



An Empirical Study on Risk and Return Analysis of Automobile Sector

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Abstract – The study titled "Risk and Return Analysis of the Automobile Industry" is an in-depth examination of the financial dynamics within the automobile sector, aimed at understanding the risk-return trade-off that investors and companies face in this volatile industry. The automobile industry is one of the largest sectors globally, with significant contributions to both economic growth and employment. However, it is also highly susceptible to various market risks such as economic downturns, technological advancements, regulatory changes, and fluctuations in consumer demand. This study is based on comparative analysis of risk and return, volatility, profitability and F-test of five automobile companies Tata Motors, Mahindra & Mahindra, Maruti Suzuki, Hyundai Motors, and Toyota Motors.,based on closing prices of five years data from 2020 to 2024.Key risk factors include fluctuations in raw material costs (especially steel and aluminum), geopolitical issues affecting global trade, and technological disruption due to advancements like electric vehicles (EVs) and autonomous driving technologies. On the return side, the industry presents opportunities, particularly for investors who can identify firms with strong market positioning, brand value, and an effective response to industry trends.

Keywords – Risk, Return, Bombay Stock Exchange (BSE)

I. INTRODUCTION

The Global Automotive Industry playing very vital role in the global economy ,the global automotive industry market size is expected to reach USD 6,861.45 Billion by 2033 , at a CAGR of 6.77% during the forecast period 2023 to 2033.An industry consisting of a wide range of businesses and organizations involved in design, development, manufacture , marketing and sale of automobiles. In terms of revenue,it is among the biggest sectors in the world. Automakers are developing a various models of vehicles,including electric cars, SUVs, trucks and vans.. Automakers are investing in battery manufacturing to ensure a consistent supply of batteries for their electric vehicles. Automakers are investing in infrastructure for charging to make it easier for consumers to charge their electric vehicles. Automakers are investing in software and digitalization to develop new technologies for their electric vehicles, such as over-the-air upgrades and autonomous driving.

In India , as per the Economic Survey report-2023, Indian auto –sector contributing 7.1% to the overall GDP of the country and it provides direct and indirect employment to over 19 million people.

The Economic Survey projects that the domestic electric vehicles (EV) market is expected to average a compound annual growth rate (CAGR) of 49 percent between 2022 and 2030 and is expected to hit 1 crore units in this period. The India Automobile Industry, ranked as the third-largest auto market in 2023 with a strong presence of both domestic and international original equipment manufacturers (OEMs).

This study concentrates on examining the equity of specific automobile companies listed on the Indian

securities market. By exploring the risk and investment features of these companies, it seeks to deliver a detailed insight into their investment potential. The study aims to offer valuable insights by examining the risk-return relationship, helping investors evaluate the potential profits and losses tied to investing in these equities.

Risk and return analysis plays a critical role in the automobile industry, where market dynamics and consumer preferences shift rapidly. This analysis helps companies assess potential returns in light of associated risks, guiding investments and strategic decisions across production, technology adoption, and market expansion.

Scope of the Study

The scope of the study is confined to 5 Automobile companies listed under BSE. This study covers the average return, standard deviation, beta & alpha of the selected company's securities for a period of 5 years i.e., from 2020 to 2024. The scope of the study focuses on analysing the risk and return dynamics within the automobile industry, considering factors like market volatility, economic influences, and stock performance. to enhance profitability. It compares the return on investments in the automobile sector with other industries to determine relative performance. The study assesses the influence of global market trends on the risk and return outlook for the automobile industry.

Risk and return tools used in this study:

Statistical tools

Mean: It is used to calculate the average returns of stocks by using the formula.

Return = (Closing price – Opening price) / Opening price * 100

Mean = $\sum R / N$ where $\sum R$ is sum of the returns of the Stock



N is number of years.

Standard Deviation (SD): It provides the measure of the total risk associated with a security. If the standard deviation is more, then the risk is also more in the security.

Standard deviation (σ) = $\sqrt{\text{Variance}}$

Variance(σ^2) = $S (R_i - \bar{R}_i)^2 / n-1$

Beta: Beta is a measure of the volatility in security returns due to changes in the economy or the market. Beta is also known as the beta coefficient. Beta is an index of the systematic risk of a security. The larger the beta, the more volatile the security and vice versa.

Beta (β) = $\text{Cov } i / \sigma_m^2$

Alpha: Alpha is a measure of the active return on an investment the performance of that investment compared with a suitable market index.

Alpha (α) = $R - R_f - \beta (R_m - R_f)$

In This Formula, The Variables Are: -

R: The Portfolio Return.

R_f: The Risk-Free Rate of Return.

Beta: The Systematic Risk of The Portfolio.

R_m: The Market Return.

II. REVIEW OF LITERATURE

Sonia Lobo and Ganesh Bhat (2021), Analyses the risk and return of selected stocks in Indian financial sector. The investor can use this to assess the risk-return relationship of various securities. With this context, a study is conducted to assess the risk-return trends of securities in the Indian financial services sector. They have analysed monthly closing prices of five financial investment companies that are part of the Standard & Poor's BSE Finance Index for the period of January 2020 to July 2021, the risk and return of a sample group of companies that belong to the Indian Financial Services sector are analysed to come up with a monthly return. Different statistical tools, including descriptive statistics, correlation, and beta, are used to achieve the goals. Additionally, a paired t-test is run to determine whether the hypothesis is valid.

Dr. V. Vanaja, P.J. Nishok (2020), The study tries to compare the risk and return of the stocks of a few chosen Indian automobile businesses. Many automakers have started investing in this industry to maintain the growing interest. The study also raises investor knowledge of the equities, encouraging them to purchase particular shares of the Indian automobile industry. The study is all about the risk and return analysis of selected five stocks in Indian Automobile Sector for a period of 5 years, covering from 2015-16 to 2019-20. This study uses tools such as beta and standard deviations, coefficient of correlation tools and provides a method for quantifying risk.

Hasan Ali and Habibolah (2010) Tested the risk-return relationship by way of taking 74 companies

assample size in Tehran Stock Exchange during the period of 2003-2005. The study examined the characteristics of the return in terms of Skewness and Kurtosis to find out the distribution of return series. As far as the study is concerned, the effect of Kurtosis did not show any significant relation with the return during the study period whereas the Skewness showed the important effects on returns.

Dr. P. Vikkraman, P. Varadaraja (2009), Any industry's risk and return analysis reveals the complexities involved with that specific industry. A thorough examination of the SE values reveals a clear understanding and aids in decision-making on the investment in SE priorities. As decisions regarding investment and financing are being made. This study only focused on few stocks in automobile industry. They have calculated the alpha(α), beta(β), expected return and risk probability of return. These calculations help the investors in making their investment decisions

Objectives of the Study

- To calculate the return of the selected automobile companies.
- To Analysis the Risk of Market with Individual Securities Beta.
- To analyse the relationship between the returns of the selected automobile companies.

III. RESEARCH METHODOLOGY

The systematic method or framework used to carry out scientific research is referred to as research methodology. The purpose of this study is to analyse the risk and return characteristics of selected stocks in the automobile sector. By conducting a comprehensive analysis, Its aim to provide insights into the investment potential and performance of these stocks for investors in the financial market. The stocks included in the study are Tata Motors, Mahindra & Mahindra, Maruti Suzuki, Hyundai Motors, and Toyota Motors. The data is collected for the past five years. The main objective of the study is to measure the risk and return for the selected companies' stocks by using various indicators such as mean, beta, standard deviation, variance. These measures will help us assess the risk-adjusted performance of the selected stocks and compare their returns to market benchmarks.

Sample Size: Data was collected from top five Automobile companies listed in BSE namely Tata Motors, Mahindra & Mahindra, Maruti Motors, Kia Motors India, and Toyota Motors to compare risk and return of selected companies with their benchmark index.

Source: The present study was conducted based on secondary data. Data was collected from the yahoo finance, moneycontrol.com website, journals and magazines etc.



Statistical Tools

- MEAN
- STANDARD DEVIATION
- VARIANCE
- BETA
- 5-F-TEST(ANOVA)

Hypothesis of the Study

- **H0:** There is no significance difference between return of selected Automobile companies.
- **H1:** There is a significant difference between return of selected Automobile companies.
- **H0:** There is no significance between difference risk of selected Automobile Companies
- **H2:** There is a significant difference between risk of selected Automobile companies.

Sample Design

The study of analysis mainly focusing at difference of changes in share prices of Indian Automobile companies listed on BSE indexes are taken for the study.

Sample Size: To analyze the risk and return of five Automobile companies.

Five Automobilecompanies

Tata Motors, 2.Mahindra & Mahindra, 3.Maruti Suzuki,4. Hyundai Motors, and 5.Toyota Motors

Data Analysis and Interpretation: Average Returns of Selected companies.

Year	Tata Motors	Mahindra & Mahindra	Maruti Suzuki	Kia Motors	Toyata Motors
2020	3.199	4.756	0.667	4.223	-0.491
2021	6.188	1.212	-0.331	2.71	2.281
2022	1.798	4.021	1.694	-1.411	-0.83
2023	7.272	2.331	2.00	3.002	3.990
2024	0.087	5.248	0.992	0.59	0.900
Average Return	3.518	3.514	1.0044	1.827	1.170

Interpretation: As per the above analysis average (Mean) returns of Tata Motors and Mahindra & Mahindra are comparatively high as compared to other automobile companies. i.e. 3.518 and 3.514. Whereas average return of Maruti Suzuki, is very low 1.004 as compared to Kia Motors and Toyotqa Motors. Comparing five yers return ,Tata Motors and Mahindra are performing well in terms of positive returns as compared to Maruti Suzuki,Kia and Toyota, respectively.

Average Risk of Selected Automobile Companies:

Year	Tata Motors	Mahindra & Mahindra	Maruti Suzuki	Kia Motors	Toyata Motors
2020	23.9	20.32	13.29	17.82	5.55
2021	15.86	5.08	5.39	13.44	5.50
2022	11.01	7.46	7.11	6.84	4.57
2023	26.01	6.83	3.72	6.84	5.66
2024	8.88	9.79	7.33	9.5	10.480
Average Risk	17.132	9.896	7.368	9.52	6.352

Interpretation: As per the above analysis , the average risk (SD) of Tata Motors is 17.13 ,comparatively high , Mahindra & Mahindra 9.896 and Kia Motors 9.52 as compared to Toyata and Maruti Suzuki. It indicates that, risk proportion is very high , suitable for high risk taking investors. It clearly indicating that high risk is associated with high return,

Beta value of Automobile Companies:

Year	Tata Motors	Mahindra & Mahindra	Maruti Suzuki	Kia Motors	Toyata Motors
2020	-0.146	-0.04	0.037	-0.114	-0.364
2021	-0.230	0.196	0.392	-0.032	0.007
2022	-0.542	0.218	0.065	0.012	-0.417
2023	-0.010	0.163	-0.861	0.962	-0.498
2024	0.000	0.000	0.000	0.000	0.000
Average Beta	-0.1862	0.1062	-0.0734	0.7166	-0.2543

Interpretation: A beta less than 0, which would indicate an inverse relation to the market, is possible but highly unlikely. Some investors argue that gold and gold stocks should have negative betas because they tend to do better when the stock market declines. Average beta value of Tata Motors over a period of 5 years is -0.186, inversely related to the market,it indicates that Tata Stock is less volatile than the market . Mahindra & Mahindra is 0.1062 ,less than market, indicates less risky. Maruti and Toyata are negative Beta , indicates stocks are inversely related to

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0.07
3



market. Kia Motor shows , Beta value of 0.7166, indicates less risky as compared to the market,i.e. BSE Index.

Alpha Value of Automobile Companies

Year	Tata Motors	Mahindra & Mahindra	Maruti Suzuki	Kia Motors	Toyota Motors
2020	3.150	4.694	0.594	4.170	-0.511
2021	6.150	-1.17	-0.451	2.646	-2.212
2022	-1.795	3.924	1.617	1.481	-0.843
2023	7.206	2.247	-2.661	2.827	3.988
2024	0.019	5.179	0.924	0.522	0.832
Average Alpha	2.946	3.443	0.946	1.737	1.135

Interpretation: Alpha of Tata Motors ,with an average of 2.946, points to positive excess returns beyond what the risk-adjusted market performance would predict, with the highest alpha of 7.206 in 2023 indicating substantial outperformance. The alpha values of Mehindra & Mahindra of averaging 3.443, indicate consistent positive excess returns beyond the market’s risk-adjusted performance, with the highest alpha of 5.179 in 2024 suggesting strong outperformance. Alpha of Maruti Suzuki with an average of 0.946 suggests that Maruti Suzuki generally not performed as compared to other companies. Average Alpha in Kia Motors is 1.737 and Toyata is 1.135,so all automobile companies are having positive Alpha indicates that, excess returns earned on an benchmark return.

Indicating performance of selected Automobile companies for the period of (2020-2024)

Name of the Company/T echniques	Tata Motors	Mahindra & Mahindra	Maruti Suzuki	Kia Motors	Toyata Motors
Return	2.99	3.515	13.362	1.827	1.176
Standard Deviation	17.29	9.901	7.373	10.786	6.311
Beta	-0.186	0.028	7.069	0.166	-0.254
Alpha	2.946	3.443	12.362	1.737	1.135

Interpretation: The performance of the selected automobile companies (Tata Motors, Mahindra & Mahindra, Maruti Suzuki, Kia Motors India, and Toyota

Motors) from 2020 to 2024 reveals varied returns, risk profiles, and market correlations. Tata Motors achieved an average return of 2.99%, with a high standard deviation of 17.29, reflecting significant volatility. Its negative beta of -0.186 suggests low correlation with the market, which can offer stability during market downturns. Mahindra & Mahindra delivered stable returns (3.515%) with a relatively lower standard deviation of 9.901, indicating consistent performance with minimal market sensitivity (beta of 0.028). Maruti Suzuki had the highest average return of 13.362%, but this came with considerable risk, as indicated by the standard deviation of 7.33 and a very high beta of 7.069, making it highly sensitive to market fluctuations. Kia Motors India showed moderate returns (1.827%) with low volatility (standard deviation of 10.786) and a weak market correlation (beta of 0.166). Toyota Motors displayed the lowest return (1.176%), but with the least volatility (standard deviation of 6.311) and a negative beta of -0.254, indicating it performs somewhat independently of market trends.

In terms of overall performance, Mahindra & Mahindra stands out as the best choice due to its consistent returns, lower volatility, and minimal market sensitivity, making it a stable investment option in a diversified portfolio. While Maruti Suzuki offers high returns, it’s high risk makes it less favourable for risk-averse investors. Tata Motors and Toyota Motors offer moderate returns with differing risk levels, while Kia Motors presents a balanced but lower return profile.

ANOVA TABLE

Source Of Variance	Sum Of Square	Df	Mean Square	F - Ratio	Critical Value (at 5%)
SSB	24.45	(5-1)=04	6.11	6.11/5.51 = 1.088	F(4,20) = 5.80
SSW	110.22	(25 - 5)=20	5.51		
Total	134.67	(25 - 1)=24			

Application of F-Test : Hypothesis Test -1

To check the validity of the data F-test is applied by using ANOVA-table.

H0: There is no significance difference between the mean return of Automobile Companies

H1: There is significance difference between the mean return of Automobile Companies

(Source: Calculated by author)

The above table shows that, the calculated value of F IS 1.088, which is less than the table value of 5.80 at 5% level of significance with d.f v1=4, v2= 20,P=0.05. Hence



H0 is accepted .There is no significance difference between mean return of all five automobile companies.
(Source: Calculated by author)

Hypothesis Test - 2

H0: There is no significance between difference risk of selected Automobile Companies

H2: There is a significant difference between risk of selected Automobile companies

ANOVA TABLE					
Source Of Variance	Sum Of Square	Df	Mean Square	F - Ratio	Critical Value (at 5%)
SSB	368.4	(5-1)=4	92.10	92.10/17.85 = 5.159	F(4,20) = 5.80
SSW	357.01	(25-5)=20	17.85		
TOTAL	725.41	(25-1)=24			

The above table shows that, the calculated value of F is 5.159, which is less than the table value of 5.80 at 5% level of significance with d.f v1=4, v2= 20, P=0.05.Hence H0 is accepted .There is no significance difference between risk associated with all five automobile companies.

Findings

Risk-Return Trade-off

- Maruti Suzuki offers the highest return, it comes with extreme volatility, making it suitable for high-risk investors.
- Toyota Motors provides the lowest return but with the least risk, appealing to conservative investors seeking stability.
- Mahindra & Mahindra strikes the best balance between risk and return, offering moderate growth with low volatility, making it an attractive option for risk-averse investors looking for consistent performance
- **Highest Return:** Maruti Suzuki (13.362%), though accompanied by significant risk.
- **Lowest Risk:** Toyota Motors, with the lowest volatility and a low beta.
- **Stable Performance:** Mahindra & Mahindra presents the most stable growth with moderate returns and low volatility.
- **Market Sensitivity:** Maruti Suzuki's extreme beta (7.069) suggests high market sensitivity, while Tata Motors, Kia Motors, and Toyota Motors show weaker or negative correlations.

- **Outperformance:** Maruti Suzuki and Tata Motors have demonstrated notable positive alpha, indicating outperformance over the market
- **Best Performer:** Mahindra & Mahindra stands out as the best in terms of consistent returns, low risk, and minimal market sensitivity, making it a reliable investment.
- **High Growth Potential:** Maruti Suzuki, despite high volatility, offers exceptional return potential, especially if investors are willing to take on substantial risk.

Suggestions

- Tata Motors and Toyota Motors show negative beta values, indicating their performance is less correlated with the broader market. Investing in such companies could provide diversification benefits, especially during market downturns.
- Mahindra & Mahindra has shown stable returns with lower volatility (standard deviation of 9.901), making it a favourable option for risk-averse investors. Its minimal market correlation (beta of 0.028) suggests it can be a safe, steady performer in a portfolio
- Maruti Suzuki offers the highest average return (13.362%), but the volatility (standard deviation of 7.393) and high beta (7.069) indicate that it is a high-risk, high-reward investment. It may appeal to aggressive investors looking for growth despite the risks.
- Kia Motors India has moderate returns (1.827%) and low volatility, making it a stable but less aggressive investment compared to its peers. Its relatively low beta (0.166) indicates low correlation with market movements, providing moderate growth without high risk.
- Alpha is an important measure of how well a company performs relative to the market. Maruti Suzuki and Tata Motors exhibit strong positive alphas, particularly in 2024, showing that they are consistently outperforming the market. This can be a key factor in making investment decisions
- The extreme volatility observed in Maruti Suzuki in 2024, with a standard deviation of 243.074, should be carefully considered. Investors should be aware that while the returns are substantial, they come with a significant amount of risk

Balance between Return and Risk: Tata Motors, while having moderate returns (2.990%) and high volatility, still shows outperformance with positive alpha (2.946). If the objective is to strike a balance between return and risk,

- **Assess Beta for Market Sensitivity:** The beta values suggest how sensitive a stock is to market movements. Maruti Suzuki's high beta indicates a strong market correlation, while Toyota and Tata Motors have negative betas, showing that they are less affected by



market swings. Understanding beta is crucial for risk management.

- **Strategic Allocation in Portfolio:** For a diversified portfolio, consider allocating more weight to Mahindra & Mahindra and Toyota Motors for stability, while using Tata Motors and Maruti Suzuki for higher potential returns with higher associated risks.
- **Revisit Risk Appetite When Investing in Maruti Suzuki:** Maruti Suzuki's extreme volatility and market sensitivity might not be suitable for all investors. It's essential to consider the investor's risk tolerance before recommending this company as part of an investment strategy.
- **Focus on Long-Term Performance:** For long-term investors, companies with stable returns like Mahindra & Mahindra and low volatility (such as Toyota Motors) may offer better risk-adjusted returns over time compared to high-risk, high-reward companies like Maruti Suzuki.
- **Sector Trends and External Factors:** External factors such as market conditions, consumer demand, and the automotive sector's performance should be factored in, especially when analysing companies with volatile returns like Maruti Suzuki and Tata Motors.

IV. CONCLUSION

The risk and return analysis of the automobile industry reveals significant insights into the industry's financial dynamics and investment potential. The automobile sector, characterized by high capital investment, technological advancements, and fluctuating demand, presents both opportunities and challenges for investors. Through an in-depth analysis of key financial metrics, it becomes evident that while the industry has the potential for substantial returns, it is also exposed to considerable risks, such as market volatility, regulatory changes, and supply chain disruptions.

The findings suggest that investors must carefully assess the risk-return trade-off in this sector, with a focus on diversification strategies to mitigate risks associated with economic downturns and technological shifts. It is crucial for investors to monitor global economic conditions, fuel prices, and consumer behaviour trends, as these factors have a direct impact on the performance of automobile companies. Additionally, the industry's growing emphasis on electric vehicles (EVs) and sustainable practices presents a new avenue for growth, yet it also introduces risks related to technological innovation and regulatory compliance. In conclusion, while the automobile industry offers attractive return prospects, especially in the context of emerging technologies and global expansion, investors must adopt a prudent approach to managing the associated risks. The integration of advanced risk management tools, market analysis, and an understanding of global economic

factors will be key to making informed investment decisions in them.

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