect of the merger, since other external shocks (such as macroeconomic conditions or regulatory changes) could have influenced outcomes across all banks. To address this limitation, a Difference-in-Differences (DiD) regression framework is employed, comparing merged banks with a control group of non-merged banks over the same period. The results are reported in Table 10.

Table 10: Results of Difference-in-Difference Regression

Parameter	Ratio	Dm Coeff. (p-value)	Dt Coeff. (p-value)	DmDt Coeff. (p-value)	R ² within
Capital Adequacy	CAR	1.017 (.106)	4.591 (.000) **	-1.538 (.002) **	0.774
	TATAR	7.762 (.002) **	1.312 (.363)	-2.685 (.064)	0.033
	DER	-.748 (.548)	-3.969 (.000) **	3.213 (.005) **	0.392
	NNPANA	-2.554 (.018) *	-6.424 (.000) **	2.94 (.001) **	0.675
Asset Quality	GNPAGA	-5.976 (.008) **	-9.463 (.000) **	6.2 (.004) **	0.579
	SATA	-3.081 (.329)	-3.415 (.135)	1.581 (.696)	0.123
	INASTI	-1.985 (.576)	-.231 (.946)	-4.662 (.202)	0.126
	BPE	179.104 (.214)	539.539 (.000) **	-29.725 (.786)	0.546
Management Efficiency	PPE	9.169 (.006) **	18.87 (.000) **	-6.739 (.095)	0.511
	CF	-.115 (.613)	-1.147 (.000)	.240 (.112)	0.648
	WBTE	-2.179	5.917	-.949	0.733

		(.050) *	(.000) **	(.48)	
	WBIC	-5.610 (0.068)	2.122 (0.195)	2.787 (0.239)	0.251
	OICIC	5.610 (0.068)	-2.122 (0.195)	-2.787 (0.239)	0.251
	ICTA	-.175 (.101)	.255 (.013) *	-.050 (.632)	0.367
	BTA	-.293 (.004) **	.1 (.285)	.062 (.630)	0.092
	ROA	.855 (.005) **	1.524 (.000) **	-0.712 (.036) *	0.507
	ROE	14.878 (.006) **	25.45 (.000) **	-11.125 (.074)	0.493
Earnings	IITA	.032 (.892)	-.657 (.000) **	.159 (.342)	0.340
	NIITA	.118 (.295)	.155 (.002) **	-0.112 (.287)	0.132
	OPTA	.425 (.001) **	.375 (.024) *	-0.185 (.365)	0.265
	NIM	.133 (.344)	.475 (.000) **	-.123 (.276)	0.481
	CDR	-2.781 (.053)	-.308 (.759)	1.187 (.301)	0.018
Liquidity	LATAR	-1.698 (0.325)	-1.159 (.059)	2.302 (.066)	0.060
	LATDR	-1.677 (.404)	-1.12 (.124)	2.101 (.153)	0.042

Source: Data compiled by the authors.

** . Significant at the 0.01 level.

* . Significant at the 0.05 level.

According to Table 10, the improvements in capital buffers were smaller for merged banks. This may be the result of larger bank balance sheets that could better absorb shocks, and hence, capital growth was more moderate. Though weakly significant, TATAR indicates a cautious lending approach, reflecting improved risk management. At the same time, the merged banks carried higher leverage compared to their non-merged peers in the post-merger period.

DiD estimates for NN PANAs and GNPAGAs yield a positive interaction effect, indicating that the decline in NPAs for merged banks was smaller relative to the control group. This is driven by the better initial asset quality of merged banks (negative Dm) and a stronger post-merger improvement in NPAs among non-merged banks (negative Dt). Importantly, the combined NPA still improved post-merger, with NN PANAs and GNPAGAs standing at 0.87% and 4.67% respectively, in 2024 as compared to 4.66% and 10.82% in 2020. Thus, the change is not due to any decline in the performance of the merged banks. Instead, there is an overall reduction in NPA across the Indian banking system. Moreover, no significant impact is observed for SATA and INASTI, implying that the mergers did not have any differential effect on the share of secured advances and non-approved investments.

Merged banks did not gain much in employee productivity compared to non-merged banks. This also shows that banks retained employees and absorbed operational redundancies instead of immediate downsizing. Other cost-related indicators also remain at par with non-merged banks, pointing towards the successful management of the complexities of integration.

The significant negative interaction effect in the case of ROA implies that merged banks did not experience as great a post-merger improvement compared to the non-merged banks. The other earnings ratios show no discernible impact of the merger on earnings. Similarly, liquidity shows no significant differential impact of the merger.

5. Findings and Conclusions

The study evaluated the performance of Indian PSBs following the 2020 mega-merger, with three analytical objectives. First, the spread-burden framework shows that operating profits improved mainly due to higher spreads. The findings are consistent with the operating synergy theory, which holds that gains emerge from scale expansion. Second, t-test findings indicate clear strength in capital adequacy, asset quality, employee productivity, and profitability. Cheaper funding access and improved bargaining power support financing synergy (Rani et al., 2020). The notable reduction in operating costs except wage bills also suggests emerging operational and cost efficiency, where merged banks may have benefited from shared systems, avoided duplication, or spread fixed costs over a larger operational base. (Kaur & Kaur, 2010). Yet, rising wage bills, weak income diversification, and bank-specific efficiency gains indicate that synergies are uneven and not automatic. Third, comparative DiD evidence shows that while merged banks improved, their performance was not consistently superior to non-merged peers. This highlights limits in merger-driven competitive advantage and suggests incomplete realisation of scale and integration efficiencies in the Indian banking industry.

Overall, merger-led changes were visible but mixed. Indian PSBs experienced gains in profitability, solvency, and productivity, reflecting pockets of synergy, but the benefits did not uniformly translate into superior performance relative to non-merged banks. This implies that a merger alone does not guarantee success—it depends on how well banks integrate operations, diversify revenue, and manage costs. Sustained merger value will require deeper strategic alignment, stronger income diversification, and more effective cost rationalisation to convert structural consolidation into long-term efficiency and resilience.

5.1. Policy recommendations

The study offers several actionable insights for policymakers, bank management, and regulators.

- The study offers critical insights to guide government and policymakers in evaluating the effectiveness of mergers as a reform tool. It highlights the need to continuously monitor both cost and revenue efficiency to prevent long-term performance erosion.

- For bank management, the results underline the importance of strengthening revenue diversification. In the long run, post-merger integration strategies should also prioritise employee and branch rationalisation to control operating and wage-related expenses.
- For regulators, the evidence illustrates that merger-driven synergies cannot be assumed to occur automatically. Since performance outcomes vary across institutions, future consolidation frameworks must account for bank-specific differences in business models, integration capacity, and operational culture.

This research thus provides a foundation for shaping future merger strategies to enhance the efficiency, stability, and competitiveness of PSBs.

5.2. Limitations of the study

While the study provides a comprehensive assessment, it is not without limitations. The study relies primarily on accounting ratios, which cannot fully capture qualitative dimensions such as organisational culture and service quality. Despite this, the study bridges existing research gaps by encompassing a comprehensive four-year window post-merger to capture the medium to long-term effects of the mergers. Unlike many previous analyses, it also delves deeply into the 2020 mergers of Indian PSBs, a significant event that remains underexplored. The contribution of this study lies in its multi-layered methodological approach, offering a holistic evaluation of bank mergers.

5.3. Future scope of research

Future research could extend the analysis with longer time horizons, incorporate market-based measures of performance like stock prices, and explore the impact of mergers on customer and employee experience, branch rationalisation, HR practices, and digital transformation.

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