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Impact of Regulatory Shocks and Consolidation on the Stock Market Reactions of Previously Merged firms in the Indian Automobile and Banking Sectors

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Abstract

The study examines the short-run stock market impact of major environmental and regulatory shocks on firms that had previously undergone mergers in the automobile and banking sectors and systemic consolidation in the Indian banking sector. The study aims to determine whether markets perceived (a) regulatory shocks, i.e., the ban on >2000 cc diesel vehicles in NCR (16 December 2015) and the enforcement of BS-VI emission norms (19 February 2016) as value-destroying or stabilizing for previously merged automobile firms, and (b) the August 30, 2019 announcement of the 10 PSBs merged into four major entities as a signal of enhanced stability for previously merged banks. To test this, the study employs a ±7-day event window to analyze average abnormal returns (AAR) and cumulative average abnormal returns (CAAR), using both parametric and non-parametric statistical tests, including the t-test, Patell's test, Wilcoxon signed-rank test, Sign test, Corrado test, and BMP test. The results indicate that the market did not view these regulatory events as major shocks. The findings have implications for policymakers, bank management, and investors regarding how merger history and anticipated stability influence stock valuation during periods of structural change.

Keywords: Mergers and acquisitions; Indian banks; Automobile companies; Event study analysis; Shareholders wealth.

1. Introduction

In past years, the Indian automobile industry has undergone profound structural and regulatory changes. On one hand, firms have engaged in mergers and acquisitions; consolidating operations, combining product portfolios, and attempting to gain competitive advantage through scale and synergies. On the other hand, external regulatory shocks especially those aimed at curbing environmental pollution have increasingly shaped industry dynamics. Two landmark events exemplify this dual pressure: the ban (from 16 December 2015) on diesel vehicles above 2000 cc in the National Capital Region (NCR), and the nationwide leap to the Bharat Stage VI (BS-VI) emission norms, announced on 19 February, 2016.

The Indian government decided in early 2016 to leapfrog from BS-IV emission norms directly to BS-VI, skipping BS-V, with implementation effective from 1 April 2020. (The Indian Express). The BS-VI is considerably stricter: the new fuel (petrol/diesel) must have Sulphur content reduced to 10 ppm (from 50 ppm under BS-IV), enabling advanced exhaust after-treatment

systems (e.g., particulate filters, NOx controls) in vehicles. The transition required large investments across the auto industry: re-engineered engines, new components, updated fuel supply making compliance costly.
For the 2015 ban on diesel vehicles (> 2000 cc) in Delhi-NCR; "The ban affected registration of new diesel cars and SUVs with engine capacity above 2,000 cc" (The Indian Express). According to industry bodies, the ban led to a substantial hit: as reported by Society of Indian Automobile Manufacturers (SIAM), about 11,000 vehicles' production was lost during the ban period, translating into ~5,000 jobs affected (for NCR-centric sales and manufacturing) between Dec 2015 and April 2016. Several major automakers (especially luxury carmakers and companies heavily dependent on high-cc diesel SUVs) publicly warned that the ban threatened sales and could lead to job losses (The Indian Express; The Times of India). So, from an economic and industry-level standpoint, the ban had real and significant adverse effects on lost sales, production disruption, cost and volume losses.

This paper seeks to address that question by focusing on four automobile firms that underwent mergers between 2010 and 2015. These firms are Mahindra & Mahindra, Volkswagen (post-merger with Porsche), Ashok Leyland Limited (after its acquisition of Hinduja Tech Limited), and Fiat Chrysler Automobiles (Fiat after merger with Chrysler) are taken for analysis. To assess how their stock returns behaved around two critical events: the diesel-vehicle ban announcement in December 2015, and the enforcement of BS-VI norms in April 2020.

The Indian banking sector has undergone significant structural modifications in the last few years, particularly through a series of mergers aimed at strengthening the financial health, operational efficiency, and competitive positioning of public sector banks (PSBs). One of the most impactful consolidation initiatives occurred in 2019, when the Government of India announced the merger of 10 PSBs into four major entities, a policy decision designed to create larger, more resilient institutions capable of navigating increasing competition and systemic challenges. Among the banks that had previously undergone major mergers were "Bank of Baroda" (merged in 2019), "State Bank of India" (merged in 2017) and "Kotak Mahindra Bank" (merged in 2015). These institutions provide a unique opportunity to assess whether prior consolidation confers perceived stability or resilience in the eyes of investors when the broader banking sector is undergoing systemic restructuring.

This study evaluates the short-run impact of the August 30, 2019 consolidation announcement on the stock prices of these previously merged banks, using an event-study methodology. The core objective is to determine whether the market viewed these banks as safer or more stable relative to their peers during a period of sector-wide turmoil. "According to the efficient market hypothesis (EMH), stock prices should adjust rapidly to new information; therefore, any investor perception of enhanced stability or risk associated with these banks should manifest in abnormal stock returns around the announcement date. By examining market reaction to the PSU consolidation announcement through the lens of previously merged banks, this research contributes to a deeper understanding of investor behavior in the context of large-scale regulatory and policy-driven events."

For the purpose of the study, we have used an event-study methodology, which quantifies average abnormal returns (AAR) and cumulative average abnormal returns (CAAR) around the event windows and apply both parametric and non-parametric statistical tests to ascertain whether the regulatory events triggered any significant market reaction. By applying event-study methodology to compute abnormal returns around these announcements, this research investigates whether the market viewed these previously merged firms as resilient or exposed during periods of sector-wide change.

2. Literature Review

The success of cross-border M&As in the automobile sector often depends "on the ability of the acquiring company to integrate the target firm effectively". For example, the acquisition of Volvo by Geely was successful in part due to Geely's ability to leverage Volvo's technology and brand reputation although maintaining Volvo's autonomy (Meng & Wang, 2021) (Gao, 2015). Conversely, the Daimler-Chrysler merger failed due to cultural differences and integration challenges, highlighting the importance of cultural compatibility in cross-border M&As (Fitriani et al., 2021). The paper analyzed 100 horizontal international mergers and acquisitions in the automotive supply industry from 1986 to 2004, using event study methodology to assess stock price reactions, confirming positive shareholders' wealth effects despite the negative cross-border effect. This study on cross-border mergers in the automotive supply industry revealed that such transactions often result in positive abnormal returns for acquiring companies, particularly when the target is a subsidiary (Mentz & Schiereck, 2008). The research findings suggest that investors generally align with authors who have reported zero or positive abnormal return to shareholders in short-run around the announcement period in the US market such as (Lang et al., 1991), (Moeller et al., 2004, 2005), (Faccio et al., 2006), (Masulis et al., 2007), (Asquith, 1983), (Schwert, 2000). Many studies reported a negative abnormal return to shareholders in the short run around the announcement period in the US market, (Franks et al., 1991), (Healy et al., 1992)". M&As in the automobile sector as value-creating events in the short term. (Sachdeva et al, 2015) found that acquiring company shareholders generated negative but insignificant returns post-merger announcement in the short run. Also, acquiring companies' shareholders receive a substantial significant and positive average abnormal return around the announcement day of merger and acquisition only.

Numerous studies have employed event-study methodology "to examine the impact of mergers and acquisitions (M&A) on stock returns, providing context for analyzing the market reaction to consolidation announcements in the banking sector. Event studies typically measure abnormal returns (AR) and cumulative abnormal returns (CAR) around announcement dates to determine whether markets view such corporate actions as value-creating or value-destroying." For example, (Rai et al., 2022) "used an event study to analyse the effects of bank mergers in India and found that merger announcements significantly impacted bidder and target banks' stock returns, with target banks enjoying positive effects on the event day followed by negative returns later on, highlighting that market perceptions can vary by role in the merger". Similarly, (Pandey and Kumari, 2020) "reported that merger announcements generate significant abnormal returns for acquiring banks in India, suggesting that financial markets in emerging economies are sensitive to merger information and adjust firm valuations accordingly".

Studies examining M&A announcements in the broader Indian corporate sector also provide useful insights. (Monga, 2025) investigated short-term market reactions to merger announcements across 40 Indian acquirer firms and found that announcement dates often yielded positive and significant abnormal returns, indicating that investors may perceive M&A activity as wealth-creating under certain conditions. Other research on M&A in Indian firms has shown mixed results: some studies find positive abnormal returns and some others report negative or statistically insignificant effects, underlining that investor response can vary based on industry, firm characteristics, and the specifics of the transaction.

Although much of the M&A literature focuses on mergers themselves, studies also consider the broader context of banking performance post-merger. For example, (Chaudhary et al., 2024) "analyzed government-initiated bank mergers and found that operational performance, including stock market indicators, varied significantly across time horizons", indicating that short-term market reactions may not fully capture long-term operational effects. Research by (Yadav and Aggarwal, 2017) on Indian bank share prices using event study methodology also supports the view that merger announcements can be reflected in abnormal returns, although the results may differ across banks and time windows, suggesting heterogeneous investor responses. "In the selected various automobile companies, the merger announcement has no significant change except in the cases of Tata Motors and Nissan Motors. In case of banking sector, all the selected banks in the merger announcement period have short-lived market reaction with initial volatility" (Saha et al., 2025).

Beyond the banking sector, event-study research has been applied in other industries to test market reactions to policy or regulatory changes, which is relevant for the automobile sector in your extended research context. (Kedia & Satpathy, 2023), suggest that "Regime changes are efficiently reflected in the prices of individual stocks and investors react to political uncertainties stemming from elections and transfer of power". (Chen, 2022), for instance, analyzed the impact of China's "China VI" emission standards on automobile stocks and found heterogeneous market responses with positive abnormal returns in some cases highlighting that regulatory announcements may be interpreted as catalysts for technological upgrade rather than just cost burdens. Likewise, studies on environmental policies find that stock markets may react variably to regulatory announcements, with some research showing insignificant average reactions, suggesting that investors may already price anticipated policy effects or view them as long-term structural changes rather than short-term shocks (Chen & Singhal, 2021).

In the Indonesian banking sector, "M&A activities led to increased stock returns and positive cumulative abnormal returns, indicating a favorable market response. This suggests that investors anticipate profit gains from such activities, which can be beneficial for both internal management and investment decisions" (Suidarma & Remses, 2023). "A study concluded in Saudi Arabia, in that mergers were met with immediate positive market reactions, driven by expectations of synergistic benefits. However, the long-term effects varied, highlighting the complexity of M&A outcomes" (Sayed, 2024). (Varghese & Thaha, 2017) found significant AR for Kotak on the merger announcement day with ING Vysya, though short-term performance didn't change materially post-event

Contrarily, in India's banking sector, the majority of banks experienced negative AR and CAR following M&A events, suggesting an unfavorable market response. This indicates that even as some banks benefited, the overall sentiment was negative, possibly due to market saturation or other economic factors (Rani & Sangeeta, 2023). The merger of the State Bank of India with its associates showed no significant difference in abnormal returns pre- and post-merger, implying that the market had already anticipated the merger's effects. This suggests that the market's efficiency in processing information can lead to neutral responses in some cases (Sasikala et al., 2024). The M&A market in the banking sector also exhibits specific characteristics during catastrophic events, such as those between 2020 and 2023. These events can alter the typical market dynamics, necessitating further research into their long-term impacts on M&A activities (Melnarowicz, 2024).

Altogether, this body of literature suggests that event studies are a rigorous method for detecting market reactions around major announcements such as mergers, acquisitions, or regulatory shifts. Results from banking, automobiles and other sectors indicate that investor response can vary in direction and magnitude depending on the nature of the event, firm characteristics, and market context.

3. Research Methodology

3.1. Objective

To evaluate the impact of merger announcement of the Ban on >2000 cc diesel vehicles in NCR and the Enforcement of BS-VI norms from 1 April 2020 on the previous merged automobile companies stock price during their post M&A period. The study included the previous merged automobile companies in last five years from the selected events' announcement date.
The objective of the study is to determine if the market viewed these merged banks as safer and stable when the rest of the sector was undergoing large-scale restructuring. The three banks that underwent major mergers prior to the 2019 announcement (SBI in 2017, BoB in 2019, and Kotak in 2015) were selected to test the core hypothesis."

3.2. Data Description

Merged Automobile Companies Other Event Analysis
Event: Ban on >2000 cc diesel vehicles in NCR. Primary Event Date (t=0): 16 December 2015. Although the regulatory process involved subsequent extensions (March 2016) and enforcement deadlines (April 2020), the analysis identifies 16 December 2015 as the primary event day (t=0). This date represents the initial Supreme Court order, which served as the first public disclosure of the unexpected regulatory shift.
Automobile Companies taken for analysis are as follows: -

Table 1: Mergers and Acquisitions occurred in selected Automobile Industries: -

Sl. No.	Anchor Automobile Company	Merged Automobile Companies	Year of Merger	Merger Announcement Date	Events
1.	Mahindra & Mahindra	SsangYong Motor Company	March 2011	23 November 2010	Ban on >2000 cc diesel vehicles in NCR. Ordered: 16

					December 2015; and Enforced BS-VI emission norms. Notified: 19 February 2016
2.	Volkswagen	Porsche	1 August 2012	5 July 2012	-do-
3.	Ashok Leyland Limited	Hinduja Tech limited	November 2014	1 October 2014	-do-
4.	Fiat	Chrysler	2014	20 January 2009	-do-

Source: Author's compilation.

This study evaluates the impact of the major Public Sector Bank (PSB) consolidation announcement of the event where 10 PSBs were merged into four major entities, on the stock prices of banks that had previously undergone mergers in last five years from the selected event announcement date. The event announcement date under analysis was August 30, 2019. The specific banks selected for this analysis are those that completed major mergers between 2015 and 2019: State Bank of India (merged in 2017), Bank of Baroda (merged in 2019), and Kotak Mahindra Bank (merged in 2015).

Table 2: Mergers and Acquisitions occurred in selected Banks: -

Sl. No.	Anchor Bank	Merger Banks	Date of Merger	Merger Announcement Date	Events
1	Bank of Baroda	Dena Bank Vijaya Bank	1 April 2019	2 January 2019	10 PSBs merged into 4 major entities Announced on 30 August 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	1 April 2017	24 February 2017	-do-
3	Kotak Mahindra	ING Vysya	1 April	20 November	-do-

	Bank	Bank	2015	2014	

Source: Author's compilation.

3.3. Methodology

The study seeks to investigate the consequences of the announcement banning diesel vehicles over 2000 cc in the NCR, alongside the enforcement of BS-VI standards, on the stock performance of automobile companies that have undergone mergers, over a five-year period following these mergers. There are multiple ways to assess the impact of a merger on a company's performance, out of which event studies being a widely used method. The study focuses on four automobile companies that merged between 2010 and 2015: Mahindra & Mahindra, Volkswagen, Ashok Leyland Limited, and Fiat. In the banking sector, the research aims to evaluate the effects of the merger announcement involving the consolidation of 10 public sector banks into four major entities on the stock returns of these merged banks over a five-year period post-merger. Similar to the automobile sector, the impact of mergers on company performance can be analyzed through various methods, but the event studies method being a preferred approach. A sample of three banks that merged between 2014-2019 were taken for the study. The Banking companies include, Bank of Baroda, State Bank of India, Kotak Mahindra Bank. To conduct an event study, we need daily closing price data of the selected companies and Nifty 50 were extracted from National Stock Exchange database (nseindia.in), International Stock Exchange databases for foreign companies and Yahoo finance. The market index serves as the benchmark/control for general economic and industry-wide fluctuations. An Event window of 15 days was taken for the study. This period was divided into pre-event window period (t-7 to t-1 days), post-event window period (t+1 to +7 days) and event day (t). The event day (t) is defined as the public announcement date of the merger or acquisition. We focus on this date because the efficient market hypothesis suggests that stock prices will adjust to new information as soon as it is disclosed, rather than on the later, less information rich effective date of the merger. "Based upon standard literature an estimation period of 250 days (i.e., 250 days preceding the day t-7) was taken for calculating the normal returns. This was done to avoid any overlapping of the estimation period and the event period." The daily stock price data was processed and analyzed using Python programming, employing standard data analysis libraries (for example, pandas, numpy, y.finance, nsepython and linregress) and financial data retrieval tools. After which, the data was extracted to excel for further processing and analysis. The Jarque–Bera test and Parametric and Non-parametric test like t-test, Patell's test, Wilcoxon signed-rank test and Sign test have been used to analyse the abnormal returns.

The Jarque–Bera test is used to check the normality of the data. Under H_0 JB follows a chi-square distribution with 2 degrees of freedom, with a critical value of 5.99 at α=0.05. If p-value < α, H_0 is rejected, which indicates data is not normal. If p-value ≥ α, H_0 is not reject, which indicates normality.

The parametric tests selected for this paper includes the simple t-test and standardized Patell's test, 1976. The non-parametric test includes Sign test, Wilcoxon test, Corrado test, and BMP test. "The simple t-test has been widely used and seems to well specified under different capital market conditions (Mackinlay, 1997)". "Patell's test adjusts for cross-sectional correlation and ranks daily abnormal returns (AR) against their standard deviations. In the Patell's test the t-stat absolute value ≥ 1.96 means statistically significant at 5% level. Absolute value between 1.645

and 1.96 means marginally significant at 10% level. Absolute value below 1.645 means not statistically significant." Wilcoxon signed-rank test checks whether the distribution of CAARs is symmetrically centered around zero, without assuming normality. "Sign test is a non-parametric statistical method used to evaluate the directionality of paired differences. It assesses whether the number of positive ARs differs significantly from what would be expected by chance. H_0 states that probability of a positive abnormal return is 0.5, which indicates no effect. H_1 states probability of a positive abnormal return is not 0.5, which indicates there is an effect." Using multiple tests (parametric and non-parametric / cross-sectionally adjusted) helps rigorousness, because return distributions may deviate from normality or there may be cross-sectional correlations. The current tests (t-test, Patell) assume stock returns are normally distributed. In reality, stock returns often have "fat tails" (extreme values). The Corrado Rank test is a non-parametric test that is far more reliable to these deviations than the Wilcoxon test, specifically for event studies. M&A announcements often cause volatility (variance) to increase, not just the price. Standard t-tests fail if the variance changes. The BMP test (Boehmer, Musumeci, and Poulsen) specifically adjusts for this "event-induced volatility," ensuring you don't falsely find a significant result just because the stock became more volatile.

3.4. Event Date Selection and Justification:

For the diesel ban event analysis, 16 December 2015 was selected as the event day (t=0). According to the Efficient Market Hypothesis (EMH), security prices should adjust rapidly to the first public disclosure of new information. The later dates involved implementation details, but the 16 December announcement represented the primary "information shock" an unexpected regulatory intervention that fundamentally altered the future operating environment for high-capacity diesel vehicles. By focusing on this initial date, the study ensures that the market's information set at the time of the event is clearly defined, capturing the immediate reaction to the surprise policy shift rather than subsequent, anticipated developments. The event date is 19 February 2016, when the Government of India formally notified the nationwide enforcement of BS-VI emission standards, providing regulatory certainty to automobile manufacturers. This announcement significantly affected the automobile sector by accelerating technology upgrades, raising compliance costs, and reshaping product strategies toward cleaner vehicles.

The event date is set as 30 August 2019, when the Government of India officially announced the merger of 10 Public Sector Banks into 4 entities, making the information public and immediately actionable for markets and stakeholders. This announcement marked a structural reform aimed at strengthening balance sheets, improving operational efficiency, and enhancing credit capacity across the banking sector.

3.5. Event Study Methodology

"An event study is an empirical analysis that is normally used to measure the effect of an event on stock prices (returns). The event study is of importance because it can be used to evaluate the impact of company policies on firm value."

Analysis and Results

Table 3: Results of Jarque-Bera test of Automobile Companies

Sl. No.	Sector	Jarque-Bera test	p-value	Interpretation

1	Automobile Companies (2015)	0.3076	0.8574	Normally distributed
2	Automobile Companies (2016)	0.5664	0.7533	Normally distributed
3	Banks	0.8807	0.6437	Normally distributed

Table 3 provides the results of the Jarque-Bera test of the four automobile companies together. All the automobile companies together show a p-value greater than 0.05 indicating normality. The merged automobile companies in both the event periods show a Jarque-Bera statistic value of 0.307, 0.566; and p-value of 0.8574, 0.7533; therefore, accepting the null hypothesis of normality and indicating that the data is normal in both the event cases in the automobile sector. It also provides the results of the Jarque-Bera test of the 3 banks together. All the Banks together show a p-value greater than 0.05 indicating normality. The Banks show a Jarque-Bera statistic value of 0.8807 and p-value of 0.6437 accepting the null hypothesis of normality and indicating that the data is normal.

Table 4: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) (2015)

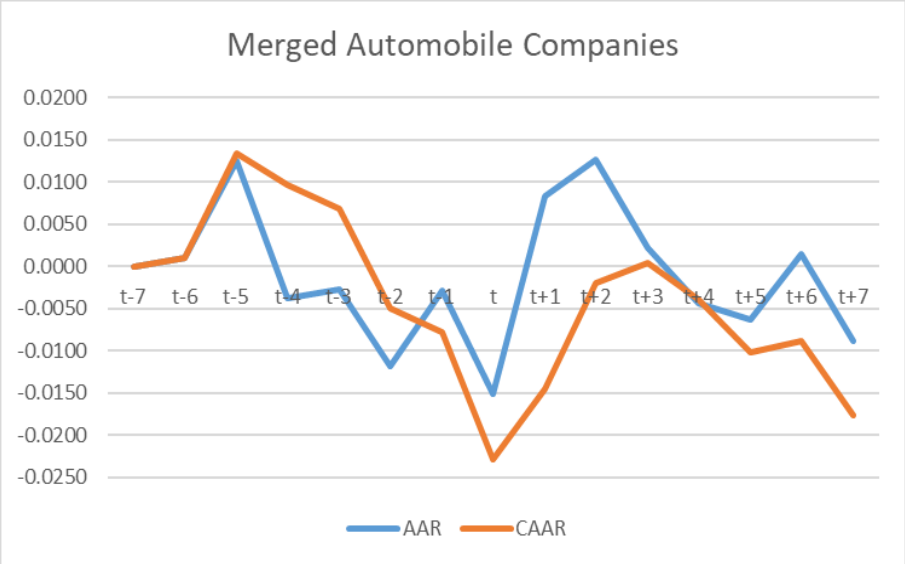
Day	Average Abnormal Returns (AAR)	Cumulative Average Abnormal Returns (CAAR)
-7	0.0000	0
-6	0.0010	0.0010
-5	0.0125	0.0134
-4	-0.0038	0.0096
-3	-0.0028	0.0069
-2	-0.0118	-0.0050
-1	-0.0028	-0.0078
t	-0.0151	-0.0229
1	0.0083	-0.0145
2	0.0126	-0.0019
3	0.0023	0.0004
4	-0.0043	-0.0039
5	-0.0063	-0.0102
6	0.0014	-0.0088
7	-0.0089	-0.0177

Note: The event day t=0 corresponds to the initial diesel ban order date of 16 December 2015.

Table 4 shows the AAR and CAAR of the four automobile companies together. AAR is the average abnormal return across the four merged automobile companies on day t. “Abnormal return” means actual return minus what would be “normal” (e.g., according to a market model) on that day. CAAR is the cumulative sum of AARs from some start to the day t. In other words,

CAAR shows the aggregate abnormal return over time, giving a sense of the total effect around the event window.

Graph 1: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) (2015)



Graph 1 shows the AAR and CAAR of the merged automobile companies in 2015. Before the event (days t–7 to t–1), AAR fluctuates some days positive, some negative. CAAR drifts slightly up and down but stays modest in magnitude. On event day (t = 0) and immediately after, there's a dip (negative AARs / drop in CAAR), suggesting some market concern or negative reaction. In the days after the event (especially around t+6), there is somewhat of a rebound, the AAR becomes positive; and the CAAR recovers partially, though not strongly. Overall, by the end of the window (t+7), CAAR remains negative (or around zero), indicating that over the short window there was no strong, sustained positive gain; instead, the net effect seems modestly negative or negligible.

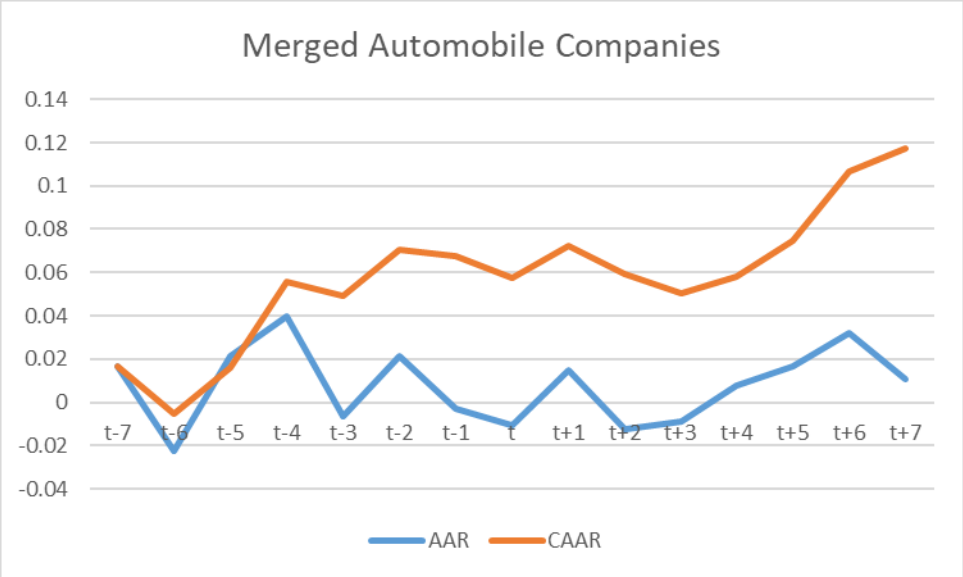
Despite a substantial industry-level impact, the four selected formerly-merged automobile companies did not experience a strong, statistically significant short-term decline (or spike) in stock returns around the diesel-ban event (Dec 16, 2015), at least within the ±7 days' window studied. This implies that for these firms, either the negative effects of the ban were perceived as manageable (due to diversification or mitigation strategies), or that the risk was already anticipated by the market, leaving little new negative information at announcement.

Table 5 presents the Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) for the four previously merged automobile companies around the 2016 BS-VI enforcement announcement. As shown in the subsequent statistical tests, the results reveal statistically insignificant abnormal returns, suggesting the market did not perceive this regulatory shift as a major shock to these specific firms.

Table 5: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) (2016)

Day	Average Abnormal Returns (AAR)	Cumulative Average Abnormal Returns (CAAR)
-7	0.016792	0.016792
-6	-0.02222	-0.00543
-5	0.021432	0.016005
-4	0.039421	0.055427
-3	-0.00627	0.049154
-2	0.021338	0.070493
-1	-0.00273	0.067766
t	-0.01049	0.057277
1	0.01478	0.072056
2	-0.01254	0.059513
3	-0.00888	0.050636
4	0.007624	0.05826
5	0.016344	0.074605
6	0.032217	0.106822
7	0.01078	0.117602

Graph 2: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) (2016)



Graph 2 shows the impact on the four previously-merged automobile companies around the BS-VI enforcement announcement date. The AAR (blue line) fluctuates some days positive, some

negative. There isn't a large, sharp negative spike on the event day (t = 0). The CAAR (orange line) cumulative abnormal returns appears to trend upward over the window, ending at a positive cumulative abnormal return by t+7 (after enforcement).

This suggests that, on average, across these firms, stock prices did not suffer a sharp drop at the event; rather, cumulative returns over the window are modestly positive. The imposition of BS-VI emission norms did not trigger a strong negative stock price reaction in the immediate short run around the enforcement date on the four merged automobile companies. Instead, over the 7-day event window, the cumulative abnormal return (CAAR) was slightly positive, suggesting either a neutral or modestly positive market interpretation of the regulatory shift. Thus, contradictory to expectation that stricter norms and associated compliance costs would depress valuations the market seems to have treated these firms with relative calm, or even mild optimism.

Table 6 provides the detailed parametric and non-parametric test results for the automobile companies. The results across all tests including the t-test (p=0.3407) and Patell's test (p=0.3398) on the event day confirm that the returns are statistically insignificant. For these specific previously merged firms, the market did not view these regulatory events as major shocks, as evidenced by the lack of reliably distinguishable price movements from random noise.

Table 6: Average Abnormal Returns (AAR), t statistic and results of Patell's test, Corrado test, BMP test of the Automobile companies.

Day	AAR	t-test		Patell's test		Corrado test		BMP test	
		t-statistics	p-value	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
t-7	-0.00	-0.001	0.9995	-0.001	0.9995	-0.060	0.9518	-0.001	0.9991
t-6	0.0010	0.061	0.9515	0.061	0.9515	0.007	0.9946	0.120	0.9048
t-5	0.0125	0.787	0.4318	0.787	0.4311	0.947	0.3438	1.548	0.1215
t-4	-0.0038	-0.239	0.8109	-0.239	0.8107	-0.477	0.6336	-0.471	0.6377
t-3	-0.0028	-0.174	0.8618	-0.174	0.8617	-0.302	0.7626	-0.343	0.7318
t-2	-0.0118	-0.748	0.4551	-0.748	0.4544	-1.121	0.2622	-1.471	0.1412
t-1	-0.0028	-0.176	0.8602	-0.176	0.8601	-0.329	0.7422	-0.347	0.7288
t	-0.0151	-0.955	0.3407	-0.955	0.3398	-1.255	0.2093	-1.877	0.0605
t+1	0.0083	0.526	0.5991	0.526	0.5987	0.624	0.5324	1.035	0.3006
t+2	0.0126	0.799	0.4252	0.799	0.4245	0.973	0.3303	1.571	0.1162
t+3	0.0023	0.143	0.8868	0.143	0.8867	0.128	0.8985	0.280	0.7792
t+4	-0.0043	-0.270	0.7871	-0.270	0.7869	-0.517	0.6052	-0.532	0.5949
t+5	-0.0063	-0.398	0.6913	-0.398	0.6910	-0.691	0.4893	-0.782	0.4343
t+6	0.0014	0.088	0.9297	0.088	0.9296	0.034	0.9782	0.174	0.8621
t+7	-0.0089	-0.562	0.5749	-0.562	0.5744	-0.879	0.3792	-1.104	0.2694

Note: The event day t=0 corresponds to the initial diesel ban order date of 16 December 2015.

The table shows the Average Abnormal Returns (AAR) and the results of test statistics (t-test, Patell's test, Corrado test, BMP test) for four previously merged automobile companies, in the context of an event study for the "Ban on >2000 cc diesel vehicles in NCR" (event date 16

December 2015). The table's combination both the parametric and non-parametric tests is methodologically sound and thus, aims to check the rigorousness of any abnormal return signals. The AARs on most days are quite small typically in the ±1% range (often much smaller) and on the event day (t = 0) AAR = –0.0151 (–1.51%). None of the t-tests, Patell's tests, Corrado tests or BMP tests produce p-values below conventional significance value (e.g., $p < 0.05$). For instance, on the event day, t-test p = 0.3407, Patell p = 0.3398, Corrado p = 0.2093, BMP p = 0.0605 (the BMP comes closest but still > 0.05). Across the entire −7 to +7 window, no single day shows a consistent, statistically significant abnormal return under all or most of the tests. Thus, the event (the 2015 ban on >2000 cc diesel vehicles in NCR) did not cause a statistically significant abnormal return for the four automobile firms in the days immediately surrounding the announcement. The absence of significance across both parametric and non-parametric tests suggests that even if there were small price movements, they are not reliably distinguishable from random 'noise' in stock returns. Consequently, these results are statistically insignificant, indicating that the market did not perceive the events as having a substantial or lasting impact on the valuation or expected future profitability of these firms. Event studies over a ±7-day window capture only immediate investor reaction; long-term operational or fundamental impacts (e.g., reduced sales, cost restructuring, strategic shift) may occur over months or years, and are not captured here.

Table 7: Average Abnormal Returns (AAR), t statistic and results of Patell's test, Corrado test, BMP test of the Automobile companies.

Day	AAR	t-test		Patell's test		Corrado test		BMP test	
		t-statistics	p-value	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
t-7	0.0168	1.015	0.3113	1.015	0.3103	1.229	0.2192	0.946	0.3443
t-6	-0.0222	-1.342	0.1807	-1.342	0.1795	-1.443	0.1489	-1.251	0.2108
t-5	0.0214	1.295	0.1965	1.295	0.1954	1.39	0.1646	1.207	0.2274
t-4	0.0394	2.382	0.0180	2.382	0.0172	1.725	0.0845	2.22	0.0264
t-3	-0.0063	-0.379	0.7050	-0.379	0.7047	-0.611	0.5413	-0.353	0.7239
t-2	0.0213	1.289	0.1985	1.289	0.1973	1.390	0.1646	1.202	0.2294
t-1	-0.0027	-0.165	0.8693	-0.165	0.8692	-0.235	0.8142	-0.154	0.8779
t	-0.0105	-0.634	0.5268	-0.634	0.5262	-0.960	0.3370	-0.591	0.5546
t+1	0.0148	0.893	0.3727	0.893	0.3719	1.121	0.2622	0.832	0.4052
t+2	-0.0125	-0.758	0.4493	-0.758	0.4486	-1.094	0.2738	-0.706	0.4799
t+3	-0.0089	-0.536	0.5922	-0.536	0.5917	-0.812	0.4166	-0.500	0.6171
t+4	0.0076	0.461	0.6455	0.461	0.6451	0.665	0.5063	0.429	0.6676
t+5	0.0163	0.987	0.3243	0.987	0.3234	1.188	0.2347	0.921	0.3573
t+6	0.0322	1.946	0.0527	1.946	0.0516	1.672	0.0946	1.815	0.0696
t+7	0.0108	0.651	0.5154	0.651	0.5149	0.893	0.3719	0.607	0.5437

Table 7 shows the Average Abnormal Returns (AAR) and the results of test statistics (t-test, Patell's test, Corrado test, BMP test). The results indicate that the event (Enforced BS-VI norms from 1 April 2020, 19 February 2016) did not produce a strong, rigorous, statistically significant

abnormal return across the sample of four automobile companies at least not in a consistent way across the ±7-day window. There is no clear evidence of a unified negative market reaction (i.e., the market did not systematically punish these firms' share prices immediately around the announcement). Nor is there strong evidence of a positive reaction or "safe-haven" effect only a single day (t–4) shows a statistically significant positive AAR, but this is likely a noise or one-off fluctuation, given lack of follow-through and inconsistent significance across tests. Overall, the event seems to have had minimal impact on stock prices of these firms in the short-term (first week), as per standard event-study detection methods.

Table 8: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) of the Merged Banks

Day	Average Abnormal Returns (AAR)	Cumulative Average Abnormal Returns (CAAR)
-7	-0.0081	-0.00811
-6	-0.0095	-0.0176
-5	-0.0009	-0.01672
-4	-0.002	-0.01877
-3	0.0063	-0.01249
-2	-0.0071	-0.01957
-1	-0.0171	-0.03669
t	-0.0113	-0.04803
1	0.0135	-0.03454
2	0.0122	-0.02235
3	-0.0045	-0.02685
4	-0.0015	-0.02836
5	0.009	-0.01935
6	0.0177	-0.0016
7	0.0118	0.010153

Table 8 shows the AAR and CAAR of the three banks together. AAR_t is the average abnormal return across the three merged banks on day t. "Abnormal return" means actual return minus what would be "normal" (e.g., according to a market model) on that day. $CAAR_t$ is the cumulative sum of AARs from some start to the day t. In other words, CAAR shows the aggregate abnormal return over time, giving a sense of the total effect around the event window.
Graph 3 shows the impact AAR and CAAR of the merged Banking Companies. The AAR line (blue) fluctuates around zero. On some days there are small positive abnormal returns, on certain days' small negative ones, but none seems very large. The CAAR line (orange) shows the cumulative sum of AAR which is initially drifts negative (likely due to a few negative AARs early on), reaches a trough (most negative) somewhere around the event day or early post-event days, and then moves upward. Toward the right end (around t +7) it appears to approach or cross back toward zero (or maybe slightly positive). When the CAAR line moves significantly away

from zero, it suggests that the event (here, merger) had a non-trivial impact on stock prices over the period (positive or negative).

Graph 3: Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR)

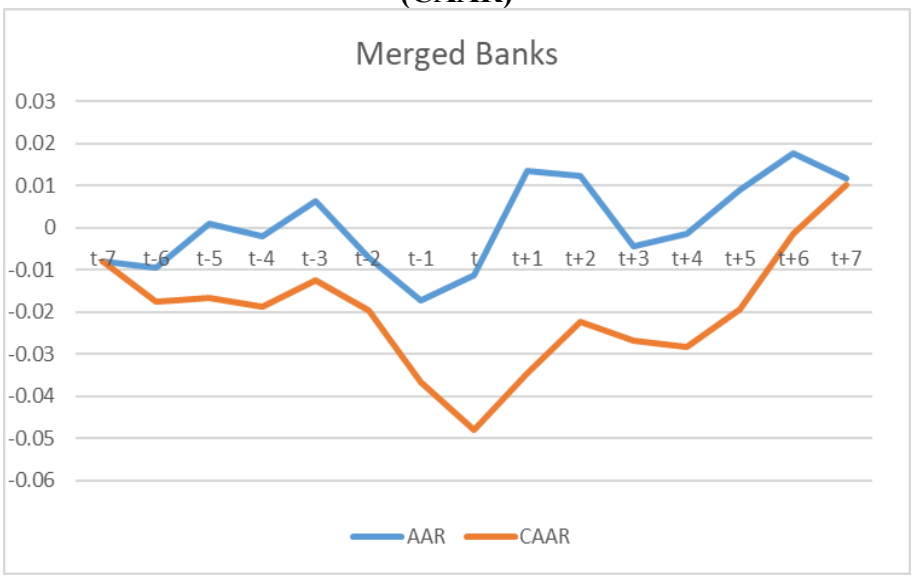


Table 9 shows Average Abnormal Returns (AAR) over a window of days around the10 PSBs merged into 4 major entities event (Days –7 to +7) along with Parametric and Non-parametric test statistics (t-test, Patell's test, Corrado test, BMP test) for statistical significance. The event date or the merger announcement date was 30th August 2019. The AAR values are fairly small (both positive and negative), typically around ±1–2%. The p-values of all the tests (t-test, Patell, Corrado, BMP) are well above common significance (e.g., 0.05). On the Event day (day 0): AAR = –0.0113, t-test p = 0.4914; Patell p = 0.4908; Corrado p = 0.3490; BMP p = 0.2815, all are non-significant. Similarly, for the days before (–7 to –1) and after (+1 to +7), none of the p-values appear below 0.10 or 0.05; the lowest seems around 0.0920 (BMP on day +6), but that's still above typical 5% significance. For this sample of three merged banks, there is no evidence of statistically significant abnormal returns around the merger event. The AARs fluctuate but are not large enough (in absolute terms) and not statistically different from zero under any of the applied tests.

For the three merged banks (SBI, BOB, KMB) in the sample, the event-study analysis shows no statistically significant abnormal returns around the merger announcement (days –7 to +7). The market did not react with a consistent, significant price jump (or drop) for these banks around the merger announcement, at least not on average across these selected three banks. This suggests that, on average, the10 PSBs merged into 4 major entities merger announcement did not generate a detectable market reaction (positive or negative) for these banks in the short run.

Table 9: Average Abnormal Returns (AAR), t statistic and results of Patell's test, Corrado test, BMP test of the banks.

Day	AAR	t-test		Patell's test		Corrado test		BMP test	
		t-statistics	p-value	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
t-7	-0.0081	-0.493	0.6224	-0.493	0.6220	-0.655	0.5126	-0.771	0.4410
t-6	-0.0095	-0.576	0.5649	-0.576	0.5644	-0.810	0.4181	-0.901	0.3677
t-5	-0.0009	0.053	0.9575	0.053	0.9575	0.162	0.8714	0.083	0.9336
t-4	-0.002	-0.124	0.9011	-0.124	0.9010	-0.148	0.8825	-0.194	0.8458
t-3	0.0063	0.382	0.7031	0.382	0.7027	0.542	0.5877	0.596	0.5509
t-2	-0.0071	-0.430	0.6673	-0.430	0.6669	-0.528	0.5975	-0.673	0.5012
t-1	-0.0171	-1.040	0.2994	-1.040	0.2984	-1.288	0.1976	-1.625	0.1041
t	-0.0113	-0.689	0.4914	-0.689	0.4908	-0.936	0.3490	-1.077	0.2815
t+1	0.0135	0.820	0.4131	0.820	0.4123	1.077	0.2814	1.281	0.2001
t+2	0.0122	0.741	0.4596	0.741	0.4589	1.007	0.3140	1.158	0.2470
t+3	-0.0045	-0.274	0.7844	-0.274	0.7841	-0.331	0.7407	-0.428	0.6686
t+4	-0.0015	-0.092	0.9272	-0.092	0.9271	-0.077	0.9383	-0.143	0.8863
t+5	0.009	0.548	0.5844	0.548	0.5839	0.753	0.4512	0.856	0.3921
t+6	0.0177	1.078	0.2820	1.078	0.2810	1.317	0.1880	1.685	0.0920
t+7	0.0118	0.714	0.4757	0.714	0.4751	0.979	0.3277	1.116	0.2643

Paired t test, Wilcoxon test, Sign Test

The table 10 and 11 shows the results of the Paired t-test, Wilcoxon Signed-Rank Test, and Sign Test of the selected automobile companies. The paired t-test evaluates whether the mean abnormal return before and after the event is significantly different. The Wilcoxon test is a non-parametric alternative that checks for median differences in paired data. The sign test counts the number of positive average abnormal returns (AARs) in the event window and compares it against the total number of non-zero observations to test if the proportion is significantly different from 0.5. Like the previous tests, the sign test also yields no statistically significant results for any automobile companies.

Table no.- 10: Results of Paired t test, Wilcoxon test, Sign test of Automobile companies

Automobile companies	Paired t test	p-value	Wilcoxon Test	p-value	Sign Test	p-value
Automobile companies (2015)	-0.5294	0.6155	11	0.6875	No. of Positive R- 6 Non Zero R- 15	0.6875
Automobile companies (2016)	0.1294	0.9012	14	1	No. of Positive R- 9 Non Zero R- 15	0.98

The results for "previously merged Automobile companies" for two different years (2015 and 2016). For each year, show a paired t-test statistic (or mean difference), Wilcoxon test, and Sign

test, with p-values. In the year 2015 the result of Paired t-test: −0.5294, p = 0.6155 which indicates the test is not significant. The Wilcoxon signed-rank: p = 0.6875 it also indicates not significant. The Sign test: number of positive returns = 6 (out of 15 non-zero), p = 0.6875 which also indicates not significant. In the year 2016, the result of Paired t-test: 0.1294, p = 0.9012 show the result is not significant. In the Wilcoxon: p = 1.000 which is also not significant. The Sign test: number of positive returns = 9 (out of 15 non-zero), p = 0.98 indicates not significant.
In both years, all three tests fail to reject the null hypothesis and interprets no statistically significant difference in (paired) returns, i.e., no evidence that the "before vs after event" returns changed in mean, median, or direction in a systematic way.

For the sample of four automobile companies around the 2015 and 2016 event, the data do not support a conclusion that their stock returns changed in a systematically positive or negative way. There is no reliable evidence of a shift in performance (as measured by returns) in those years, whether judged by mean difference (t-test), median difference (Wilcoxon), or directional bias (Sign test).
This suggests that, at least via this paired-sample analysis, the event (ban on >2000 cc diesel vehicles or Enforced BS-VI norms from 1 April 2020) did not produce a consistent, across-the-board impact on those companies' returns.

Table no.- 11: Results of Paired t test, Wilcoxon test, Sign test of Banking companies

Banks	Paired t test	p-value	Wilcoxon Test	p-value	Sign Test	p-value
Banks	-2.6040	0.004	3	0.0781	No. of Positive R-6 Non Zero R- 15	0.0781

Paired t-test: t = –2.6040, p = 0.004; this p-value is well below the conventional 0.05 threshold. That means the difference (pre- vs. post-merger, or before vs after whatever you paired) is statistically significant under the t-test. In other words: the mean of the paired differences is unlikely to be zero; there is evidence of a change.
Wilcoxon test: p = 0.0781; this is above 0.05, so not statistically significant at the 5% level. This suggests that the median of the differences is not significantly different from zero, or at least you don't have strong evidence under this non-parametric test.
Sign test: p = 0.0781; also not significant; thus, there is no strong evidence that a majority of paired firms consistently show improvement (or deterioration) after the event.
So, only the paired t-test shows significance; the non-parametric tests (Wilcoxon, Sign) do not.
The significant paired t-test suggests that on average there is a change in the variable measured performance ratio in post-event compared to pre-event.
Concerns arise from the non-significant outcomes of the Wilcoxon and Sign tests, questioning whether the observed changes are uniform across banks, suggesting a widespread improvement, or if they are skewed by a few extreme outliers. The Wilcoxon test, which focuses on median-based evaluation and considers the magnitude of differences, may show a median difference close to zero if there is a significant disparity in bank performance, with some banks excelling and others underperforming, even when the average difference is not zero.

4. Findings

The study examined the impact of two significant regulatory events: the 2015–2016 ban on diesel vehicles over 2000 cc in NCR and the implementation of BS-VI emission standards, on the stock market reactions of four previously merged automobile companies. By applying event-study methodology with a 15-day window (t – 7 to t + 7) and utilizing both parametric (t-test, Patell) and non-parametric tests (Corrado, BMP, Wilcoxon, Sign tests), we aimed to identify abnormal returns (AAR) and cumulative abnormal returns (CAAR) surrounding the announcement dates.

Abnormal returns on the event days and over the event windows remain small (typically in the ±1–2 % range) and none of the tests yields consistent, statistically significant results across days. Even where a single-day spike occurs (e.g., a positive AAR at t-4 in one of the windows), the result lacks rigorousness, it is not followed by sustained abnormal returns, and significance does not hold across all tests. The CAAR trajectories do not show a sharp drop or a consistent negative run in the post-event period; in some cases, (e.g., around BS-VI enforcement) CAAR trends modestly upward, though again without rigorous statistical backing. Paired-sample tests (Wilcoxon signed-rank, Sign test) comparing "before vs after" returns likewise fail to reject the null hypothesis of no change, reinforcing the lack of a consistent directional effect. Taken together, these results suggest that in the short-term, the market did not penalize (or reward) the selected automobile firms in a comprehensive manner in response to these regulatory shocks. In other words, at least in the first trading week around the announcements, investors appeared neither convinced of major value destruction nor of sudden opportunity. This empirical outcome a muted or neutral market reaction is plausible in light of real-world developments. The transition to BS-VI required substantial investments by automobile manufacturers: engine re-engineering, exhaust after-treatment systems, supply-chain adjustments, and likely higher production costs. The requirement to retrofit or redesign vehicles, retire old inventory, and comply with stricter fuel standards represented a heavy burden for the industry.

In case of banking sector, the study examined whether the 30 August 2019 announcement about the merger of 10 Public Sector Banks (PSBs) into four major entities had a noticeable short-term impact on the stock prices of three previously merged banks. These banks had already undergone merger before august 2019 (SBI in 2017, Kotak in 2015, BoB in early 2019), and the hypothesis was that investors might view them as safer or more stable relative to the rest of the banking sector when the broader PSB consolidation news broke. Based on the results, there is no convincing evidence that the 2019 PSB consolidation announcement generated a short-term abnormal return benefit for the three previously merged banks. In other words, from the perspective of the stock market (in the first one trading week after the announcement), investors did not seem to reward these banks with a price premium. This outcome suggests one of two possibilities (or a combination): first, the market may have already anticipated such a consolidation given the banking environment, so the announcement did not bring "new" information about relative stability or safety of already-merged banks; or secondly, investors may have perceived risks, uncertainties, or limited benefits from the consolidation for these particular banks or at least were unwilling to price in a premium in the short run.

5. Limitations

With only four firms (and only those that had previously undergone mergers), the sample may not be representative of the broader automobile industry; results could be driven by survivorship or sampling bias (for example, larger, more resilient firms survive). Regulatory changes coincide with broader macroeconomic factors (like, global demand shifts, supply-chain disruptions, macroeconomic cycles). Such confounders might conceal or offset the regulatory shock's effect on stock returns.

Only three banks (State Bank of India, Bank of Baroda, Kotak Mahindra Bank) is a very small cross-section. A small sample, statistical power is low, making it difficult to detect moderate abnormal returns. Short-term share-price movements often reflect sentiment, expectations, and information flow may not necessarily affect long-run profitability, cash flows, or operational health, which may bear the brunt of regulatory costs over time.

6. Conclusion

The theory and prior research suggest that banking-sector mergers and consolidation should lead to value creation (through economies of scale, risk diversification, cost reduction), the empirical evidence from this study based upon the short-term stock market reaction of previously merged banks does not support a clear market-driven reward for stability or safety. The absence of statistically significant abnormal returns around the 2019 consolidation announcement indicates that, at least in the short run, investors did not treat already-merged banks as significantly safer or more valuable relative to their peers.

In the automobile sector, abnormal returns (AARs) and cumulative abnormal returns (CAARs) for the four previously merged firms i.e., Mahindra & Mahindra, Volkswagen, Ashok Leyland Limited, and Fiat Chrysler Automobiles remained small and statistically insignificant across the event windows for both the 2015 diesel-ban and 2020 BS-VI enforcement events. Despite industry evidence suggesting the diesel ban caused production losses, job displacement, and compliance costs, and the BS-VI transition requiring substantial investments in emission-control technologies, the stock market did not register a consistent negative reaction for these firms in the short run. Occasional isolated spikes in AARs (at t – 4 for BS-VI) lacked rigorousness across multiple tests and did not persist. Paired-sample tests (Wilcoxon signed-rank and Sign tests) similarly failed to reject null hypotheses of no effect, reinforcing the conclusion that these regulatory announcements did not generate statistically significant abnormal returns for the automobile firms studied.

In the banking sector, the event study of three previously merged banks are State Bank of India (2017), Bank of Baroda (2019), and Kotak Mahindra Bank (2015). Around the 30 August 2019 PSB consolidation announcement found that average abnormal returns were generally small and statistically indistinguishable from zero over the ±7 days window. None of the parametric (t-test, Patell) or non-parametric (Corrado, BMP) tests indicated a clear market reaction on the event day or in the surrounding days. A paired t-test suggested a mean difference pre- and post-event in descriptive statistics. However, this was not confirmed by Wilcoxon and Sign tests; because these non-parametric tests are less sensitive to non-normal distributions and outliers, the results indicate that the observed change was not systematic across banks. These results imply that investors did not treat these previously merged banks as significantly safer or more value-

creating relative to peers in the short run, either because markets had already anticipated the consolidation or because the announcement did not carry new information strong enough to alter valuations.

Together, these findings suggest that short-term stock market reactions to major policy and consolidation announcements are muted when markets have either anticipated the event or when firms possess structural resilience. In the automobile context, early regulatory notice and adaptive strategies (like: retooling for BS-VI, diversification of product lines) likely reduced surprise and dampened abnormal returns. In the banking context, consolidation may have been anticipated by sophisticated investors, or the anticipated stability effects may have been offset by concerns regarding integration risk, asset quality, or broader macroeconomic pressures.

Event studies effectively capture immediate investor sentiment; however, they are restricted to short-run expectations and do not necessarily reflect medium- or long-term operational shifts such as sales performance or strategic realignment costs. Consequently, the absence of statistically significant abnormal returns does not imply that these regulatory or consolidation events lacked economic impact. Instead, it indicates that markets did not adjust stock prices sharply in the immediate aftermath. To advance these findings, future research should adopt a dual-focus methodology that bridges the gap between immediate market sentiment and long-term economic reality.

Future studies should analyze changes in profitability ratios like Return on Assets (ROA), efficiency ratios such as the Cost-to-Income ratio (for banks), and leverage metrics. This dual-focus approach combining the short-run market expectations found in the in this study with sustained, long-term operational performance metrics will provide the comprehensive economic impact assessment that the paper identifies as being absent from a pure event-study. Integrating short-run market expectations with sustained operational data will provide the comprehensive economic impact assessment necessary to determine if regulatory shocks and consolidations yield structural benefits beyond the initial window of information disclosure.

Overall, this research contributes to the understanding of how investors interpret and price regulatory and policy-driven events for firms that have already gone through major mergers. The results highlight a muted or neutral short-term market reaction for both automobile firms facing regulatory shocks and merged banks during systemic consolidation, indicating the importance of expectation formation, market anticipation, and firm-level resilience in shaping stock market responses.

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