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Mergers Effects on Financial Performance: A Difference-in-Difference based Event Study in Automobile Sector

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Abstract
The merger success is driven more by long-term integration and operational synergy than immediate financial performance. This study investigates whether mergers in the Indian automobile sector generate measurable financial benefits, using a combination of Difference-in-Differences (DID), Event Study analysis, correlation assessment, and trend comparison between merged and non-merged firms. The study uses only two merged firms (Bharat Forge and Nissan Motors merged in 2016) and compared with six non-merged firms. This small "treated" group may limit the generalizability of the findings. The DID results show that the merger had no statistically significant causal impact on key performance indicators such as Net Profit, ROAA, ROAE, and EPS. Event-study estimates reinforce this finding, revealing no consistent or sustained post-merger performance effects, aside from a temporary ROE decline in the 4th pre-merger year, and then it rises. Correlation analysis indicates strong interdependence among profitability indicators (NP, ROAA, ROAE) and moderate connection with EPS. Trend analysis reveals that while merged firms do not experience notable causal gains, they demonstrate greater financial stability and lower volatility, particularly during market disruptions such as the COVID-19 period, compared to non-merged firms. Overall, the evidence suggests that mergers in the automobile industry provide strategic stability rather than measurable short-term profitability improvements.

Keywords: Automobile Firms, Difference-in-Difference Analysis, Event Study, Mergers and acquisitions.

Introduction

A Difference-in-Differences (DiD) test is a quasi-experimental method for estimating the causal effect of a treatment by comparing changes in outcomes over time between a group that received the treatment (treatment group) and a group that did not (control group). It works by calculating the "before-and-after" change in the treatment group and subtracting the "before-and-after" change in the control group to account for external factors that affect both groups, assuming their trends would have been parallel without the treatment.Mergers and acquisitions (M&A) have long been examined as strategic tools for achieving growth, improving efficiency, and enhancing firm performance. Early empirical work demonstrated that mergers are often driven by expectations of synergy creation, including cost reductions, scale economies, and market power gains (Trautwein, 1990). However, evidence on whether these expected gains translate into actual financial improvements remains mixed. For instance, Healy, Palepu, et.al. (1992) found that post-merger firms often experience improved asset productivity, although profitability outcomes may not change significantly. Similarly, Andrade, Mitchell, and Stafford (2001) noted that while mergers typically generate positive value for target firms, acquiring firms frequently show neutral or insignificant performance effects. Studies with a financial–performance focus further highlight that accounting-based outcomes such as ROA, ROE, and net profit often fail to show consistent improvement following mergers, suggesting that short-term gains may be limited (Ghosh, 2001). Event-study literature also suggests that stock market reactions to mergers tend to anticipate long-term synergies, but realized operational benefits depend heavily on integration quality and industry conditions (Campbell, Ghosh, & Sirmans, 1998).In developing economies, merger outcomes exhibit additional complexity due to structural inefficiencies, regulatory constraints, and varying levels of market competition. Research focused on India, for example, finds that M&A activity is often motivated by survival, capacity expansion, and diversification rather than efficiency improvements alone (Beena, 2000). Studies on Indian manufacturing and automobile firms reveal that post-merger financial performance frequently remains statistically insignificant, despite strategic advantages such as enhanced market presence and operational consolidation (Bhaumik & Selarka, 2012). This aligns with global findings that synergy realization is neither immediate nor guaranteed, and that profitability indicators may not accurately capture long-term integration benefits (King et al., 2004). Event-study approaches also emphasize the importance of validating the parallel trends assumption when evaluating causal effects; deviations in pre-merger trends can render DID estimates unreliable (Wing, Simon, & Bello-Gomez, 2018). Overall, the literature suggests that while mergers can stabilize firms and strengthen strategic positioning, their short-term financial impact is often limited, context-dependent, and sensitive to methodological assumptions.

Objectives

The goal is to determine if the merger had a causal effect on profitability, as measured by selected financial ratios: ROAA, ROAE, Average NP, and Average EPS. The DID estimate will tell us the additional change in these metrics for the merged automobile firms that cannot be explained by general economic trends or pre-existing differences between the two groups (treated and controlled group).

Research Methodology

For the long-term impact on shareholders' wealth using accounting measures, we have taken both pre- and post-merger data of merged and non-merged automobile companies data. For comparing the performance of automobile companies we have taken 5 years' post-merger data, but to understand if the merger caused an improvement or decline, we have also taken 5 years' pre-merger performance data as a baseline. We have taken Net Profit ratio, Return on Asset, Return on Equity and Earning per Share Ratio for our study. For example, a firm's ROA might increase after a merger, but if its ROA was already higher than the industry average before the merger, the merger's impact may be less significant than it first appears. We have taken 2016 as merger year. We have taken 2 merged companies (Bharat Forge and Nissan Motors) and 6 non-merged companies (Maruti Suzuki India, Hindustan Motors, Force Motors, General Motors, Eicher Motors, BMW Industries). For selecting the non-merged companies, we have first remove the merged companies in recent years, then on the basis of data availability, companies are selected for the further analysis. We have calculated Correlations between Financial Ratios to know the correlation between different outcome variables (for example, the correlation between ROAA and ROAE) to see if they move together. A high positive correlation would confirm that the automobile companies have become more profitable in one way (ROAA) also become more profitable in another (ROAE). We have done DID analysis, for which we have used panel data that is, financial ratio data for the automobile companies over 10 years' time period. The Pearson Correlation test is conducted between ROAA and ROAE, ROAA and Average NP, ROAA and Average EPS, ROAE and Average NP, ROAE and Average NP, Average EPS and Average NP variables of the Automobile Companies' data used for the analysis. The Formal Test of the Parallel Trends is conducted. The insignificant "Treated" coefficient is a good sign, but the way to test this assumption is using an Event Study called "leads and lags" in DID is also conducted. The coefficients on all pre-merger interaction terms (Treated X Year-2, Treated X Year-1) must be statistically insignificant. If they are insignificant, the parallel trends assumption holds. If any pre-period term is significant, the analysis is invalid. This method allows to formally plot the dynamic treatment effects over time The findings have broader financial and economic implications i.e. whether the automobile companies' mergers have led to improved profitability and stability.

Table No: - 1: Variables Description: -

Net Profit Margin	The net percentage of profit on total income	A measure of a bank's bottom line
Return on Asset	Ratio of net profit on total asset	A key profitability measure
Return on Equity	Profit after tax on share holders' fund	A key profitability measure
Earnings per Share	Return of profit to shareholders per share.	An indicator of profitability on a per-share basis.

Source: Compiled by Authors

Difference-in-Differences (DID) To isolate the causal impact of the 2016 merger from general economic trends or industry-wide growth. The DID estimator (β_3) was calculated for Net Profit, ROA, ROE, and EPS to see if the merger caused a significant change unique to the treated automobile firms.

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Pearson Correlation: To confirm that different profitability indicators (ROA, ROE, NP, EPS) move together consistently.
Event Study (Leads): To validate the Parallel Trends Assumption, ensuring the treated and control firms were following similar paths before the merger. "Leads" (t-4, t-3, t-2) were tested; for Average NP, ROAA, ROAE and Average EPS.
Event Study (Lags) To identify the timing and duration of any post-merger impact (immediate vs. long-term). "Lags" (t+0 to t+4) were tested; for Average NP, ROAA, ROAE and Average EPS and showed.
Analysis: Difference-in-Differences (DID) Analysis

Table No.: 2 Table of Coefficients of Dependent Variable Average Net Profit (NP)

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.868	2.440		1.995	.050
	TREATED	6.544	4.879	.214	1.341	.184
	POST	1.856	3.450	.070	.538	.592
	DID	-3.184	6.900	-.080	-.461	.646

a. Dependent Variable: NP

In the above table, the row for the DID variable will show its B (unstandardized coefficient) and its Sig. (p-value). The magnitude of the coefficient tells the size of the effect. The B value in the DID estimator, and the Sig. value indicates the statistical significance of the merger's effect. If the Sig. value is less than 0.05, then it suggests a significant effect, but in the above case the Sig. value is 0.646 which is more 0.05 so, it is insignificant.The Treated coefficient (β_1) indicates the pre-merger difference in the Dependent Variable (Average NP) between the treated and control groups. A P-value less than 0.05 is generally considered significant. P-value is 0.184 which is insignificant. The treated firms had slightly higher Average NP than control firms before the event, but the difference is statistically insignificant.The Post coefficient (β_2) shows the average change in the Dependent Variable (Average NP) from the pre-merger to the post-merger period for the control group. A p-value more than 0.05 indicates that the effect is statistically insignificant whereas p-value 0.592 indicates insignificant. The Average Net Profit value increased insignificantly for all firms (treated + control) after the event period. So, there is an industry-wide negative trend in Average NP, related to treatment.

Table No.: 3 Table of Coefficients of Dependent Variable Return on Average Asset (ROAA)

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.354	2.885		2.549	.013
	TREATED	.692	5.769	.019	.120	.905
	POST	1.757	4.079	.057	.431	.668
	DID	-3.579	8.159	-.077	-.439	.662

a. Dependent Variable: ROAA

In the above table, the row for the DID variable will show its B (unstandardized coefficient) and its Sig. (p-value). (β_3) is the DID estimator. This is the most important coefficient, as it measures the causal effect of the merger on the dependent variable of the merged automobile companies. The B value in the DID estimator, and the Sig. value indicates the statistical significance of the merger's effect. If the Sig. value is less than 0.05, then it suggests a significant effect, but in the above case the Sig. value is 0.662 which is more 0.05 so, it is insignificant. The Treated coefficient (β_1) indicates the pre-merger difference in the Dependent Variable (ROAA) between the treated and control groups. A P-value less than 0.05 is generally considered significant. P-value is 0.905 which is insignificant, the groups were statistically similar before the event and supports the parallel trend assumption (a good sign in DID). The Post coefficient (β_2) shows the average change in the Dependent Variable (ROAA) from the pre-merger to the post-merger period for the control group. A p-value more than 0.05 indicates that the effect is statistically significant whereas p-value 0.668 indicates insignificant. A significant positive value (1.757) suggests that overall, ROAA improved after the event period. This might reflect general market/industry-wide improvements.

Table No.: 4 Coefficients of Dependent Variable Return on Average Equity (ROAE)

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.033	2.429		7.422	.000
	TREATED	3.390	4.859	.106	.698	.487
	POST	-9.205	3.436	-.333	-2.679	.009
	DID	3.074	6.872	.074	.447	.656

a. Dependent Variable: ROAE

In the above table, the row for the DID variable will show its B (unstandardized coefficient) and its Sig. (p-value). The B value in the DID estimator, and the Sig. value indicates the statistical significance of the merger's effect. If the Sig. value is less than 0.05, then it suggests a significant effect, but in the above case the Sig. value is 0.656 which is more 0.05 so, it is insignificant.The Treated coefficient (β_1) indicates the pre-merger difference in the Dependent Variable (ROAE) between the treated and control groups. A P-value less than 0.05 is generally considered significant. P-value is 0.487 which is insignificant. The Treated firms had slightly higher ROAE than control firms before the event, but the difference is statistically insignificant. This indicates no significant pre-event differences, supporting the parallel trend assumption in DID. The Post coefficient (β_2) shows the average change in the Dependent Variable (ROAE) from the pre-merger to the post-merger period for the control group. A p-value less than 0.05 indicates that the effect is statistically significant whereas p-value 0.009 indicates highly significant. The ROAE increased substantially for all firms (treated + control) after the event. This reflects an industry-wide or market-wide improvement in return on equity post-event.

Table No.: 5 Table of Coefficients of Dependent Variable Average Earnings per Share (EPS)

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	70.025	28.573		2.451	.017
	TREATED	-48.509	57.147	-.132	-.849	.399
	POST	67.587	40.409	.212	1.673	.099
	DID	-70.571	80.818	-.146	-.873	.385

a. Dependent Variable: Average EPS

In the above table, the row for the DID variable will show its B (unstandardized coefficient) and its Sig. (p-value). The B value in the DID estimator, and the Sig. value indicates the statistical significance of the merger's effect. If the Sig. value is less than 0.05, then it suggests a significant effect, but in the above case the Sig. value is 0.385 which is more 0.05 so, it is insignificant.The Treated coefficient (β_1) indicates the pre-merger difference in the Dependent Variable (Average EPS) between the treated and control groups. A P-value more than 0.05 is generally considered insignificant. The Treated firms had

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negative Average EPS than control firms before the event, but the difference is statistically insignificant. This supports the parallel trend assumption (treated and control groups were similar before the event). The Post coefficient (β_2) shows the average change in the Dependent Variable (Average EPS) from the pre-merger to the post-merger period for the control group. A p-value is slightly more than 0.05 i.e., 0.099 indicates that the effect is statistically insignificant. The Average EPS value increased significantly for all firms (treated + control) after the event. This indicates an industry-wide or market-wide positive improvement in Average EPS during the post-event period. This also indicates a strong time effect, reflecting industry-wide or macroeconomic improvements in Average EPS.

Correlation Analysis

The Pearson Correlation test is conducted between ROAA and ROAE, ROAA and Average NP, ROAA and Average EPS, ROAE and NP, ROAE and Average NP, Average EPS and Average NP variables of the Automobile Companies' data used for the analysis.

Table No.: 6 Correlations between ROAA and ROAE

		ROAA	ROAE
ROAA	Pearson Correlation	1	.510**
	Sig. (2-tailed)		.000
	N	80	80
ROAE	Pearson Correlation	.510**	1
	Sig. (2-tailed)	.000	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

The Pearson Correlation test result value is 0.510, as the significant level is more than 0.01 so, this means there's a moderate positive and statistically significant correlation between ROAA and ROAE.

Table No.: 7 Correlations between Average NP and ROAA

		Average NP	ROAA
Average NP	Pearson Correlation	1	.785**
	Sig. (2-tailed)		.000
	N	80	80
ROAA	Pearson Correlation	.785**	1
	Sig. (2-tailed)	.000	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

The significant value is 0.785, as the significant level is more than 0.01 so, this means there's strong positive and statistically significant correlation between ROA and NP.

Table No.: 8 Correlations between Average ROA and Average EPS

		Average ROA	Average EPS
Average ROA	Pearson Correlation	1	.476**
	Sig. (2-tailed)		.000
	N	80	80
Average EPS	Pearson Correlation	.476**	1
	Sig. (2-tailed)	.000	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.476 which is more than 0.01 so, this means there's a moderate positive and statistically significant correlation between ROAA and EPS.

Table No.: 9 Correlations between Average ROE and Average NP

		Average ROE	Average NP
Average ROE	Pearson Correlation	1	.595**
	Sig. (2-tailed)		.000
	N	80	80
Average NP	Pearson Correlation	.595**	1
	Sig. (2-tailed)	.000	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.595 that is more than significance level 0.01 so, this means there's a moderate positive and statistically significant correlation between ROAE and NP.

Table No.: 10 Correlations between average EPS and ROAE

		Average EPS	ROAE
Average EPS	Pearson Correlation	1	.349**
	Sig. (2-tailed)		.002
	N	80	80
ROAE	Pearson Correlation	.349**	1
	Sig. (2-tailed)	.002	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

The significant value is 0.349 which is more than significance level 0.01 so, this means there's a low positive and statistically significant correlation between ROE and EPS.

Table No.: 11 Correlations between average EPS and average NP

		Average EPS	Average NP
Average EPS	Pearson Correlation	1	.339**
	Sig. (2-tailed)		.002
	N	80	80
Average NP	Pearson Correlation	.339**	1
	Sig. (2-tailed)	.002	
	N	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

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The result of Pearson Correlation is 0.339, as the significant level is more than 0.01 so, this means there's low positive and statistically significant correlation between NP and EPS.The Pearson Correlation test is conducted between ROAA and ROAE, ROAA and average NP, ROAA and average EPS, ROAE and average NP, ROAE and average NP, average EPS and average NP variables of the Automobile Companies' data used for the analysis.

Table No.: 12 Correlations between ROAA and ROAE

		ROAA	ROAE
ROAA	Pearson Correlation	1	.983**
	Sig. (2-tailed)		.000
	N	10	10
ROAE	Pearson Correlation	.983**	1
	Sig. (2-tailed)	.000	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.983, so, this means there's a highly positive and statistically significant correlation between ROAA and ROAE.

Table No.: 13 Correlations Between ROAE and Average NP

		ROAE	Average NP
ROAE	Pearson Correlation	1	.963**
	Sig. (2-tailed)		.000
	N	10	10
Average NP	Pearson Correlation	.963**	1
	Sig. (2-tailed)	.000	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.963, so, this means there's a highly positive and statistically significant correlation between ROAE and average Net Profit.

Table No.: 14 Correlations between Average EPS and ROAE

		Average EPS	ROAE
Average EPS	Pearson Correlation	1	.761*
	Sig. (2-tailed)		.010
	N	10	10
ROAE	Pearson Correlation	.761*	1
	Sig. (2-tailed)	.010	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

The result of Pearson Correlation is 0.761, as the significant level is more than 0.01 so, this means there's strong positive and statistically significant correlation between Average EPS and ROAE.

Table No.: 15 Correlations between Average NP and ROAA

		Average NP	ROAA
Average NP	Pearson Correlation	1	.979**
	Sig. (2-tailed)		.000
	N	10	10
ROAA	Pearson Correlation	.979**	1
	Sig. (2-tailed)	.000	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.979, so, this means there's a highly positive and statistically significant correlation between ROAA and average Net Profit.

Table No.: 16 Correlations between Average EPS and ROAA

		Average EPS	ROAA
Average EPS	Pearson Correlation	1	.843**
	Sig. (2-tailed)		.002
	N	10	10
ROAA	Pearson Correlation	.843**	1
	Sig. (2-tailed)	.002	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.843, so, this means there's a strong positive and statistically significant correlation between average EPS and ROAA.

Table No.: 17 Correlations between Average NP and Average EPS

		Average NP	Average EPS
Average NP	Pearson Correlation	1	.767**
	Sig. (2-tailed)		.010
	N	10	10
Average EPS	Pearson Correlation	.767**	1
	Sig. (2-tailed)	.010	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

As the significant level is 0.787, so, this means there's strong positive and statistically significant correlation between average Net Profit and average EPS.

Visualizing Trends

Graph No. 1: Shows Average Net profit of Merged Automobile Companies and Non-Merged Companies

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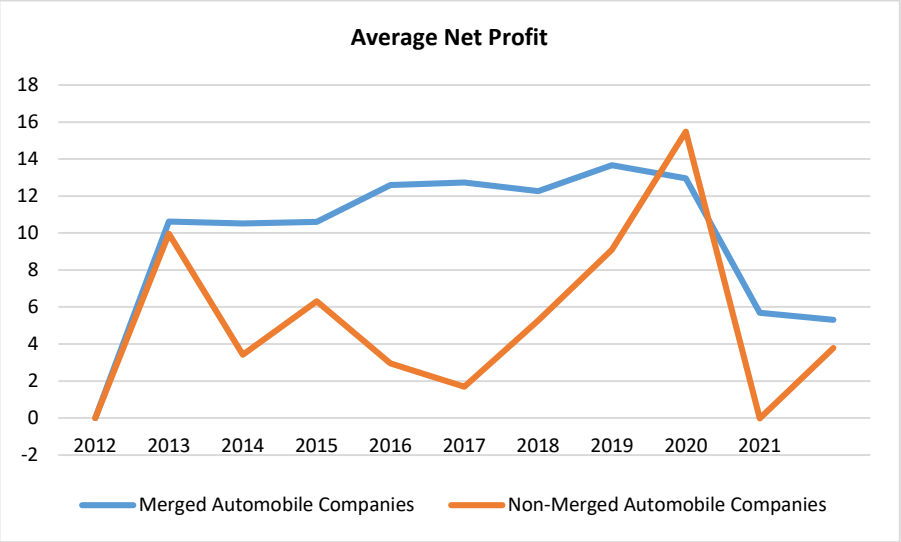
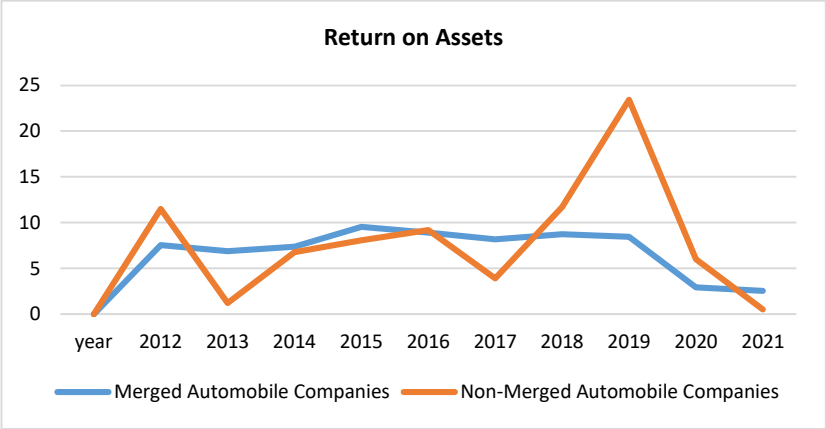


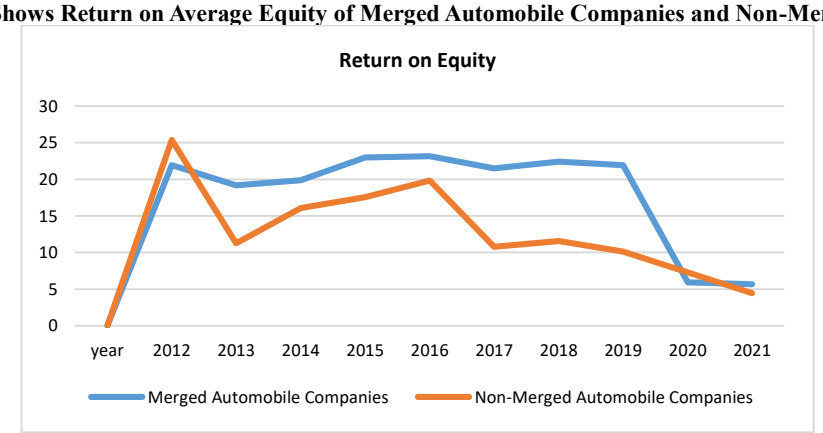
The Merged companies average net profit remained consistently stable and higher compared to non-merged firms for most of the period. A slight dip is observed after 2020, likely due to the Covid pandemic-related disruptions, but the decline is less severe than for non-merged firms. Overall, merged firms show resilience and steady profitability. The non-merged companies' trend is highly volatile and there are large fluctuations in profits year to year. From 2012 to 2014, profits rose sharply, then fell and fluctuated till 2017. A strong growth surge occurred between 2017 and 2020, peaking in 2020, surpassing merged firms. However, profits collapsed sharply after 2020, even turning negative around 2021, before a mild recovery in 2022.The Merged companies show stability and sustained growth with smaller variations which is suggesting that mergers likely enhanced operational efficiency and financial strength. The non-merged companies show more volatility, indicating greater exposure to market shocks and less operational synergy. Post-2020, both categories experienced declines, but merged firms performed relatively better, hinting at their stronger resilience during economic downturns (e.g., the pandemic period).

Graph No. 2: Shows Return on Average Assets of Merged Automobile Companies and Non-Merged Companies



The ROAA of merged companies shows a steady and moderate trend throughout the period. From 2012 to 2016, ROAA remained fairly stable, ranging between 6–10%, suggesting consistent operational efficiency. A slight decline is observed after 2017, but the drop is gradual rather than sharp. By 2021, the ROAA fell to around 2–3%, reflecting the impact of market downturns and possibly the post-pandemic slowdown. The ROAA of non-merged firms is highly volatile, showing sharp rises and falls across years. After an initial spike in 2012, it plunged in 2013, recovered again by 2015, and then experienced fluctuations until 2017. A significant surge occurred in 2019, peaking around 24%, indicating a short-term performance boom. However, this was followed by a drastic fall after 2020, dropping to almost zero or negative levels by 2021.Merged companies demonstrate consistent and stable returns, even if modest, suggesting that mergers may have led to better asset utilization and financial discipline. Non-merged companies, while occasionally achieving higher peaks, show greater instability, implying less efficient or inconsistent use of assets. Post-2019, both groups show declining returns, but the merged firms experienced a smaller fall, suggesting greater resilience during economic challenges such as the pandemic.

Graph No. 3: Shows Return on Average Equity of Merged Automobile Companies and Non-Merged Companies



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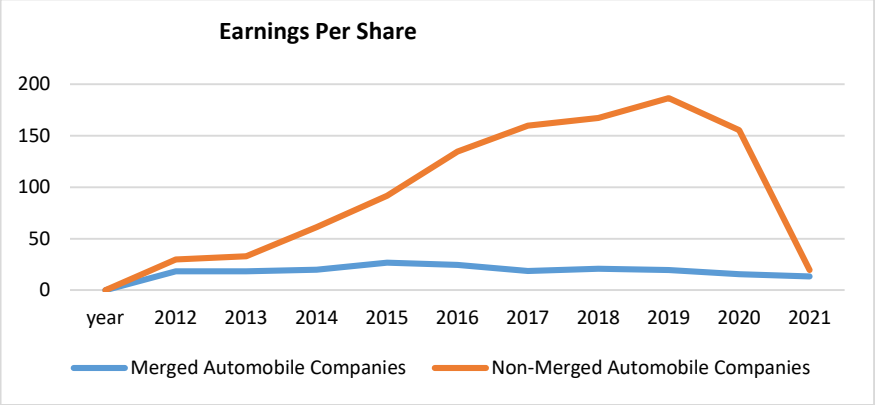
The ROAE of merged companies shows consistency and long-term stability. After an initial rise in 2012, the ROAE remained consistently strong between 2013 and 2018, fluctuating around 20–24%, showing efficient capital management and profitability. However, from 2019 onwards, there is a declining trend, dropping sharply after 2020, likely due to the economic slowdown and pandemic impact. Despite this decline, merged companies maintained better average performance for most of the period compared to non-merged firms.

The ROAE of non-merged companies shows greater volatility and inconsistency. A significant peak is observed in 2012 (around 25%), surpassing merged companies, but this is followed by a sharp drop in 2013. Between 2014 and 2016, the returns improved moderately, reaching about 20% in 2016, but then declined continuously thereafter. From 2017 to 2021, ROAE steadily decreased, reaching its lowest point in 2021 (around 5%), indicating weakening profitability and shareholder returns.

Merged companies maintained higher and more stable ROAE than non-merged firms across most years, suggesting that mergers may have contributed to improved efficiency and strategic resource utilization. Non-merged companies experienced sharp fluctuations, indicating exposure to market pressures and less effective equity management. After 2019, both groups saw declining returns, but merged companies showed slower deterioration, implying stronger resilience during economic stress.

Graph No. 4: Shows Average Earning per Shares of Merged Automobile Companies and Non-Merged Companies



The average EPS of merged companies remained relatively stable and low throughout the period. From 2012 to 2016, there was a slight increase, peaking modestly around 2016. After that, average EPS declined gradually but remained within a narrow range, showing steady but limited growth. This stability suggests consistent performance, though without major spikes, indicating a focus on maintaining balance post-merger rather than aggressive expansion. The average EPS trend for non-merged companies shows significant growth and volatility. From 2012 to 2015, average EPS increased sharply and continued to rise steeply until 2019, where it peaked around 190 which is far exceeding from the merged firms. This indicates that non-merged companies experienced strong profitability and shareholder returns during this period. However, after 2019, average EPS dropped drastically, falling almost to the level of merged companies by 2021, reflecting a major decline in profitability.Merged companies show steady but moderate average EPS, indicating stable earnings and possibly better long-term risk management. Non-merged companies achieved high growth in average EPS but were highly volatile, with a severe drop after 2019, highlighting less sustainability in their performance. The drastic fall post-2020 shows that merged firms were more resilient during adverse conditions, while non-merged firms faced significant earnings erosion. While the causal impact on profitability remains statistically flat, the trend analysis reveals a critical strategic advantage of enhanced financial resilience. Merged firms like Bharat Forge and Nissan Motors demonstrated a consistent ability to maintain steadier earnings and asset utilization compared to the extreme volatility seen in non-merged firms. This "buffer effect" was particularly evident during the post-2020 COVID-19 pandemic period, where merged entities experienced less severe declines and faster stabilization than independent competitors, who faced sharp profit collapses and even negative returns.

Mixed Model and Event Study

Table No.:18 Table showing Fixed Effects

Type III Tests of Fixed Effects[a]				
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	79	21.324	.000

a. Dependent Variable: EPS.

This means the average EPS, when all predictors = 0, is significantly different from zero. The p = 0.000 (highly significant). The intercept is statistically significant at the 1% level.

Table No.: 19 Table of Pre-Merger Lead

Interaction Term (Lead)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Parallel Trends Result
LLm4	t=-4	2012	-9.014	0.912	In-Significant
LLm3	t=-3	2013	-11.323	0.890	In-Significant
LLm2	t=-2	2014	-32.752	0.689	In-Significant

a. Dependent Variable: EPS. b. This parameter is set to zero because it is redundant.The baseline period is bft=-1 (Year 2015). Examination of the periods t=-4, -3, -2 were done and the same is shown in the following table.

Conclusion on Parallel Trends

The Parallel Trends Assumption is satisfied. Since all pre-merger lead interaction terms (t = –4, –3, –2) are statistically insignificant, there is no evidence that treated and control firms had different outcome trajectories prior to the 2016 merger. This indicates that both groups moved in parallel before the treatment, making the Difference-in-Differences and Event-Study estimates valid for causal interpretation. The insignificance of all pre-merger lead coefficients (LLm4, LLm3, LLm2) confirms that the outcome variable showed no differential trend between treated and control firms before the merger. Therefore, the Parallel Trends Assumption holds, and the DID/Event-Study framework is econometrically appropriate.

Table No.: 20 Table of Post-Merger Lags (Causal Effect)

Interaction Term (Lag)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Interpretation
LL0	t=0	2016	-88.945	0.280	Insignificant
LLp1	t=+1	2017	-106.293	0.197	Insignificant
LLp2	t=+2	2018	-112.516	0.172	Insignificant
LLp3	t=+3	2019	-127.933	0.122	Insignificant
LLp4	t=+4	2020	-102.377	0.214	Insignificant

a. Dependent Variable: EPS. b. This parameter is set to zero because it is redundant.

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Conclusion on Causal Effect (Average EPS)

This means average EPS tends to decline for the treated firms relative to control firms after the merger. The event-study analysis shows that all post-merger lag coefficients (t = 0 to t = +4) are negative, indicating a downward movement in average EPS for treated firms following the merger. However, none of these coefficients are statistically significant (p > 0.05), suggesting that the merger did not produce any measurable causal effect on average EPS in any post-merger year. Therefore, the merger does not appear to have improved or deteriorated average EPS in a statistically meaningful manner.

Table No.:21 Table showing Fixed Effects

Type III Tests of Fixed Effects[a]				
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	79	21.008	.000

a. Dependent Variable: ROAA.

The mean value of ROAA (when all predictors = 0) is significantly different from zero. The p = .000 which means the intercept is statistically significant at the 1% level.

Table No.: 22 Table of Pre-Merger Lead

Interaction Term (Lead)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Parallel Trends Result
LLm4	t=-4	2012	-9.500	0.227	Insignificant
LLm3	t=-3	2013	-1.621	0.836	Insignificant
LLm2	t=-2	2014	-5.907	0.452	Insignificant

a. Dependent Variable: ROAA. b. This parameter is set to zero because it is redundant.

The event-study (lead) analysis for ROAA indicates that all pre-merger interaction terms LLm4 (2012), LLm3 (2013), and LLm2 (2014) are statistically insignificant (p > 0.05). This confirms that treated and control firms followed similar ROAA trends prior to the 2016 merger. Therefore, the Parallel Trends Assumption is satisfied for ROAA, validating the use of Difference-in-Difference estimation.

Table No.: 23 Table Post-Merger Lags (Causal Effect)

Interaction Term (Lag)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Interpretation
LL0	t=0	2016	-8.107	0.302	Insignificant
LLp1	t=+1	2017	-3.945	0.615	Insignificant
LLp2	t=+2	2018	-9.952	0.206	Insignificant
LLp3	t=+3	2019	-18.748	0.019	Insignificant
LLp4	t=+4	2020	-4.211	0.591	Insignificant

a. Dependent Variable: ROAA. b. This parameter is set to zero because it is redundant.

Conclusion on Causal Effect (ROAA) The event-study (lag) analysis reveals that the merger does not produce a consistent or sustained causal impact on ROA. Although the coefficient for t+3 (2019) is statistically significant and negative (B = –18.748, p = 0.019), indicating a one-year decline in ROAA for treated firms, all other post-merger years (t = 0, t+1, t+2, t+4) show insignificant effects. Overall, the evidence does not support a stable or persistent improvement or deterioration in ROAA attributable to the merger, with the significant effect in 2019 appearing isolated rather than systematic.

Table No.:24 Table showing Fixed Effects

Type III Tests of Fixed Effects[a]				
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	79	22.336	.000

a. Dependent Variable: NP.

The mean value of NP (when all predictors = 0) is significantly different from zero. p = .000 which means the intercept is statistically significant at the 1% level.

Table No.: 25 Table of Pre-Merger Lead

Interaction Term (Lead)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Parallel Trends Result
LLm4	t=-4	2012	-5.956	0.383	In-Significant
LLm3	t=-3	2013	-1.021	0.881	In-Significant
LLm2	t=-2	2014	-3.221	0.637	In-Significant
LLm1	T=-1	2015	-1.197	0.861	In-Significant

a. Dependent Variable: NP.b. This parameter is set to zero because it is redundant.

The baseline period is bft=-1 (Year 2015). Examination of the periods t=-4, -3, -2 were done and the same is shown in the following table.

Conclusion on Parallel Trends

The Parallel Trends Assumption is strongly validated. Since the p-values for all three pre-merger interaction terms (0.383, 0.881, and 0.637) are much greater than the standard threshold of 0.05, therefore, the conclusion is that prior to the 2016 merger, the profitability trend in average Net Profit Ratio for the merged automobile companies was not statistically different from the profitability trend of their non-merged counterparts. This confirms that any change observed after the merger can safely be attributed to the merger event itself, and not to differing pre-existing trajectories.

Table No.: 26 Table of Post-Merger Lags (Causal Effect)

Interaction Term (Lag)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Interpretation
LL0	t=0	2016	-2.848	0.967	Insignificant
LLp1	t=+1	2017	-2.855	0.675	Insignificant
LLp2	t=+2	2018	-6.07	0.374	Insignificant
LLp3	t=+3	2019	-10.825	0.115	Insignificant
LLp4	t=+4	2020	2.767	0.685	Insignificant

a. Dependent Variable: NP.b. This parameter is set to zero because it is redundant.

Conclusion on Causal Effect (Average NP): All the post-merger lags (LL0, LLp1, LLp2, LLp3, LLp4) are all insignificant. Since Parallel Trends holds, the DID estimator correctly represents the causal effect of the merger. Even though LLp3 (2019) shows the largest negative effect (–10.825), the p-value = 0.115 is still insignificant. This confirms that treated and control firms followed similar trends before the merger. Therefore, the Parallel Trends Assumption is satisfied, and the DID estimation is valid. However, all post-merger lag coefficients remain insignificant, indicating that the merger did not produce a statistically measurable effect on Net Profit in any year after 2016.

On the basis of the findings, it can be reported that the Parallel Trends Assumption holds strongly, validating the causal identification strategy.

The baseline period is bft=-1 (Year 2015). Examination of the periods t=-4, -3, -2 were done and the same is shown in the following table.

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Table No.:27 Table showing Fixed Effects

Type III Tests of Fixed Effects[a]				
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	79.00	2.169	.141

a. Dependent Variable: ROAE.

The average ROE (when all predictors = 0) is not significantly different from zero. The p-value = 0.141 (greater than 0.05). The intercept is statistically insignificant.

Table No.: 28 Table of Pre-Merger Lead

Interaction Term (Lead)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Parallel Trends Result
LLm4	t=-4	2012	-19.783	0.004	Significant
LLm3	t=-3	2013	-8.500	0.211	In-Significant
LLm2	t=-2	2014	-3.221	0.073	In-Significant

The earliest pre-merger lead (t = –4, year 2012) is statistically marginally significant (p = 0.004), the treatment and control firms were not following similar trends before the merger. This violates the parallel trends assumption in t=-4 only, for the validity of a Difference-in-Difference (DID) causal interpretation. Although the leads for t = –3 and t = –2 are insignificant, the presence of a significant pre-trend indicates that the DID estimates for this variable should be interpreted with caution**.**

Table No.: 29 Table of Post-Merger Lags (Causal Effect)

Interaction Term (Lag)	Relative Year (t)	Actual Year	Estimate (Effect Size)	Sig. (p-value)	Interpretation
LL0	t=0	2016	-15.92	0.021	Insignificant
LLp1	t=+1	2017	-8.69	0.201	Insignificant
LLp2	t=+2	2018	-9.506	0.163	Insignificant
LLp3	t=+3	2019	-8.091	0.234	Insignificant
LLp4	t=+4	2020	-2.176	0.748	Insignificant

a. Dependent Variable: ROE.

b. This parameter is set to zero because it is redundant.

Conclusion on Causal Effect (ROE)

The event study reveals that the merger had a significant negative effect on ROAE in the merger year (2016), reducing ROAE by approximately 15.9 points. However, from 2017 to 2021, the effects remained negative but statistically insignificant, suggesting that the initial shock did not lead to sustained long-term deterioration in ROAE. Therefore, the merger had a short-term adverse profitability impact, but no strong evidence of lasting harm to ROAE in the subsequent years.

"Leads" (t-4, t-3, t-2) were tested; for average NP, ROAA, and average EPS, these were insignificant, proving the groups were statistically similar before 2016.

"Lags" (t+0 to t+4) showed that while average EPS and average NP declined for treated firms, the changes were not statistically significant in any specific year. It is important to note an important methodological point regarding Return on Equity (ROE). The parallel trends assumption was strongly satisfied for Net Profit, ROAA, and EPS but it was statistically violated for the ROE metric at the t = -4 lead interaction (p = 0.004). This indicates that the treatment and control groups were not following identical trajectories for this specific ratio prior to the 2016 merger; rendering standard DID causal interpretations for ROE less reliable. To address this in future research, the application of the Synthetic Control Method is recommended to construct a more accurate counterfactual for equity-based performance.

General conclusion on Causal Effects

The mergers in the Indian automobile sector did not yield immediate or statistically significant causal improvements in profitability; they acted as a vital mechanism for strategic stability. The Difference-in-Differences (DID) results for Net Profit, ROAA, and EPS consistently showed that the parallel trends assumptions were accepted, but the post-merger causal effects remained insignificant across these metrics. This suggests that the expected financial synergies, such as immediate jumps in earnings or asset productivity, were not realized in the short term, aligning with broader literature that finds realized operational benefits often depend on long-term integration quality. This explains the fact that the statistical "insignificance" is not a failure of the study, but a finding that mergers in this sector do not drive immediate financial gains.

The statistically insignificant Difference-in-Differences (DID) coefficients for Net Profit, ROAA, and EPS should not be viewed as a lack of finding, but rather as evidence that Indian automobile mergers are primarily driven by survival and consolidation rather than immediate efficiency improvements. This suggests that the expected financial synergies, such as rapid jumps in earnings or asset productivity, are not realized in the short term within this sector. Such a result aligns with the observations of Beena (2000), who noted that M&A activity in the Indian manufacturing context is often a response to internal restructuring and liberalized policies rather than a pursuit of immediate performance gains.

Limitation of the study

The study uses only two merged firms (Bharat Forge and Nissan Motors) (merged in 2016) compared to six non-merged firms. This small "treated" group may limit the generalizability of the findings. The Parallel Trends Assumption holds strongly for average Net Profit, ROAA, and average EPS. These three metrics provide a consistent and valid picture of the merger's impact but for ROE, pre-existing marginally differences in pre-merger period made causal inference impossible with DID so further research can use Synthetic Control Method to investigate this specific ratio.

Conclusion

The Mergers and acquisitions (M&A) may contribute to financial stability and consistent profitability. The non-merged firms may achieve high profits in boom years but face greater risks and instability during adverse conditions. The Mergers and acquisitions tend to enhance long-term stability and asset efficiency. Overall, merged automobile companies appear to maintain sustainable and balanced performance, while non-merged firms display instability despite occasional high returns. The Merged automobile companies achieved sustained and high returns on equity then the non-merger automobile companies during the merger period merger, reflecting the benefits of consolidation and synergy from mergers. Overall, mergers appear to enhance long-term shareholder value and financial strength compared to companies that remained independent. The Merged automobile companies maintained steady and predictable earnings, reflecting consistent financial management post-merger. The non-merged automobile companies showed short-term gains but long-term instability, with a steep EPS decline after 2019. Overall, mergers appear to contribute to financial stability and resilience, while non-merged firms, though initially more profitable, are more vulnerable to market fluctuations.

The financial performance analysis of merged and non-merged automobile companies, as illustrated through the four indicators i.e. Average Net Profit, Return on Average Assets (ROAA), Return on Average Equity (ROAE), and Average Earnings Per Share (EPS) has reveals clear contrasts in profitability trends, stability, and resilience over the period 2012–2021. Across all parameters, merged automobile companies exhibit consistent

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and stable performance with moderate growth, reflecting the positive impact of mergers in achieving operational efficiency, better resource utilization, and financial sustainability. Their profitability indicators, though not exceptionally high, remain steady and less volatile, demonstrating long-term stability and resilience, particularly during adverse economic periods such as the post-2020 downturn. In contrast, non-merged automobile companies show high short-term gains but significant volatility across all metrics. Their profits, returns, and earnings per share peaked notably between 2017 and 2019, but experienced a sharp decline thereafter, indicating vulnerability to market fluctuations and weaker financial sustainability. Overall, the comparative analysis suggests that while non-merged firms occasionally outperform merged firms in certain years, merged automobile companies maintain more sustainable and balanced financial performance, underscoring the strategic advantages of mergers and acquisitions in fostering stability and long-term value creation in the automobile sector. Further study can be done taking more number of merged firms. Another study can be done taking the other firms from other sector or different sectors. The merger did not generate measurable financial gains in profitability or shareholder wealth. The Merged firms, however, show greater stability and resilience, even though the gains are not statistically causal. The non-merged firms exhibit high volatility and sharper downturns. Mergers in the automobile sector appear to provide stability and risk reduction, but not significant causal improvement in profitability. The merger's impact is strategic and long-term rather than short-term financial.

The analysis of the automobile sector reveals that mergers act primarily as a tool for stability and resilience rather than rapid financial growth. The automobile data shows that merged firms maintain steady and predictable earnings (EPS) and consistent returns (ROAE), this finding is in contrast to several global studies. For instance, King et al. (2004) found that most acquiring firms do not see positive performance changes and often experience modest declines. This suggests the automobile sector's success in achieving "sustainable and balanced performance" might be an exception or a result of industry-specific "operational efficiency".

Efficiency remains a point of contention. The automobile sector results suggest that mergers help achieve better resource utilization. This aligns with Healy (1992), who found improvements in asset productivity and operating cash flows. However, Trautwein (1990) cautions that efficiency gains are often more of a "language for communicating" a position rather than the actual motive, which is frequently driven by managerial empire-building or private information.

The Indian context provides a unique picture. The automobile sector mergers provide a buffer against market fluctuations, particularly during downturns like the post-2020 period. Similarly, Beena (2000) observed that Indian mergers in the 1990s were often driven by internal restructuring in response to liberalized policies. However, Bhaumik and Selarka (2012) point out that in India, ownership concentration can lead to agency conflicts that may prevent mergers from improving performance, despite the potential for reduced manager-owner friction.

Additionally, the "resilience" found in the automobile sector contrasts with the high volatility seen in independent firms. Ghosh (2001) highlights that systemic risk and crises can amplify shocks in financial markets, suggesting that the "stability" provided by automobile mergers is a critical strategic advantage even if it does not result in statistically causal profit improvements.

The automobile sector study demonstrates that mergers foster long-term value and financial strength, but academic literature from Andrade (2001) and Campbell et al. (1998) suggests these results are highly dependent on industry shocks and the method of financing. Finally, the automobile sector confirms that M&A is a strategic long-term move, providing a safety net against the "steep declines" faced by non-merged competitors. The qualitative trend analysis offers a better degree of statistical view. The merged firms (like Bharat Forge and Nissan Motors) demonstrated significantly higher financial resilience compared to their non-merged counterparts. Though independent firms experienced extreme volatility and sharp profit collapses during market disruptions like the COVID-19 pandemic, merged entities maintained steadier earnings and more consistent asset utilization. Consequently, the merger's value is best interpreted not as a driver of rapid growth, but as a "safety net" that enhances long-term sustainability and risk reduction in a volatile industry like automobile.

The findings of this study offer a unique contrast to global M&A literature. The automobile sector's success in achieving "sustainable and balanced performance" post-merger is evident in the trends but it stands in partial opposition to the meta-analysis by King et al. (2004), which found that most acquiring firms do not see positive performance changes and often experience modest declines. However, the resilience and asset utilization observed here do align with Healy et al. (1992), who argued that mergers can lead to improved operational productivity even if bottom-line accounting profits do not show immediate spikes.

From a managerial perspective, these results suggest that mergers in the automobile industry should be evaluated as long-term strategic tools for risk reduction rather than short-term financial fixes. For corporate leaders and policymakers, the evidence implies that M&A provides a "safety net" against market fluctuations and systemic shocks, fostering a more sustainable organizational structure. Consequently, merger success should be measured by long-term integration success and strategic stability rather than immediate quarter-on-quarter profitability growth.

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