Advances in Research on Russian Business and Management
ISSN: 2578-725X, e-ISSN: 2578-7268
Vol. 2023

Financial Performance Analysis of Mergers and Acquisitions in the Indian Automobile and Banking Industries

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Abstract

In the present dynamic and unpredictable business environment, both the automobile and banking sectors are undergoing intensified competition from both domestic and international markets. To address these challenges and achieve survival, growth, and competitive advantage in such environments, a firm must implement strategic initiatives, including mergers and acquisitions as well as corporate restructuring. These approaches enable organizations to consolidate resources, achieve economies of scale, and enhance operational efficiency, thereby strengthening their market position in an ever-evolving global environment. Like all other industries, the financial services industry is also experiencing merger waves; so as mergers of various Indian banks are also occurring, leading to the emergence of large banks as well as large financial entities. The automobile companies and bank mergers will help boost the Indian economy in present and future eras. In this study, Indian bank mergers that took place between 2007 to 2019 and automobile company mergers that took place between 2008 to 2016 have been used for analysis. Our objective in this paper is to assess the post-merger effect on financial efficiency resulting from automobile companies and bank mergers. We evaluate different financial information, such as return on equity, current ratio and profit margin ratios, which are calculated from the financial statements of the merged automobile firms and banks. This study also aims to determine the change in the profitability of automobile companies and banks after a merger and its effect on shareholder wealth. The effect will be studied by comparing the data of merged banks for example five years' data before the merger and five years' data after the merger. Data were collected from secondary sources such as the annual reports of banks, published research papers, and different websites. The research methodology includes application of non-parametric techniques, Grouped Malmquist Index Data Envelopment Analysis (DEA) and A Simple Method by Ratio Analysis. Data Envelopment Analysis (DEA) employs efficiency analysis by comparing decision-making units (DMUs) to their most efficient counterparts, known as the efficient frontier, rather than to average performers. This method is utilized to establish benchmarks for units that are identified as inefficient.

Keywords: Financial Efficiency, Indian Automobile Sector, Indian Banking Sector, Malmquist Index Data Envelopment Analysis, Merger and Acquisition.

Introduction

Mergers and acquisitions (M&A) have emerged as strategic instruments in the Indian banking and automobile sectors, facilitating substantial transformations and redefining the competitive landscape. These strategic initiatives are primarily driven by objectives such as expanding market reach, integrating advanced technologies, and achieving operational synergies. Through M&A activities, companies aim to consolidate resources, enhance efficiency, and position themselves advantageously in an increasingly competitive environment. The primary motivation behind mergers and acquisitions is to achieve cost efficiency by improving performance, increasing 'profit efficiency', and maximizing the shareholders' wealth. In such a scenario it becomes necessary to assess how M&A deals affect the automobile companies' financial performance, a factor that is critical to maintaining stability and competitiveness over time. "The strategic drivers for M&A activity in the auto sector includes the scope for a broadened geographic footprint, increased market shares and enhancement of technological capabilities" (Kumar, 2012). "Consolidation in Indian industry has accelerated as a result of economic liberalization and globalization efforts launched since 1991 by the Indian government. A steady rise in the number of mergers and acquisitions in Indian businesses has been observed over the past decade. Recently completed mergers and acquisitions are a good indicator of an industry's level of competitiveness, potentials, and capabilities" (Siddalingya, 2018).
"The Indian banking sector has witnessed two types of mergers, forced and voluntary mergers. The main objective of the RBI in initiating a forced merger is to protect the interests of the depositors of the weak bank. When a bank has shown symptoms of sickness such as huge NPAs and substantial erosion of net worth, RBI has

intervened and merged the weak bank with a strong bank. The second type of mergers is voluntary mergers with the motivation of market dynamics such as increasing size, diversification of portfolio which reduces risk, exposure to new geographical markets and improved treasury performance as the cost of funds would reduce (hence, improve spread) as it would have a better credit rating. A bank can also leverage its scale and improve its trading income. In all these cases, the acquirer banks gained the advantage of the branch network and customer clientele of the acquired banks. As these mergers are voluntary in nature, both bidder and target banks must have perceived benefit out of the mergers." (Madan Lal Singla, 2015).
"In general, there are four approaches to measure the effect of M&A (Bruner, 2002). These are (a) event studies, (b) accounting studies, (c) surveys of executives, and (d) clinical studies. Event studies are also known as ex-ante studies, which examine the returns to shareholders in the period close to the announcement of a merger. Accounting studies, also known as ex-post studies, assess merger effects by examining the financial performance of acquiring firm before and after the acquisition. In the survey of executives, a standardized questionnaire is presented to a sample of executives, and the results are aggregated based on their opinions about mergers. Clinical studies are inductive research, based on in-depth analysis combined with insights from field interviews with executives and knowledgeable observers. This study uses an ex-post approach to study the effect of M&A on financial efficiency of Banks and Automobile sector in India.

Mergers and Acquisitions in Indian Automobile Sector:

India's automotive industry has experienced remarkable mergers and acquisitions (M&A) over the past few decades, reflecting its evolution from a budding market to a global market player. India's automotive industry has gradually through exceptional mergers and acquisitions (M&A), involving both the domestic organizations and global automotive giants. These strategic moves have reshaping the industry's landscape, enhanced capabilities, expanded market reach, and fostered technological advancements. Here, we provide an overview of historic Mergers and Acquisitions activities in India's automobile sector.

M**ahindra & Mahindra and Jeep (1945)**, Mahindra began assembling Willys Jeeps in India, laying the foundation for its future as a utility vehicle manufacturer. **Maruti Suzuki (1982),** Maruti Udyog Limited entered into a joint venture with Japan's Suzuki Motor Corporation, marking a pivotal moment in India's automotive history. Initially, Suzuki held a 26% stake, which increased to 50% post the 1991 economic liberalization, facilitating technology transfer and modernization of the Indian car market. **Jaguar Land Rover Acquisition by Tata Motors (2008):** Tata Motors acquired the iconic British brands Jaguar and Land Rover from Ford worth value of $2.3 billion. This landmark deal transformed Tata into a global automotive player, allowing it to enter the luxury vehicle segment and significantly enhance its global presence. M**ahindra & Mahindra acquired SsangYong Motor** (2011), "Mahindra & Mahindra acquired a majority stake in South Korea's SsangYong Motor," aiming to strengthen its global footprint. However, owning to financial challenges, Mahindra ceased funding in 2020, leading SsangYong into receivership. Pininfarina (2015), In collaboration with Tech Mahindra, M&M acquired a 76.06% stake in the renowned Italian design firm Pininfarina, enhancing its design and engineering capabilities.

Mergers and Acquisitions in Indian Banking Sector:

"The banking system of India started in 1770 and the first Bank was the Indian Bank known as the Bank of Hindustan. Later, more banks, such as the Bank of Bombay-1840, the Bank of Madras-1843 and the Bank of Calcutta-1840 were established under the charter of the British East India Company. These Banks merged in 1921 and took the form of a new bank, the Imperial Bank of India. For the development of banking facilities in the rural areas the Imperial Bank of India partially nationalized on 1 July 1955, and named as the State Bank of India along with its 8 associate banks." "The Indian banking sector can be divided into two eras: the pre-liberalization and the post-liberalization era. In the pre-liberalization era, the Government of India nationalized 14 banks on July 19, 1969, and later, six more commercial banks were nationalized on April 15, 1980. In post-liberalization regime, the government initiated the policy of liberalization, and licenses were issued to private banks, which led to the growth of the Indian Banking sector. The second Narasimham Committee (1998) had suggested mergers among strong banks, both in the public and private sectors." (M. Rajamani and Dr. P.R. Ramakrishnan 2015)

Literature Review in Automobile Sector

Johnson et al. (2019) "investigated the effects of M&A on firm performance in the automobile industry. Their research revealed that successful integration processes, effective leadership, and cultural alignment were critical

factors influencing post-M&A performance." Smith and Jones (2018) "analyzed the motives behind M&A deals in the automobile industry and found that strategic objectives, such as gaining access to new markets or technologies, were the primary drivers. The study emphasized the importance of synergy realization and post-merger integration in achieving M&A success." Chen et al. (2017) and Kumar et al. (2018) "explored the challenges and risks associated with M&A transactions in the automobile sector, including cultural clashes, regulatory hurdles, and financial constraints. These studies underscore the importance of thorough due diligence and strategic planning in mitigating M&A risks".

"Post-acquisition, due to a slowdown in the domestic and world economy, the demand for commercial and passenger vehicles decreased. Tata Motors' major revenue came from commercial vehicles before the acquisition. This acquisition will help the company develop its brand in luxury passenger vehicles. The opportunity for Tata Motors to acquire Jaguar Land Rover was also the result of an economic downturn. A fall in domestic market demand may change their strategy to move to growing countries like China. This is also a strategic decision taken towards the fulfilment of the strategic intent of the company. Tata Motors has developed its brand value globally because of this successful acquisition and the growth of these two companies" (Laddha, 2016).

Literature Review in Banking Sector

Kaur and Kaur (2010) used DEA to study how mergers affected Indian commercial banks' cost-effectiveness. They noted that while the merging of stronger and financially troubled banks did not result in any appreciable efficiency benefits, the merger of merged institutions raised their degree of cost efficiency. Additionally, they believed that stronger banks should not be combined with smaller banks because doing so would negatively impact the stronger banks' asset quality. Jayaraman et.al. (2014) investigated, the effectiveness and impact of Indian banks after mergers and acquisitions using DEA. The efficiency of the combined banks was compared three years prior to and following the merger. They contrasted the efficiency of the combined banks with that of the separate banks to verify efficiency. Interval estimation uses an efficient frontier. Using DEA, they discovered that while banks' technical efficiency declines immediately following a merger, it improves after three years. Additionally, they discovered that mergers and acquisitions have little to no impact on the combined bank's profitability or operating expenses. Rahman et.al. (2016) "attempted to assess US commercial banking industry's post-merger marketing effectiveness. They used Data Envelopment Analysis (DEA) to quantify the efficiency utilizing two input and two output variables through an empirical analysis of 20 M&A deals. They discovered that, regardless of the merged firm's size, mergers and acquisitions had a beneficial impact on its marketing effectiveness." Henriques et al. (2018) carried out a study with DEA to assess bank efficiency in the Brazilian banking sector between 2012 and 2016. The study involved thirty-seven Brazilian banks and attempted to identify the root causes of the inefficiencies. The study involved CCR and BCC models, it was determined that measures aimed at encouraging the involvement of smaller banks in the sector could boost the industry's efficiency. Shah et.al. (2019) assessed the productivity and performance of sustainable banks and made an effort investigated the relevant practical concerns by supplying corroborating documentation. To assess sustainable bank performance and productivity over a nine-year period, they used DEA and MPI. The study revealed that sustainable banks exhibit higher efficiency and productivity. It was also stated that internal and external factors significantly influence on the productivity of both sustainable and non-sustainable banks. Using DEA, Chiu et al. (2020) examined the technical efficacy of 14 Taiwanese financial holding institutions between 2015 and 2019. To assess technical efficiency, they employed the "Resample Slack-Based Measure and Merger Potential Gain model along with the premerger evaluation idea." They discovered benefits in efficiency both before and after the merger, but they also proposed that there would be no assurance that these gains would continue to support the businesses.

Research Gap

The field of mergers and acquisitions has been extensively studied; however, there is a notable scarcity of research studies on mergers and acquisitions within the global automobile industry, with even fewer studies are related to the Indian automobile sector. Only a small number of studies have utilized Data Envelopment Analysis to investigate mergers and acquisitions in automobile companies. Most research in this area tends to concentrate on corporate governance and cross-border mergers. Researchers have thoroughly examined the impacts, drivers, and outcomes of M&A activities across various dimensions. While in the case of the Indian banking sector has been numerous studies on mergers and acquisitions, there is a relative dearth of research employing DEA and few studies are relatively uses Malmquist Index Data Envelopment Analysis to explore mergers and acquisitions impact within this sector.

Objective

The objective of this paper is to predict the financial impact on major corporations within the automobile and banking sectors resulting from mergers and acquisitions. The mergers and acquisitions occurred between 2008 and 2016 in the automobile sector and between 2006 and 2019 in the banking sector in India are taken for the study.

Table No-1: Mergers and Acquisitions occurred in selected Automobile Industries: -

Sl. No.	Anchor Automobile Company	Merged Automobile Companies	Year of Merger
1.	TATA Motors	Ford Motors (Jaguar and Land Rovers Brands	2008
2.	Mahindra & Mahindra	SsangYong Motor Company	2011
3.	Volkswagen	Porsche	2012
4.	Ashok Leyland Limited	Hinduja Tech limited	2014
5.	Fiat	Chrysler	2014
6.	Bharat Forge Limited	Walker Forge Tennessee	2016
7.	Nissan Motor Co. Ltd	Mitsubishi Motor	2016

Source: Compiled by Author.

Table No-2: Mergers and Acquisitions occurred in selected Banks: -

Sl No.	Anchor Bank	Merger Banks	Date of Merger
1	Bank of Baroda	Dena Bank Vijaya Bank	2019
2	State Bank of India	State Bank of Bikaner and Jaipur State Bank of Hyderabad State Bank of Mysore State Bank of Patiala State Bank of Travencore	2017
3	Kotak Mahindra Bank	ING Vyasa Bank	2014
4	ICICI Bank	Bank of Rajasthan Ltd.	2010
5	HDFC Bank	Centurion Bank of Punjab	2008
6	Indian Overseas Bank	Bharat Overseas Bank	2007
7	Federal Bank	Ganesh Bank of Kurandwad	2006

Source: Compiled by Author.

Research Methodology

We have selected a total sample size of 13 firms, comprising 6 automobile companies, specifically Mahindra & Mahindra, Tata Motors, Ashok Leyland Limited, Volkswagen AG, Nissan Motor Co. Ltd., and Bharat Forge Limited, as well as 7 banks, namely State Bank of India, Bank of Baroda, Kotak Mahindra Bank, ICICI Bank, HDFC Bank, Indian Overseas Bank, and Federal Bank. Secondary data were collected from their respective financial statements, covering a period of ten years, with five years' pre-merger and five years' post-merger. The impact of mergers and acquisitions (M&A) on the financial efficiency of the banks is assessed by comparing their performance five years before and five years after the merger. According to Ravichandran et al. (2010), "if the merger occurred before the midpoint of the financial year, that year is considered the starting period for post-merger analysis; conversely, if the merger occurred after the midpoint, it is considered part of the pre-merger period." Selected financial ratios, including Return on Equity, Net Profit Ratio, Return on Asset, Return on Capital Employed, Earnings per Share, and Current Ratio, are utilized to evaluate the profitability of the selected industries during their M&A period. "Researchers such as Kose (2021), Adhikari (2023), Stojanovic

(2016), Kwadwo Boateng (2020), and Jayaraman (2014) have employed various financial ratios in their studies to analyse the effects of mergers on companies' financial performance."
Data Envelopment Analysis (DEA) is being used to know the effect of merger and acquisition of automobile industries and the Banking sector in the merger period of each industry separately in their specific merger and acquisition period. We have used combined approach that gives us both simple performance snapshots (ratios) and insights into relative productivity change dynamics (grouped Malmquist indices) in this study.

Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is employed to assess the impact of mergers and acquisitions in the automobile and banking sectors during their respective M&A periods. Our study employs a combined approach that provides both simple performance snapshots (ratios) and insights into relative productivity change dynamics (grouped Malmquist indices). The foundational concept of DEA can be traced to traditional efficiency measurement techniques, as established by M.J. Farrell (Farrell, 1957), with the first DEA model developed by Charnes, Cooper, and Rhodes (Charnes et al., 1978). DEA conducts efficiency analysis by comparing decision-making units (DMUs) to their most efficient counterparts, known as the efficient frontier, rather than to average performers. This method establishes benchmarks for units identified as inefficient. Notably, DEA does not require assumptions regarding the configuration of the DMUs' frontier surface and allows for the simultaneous consideration of multiple inputs and outputs. As DEA is a technical efficiency measurement technique, we briefly discuss the concept of efficiency. "The efficiency can be defined as the ratio of output to the input."

$$Efficiency = Output / Input$$

Using the above concept, evaluating a unit's efficiency when there are several inputs and outputs becomes challenging. If there is a complex relationship and uncertain tradeoff between the inputs and outputs, the problem gets more challenging. Such circumstances frequently arise in real-world problems. The "weighted cost approach" provided by can be used to determine the efficiency score when there are several input and output sources.

$$Efficiency = \text{weighted sum of outputs} / \text{weighted sum of inputs}$$

"Data Envelopment Analysis (DEA) is an approach for comparing the relative efficiency of Decision-Making Units (DMUs) such as schools, hospitals, libraries, banks etc." (Kleine, 2004). "The DMUs under investigation often have a vector with numerous inputs and several outputs. The first DEA model was developed by Charnes Cooper and Rhodes (CCR) (Charnes et.al., 1978). The detailed reviews of the methodology are presented by Seiford and Thrall, Ali and Seiford, Charnes et al, Norman and Stoker (Seiford et.al., 1990; Norman & Stocker; 1991, Seiford, 1996). The CCR model makes a constant return to scale (CRS) assumption. The CCR model makes a constant return to scale (CRS) assumption. This is appropriate when all the DMUs are operating at an optimal scale. Imperfect competition, constraints on finance etc. may cause a DMU to be not operating at optimal scale. Banker, Charnes, Cooper (Banker, Charnes & Cooper, 1984) suggested an extension of the CRS DEA model to account of Variable Return to Scale (VRS) situations." The way returns to scale are handled in the BCC and CCR models differs primarily from one another. Constant returns to scale serve as the evaluation basis for the CCR version The BCC model which uses variable returns to scale (VRS). Variable returns to scale are permitted in the more adaptable BCC version.

Malmquist Index Components (Dynamic Performance):

Efficiency Change (effch) is employed to assess whether a firm has enhanced its efficiency relative to the frontier, either prior to or following a merger. This involves evaluating whether the merger has resulted in operational synergies and whether these synergies have improved technical or pure efficiency. Technical Change (techch) is utilized to determine if the firm benefits from shifts in the technological frontier, specifically assessing whether the merged entity demonstrates an improved capacity to adopt new technologies or innovations. Pure Efficiency Change (pech) is used to ascertain any changes in managerial efficiency during a specified period. Scale Efficiency Change (sech) evaluates whether the firm is moving towards or away from its optimal scale, as mergers are often pursued with the expectation of achieving better economies of scale. The sech component of the Malmquist index is particularly relevant for assessing improvements in scale efficiency post-merger. Total Factor Productivity Change (tfpch) is used to evaluate the overall productivity trend of the firm, assessing the net effect on total factor productivity of various variables.

The study employs a grouped Malmquist indices model to evaluate the efficiency of merged automobile companies and banks during their merger period, utilizing financial data from the merged entities.

Data Description

The research identifies five critical variables from the literature, which reflect the financial health and performance of the automobile companies. The Data Envelopment Analysis (DEA) application necessitates the classification of these variables into two categories: inputs and outputs.

Financial Ratio taken for study

NP = Net Profit Margin
CR = Current Ratio
ROE = Return on Equity
ROA = Return on Asset
ROCE = Return on Capital Employed
EPS = Earnings per share

Our goal is to measure financial performance, with Net Profit (NP) and Return on Equity (ROE) as our outputs. We are taking current inputs as: Current Ratio (CR), Earnings per Share (EPS), Return on Asset (ROA), and Return on Capital Employed (ROCE).

Analysis of inputs in the context of a DEA model where NP and ROE are outputs:
Earnings per Share (EPS): This is (Net Income - Preferred Dividends) / Average Outstanding Shares.
Earnings Per Share (EPS) is fundamentally an outcome or performance measure, akin to Net Profit. It is not a resource that a company "utilizes" or "consumes" to produce Net Profit (NP) or Return on Equity (ROE). Including NP as an output and EPS (derived from Net Income) as an input is conceptually flawed and can distort the DEA model. Consequently, EPS is excluded as an input.
Return on Asset (ROA): This is Net Income / Total Assets.
Return on Assets (ROA), calculated as Net Income divided by Total Assets, is an efficiency ratio and an outcome measure. It incorporates Net Income (as output) in its calculation. When measuring efficiency in generating NP (output) and using ROA (which already includes NP) as an input (to be minimized for a given output level), the model becomes circular, and a firm could appear efficient merely by having a low ROA, which is counterintuitive if NP is high.
Return on Capital Employed (ROCE): This is EBIT / (Total Assets - Current Liabilities).
Similar to ROA, Return on Capital Employed (ROCE) is a profitability and efficiency ratio (an outcome). It assesses how effectively a company generates profits from its capital employed. Using this as an input when NP/ROE are outputs creates similar conceptual issues as with ROA. Therefore, ROCE is also excluded as an input.
Current Ratio (CR): This is Current Assets / Current Liabilities.
The Current Ratio (CR) is a liquidity measure. Unlike the other three, it is not a direct profitability or return outcome. While not a traditional "resource consumed" like labor or capital, it represents a state of financial health or working capital management. In a DEA context, if CR were an input, a lower CR for the same level of NP and ROE could be interpreted as more efficient management of working capital to achieve those outputs. It is problematic to use EPS, ROA, or ROCE as inputs.

Taking the Current Ratio (CR) as an Input: CR is defined as Current Assets divided by Current Liabilities. It measures a company's short-term liquidity. Unlike EPS, ROA, and ROCE, it is not a direct measure of profitability or return that serves as an output itself. Although CR is not a traditional "resource consumed" (like labor hours or raw materials) or a direct investment (like total assets or equity), it represents aspects of working capital management. If CR is used as the sole input, the DEA model would assess how efficiently firms generate Net Profit and ROE relative to their liquidity position (or working capital structure). A firm that generates high NP and ROE with a comparatively lower (or more "optimal" for its operations) Current Ratio may be deemed more efficient by this model. This can imply more efficient use or management of current assets and liabilities in the pursuit of profit.

DEA Model
We have dropped EPS, ROA, and ROCE as inputs and have kept Current Ratio (CR) as single input. This would lead to a DEA model with

Input (1): Current Ratio (CR)
Outputs (2): Net Profit (NP), Return on Equity (ROE)
This model will assess how efficiently companies generate Net Profit and Return on Equity relative to their Current Ratio. A company that achieves high NP and ROE with a lower Current Ratio will be considered more efficient by this specific model. This implies efficiency in managing working capital while delivering profits.

Data Analysis and Interpretation:
In this study, we have used various financial ratios along with Malmquist Index DEA approach. The financial ratios used here are Return on Equity (ROE), Net Profit margin ratio, Current ratio. These ratios are computed from the financial statements of the selected merged automobile companies and banks taken in this study. The study aimed to assess whether mergers led to enhanced financial efficiency in acquiring automobile companies and banks during the merger period. To evaluate this, the researchers formulated a null hypothesis stating that there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period.

Data Analysis
Here we are calculating Key Output/Input Ratios per Firm per Year:
Since we have 1 input and 2 outputs, we can calculate basic productivity or performance ratios for each firm in each year.

Assessing a firm's efficiency by comparing its outputs to its input ratios each Firm-wise
Automobile Companies

Table No.-3: Mahindra & Mahindra

Year	ROE/CR	NP/CR
PrM -5	22.0292	7.854015
PrM-4	25.43	9.75
PrM-3	16.23232	6.484848
PrM-2	23.03448	9.715517
PrM-1	29.07692	12.46154
PM-1	22.2963	8.361111
PM-2	20.8	7.536364
PM-3	17.35659	7.186047
PM-4	15.26549	7.539823
PM-5	12.11017	6.635593

The above table is to asses Mahindra & Mahindra Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. Return on Equity divided by Current Ratio, indicates that how effectively the company uses its current asset to generate shareholder returns. Net Profit divided by Current ratio, reflects the profitability relative to current assets of the firm. In PrM-1, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-4: TATA Motors

Year	ROE/CR	NP/CR
PrM -5	28.9359	7.961538
PrM-4	28.07477	6.71028
PrM-3	22.192	6.088
PrM-2	25.40909	6.518182
PrM-1	32.45	8.8125
PM-1	15.2037	7.333333
PM-2	29.13462	12.17308
PM-3	15.62069	6.62069
PM-4	10.20968	3.677419
PM-5	3.270833	1.395833

The above table is to asses Tata Motors Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. Return on Equity divided by Current Ratio, indicates that how effectively the company uses its current asset to generate shareholder returns. Net Profit divided by Current ratio, reflects the

profitability relative to current assets of the firm. Here PrM means Pre-Merger years and PM means Post-Merger years. In PM-2, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-5: Ashok Leyland Limited

Year	ROE/CR	NP/CR
PrM -5	13.21014	4.108696
PrM-4	22.41509	5.320755
PrM-3	21.96629	4.94382
PrM-2	16.95062	4.283951
PrM-1	1.059524	0.345238
PM-1	8.784946	2.645161
PM-2	6.792453	1.933962
PM-3	21.46237	6.526882
PM-4	26.04396	7.153846
PM-5	25.5914	7.333333

The above table is to asses Ashok Leyland Limited Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio PM-4 shown highest value among the 10 years taken for the study.

Table No.-6: Bharat Forge Limited

Year	ROE/CR	NP/CR
PrM -5	10.68987	6.21519
PrM-4	8.21118	6.018634
PrM-3	7.610256	6.030769
PrM-2	6.785479	5.214521
PrM-1	10.6978	8.840659
PM-1	9.03268	9.888889
PM-2	11.34815	9.851852
PM-3	12.71795	10.53205
PM-4	5.325301	6.246988
PM-5	2.94382	4.797753

The above table is to asses Bharat Forge Limited Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio PM-3 shown highest value among the 10 years taken for the study.

Table No.-7: Nissan Motors Limited

Year	ROE/CR	NP/CR
PrM -5	18.15	7.923611
PrM-4	15.81132	7.132075
PrM-3	15.10303	5.721212
PrM-2	15.86875	5.86875
PrM-1	16.85535	5.899371
PM-1	18.27778	5.808642
PM-2	17.33529	8.252941
PM-3	14.75333	7.026667
PM-4	0.757576	0.757576
PM-5	3.986928	1.366013

The above table is to asses Nissan Motors Limited Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio PM-1 and Net Profit divided by Current ratio PM-2 shown highest value among the 10 years taken for the study.

Table No.-8: Volkswagen AG

Year	ROE/CR	NP/CR
PrM -5	12.38462	4.615385
PrM-4	9.758065	4.677419
PrM-3	2.293381	0.815742
PrM-2	13.02775	4.822739
PrM-1	22.60096	9.253589
PM-1	24.9057	10.52288
PM-2	10.11359	4.506796
PM-3	10.236	5.466
PM-4	1.573034	0.756895
PM-5	6.602052	2.698974

The above table is to asses Volkswagen AGs Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio PM-1 shown highest value among the 10 years taken for the study.

Banks

Table No.-9: State Bank of India

Year	ROE/CR	NP/CR
PrM -5	11.7377	8.934426
PrM-4	7.626984	6.079365
PrM-3	1.72623	1.380328
PrM-2	6.343434	5.828283
PrM-1	0.132653	0.163265
PM-1	2.232323	1.838384
PM-2	1.010309	1.247423
PM-3	7.239583	7.625
PM-4	9.326316	9.189474
PM-5	13.11702	13.32979

The above table is to asses State Bank of India Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. Return on Equity divided by Current Ratio, indicates that how effectively the company uses its current asset to generate shareholder returns. Net Profit divided by Current ratio, reflects the profitability relative to current assets of the firm. Here PrM means Pre-Merger years and PM means Post-Merger years. In PM-5, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-10: Bank of Baroda

Year	ROE/CR	NP/CR
PrM -5	45.48148	90.59259
PrM-4	44.5	84.92857
PrM-3	49.57692	98.88462
PrM-2	37	94.28125
PrM-1	29.7619	84.19048
PM-1	10.47619	9.761905
PM-2	6.05	5.95
PM-3	8.5	8.863636
PM-4	25.11765	30.85294
PM-5	30.82609	33.91304

The above table is to asses Bank of Baroda Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio, in PrM-3, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-11: Kotak Mahindra Bank

Year	ROE/CR	NP/CR
PrM -5	32.36364	39.77273
PrM-4	38.27027	45.67568
PrM-3	40.94286	48.94286
PrM-2	39.12121	58.15152
PrM-1	38.19444	35.41667
PM-1	31.39394	50.93939
PM-2	51.32	88.68
PM-3	45.48148	90.59259
PM-4	44.5	84.92857
PM-5	49.57692	98.88462

The above table is to asses Kotak Mahindra Banks Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. Return on Equity divided by Current Ratio, indicates that how effectively the company uses its current asset to generate shareholder returns. Net Profit divided by Current ratio, reflects the profitability relative to current assets of the firm. Here PrM means Pre-Merger years and PM means Post-Merger years. In case of Return on Equity divided by Current ratio, in PM-2, and Net Profit divided by Current ratio, in PM-5 peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-12: ICICI Bank

Year	ROE/CR	NP/CR
PrM -5	29.63576	35.2649
PrM-4	24.2963	27.28889
PrM-3	13.8105	13.92379
PrM-2	12.52822	15.23702
PrM-1	0.989583	11.25
PM-1	4.667418	8.043968
PM-2	8.423871	12.76205
PM-3	10.71306	17.07045
PM-4	10.83851	17.51553
PM-5	12.0938	19.76549

The above table is to asses ICICI Banks Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio, in PrM-5, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-13: HDFC Bank

Year	ROE/CR	NP/CR
PrM -5	34.72414	44.37931
PrM-4	24.07538	27.50294
PrM-3	19.82974	24.34733
PrM-2	28.84848	29.48485
PrM-1	17.85317	18.63181
PM-1	9.15506	12.10771
PM-2	6.694215	12.84435
PM-3	15.26419	19.60861
PM-4	31.05546	38.71199
PM-5	23.96419	30.33248

The above table is to asses HDFC Banks Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio, in PrM-5, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-14: Indian Overseas Bank

Year	ROE/CR	NP/CR
PrM -5	21.64715	8.103044
PrM-4	23.9021	7.972028
PrM-3	42.62857	11.19184
PrM-2	57.58621	20.22546
PrM-1	44.08037	29.7527
PM-1	18.00971	11.22053
PM-2	16.85505	9.268617
PM-3	39.27817	20.89789
PM-4	27.01456	14.90291
PM-5	12.29401	7.52809

The above table is to asses Indian Overseas Banks Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio, in PrM-1, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-15: Federal Bank

Year	ROE/CR	NP/CR
PrM -5	16.30219	8.727634
PrM-4	15.1622	6.558533
PrM-3	15.44726	1.929239
PrM-2	10.89627	1.834025
PrM-1	19.15923	0.706845
PM-1	21.31263	0.440882
PM-2	10.79618	0.183121
PM-3	10.79181	11.61922
PM-4	6.134604	6.575342
PM-5	21.31673	22.84698

The above table is to asses Federal Banks Efficiency over the merger period, by analyzing the performance ratios that is ROE/CR and NP/CR. In case of Return on Equity divided by Current ratio and Net Profit divided by Current ratio, in PM-5, both ratios peaked, indicating optimal efficiency in utilizing current assets for profitability and shareholder returns.

Table No.-16: Firm-wise Peak year of both the ratios

Firm	Peak year (ROE/CR)	Peak Year (NP/CR)
Mahindra & Mahindra	PrM-1	PrM-1
TATA Motors	PM-2	PM-2
Ashok Leyland Limited	PM-4	PM-4
Bharat Forge Limited	PM-3	PM-3
Nissan Motor Co. Ltd	PM-1	PM-2
Volkswagen	PM-1	PM-1
State Bank of India	PM-5	PM-5
Bank of Baroda	PrM-3	PrM-3
Kotak Mahindra Bank	PM-2	PM-5
ICICI Bank	PrM-5	PrM-5
HDFC Bank	PrM-5	PrM-5
Indian Overseas Bank	PrM-1	PrM-1
Federal Bank	PM-5	PM-5

In the post-merger period, TATA Motors, Bharat Forge Limited, Ashok Leyland Limited, Nissan Motors, Volkswagen, Kotak Mahindra Bank, State Bank of India, and Federal Bank exhibited optimal performance, suggesting that the mergers may have positively influenced their operational efficiency. Conversely, firms such as Mahindra & Mahindra, ICICI Bank, Bank of Baroda, Indian Overseas Bank, and HDFC Bank achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency.

These ratios serve as instruments for performance analysis in year-over-year comparisons, cross-firm analyses, and in identifying areas for operational improvements. In both scenarios, higher output/input ratios indicate that a firm is more efficient in utilizing its resources to generate substantial returns. The higher the result ratios, the greater the efficiency of the firms.

Hypothesis Testing

Table No. -17: Firm-wise Hypothesis Testing Results

Sector	Firm	Result of Null Hypothesis
Automobile	Mahindra & Mahindra	Accepted
	TATA Motors	Rejected
	Ashok Leyland Limited	Rejected
	Bharat Forge Limited	Rejected
	Nissan Motor Co. Ltd	Rejected
	Volkswagen	Rejected
Banking	State Bank of India	Rejected
	Bank of Baroda	Accepted
	Kotak Mahindra Bank	Rejected
	ICICI Bank	Accepted
	HDFC Bank	Accepted
	Indian Overseas Bank	Accepted
	Federal Bank	Rejected

Automobile Firms

The researchers in this paper formulated a null hypothesis stating that there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period and if there is significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period then alternative hypothesis is accepted. Since Mahindra & Mahindra achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of the acquiring firm when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. As in case of Tata Motors, the firm achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhanced their financial efficiency therefore, null hypothesis is rejected. As in case of Tata Motors, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which support the acceptance of the alternative hypothesis. Ashok Leyland Limited achieved their peak performance in the post-merger years, indicating that the mergers have immediately enhanced their financial efficiency therefore, null hypothesis is rejected. As in case of Ashok Leyland Limited, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, that support the acceptance of the alternative hypothesis. Since the Nissan Motors achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhanced their financial efficiency. Therefore, null hypothesis is rejected. As in case of Nissan Motors, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. As Volkswagen achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhance in their financial efficiency therefore, null hypothesis is rejected. As there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, that support the acceptance of the alternative hypothesis. Bharat Forge Limited achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhance in their financial efficiency therefore, null hypothesis is rejected. As in case of Bharat Forge Limited, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which support the acceptance of the alternative hypothesis.

Banks

The researchers in this paper formulated a null hypothesis stating that there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period and if there is significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period then alternative hypothesis is accepted. State Bank of India achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhanced their financial efficiency. Therefore, null hypothesis is rejected. As in case of State Bank of India, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. Bank of Baroda achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of the acquiring firm when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. Since the Kotak Mahindra Bank achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhanced their financial efficiency. Therefore, null hypothesis is rejected. As in case of Kotak Mahindra Bank, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. Since ICICI Bank achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of the acquiring firm when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. Since HDFC Bank achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of the acquiring firm when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. Since Indian Overseas Bank achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of the acquiring firm when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. Federal Bank achieved their peak performance in the post-merger years, indicating that the mergers have immediate enhanced their financial efficiency. Therefore, null hypothesis is rejected. As in case of Federal Bank, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis.

We conclude that in some case there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. In rest of the case there is significant change in the financial efficiency of these acquiring firms is observed when comparing the post-merger period to the pre-merger period, that support the acceptance of the alternative hypothesis.

Analyzing Ratios all the Firms Together Sector-wise of each Year:

Analysing each ratio collectively for all firms on a sectoral basis each year involves calculating the chosen financial ratio for each year and grouping the firms according to their sectors (Automobile vs. Banking). This includes calculating the average (mean) of each chosen ratio for the Automobile firms and the Banking firms separately. Comparisons are made for these average ratios between the two sectors for each year to determine the sector-wise "best" for each financial ratio separately. This approach provides a straightforward comparison of average productivity financial ratios across all firms within specific sectors.

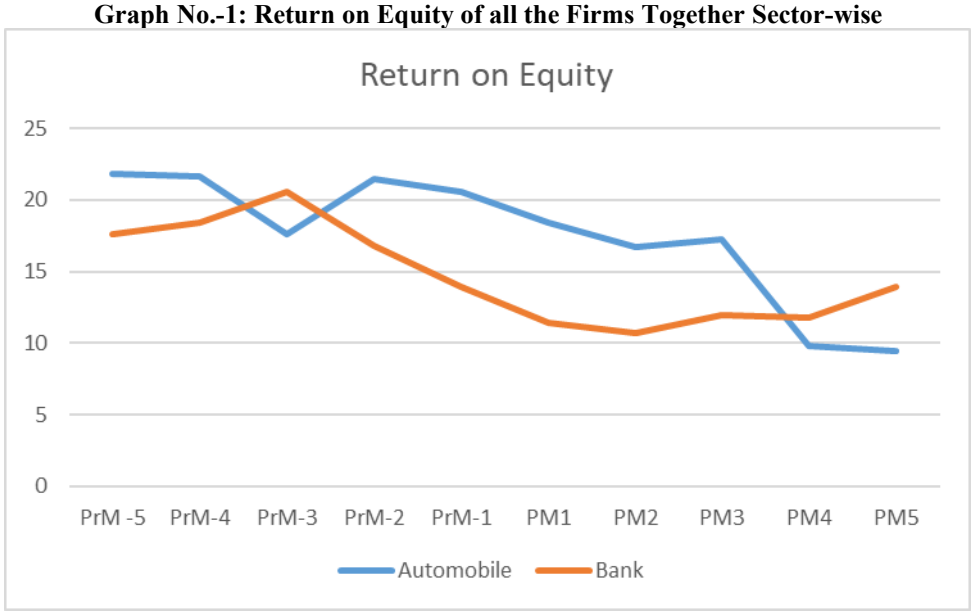
Table No.-18: Analyzing the Return to Equity Ratio for Sector-Wise Comparison "Better"

Year	Automobile	Bank	Sector-wise Comparison "Better"
PrM -5	21.828	17.572	Automobile
PrM-4	21.615	18.392	Automobile
PrM-3	17.614	20.57	Bank
PrM-2	21.483	16.81	Automobile
PrM-1	20.533	13.95	Automobile
PM-1	18.427	11.45	Automobile

PM-2	16.739	10.665	Automobile
PM-3	17.269	11.944	Automobile
PM-4	9.776	11.801	Bank
PM-5	9.465	13.955	Bank

In the above table, here 'PrM' means Pre-Merger and 'PM' means Post-Merger. We can observe that in case of Return on Equity, banking sector is performing better than automobile sector in only 3 years (for example: pre-merger 3rd year, post-merger 4th year and 5th year). In rest 7 year out of 10 years (for example: pre-merger 5 years and post-merger 5 years) automobile sector is performing better than banking sector.

Graph No.-1: Return on Equity of all the Firms Together Sector-wise



Graphical Representation of Return on Equity of All the Firms Together Sector-Wise of Both the Sector for 10 Years of Merger Period. The graph titled "Return on Equity (ROE)" illustrates the trends in return on equity for the Automobile and Banking sectors across five years' pre-merger (PrM-5 to PrM-1) and five years' post-merger (PM1 to PM5).

Interpretation of the Graph:
Automobile Sector (Blue Line):
Pre-Merger Period: The automobile sector generally shows a high ROE in the initial pre-merger years, starting around 22% in PrM-5, with a slight dip in PrM-3 (around 17.5%) before recovering to above 20% in PrM-2. It then shows a declining trend towards the merger, reaching approximately 18% in PrM-1.

Post-Merger Period: Following the merger, the ROE for the automobile sector continues its declining trend, starting from around 16% in PM1 and gradually decreasing. There's a minor recovery around PM3 (17%) before a sharp drop to around 10% in PM4 and further to approximately 9.5% in PM5. This suggests that, on average, the post-merger period for the selected automobile companies was associated with a decline in ROE compared to most of the pre-merger phase.

Banking Sector (Orange Line):
Pre-Merger Period: The banking sector's ROE starts around 17.5% in PrM-5 and shows an increasing trend, peaking around 20.5% in PrM-3. After this peak, it experiences a significant decline, reaching approximately 11% in PrM-1.

Post-Merger Period: In the post-merger phase, the banking sector's ROE initially drops further to around 10.5% in PM2. However, unlike the automobile sector, it then shows a recovery trend, increasing to approximately 12.5% in PM3, stabilizing around 12% in PM4, and showing a noticeable rise to about 14% in PM5.

Comparative Performance and Trends:
Pre-Merger: The automobile sector generally maintained a higher ROE than the banking sector for most of the pre-merger period, particularly from PrM-5 to PrM-2. However, the banking sector briefly surpassed the automobile sector in PrM-3. Both sectors experienced a decline in ROE towards the immediate pre-merger period (PrM-1).

Post-Merger: In the initial post-merger years (PM1-PM3), the automobile sector's ROE remained slightly higher or comparable to the banking sector. However, a significant divergence occurs from PM4 onwards. The automobile sector experiences a sharp drop in ROE, falling below the banking sector's performance. The banking sector, on the other hand, shows a more resilient and even recovering trend in its ROE during the later post-merger years (PM3-PM5), while the automobile sector continues its decline.

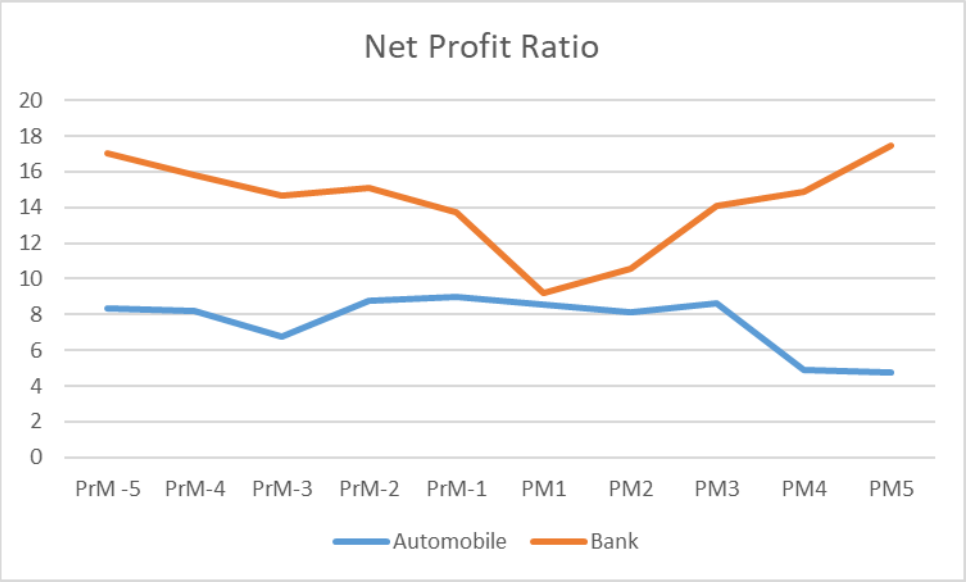
Overall Impact: The graph suggests that the mergers had a more sustained negative impact on the average Return on Equity of the automobile companies in the long run (PM4, PM5), leading to a decline in their ROE from pre-merger levels. Conversely, the banking sector, after an initial post-merger dip, showed signs of recovery and improved ROE in the later post-merger years, indicating a more positive long-term financial efficiency impact or recovery from the M&A effects compared to the automobile sector.

Table No.-19: Analyzing the Net Profit Margin for Sector-Wise Comparison "Better"

Year	Automobile	Bank	Sector-wise Comparison "Better"
PrM -5	8.311	17.008	Bank
PrM-4	8.233	15.83	Bank
PrM-3	6.757	14.69	Bank
PrM-2	8.747	15.078	Bank
PrM-1	8.97	13.717	Bank
PM-1	8.543	9.23	Bank
PM-2	8.107	10.581	Bank
PM-3	8.602	14.081	Bank
PM-4	4.903	14.911	Bank
PM-5	4.7195	17.434	Bank

From the above table, we can observe that in case of Net Profit Margin, banking sector is performing better than automobile sector in all the 10 years' merger period taken for the study.

Graph No.-2: Net Profit ratio of all the Firms Together Sector-Wise



Graphical represent of Net Profit ratio of all the firms together sector-wise of both the sector for 10 years of merger period. The graph titled "Net Profit (NP)" illustrates the trends in Net Profit for the Automobile and Banking sectors across five years' pre-merger (PrM-5 to PrM-1) and five years' post-merger (PM1 to PM5).

Interpretation of the Graph:
Automobile Sector (Blue Line):
Pre-Merger Period: The Net Profit of the automobile sector initially lags behind that of the banking sector, starting at approximately 8% in PrM-5. The automobile sector's Net Profit continues to decline, reaching its nadir at around 6% in PrM-3. However, it subsequently exhibits a robust and sustained recovery, increasing steadily through PrM-2 to approximately 8%, and attaining its peak in the merger period at about 9% in PrM-1. Overall, the pre-merger Net Profit levels are notably lower and exhibit volatility.

Post-Merger Period: In the post-merger phase, the automobile sector's Net Profit continues its decline from PM-1, reaching its lowest point at approximately 4% in PM5. A modest recovery is observed in PM3, with Net Profit around 8.6%, followed by a decline in PM4 and PM5 to approximately 4.9% and 7%, respectively. However, it resumes a downward trend, reaching its lowest point at approximately 4.71% in PM5. Overall, the post-merger Net Profit levels are significantly lower and more volatile than in the initial pre-merger years.

Banking Sector (Orange Line):
Pre-Merger Period: The Net Profit for the banking sector commences at around 17% in PrM-5 and initially declines, peaking at approximately 14.69% in PrM-3. Subsequently, there is an upward trend, with Net Profit around 15% in PrM-2, followed by a sharp decline to approximately 13.71% in PrM-1, just prior to the merger. This indicates significant volatility in the pre-merger phase, culminating in a sharp drop in profitability.

Post-Merger Period: Immediately following the merger (PM1), the Net Profit for the banking sector declines to about 9.23%. However, it then demonstrates a strong and sustained recovery, increasing steadily through PM2 (around 10.58%), PM3 (around 14.08%), PM4 (around 14.91%), and reaching its highest post-merger point of approximately 17.43% in PM5. It exhibits a consistent upward trend, peaking impressively at approximately 17.43% in PM-5.

Comparative Performance and Trends:
Pre-Merger: The banking sector maintained a higher Net Profit than the automobile sector throughout the overall merger years. However, the banking sector experienced a rapid decline in PrM3, a slight rise from PrM-2, and another decline in PrM-1, consistently surpassing the automobile sector during the pre-merger period. Both sectors experienced a sharp decline in Net Profit in different years, such as the automobile sector's drop in PrM-3.

Post-Merger: In the immediate post-merger period (PM1 and PM3), the automobile sector's Net Profits remained relatively low, with the banking sector consistently outperforming the automobile sector. However, the banking sector exhibited a remarkable and consistent recovery in Net Profit from PM1 to PM5, while the automobile sector's performance significantly declined in the later post-merger years (PM4, PM5). The automobile sector's Net Profit remained relatively low and stagnant in the post-merger period compared to its initial pre-merger performance.

Overall Impact: The data suggests a generally negative impact on the Net Profit of the automobile sector in the later post-merger period (PM-4, PM-5), with performance remaining significantly below initial pre-merger levels. In contrast, the banking sector demonstrated a strong recovery and growth in Net Profit during the post-merger period.

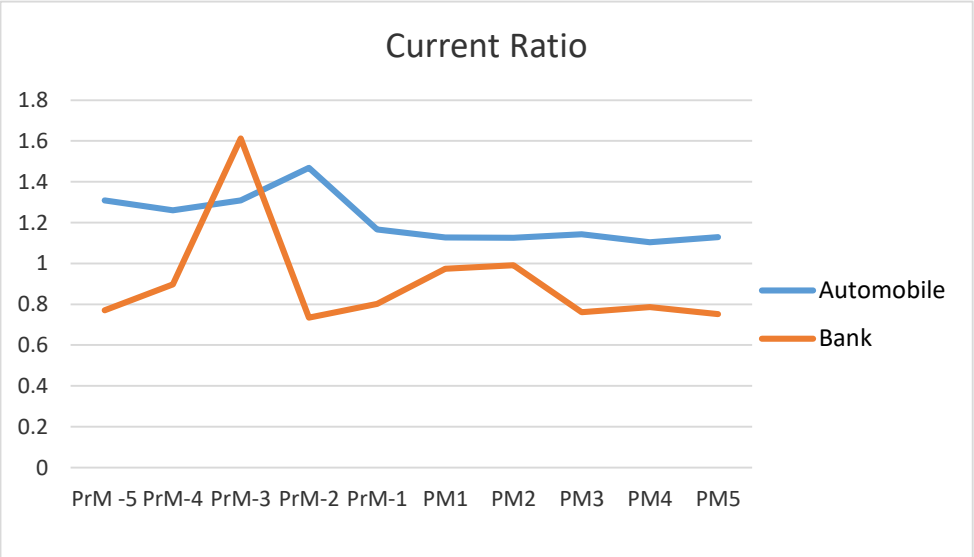
Table No.-20: Analyzing the Current Ratio for Sector-Wise Comparison "Better"

Year	Automobile	Bank	Sector-wise Comparison "Better"
PrM -5	1.308	0.771	Automobile
PrM-4	1.261	0.897	Automobile
PrM-3	1.308	1.612	Bank
PrM-2	1.469	0.735	Automobile

PrM-1	1.167	0.801	Automobile
PM-1	1.128	0.974	Automobile
PM-2	1.126	0.991	Automobile
PM-3	1.143	0.761	Automobile
PM-4	1.103	0.786	Automobile
PM-5	1.129	0.752	Automobile

In this above table we can observe that the Automobile sector is performing better than the banking sector in the 9 years out of 10 years of the merger period and only in 1 year banking sector is better than automobile sector.

Graph No.-3: Current Ratio of all the Firms Together Sector-wise



Graphical represent of Current Ratio of all the firms together sector-wise of both the sectors i.e. sssautomobile and bank for 10 years of merger period. This graph shows that the current ratio of automobile companies is reaching to its peak in pre-merger period of both the sectors.
The graph titled "Current Ratio (CR)" illustrates the trends in the Current Ratio for the Automobile and Banking sectors across five years' pre-merger (PrM-5 to PrM-1) and five years' post-merger (PM1 to PM5). "The Current Ratio is a type of liquidity ratio which is used to calculate a company's ability to pay off its short-term liabilities with its short-term assets. A higher current ratio generally indicates better short-term financial health."

Interpretation of the Graph:
Automobile Sector (Blue Line):
Pre-Merger Period: The automobile sector starts with a relatively high current ratio of around 1.3 in PrM-5. It shows a significant increasing trend, peaking at approximately 1.47 in PrM-2. This indicates a healthy liquidity position leading up to the merger. There is a slight dip to around 1.17 in PrM-1, but the overall trend in the pre-merger phase is positive.

Post-Merger Period: Immediately after the merger (PM1), the current ratio for the automobile sector is around 1.128. In the post-merger phase, the automobile sector's current ratio remains remarkably stable. It hovers consistently around 1.1 to 1.129 from PM1 to PM5, showing very little fluctuation. This indicates a steady and predictable liquidity position for the automobile sector after mergers.

Banking Sector (Orange Line):
Pre-Merger Period: The banking sector starts with current ratio of 0.771 in PrM-5. Before the merger (PrM-3), the current ratio for the banking sector rises sharply to around 1.612. It continues to decline, reaching its lowest point in the entire period at approximately 0.735 in PrM-2. There's a slight recovery to around 0.8 in PrM-1 before it drops again to about 0.752 in PM-5. This indicates a significant deterioration in the banking sector's liquidity post-merger, suggesting possible strain on short-term solvency.

Post-Merger Period: Immediately after the merger (PM2), the current ratio for the banking sector drops sharply to around 0.761. It continues to decline, reaching its lowest point in the post-merger period at approximately 0.752 in PM5. There's a slight recovery to around 0.786 in PM4 before it drops again to about 0.752 in PM5. This indicates a significant deterioration in the banking sector's liquidity post-merger, suggesting likely strain on short-term solvency.

Comparative Performance and Trends:
Pre-Merger: The automobile sector consistently maintained a significantly higher current ratio than the banking sector almost throughout the entire pre-merger period, suggesting stronger short-term solvency.

Post-Merger: A stark contrast emerges in the post-merger period. The banking sector experiences a dramatic decline in its current ratio, while the automobile sector maintains its relatively stable, although lower, current ratio. By PM3 onwards, the automobile sector's current ratio is higher than that of the banking sector, a complete reversal from the pre-merger (PrM-3) situation.

Overall Impact: The graph strongly suggests a negative impact of mergers on the short-term liquidity of the banking sector, with the current ratio falling significantly post-merger. In contrast, the automobile sector's current ratio remains quite stable and resilient through the merger event, implying that mergers did not significantly disrupt their short-term financial solvency or that they managed it more effectively. The post-merger period sees the automobile sector showing superior short-term liquidity compared to the banking sector.
Based on the analysis of the three graphs (Return on Equity, Net Profit, and Current Ratio), a clear distinction emerges in the short-to-medium term financial impact of mergers and acquisitions on the automobile and banking sectors:

Automobile Sector: For the automobile sector, the period following mergers generally appears to be associated with a decline in key financial performance indicators. Return on Equity (ROE) showed a declining trend post-merger, especially in the later years, falling below pre-merger levels. Similarly, Net Profit (NP) also experienced a sharp drop from PM3 to PM4 in later post-merger period and remained at significantly lower levels post-merger compared to its initial pre-merger performance. Most significantly, the Current Ratio for the automobile sector remained remarkably stable and consistent throughout the entire post-merger period, indicating effective management of short-term liquidity. This implies that the automobile sector, on average, either managed the integration effects of mergers more effectively or experienced a more positive financial impact in terms of profitability recovery and maintained liquidity compared to the banking sector.
The researchers in this paper formulated a null hypothesis stating that there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period and if there is significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period then alternative hypothesis is accepted. In cases of automobile sector, there is no significant change in the financial efficiency of these acquiring firms together, when comparing the post-merger period to the pre-merger period, therefore, null hypothesis is accepted here.

Banking Sector: In contrast to automobile sector the banking sector demonstrated a more resilient and even recovering trend in its financial performance post-merger even though it has some initial dips. While Net Profit shows an immediate dip post-merger, it showed a strong and sustained recovery, eventually reaching respectable levels in the later post-merger years. Return on Equity also, after an initial decline, showed signs of recovery and improvement in the later post-merger years, surpassing the automobile sector's ROE. Most notably, the Current Ratio (CR), a crucial liquidity indicator, suffered a severe decline post-merger, indicating a significant deterioration in short-term solvency. This suggests that, on average, the mergers had a detrimental impact on the profitability and liquidity of the banking sector in the post-merger period depicted.

The researchers in this paper formulated a null hypothesis stating that there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period and if there is significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period then alternative hypothesis is accepted. In cases of banking sector, there is no significant change in the financial efficiency of these acquiring firms together, when comparing the post-merger period to the pre-merger period, therefore, null hypothesis is accepted here.

Overall, the data from these three graphs suggests a differential impact of mergers and acquisitions on the financial performance of the two sectors. The banking sector appears to have faced more significant challenges

in maintaining profitability and liquidity in the post-merger period, showing a general decline across all three metrics. Conversely, the automobile sector, despite some initial fluctuations, demonstrated a greater capacity for recovery in profitability and maintained strong liquidity post-merger. This highlights that the success and financial implications of M&A can vary significantly across industries, depending on sector-specific dynamics, integration complexities, and management strategies.

From the above tables and graphs we can conclude that by Comparing these average ratios between the two Sectors (Automobile and Banking) for each year. This gives us a simple, direct comparison of average productivity of the specific ratios taken for the analysis, year by year. And this direct comparison shows that the automobile sector is performing better than banking sector in its merger period. This combined approach gives us both simple performance snapshots (ratios) and insights into relative productivity change dynamics (grouped Malmquist indices), even if we cannot perform an industry-specific frontier analysis each year due to data limitations as we have taken 6 merged automobile companies and 7 merged banks for our study.

Table No.- 21: Malmquist Index Summary of Firm Means of All the Firms

firm	effch	techch	pech	sech	tfpch
1	1.031	1.075	1	1.031	1.109
2	0.977	1.008	1.009	0.968	0.985
3	0.95	0.979	1.013	0.938	0.93
4	0.931	0.946	0.967	0.963	0.881
5	0.9	0.957	0.993	0.906	0.861
6	0.928	0.992	1.009	0.921	0.921
7	0.9	1.096	0.955	0.943	0.986
8	0.978	1.041	1.022	0.957	1.018
9	0.988	1.071	1.018	0.971	1.058
10	0.929	1.099	0.972	0.956	1.021
11	0.928	1.024	1	0.928	0.95
12	0.874	1.022	0.982	0.891	0.893
13	1.03	1.084	1.009	1.021	1.117

Table No.-22: Malmquist Index Summary of Firm Means of Automobile Companies

firm	effch	techch	pech	sech	tfpch
1	1.031	1.075	1	1.031	1.109
2	0.977	1.008	1.009	0.968	0.985
3	0.95	0.979	1.013	0.938	0.93
4	0.931	0.946	0.967	0.963	0.881
5	0.9	0.957	0.993	0.906	0.861
6	0.928	0.992	1.009	0.921	0.921

Table No.-23: Malmquist Index Summary of Firm Means of Banks

firm	effch	techch	pech	sech	tfpch
7	0.9	1.096	0.955	0.943	0.986
8	0.978	1.041	1.022	0.957	1.018
9	0.988	1.071	1.018	0.971	1.058
10	0.929	1.099	0.972	0.956	1.021
11	0.928	1.024	1	0.928	0.95
12	0.874	1.022	0.982	0.891	0.893
13	1.03	1.084	1.009	1.021	1.117

Table No.-24: Geometric Mean of Automobile Companies

firm	effch	techch	tfpch
1	1.031	1.075	1.109
2	0.977	1.008	0.985
3	0.95	0.979	0.93
4	0.931	0.946	0.881
5	0.9	0.957	0.861
6	0.928	0.992	0.921
Mean	0.952833	0.992833	0.947833
Geometric Mean	0.951925	0.991961	0.944456

Table No.- 25: Geometric Mean of Banks

firm	effch	techch	tfpch
1	0.9	1.096	0.986
2	0.978	1.041	1.018
3	0.988	1.071	1.058
4	0.929	1.099	1.021
5	0.928	1.024	0.95
6	0.874	1.022	0.893
7	1.03	1.084	1.117
Mean	0.946714	1.062429	1.006143
Geometric Mean	0.945382	1.061985	1.003877

Table No.-26: Geometric Mean of Automobile Companies and Banks

	Automobile	Banks	Sector wise Comparison “Better”
tfpch	0.944	1.006	Bank
effch	0.951	0.945	Automobile
techch	0.991	1.061	Bank

The Geometric mean tfpch for the Banking group is significantly higher than for the Automobile group in a certain period, it suggests that the Banking firms in this sample, on average, experienced greater productivity growth relative to the pooled frontier during that period compared to the Banking firms.
The Geometric mean of effch for the Automobile group is significantly higher than for the Banking group in a certain period, it suggests that the Automobile firms in this sample, on average, experienced greater productivity growth relative to the pooled frontier during that period compared to the Banking firms.

The Geometric mean techch for the Banking group is significantly higher than for the Automobile group in a certain period, it suggests that the Banking firms in this sample, on average, experienced greater productivity growth relative to the pooled frontier during that period compared to the Banking firms.

Table No- 27: Malmquist Index Summary of Annual Means

year	effch	techch	pech	sech	tfpch
2	0.55	1.047	0.644	0.855	0.576
3	1.722	0.798	1.448	1.189	1.374
4	0.525	0.802	0.79	0.665	0.421
5	0.226	0.763	0.686	0.329	0.172
6	3.041	5.918	1.357	2.24	17.997
7	2.874	1.025	1.532	1.876	2.946

8	0.611	0.592	0.823	0.742	0.362
9	1.207	1.038	1.099	1.098	1.254
10	0.858	0.679	1.013	0.847	0.583

An analysis of the Malmquist index DEA table, which includes data from 13 firms (comprising 6 automobile companies and 7 banks) with 5 years of pre-merger and 5 years of post-merger financial ratio data, reveals that the effch value is at its maximum in the sixth year (i.e., the first year post-merger) as the companies merged among themselves so, the values are more as compared to other 9 years. Overall, the firms (aggregate) improve its efficiency relative to the frontier after merger than that of before merger. The techch value of all 5 years of post-merger period is more than all 5 years of the pre-merger period. The techch value is maximum in its 6th year (i.e. in its 1st year of post-merger) as the companies merged among themselves the financial ratio values are high so, the result values are also more as compared to other 9 years. We have observed that technical change has a positive impact on all the firm efficiency. All the firms have been benefited from shifts in the technological frontier. And that shows the merged entity has improved capacity to adopt new technologies or innovations in the post-merger period. The tfpch value is maximum among all the value in the table is in its 6th year (i.e. in its 1st year of post-merger) as the companies merged among themselves the values are more as compared to other 9 years. All the firm's overall productivity trend has increased in the post-merger period as total Factor Productivity Change is use to check the net effect on total factor productivity of variables. The overall result of the Malmquist index DEA table is very high in the 6th year as the companies' mergers the financial data of the all firms also increases which is reflected in the results of component of the Malmquist index DEA table. Overall, the results exhibit a fluctuating nature, with post-merger outcomes surpassing those of the pre-merger period.

Conclusion

Mergers and acquisitions have played a pivotal role in shaping India's automotive industry and banking sector. These strategic activities foster innovation, enhance market share, increase capital and profit gains, introduce new technologies, and position Indian companies as significant players in the global market. Furthermore, mergers and acquisitions in the automobile industry have proven beneficial for automotive companies. Our analysis acknowledges that ratio comparisons serve as simple indicators, and the Malmquist results are derived from a pooled, mixed-industry frontier due to sample size limitations; thus, they should be interpreted with caution, particularly when comparing absolute efficiency levels. It is advisable to focus on trends and relative changes between groups. This combined approach provides both straightforward performance snapshots (ratios) and insights into relative productivity change dynamics (grouped Malmquist indices), even if an industry-specific frontier analysis cannot be conducted annually due to data constraints.

The study employed a combined methodology of Data Envelopment Analysis (DEA) with the grouped Malmquist Index model and Ratio Analysis, examining financial data for five years preceding and five years following mergers for selected automobile companies and banks. The core of the analysis involved assessing efficiency using ratios of Net Profit (NP) and Return on Equity (ROE) to Current Ratio (CR). In the automobile sector, companies such as Tata Motors, Ashok Leyland, Nissan Motors, Volkswagen, and Bharat Forge demonstrated peak efficiency in various post-merger years, suggesting that mergers generally led to improved financial performance in the medium term. Conversely, Mahindra & Mahindra exhibited peak efficiency in pre-merger periods, indicating varied outcomes across entities. In these instances, there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. As in case of Tata Motors, there is significant change in the financial efficiency of the acquiring firms is observed when comparing the post-merger period to the pre-merger period, which support the acceptance of the alternative hypothesis. As in case of Ashok Leyland Limited, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, that support the acceptance of the alternative hypothesis. Nissan Motors, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. As in case of Bharat Forge Limited, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which support the acceptance of the alternative hypothesis. As in case of Volkswagen also, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which support the acceptance of the alternative hypothesis. Similarly, in the banking sector, institutions

like Kotak Mahindra Bank, State Bank of India, and Federal Bank showed peak efficiency in various post-merger years, suggesting that mergers generally led to improved financial performance in the medium term. However, Bank of Baroda, ICICI Bank, Indian Overseas Bank, and HDFC Bank exhibited peak efficiency in pre-merger periods, indicating varied outcomes across entities. As in case of State Bank of India, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. Since in case Bank of Baroda, there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. As in case of Kotak Mahindra Bank, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. Since ICICI Bank achieved their peak performance in the pre-merger years, indicating that the mergers did not immediately enhance their financial efficiency therefore, there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. As in case of HDFC Bank, there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. Since in case of Indian Overseas Bank, there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. As in case of Federal Bank, there is significant change in the financial efficiency of the acquiring firm is observed when comparing the post-merger period to the pre-merger period, which supports the acceptance of the alternative hypothesis. We conclude that in some case there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, thus leading to the acceptance of the null hypothesis. In rest of the case there is significant change in the financial efficiency of these acquiring firms is observed when comparing the post-merger period to the pre-merger period, that support the acceptance of the alternative hypothesis.While comparing each financial ratio collectively for all firms on a sectoral basis each year of both the sectors (automotive sector and banking sector), there is no significant change in the financial efficiency of these acquiring firms when comparing the post-merger period to the pre-merger period, therefore, null hypothesis is accepted here.

The findings of the study present mixed results concerning the impact of mergers and acquisitions on financial performance. While certain entities exhibited improved efficiency and profitability in the post-merger period, others performed better prior to the merger or demonstrated efficiency peaks at various stages. A critical correction within the paper underscores the significance of selecting appropriate inputs for the DEA model. Initially, the authors considered several financial performance measures as inputs but correctly identified that only the Current Ratio (CR) should be used as an input, alongside Net Profit (NP) and Return on Equity (ROE) as outputs, to avoid conceptual flaws and achieve a valid assessment of efficiency.

In conclusion, the paper suggests that mergers and acquisitions can indeed influence the financial performance of automobile companies and banks, but the impact is not uniformly positive across all entities or timeframes. The effectiveness of mergers and acquisitions in enhancing financial efficiency appears to be contingent on various factors specific to each organization and the strategic management of their post-merger integration. Emphasizing proper methodological design, particularly the careful selection of inputs and outputs in DEA, is critical for drawing accurate conclusions regarding the real effect of mergers and acquisitions on financial efficiency.

Managerial Implications and Future Scope of the Study

The study employs Malmquist indices DEA as a methodology to assess the impact of mergers and acquisitions in the Indian automobile and banking sectors through the examination of selected Indian automobile companies and banks. This study can be highly beneficial for managers involved in decision-making processes regarding mergers and acquisitions within their companies. Understanding the key factors that influence a company's financial efficiency in the post-merger period can guide strategic decisions regarding mergers and acquisitions. Managers should ensure that the integration process addresses critical aspects contributing to the financial health of the automobile sector. Continuous monitoring of the variables under study can provide insights into the success of integration efforts and help identify areas that may require adjustments or improvements. The study can assist managers in establishing a robust and reliable monitoring mechanism to track the effectiveness of integration operations. They should also remain adaptable when it comes to modifying plans in response to ongoing evaluations. Investors can also utilize this information during companies' merger periods to assess the effectiveness of a firm's management and its ability to generate returns over the merger timeframe. The findings

of this study can provide insights into the financial and shareholder aspects of managerial decision-making in the context of mergers and acquisitions in the Indian automobile and banking sectors.

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