

CHAPTER THREE

Case Study (Qualitative Analysis)

Table of Contents

3.1	Introduction.....	102
3.2	Steps Applied in Case Studies	106
3.2.1	Step 1: Company Analysis.....	106
3.2.2	Step 2: Industry Analysis	121
3.2.3	Step 3: Economic Analysis	122
3.2.4	Step 4: E-I-C Framework Analysis.....	123
3.3	CASE STUDY 1: TATA Consultancy Limited (TCS).....	124
3.3.1	Step 1: Company Analysis of Tata Consultancy Limited.....	124
3.3.2	Step 2: Industry Analysis of TATA Consultancy Limited	140
3.3.3	Step 3: Economic Analysis of Tata Consultancy Limited	142
3.3.4	Step 4: E-I-C Framework for Tata Consultancy Limited	144
3.4	CASE STUDY 2: Infosys Limited	148
3.4.1	Step 1: Company Analysis of Infosys Limited	148
3.4.2	Step 2: Industry Analysis for Infosys Limited.....	164
3.4.3	Step 3: Economic Analysis for Infosys Limited	166
3.4.4	Step 4: E-I-C Framework for Infosys Limited.....	168
3.5	CASE STUDY 3: Bajaj Auto Limited.....	171
3.5.1	Step 1: Company Analysis of Bajaj Auto Limited	172
3.5.2	Step 2: Industry Analysis for Bajaj Auto.....	187
3.5.3	Step 3: Economic Analysis for Bajaj Auto	189
3.5.4	Step 4: E-I-C Framework for Bajaj Auto Limited	191
3.6	CASE STUDY 4: Hero MotoCorp Limited.....	195
3.6.1	Step 1: Company Analysis of Hero MotoCorp Limited	196
3.6.2	Step 2: Industry Analysis for Hero MotoCorp Limited	212

3.6.3	Step 3: Economic Analysis for Hero MotoCorp Limited	214
3.6.4	Step 4: E-I-C Framework for Hero MotoCorp Limited.....	216
3.6.5	Step 5: Identification of Other Factors Influencing Movement of Share Price of Hero MotoCorp	219
3.7	Summary of Variables Identified for Efficient Valuation & Accurate Tracking of Share Prices of Company	222
	Works Cited.....	226

Chapter Three: Case Study

3.1 Introduction

The present competitive era is with high risk and uncertainty as far as the individual is concerned and for the business world also. These uncertainties related to human life, income, and future sustainability have increased awareness about investment tremendously. At the same time, due to globalization of business, returns are affected by a number of internal as well as external factors. The present research endeavor tries to check and analyze factors related to economy, industry as well as company, having impact on valuation of shares and thereby return to the investors. for these purpose, different valuation methods with its evolution and historical development studied. In the previous chapter, we found that Economy-Industry-Company (E-I-C) is a more appropriate and useful valuation method in the present investment scenario. Therefore, this chapter expound to check the validity of different valuation methods suggested in literature and practically used traditionally as well as in the modern era of risk and uncertainty for this case study method is followed and valuation derived by different methods compared with the actual market price to achieve this goal. The present chapter deals with valuation, by following different methods, for four different business enterprises selected from nifty 50 companies. These companies are selected from two different sectors, which are experiencing a boom and flourishing like anything in the last decade. For selection purpose, 5 major contributing sectors of Nifty 50 member companies, are grouped industry wise as follows:

- i. Information Technology (IT)
- ii. Automobile and Auto Components
- iii. Financial Services
- iv. Fast Moving Consumer Goods (FMCG)
- v. Oil Gas & Consumable Fuels

Of these companies, companies representing Financial Services are eliminated from the study as they are not covered under the Companies Act and must follow bank law. Thus, their financial statements become incomparable with other sectors of companies. Fast Moving Consumer Goods (FMCG) companies are dealing with consumer goods where a wide range of products are produced and sold, and different products are affected by different factors. Hence, valuation and analysis of

these companies also becomes incomparable as well as unreliable. Hence, these groups of companies are eliminated from the study. The Oil and gas sector companies are also eliminated from the present study as most of their products are imported from different regions and they are also incomparable. Therefore, these three sectors Financial Services, FMCG, Oil & Gas are eliminated, and the remaining two sectors are:

- Information Technology (IT)
- Automobile and Auto Components, Considered for the study.

Companies from the Automobile sector deal with different kind of products and sold in different markets. The outcome of our analysis shows that only two companies- Bajaj Auto Limited and Hero MotoCorp Limited are dealing in the more or less same kind of products so selected considering them comparable as they operate in the field of the same product line. Another sector selected for our study is Information Technology. In our population of Nifty50 companies, 5 companies represent the Information Technology sector. These companies deal in the service sector and address more or less same kind of demands for services from different customers. As all these companies are dealing with more or less same product line, all these companies are comparable. Therefore, based on market capitalization on November 30, 2022, two companies are selected for our study. These companies are Tata Consultancy Services Limited (TCS) & Infosys Limited. Finally, the present study short-listed the following 4 companies.

- i. Tata Consultancy Services Limited (TCS)
- ii. Infosys Limited
- iii. Bajaj Auto Limited
- iv. Hero MotoCorp Limited a

Case study analysis is carried out by comparing Intrinsic Values of the above listed companies, calculated through different valuation methods, with the market price per share of the respective company. For this purpose, the study has selected 5 financial years, from 2014-15 to 2018-19 for calculating intrinsic value by considering its next 10 years' Annual Data for each year's valuation.

Valuation aims to determine the intrinsic value, or true worth, of the equity share of the Company under consideration. The objective is to assess whether this value is above or below the current market price. Technical analysts often use the P/E ratio for short-term price forecasts, but this ratio is unsuitable for long-term investors due to its dependence on potentially manipulable accounting profits, failure to consider discount rates, and disregard for a company's assets and liabilities. For long-term investments, comprehensive methods, as an illustration Discounted Cash Flow (DCF), Residual Income Models and Dividend Discount Models (DDM) Valuation are recommended. Estimating an intrinsic value and including various factors from Economy, Industry & Company improves valuation precision.

The previous chapter discussed that valuation initially used the Dividend Discount Method (DDM). Nevertheless, the challenge of valuing companies without dividend payments led to the development of the Discounted Cash Flow (DCF) method, which focuses on cash flows. The literature review indicates that DCF is a popular method among analysts but challenge to value companies with negative cashflow led to development of residual income valuation (RIV). The latest method, Residual Income Valuation (RIV), based on the Economic Value concept, uses profit after tax and book value of equity, making it suitable for companies with unpredictable cash flows & dividend payments. While different studies recommend various methods as the best for valuation, no single method is universally accepted. So, this study applies all three methods for case study purpose. i.e.

- Dividend discount method (DDM)
- Discounted Cash flow (DCF)
- Residual income (RIV)

Further, researchers believe that not only company, but related industry & economy also have impact on movement of share price. So, the study applies E-I-C framework.

Framework Applied: Economy- Industry- Company (E-I-C) Framework for analyzing future stock price of the company.

- **Economy Analysis:** Economy analysis measures the impact of selected macroeconomic variables on stock price movement of selected company.
- **Industry Analysis:** industry analysis measures the impact of selected macroeconomic variables on stock price movement of selected company.
- **Company Analysis:** company analysis calculates intrinsic value considering Dividend discount method (DDM), Discounted Cash flow (DCF)& Residual income (RIV) methods

Sample Size for Company Analysis: 4 companies from Nifty 50 index are selected using above mentioned filtering process.

- i. Tata Consultancy Services Limited (TCS)
- ii. Infosys Limited
- iii. Bajaj Auto Limited
- iv. Hero MotoCorp Limited

Period of Study: Broadly from 2011-12 to 2023-24

- **Economic Analysis:** 2011-12 to 2022-23
- **Industry analysis:** 2011-12 to 2022-23
- **Company analysis:** The research uses historical data from 2014-15 to 2023-24 for all four companies, supplemented by projected figures from 2024-25 to 2028-29. These projections are based on each company's 5-year Revenue Compound Annual Growth Rate (CAGR)

Statistical Tool Applied in Case Studies:

- Correlation
- Regression
- Mean Absolute Error (MAE)
- Mean Absolute Percentage Error (MAPE)
- Mean Squared Error (MSE)
- Root Mean Squared Error (RMSE)

3.2 Steps Applied in Case Studies

The study performs an in-depth analysis of each of the four companies utilizing the E-I-C framework. Since a company's performance greatly influences its share prices, the analysis starts with a detailed evaluation of the company. Prior to initiating the case study, it is essential to discuss the common inputs utilized across all methods. The study will also elaborate on the process of finalizing and selecting these inputs for the case study.

3.2.1 Step 1: Company Analysis

Common Inputs Applicable to All the four Companies: All valuation methods use the same perpetual growth rate and discounting factors, leading to variations in intrinsic values due to different key variables—dividends, cash flows, and residual income. Researchers' subjectivity in determining growth rate and discounting factors has minimal impact on the valuation, with the Main differences arising from the key variables themselves.

Discounting Factor: All the four companies used in the case study have zero debt. In such cases its WACC and Cost of Equity are the same. So, dividends, free cashflow and Residual income are being discounted using the required cost of equity. Here, cost of equity is being calculated using Capital Asset Pricing Model (CAPM).

Formula for calculating cost of equity = $R_f + \beta (R_m - R_f)$

Here,

R_f = Risk Free Rate of Return.

β = Beta indicates the systemic risk being faced by the company. In other words, beta indicates a change in the stock's return with respect to market return.

R_m = Market Rate of Return.

Perpetual Growth Rate: In practice, researchers and analysts conduct valuations using forecasted data for the next 5 to 10 years, followed by determining a terminal value for an infinite period. This process is split into two segments: the first is the predicted period, which relies on recent data and future expectations, and the second is the infinite period, where the company is assumed to grow at a constant rate indefinitely. To prevent unrealistic assumptions, the perpetual growth rate should not exceed the country's growth rate. In this study, India's GDP growth rate for the reference

year (next financial year) is adopted as the perpetual growth rate. This approach supports accurate long-term forecasts, which are vital for calculating terminal values in all three valuation methods and highlights the importance of projecting long-term economic trends for evaluating investment opportunities and economic usingbility.

Table 3. 1 Selection of Perpetual Growth Rate for Calculating Intrinsic Value

Year for Intrinsic Value	Reference Year for Perpetual Growth rate	GDP Growth Rate of Reference year	Perpetual Growth Rate
2014-15	2015-16	8.00%	8.00%
2015-16	2016-17	8.26%	8.26%
2016-17	2017-18	7.04%	7.04%
2017-18	2018-19	6.12%	6.12%
2018-19	2019-20	6.12%*	6.12%*

(Source: Handbook of RBI)

The present study calculates intrinsic value for 5 financial years i.e. from 2014-15 to 2018-19 using all the three methods i.e. Dividend Discount Model, Discounted Free Cash Flow Model & Residual Income Valuation Model. The above table indicates the steps followed in selection of the perpetual growth rate used for calculating terminal value of the firm. The first column indicates the year for which the intrinsic value is being calculated. The second column indicates financial years/ reference year whose GDP growth is taken as perpetual growth rate. Here, the next financial year is taken as reference year. Third column indicts the GDP growth rate of India in reference year while the fourth column confirms that the GDP growth rate of reference year is taken as perpetual growth rate. To be noted, actual GDP growth rate for year 2018-19 is 3.74% which is extremely rare. India is still developing country, so its GDP's normal range is between 6% to 8%. So, the present study uses GDP growth rate 2018-19 itself instead of GDP growth rate of reference year with the intension of avoiding influence abnormal years while predicting the terminal values. Thus, for 2018-19 the perpetual growth rate is taken as 6.12%*.

The next move is to summarize the selection of perpetual growth rate & Weighted Average Cost of Capital (WACC).

Table 3. 2: Summary of Common Inputs Used for All the Methods

Intrinsic Value Year	Prediction period (Next 10 years)	Terminal Value Year	Perpetual Growth Rate	WACC
2014-15	2015-16 to 2024-25	2024-25	8.00%	Cost of equity of 2014-15 of the company
2015-16	2016-17 to 2025-26	2025-26	8.26%	Cost of equity of 2015-16 of the company
2016-17	2017-18 to 2026-27	2026-27	7.04%	Cost of equity of 2016-17 of the company
2017-18	2018-19 to 2027-28	2027-28	6.12%	Cost of equity of 2017-18 of the company
2018-19	2019-20 to 2028-29	2028-29	6.12%	Cost of equity of 2018-19 of the company

(Source: Growth rate of GDP taken from Handbook of RBI)

The above table gives the information about the common growth rate & WACC used by all the three methods for calculating intrinsic value for 5 financial years i.e. 2014-15, 2015-16, 2016-17, 2017-18, 2018-19.

- For calculating intrinsic value of the year 2014-15, the next 10 years' Data are used. Here actual dividend/Free cash flow/ Residual income for next 9 years are available and for 10th year dividend/Free cash flow/ Residual income are forecasted. Thus, from 2015-16 to 2023-24 actual dividend/Free cash flow/ Residual income are used while for the 10th year i.e. for 2024-25, dividend/Free cash flow/ Residual income are forecasted. Further, present value is being calculated by discounting all dividend/Free cash flow/ Residual income using Weighted Average Cost of Capital. For calculating intrinsic value of 2014-15, WACC of 2014-15 is being used.
- For calculating intrinsic value of the year 2015-16, the next 10 years' Data are used. Here actual dividend/Free cash flow/ Residual income for next 8 years are available and for 9th & 10th year dividend/Free cash flow/ Residual income are forecasted. Thus, from 2016-17 to 2023-24 actual dividend/Free cash flow/ Residual income are used while for the 9th & 10th year i.e. for 2024-25 & 2025-26 dividend/Free cash flow/ Residual income are forecasted. Further, present value is being calculated by discounting all dividend/Free cash

flow/ Residual income using Weighted Average Cost of Capital. For calculating intrinsic value of 2015-16, WACC of 2015-16 is being used.

- For calculating intrinsic value of the year 2016-17, the next 10 years' Data are used. Here actual dividend/Free cash flow/ Residual income for next 7 years are available and for 8th to 10th year, the dividend/Free cash flow/ Residual income are forecasted. Thus, from 2017-18 to 2023-24 actual dividend/Free cash flow/ Residual income are used while for the 8th, 9th & 10th year i.e. for 2024-25, 2025-26 & 2026-27 dividend/Free cash flow/ Residual income are forecasted. Further, present value is being calculated by discounting all dividend/Free cash flow/ Residual income using Weighted Average Cost of Capital. For calculating intrinsic value of 2016-17, WACC of 2016-17 is being used.
- For calculating intrinsic value of the year 2017-18, the next 10 years' Data are used. Here actual dividend/Free cash flow/ Residual income for next 6 years are available and for 7th to 10th year dividend/Free cash flow/ Residual income are forecasted. Thus, from 2018-19 to 2023-24 actual dividend/Free cash flow/ Residual income are used while for the 7th, 8th, 9th & 10th year i.e. for 2024-25, 2025-26, 2026-27 & 2027-28 dividend/Free cash flow/ Residual income are forecasted. Further, present value is being calculated by discounting all dividend/Free cash flow/ Residual income using Weighted Average Cost of Capital. For calculating intrinsic value of 2017-18, WACC of 2017-18 is being used.
- For calculating intrinsic value of the year 2018-19, the next 10 years' Data are used. Here actual dividend/Free cash flow/ Residual income for next 5 years are available and for 6th to 10th year dividend/Free cash flow/ Residual income are forecasted. Thus, from 2015-16 to 2023-24 actual dividend/Free cash flow/ Residual income are used while for 6th to 10th year i.e. for 2024-25 to 2028-29 dividend/Free cash flow/ Residual income are forecasted. Further, present value is being calculated by discounting all dividend/Free cash flow/ Residual income using Weighted Average Cost of Capital. For calculating intrinsic value of 2018-19, WACC of 2018-19 is being used.

Intrinsic values for the year 2014-15 to 2018-19 are being calculated using the above stated inputs & valuation methods i.e. Dividend Discount Method, Discounted Cashflow Method & Residual Income Method.

Dividend Discount Method (DDM)

The Dividend Discount Model (DDM) asserts that the intrinsic value of a stock is equivalent to the present value of its expected dividend stream, discounted to the present. Damodaran views the DDM as a specific approach to equity valuation, where the valuation is achieved by discounting the anticipated future dividends at the cost of equity (Damodaran, 2006).

The present study calculates the intrinsic value of shares by dividing the life of the company in to two period i.e. finite period & infinite period. So, the study uses two stage dividend discount model with some alteration.

Formula for Two stage growth models:

$$V_0 = \sum_{t=1}^n \frac{D_0(1 + g_s)^t}{(1 + K_E)^t} + \frac{D_0 \times (1 + g_s)^n \times (1 + g_L)}{(1 + K_E)^n \times (K_E - g_L)}$$

Here, D_0 = Current Dividend

G_s = Super Normal Growth Rate

G_L = Normal/Stable Growth Rate, and

K_e = Cost of Equity

Alteration in formula: In real life, Dividend discount model uses predicted dividend for carrying out valuation. Nevertheless, the purpose of present study is to compare the results of all the three methods and suggest the method with least prediction errors, so the study do not predicts but uses actual dividend data as far as possible. In this study, actual data are taken up to the financial year 2023-24 during super normal growth rate period instead of multiplying the past data with expected supernormal growth rate because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future dividends are calculated using Revenue CAGR for the past 5 years i.e. from 2019-20 to 2023-24. For prediction purposes, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily as compared to dividends, free cash flow, and residual income. Here, revenue for past 5 years is considered and then CAGR is calculated using the formula: $((\frac{\text{value at the end}}{\text{value at the beginning}})^{(1/n)) - 1$

So, Considering the above discussion, formula applied in predictable period rate is:

$$\sum_{t=1}^{10} \frac{D_0(1 + g_s)^t}{(1 + K_e)^t}$$

Here, D_0 stands for current dividend, 't' represents time which ranges from 1 to 10 years & G_s stands for super normal Growth, K_e is cost of equity.

While formula applied in infinite period with perpetual growth rate is:

$$\frac{D_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

Here, g_L is normal/ Perpetual growth rate

So, the full formula applied in the study while applying DDM is:

$$\sum_{t=1}^{10} \frac{D_0(1 + g_s)^t}{(1 + K_e)^t} + \frac{D_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

Intrinsic value per share: The above-mentioned formula gives the value of the firm as a whole. The value of the firm is divided by number of equities share to get per share intrinsic value.

Discounted Cashflow Method (DCF):

The Discounted Cash Flow (DCF) valuation model is essentially a variation of the Dividend Discount Model (DDM). The DCF model does not represent a considerable departure from the traditional DDM approach (DeMarzo, 2008). Free cash flow pertains to the cash that a company can freely distribute to shareholders and creditors, as it is not needed for working capital or fixed asset investments (Ross, Westerfield., & Jaffe, 2010). Thus, The Discounted Cash Flow (DCF) method relies on free cash flow as the Main variable.

The present study calculates the intrinsic value of shares by dividing the life of the company in to two period i.e. finite period & infinite period. So, the study uses two stage Discounted Cashflow Model with some alteration.

Formula for Two stage growth models:

$$V_0 = \sum_{t=1}^n \frac{FCFF_0(1 + g_s)^t}{(1 + K_E)^t} + \frac{FCFF_0 \times (1 + g_s)^n \times (1 + g_L)}{(1 + K_E)^n \times (K_E - g_L)}$$

Here, $FCFF_0$ = Free Cashflow to Firm

G_s = Super Normal Growth Rate

G_L = Normal/Stable Growth Rate, and

K_E = Cost of Equity

Alteration in formula: In real life, Discounted Cashflow Model uses predicted free Cashflow for carrying out valuation. Nevertheless, the purpose of the present study is to compare the results of all the three methods and suggest the method with the least prediction errors, so the study does not predict but uses actual free cashflow data as far as possible. In this study, actual data are taken up to the financial year 2023-24 during super normal growth rate period instead of multiplying the past data with expected supernormal growth rate because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future free cash flows are calculated using Revenue CAGR for past 5 years (2019-20 to 2023-24). For prediction purposes, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily and behaves normally as compared to dividends, free cash flow, and residual income. In addition to that, the revenue growth is also an indication of the company's growth.

Here, revenue for past 5 years is considered and then CAGR is calculated using the formula:

$$\left(\left(\frac{\text{value at the end}}{\text{value at the beginning}} \right)^{1/n} \right) - 1$$

So, considering above discussion, formula applied in predictable period rate is:

$$\sum_{t=1}^{10} \frac{FCFF_0(1 + g_s)^t}{(1 + K_e)^t}$$

Here, FCCF represents Free Cashflow to Firm ‘t’ is time period that ranges from 1 to 10 years. ‘g_s’ is supernormal growth rate & ‘K_e’ is cost of equity.

While formula applied in infinite period with perpetual growth rate is:

$$\frac{FCFF_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

Here, g_L represents normal growth rate, it also called perpetual growth rate.

So, the full formula applied in the study while applying DCF is:

$$\sum_{t=1}^{10} \frac{FCFF_0(1 + g_s)^t}{(1 + K_e)^t} + \frac{FCFF_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

Table 3. 3: Calculations of Free Cashflow to Firm

Total Operating Revenues	XXXX
Less: Total Operating Expenses	X
Operating profit i.e. EBIT (except extra ordinary items)	XXX
Net Operating Profit After Tax (NOPAT) = [EBIT(1-T)]	XXX
Add: Depreciation And Amortization Expenses	X
Less: capital expenditure during the year	X
Less: change in networking capital	X
Free cash flow of firm (FCFF)	XX

(Source: Chartered Financial Analyst & Corporate Finance Institute)

Explanation of the elements in the above table & derivation of FCFF.

- Total Operating Revenue: This refers to the total income generated from a company’s Main business activities, excluding any non-operating income. It includes the revenue from the sale of goods or services.
- Total Operating Expenses: These are the costs incurred to generate the operating revenues. They encompass the cost of materials consumed, purchase of stock-in-trade, operating and direct expenses, changes in inventories of finished goods, work-in-progress, and stock-in-trade, employee benefit expenses, finance costs, depreciation and amortization expenses, and other expenses directly linked to core business activities. It’s crucial to note that Tata Consultancy Services (TCS) incurs finance costs related to lease liabilities, tax matters,

and other interest expenses, but not from long-term loans. An analysis of their annual reports reveals that their long-term liabilities are mainly long-term financial leases, indicating that TCS is a debt-free company (Ind AS 109: Financial Instruments). Consequently, their finance costs are tied to short-term financing needs like trade payables and working capital, thus making these costs part of their operating expenses.

- Operating Profit or EBIT (excluding extraordinary items): EBIT, or Earnings Before Interest and Taxes, represents the profit from a company's operations, excluding interest and tax expenses and extraordinary items. When extraordinary items are excluded from EBIT, it results in Operating Profit. Hence, Operating Profit = EBIT (excluding extraordinary items).
- Net Operating Profit After Tax (NOPAT): NOPAT is the after-tax profit from a company's core operations. It adjusts EBIT for taxes and is calculated as: $NOPAT = EBIT \times (1 - \text{Tax Rate})$.
- Depreciation and Amortization Expenses: These non-cash expenses reduce the value of tangible and intangible assets over time. They are added back to NOPAT because they are accounting expenses, not actual cash outflows.
- Capital Expenditure During the Year: This is the amount spent on acquiring or maintaining fixed assets as an illustration property, plant, and equipment. It represents a cash outflow that needs to be deducted from the cash flow.
- Change in Net Working Capital: Net working capital is the difference between current assets and current liabilities. A change in net working capital impacts cash flow: an increase in net working capital is a use of cash, while a decrease is a source of cash.
- Free Cash Flow to the Firm (FCFF): FCFF measures a company's financial performance, showing the cash available to investors after all expenses, reinvestments, and changes in working capital.

FCFF is calculated as:

$$FCFF = NOPAT + \text{Dep. \& Amortization} - \text{Capital Expenditure} - \text{Change in Net Working Capital}$$

This formula indicates how much cash a company generates after covering the costs required to maintain or expand its asset base.

Table 3. 4: Calculation of Change in Capital Expenditure:

Particular	Previous year	Current Year
Tangible Assets	X	Y
Add: Capital Work-in- Progress	X	Y
Plant, Property & Equipment at the of the year	XX	YY
Change in plant property and Equipment during the year	(YY-XX)	
Add: Depreciation (on tangible Assets) during the year	Z	
Capital Expenditure during the year	(YY-XX) + Z	

(Source: Chartered Financial Analyst & Corporate Finance Institute)

The above table indicates:

- **Tangible Assets:** Tangible Assets represent the value of the company's physical assets at the beginning (previous year) and end (current year) of the period, including items As an illustration machinery, buildings, and equipment. Notably, intangible assets are excluded from capital expenditure calculations because they do not have a physical presence, are less marketable, and are subject to amortization or impairment. Their costs are typically expensed or amortized rather than capitalized. Therefore, capital expenditure calculations are focused on tangible assets, which require substantial capital investments.
- **Capital Work-in-Progress:** This category includes ongoing investments in tangible assets that are not yet finished or in use. Examples include the construction of new facilities and the installation of new machinery.
- **Plant, Property & Equipment (PP&E) at the end of the year:** This is the sum of tangible assets and capital work-in-progress, indicating the total value of physical infrastructure and assets at the end of the respective years.
- **Change in Plant, Property & Equipment during the year:** This metric shows the net increase or decrease in the value of PP&E over the year. A positive value signifies additional investments in tangible assets, while a negative value indicates disposals or impairments of assets.

- Depreciation: This represents the annual depreciation expense for tangible assets. Depreciation is the allocation of the cost of tangible assets over their useful lives, accounting for wear and tear, aging, or obsolescence.
- Capital Expenditure during the year: Capital Expenditure (CapEx) refers to the total spending on tangible assets during the year. It includes the net change in PP&E plus the depreciation expense.

Table 3. 5: calculation of Change in Networking Capital

Particular	Previous year	Current Year
Current Assets Excluding Cash & Cash Equivalents	X	Y
Total Current Liabilities	X	Y
Net Working Capital	XX	YY
Change in Net Working Capital	(YY-XX)	

(Source: Corporate Finance Institute)

Clarification of the terms written in the above table.

- Current Assets Excluding Cash & Cash Equivalents: These include accounts receivable, inventories, and prepaid expenses, essential for daily operations and expected to convert into cash within a year. Cash and cash equivalents, which can be accessed through financing or investments, are excluded from the net working capital (NWC) calculation for FCFF. FCFF focuses on operational cash flows and the necessary working capital to sustain ongoing business activities.
- Total Current Liabilities: This category includes obligations due within a year, as an illustration accounts payable, short-term debt, and accrued expenses, providing insight into the company's short-term financial commitments.
- Net Working Capital: Calculated as Current Assets Excluding Cash & Cash Equivalents minus Total Current Liabilities. A positive Net Working Capital indicates more funds allocated to working capital, while a negative figure indicates fewer funds allocated.
- Change in Net Working Capital: Determined by subtracting the previous year's Net Working Capital from the current year's figure. A positive change indicates more funds tied up in current assets, reducing FCFF. Conversely, a negative change means fewer funds tied up, potentially increasing FCFF.

Residual Income Valuation Method (RIV)

The Residual Income (RI) model is a method used to determine the intrinsic value of a share based on the clean surplus available to a company after fulfilling all obligations, including operating and non-operating expenses. It calculates payments to equity shareholders using the Capital Asset Pricing Model (CAPM) or the opportunity cost concept. The RIM is similar to the concept of Economic Value Added (EVA) and is suitable for situations where cash flows are unpredictable. RIM is theoretically equivalent to the Dividend Discount Model (DDM) under clean surplus accounting but offers the added benefit of being applicable to both dividend-paying and non-dividend-paying companies.

The present study calculates the intrinsic value of shares by dividing the life of the company in to two periods i.e. finite period & infinite period. So, the study uses two stage Residual Income Valuation (RIV) Model with some alteration.

Formula for Two stage growth models:

$$V_0 = \sum_{t=1}^n \frac{RI_0(1+g_s)^t}{(1+K_E)^t} + \frac{RI_0 \times (1+g_s)^n \times (1+g_L)}{(1+K_E)^n \times (K_E - g_L)}$$

Here, RI_0 = Residual Income

G_s = Super Normal Growth Rate

G_L = Normal/Stable Growth Rate, and

K_e = Cost of Equity

Alterations in the Formula: In practice, the Residual Income Valuation (RIV) Model typically uses projected residual income for valuation. Nevertheless, this study aims to compare the results of three different valuation methods and identify the one with the smallest prediction errors. Therefore, it utilizes actual residual income data whenever possible.

For the analysis, actual data is used up to the financial year 2023-24, covering the period of supernormal growth. This approach is taken instead of extrapolating past data with an expected supernormal growth rate since actual data is available until 2023-24. After the financial year 2023-

24, future free cash flows are projected using the Revenue Compound Annual Growth Rate (CAGR) from the past five years (2019-20 to 2023-24).

The Revenue CAGR is chosen for forecasting residual income because it has shown a consistent increase and behaves more predictably compared to residual income. In addition to this, revenue growth is a good indicator of the company's overall growth, making it a reliable measure for future projections. Here, revenue for past 5 years is considered and then CAGR is calculated using the formula:

$$\left(\left(\frac{\text{value at the end}}{\text{value at the beginning}} \right)^{1/n} \right) - 1$$

So, considering above discussion, formula applied in predictable period rate is:

$$\sum_{t=1}^{10} \frac{RI(1 + g_s)^t}{(1 + K_e)^t}$$

Here, RI represents Residual Income 't' is time period that ranges from 1 to 10 years. 'g_s' is supernormal growth rate & 'K_e' is cost of equity.

While formula applied in infinite period with perpetual growth rate is:

$$\frac{RI_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

Here, g_i represents normal growth rate it also called perpetual growth rate.

So, the full formula applied in the study while applying DCF is:

$$\sum_{t=1}^{10} \frac{RI_0(1 + g_s)^t}{(1 + K_e)^t} + \frac{RI_{10} \times (1 + g_L)}{(1 + K_e)^{10} \times (K_e - g_L)}$$

$$\text{Residual Income (RS)} = (\text{Net Income} - K_e B_{t-1})$$

(Pinto, Henry, Robinson, Stowe, & Rath, 2010)

Here, Net Income = Profit After Tax.

K_e = Required Rate of Equity.

B_{t-1} is book value at a time t-1.

Now, once intrinsic value of company is being calculated using DDM, DCF & RIV method, an attempt has been made to find out the best method with least prediction error.

Statistical Tools Applied for Selecting Best Valuation Method:

Valuation results of all the methods are compared using Mean Absolute Error (MAE) Method, Mean Absolute Percentage Error (MAPE) Method, Mean Squared Error (MSE) Method, Root Mean Squared Error (RMSE) Method.

Mean Absolute Error (MAE)

The average difference between the model's predicted values and the observed values is expressed as the mean absolute error. The mean absolute error (MAE) does consider whether the difference is positive or negative, but it only computes the absolute difference.

$$\text{Formula for MAE} = \frac{1}{n} \sum_{i=1}^n |y_i - \hat{y}_i|$$

Here, y_i = is observed / Actual Value i.e. Market price.

$\hat{y}_i$ = estimated/ predicted value i.e. Intrinsic value

$|y_i - \hat{y}_i|$ = difference between Actual value & estimated value

The study calculates the Mean Absolute Error (MAE) between market prices and intrinsic values calculated using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods from 2014-15 to 2018-19. Comparing MAE values across these methods helps identify which one more accurately estimates real-world market conditions over time. A lower MAE indicates closer predictions to actual values, implying higher method accuracy.

Mean Absolute Percentage Error (MAPE)

The Mean Absolute Percentage Error Calculates the accuracy of model. The average percentage deviation between a predicted value and its true value is shown by the mean absolute percentage error. MAPE is easy to understand because it is in percentage term. MAPE indicates the predictions of the model were erroneous by what % in either direction.

$$\text{Formula: MAPE} = \left(\frac{\sum (|\text{actual value} - \text{forecasted value}|)}{n \cdot |\text{actual value}|} \right) * 100$$

Here, n indicates the number of years.

The study calculates the Mean Absolute Percentage Error (MAPE) between actual market prices and forecasted intrinsic values using DDM, DCF, and RIV methods for the company across five years (2014-15 to 2018-19). MAPE quantifies prediction errors in percentage terms, where lower values indicate greater accuracy.

Mean Squared Error (MSE)

MSE is the mean(Average) of the sums of the squares for each difference between the estimated and true values. Thus, the average of the squared error values is determined by mean squared error.

$$\text{Formula: MSE} = \frac{1}{n} \sum_{i=1}^n (Y_i - \hat{Y}_i)^2$$

The researcher has calculated the Mean Squared Error (MSE) between the actual market prices and forecasted intrinsic values using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods for the company across five years (2014-15 to 2018-19). MSE measures the average squared difference between predicted and actual values. Lower MSE values indicate that the predictions are closer to the actual market prices, suggesting higher accuracy of the forecasting method.

Root Mean Squared Error (RMSE)

RMSE is just the square root of the MSE so for calculating the RMSE one has to follow the same step having one additional step of getting square of MSE. As RMSE is the square root of the squared error, its less affected by the outliers as compared to MSE.

$$\text{Formula: } RMSE = \sqrt{\sum_{i=1}^n \frac{(\hat{y}_i - y_i)^2}{n}}$$

The study calculates Root Mean Squared Error (RMSE) values for the DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods in forecasting the company's market prices from 2014-15 to 2018-19. The lower digit of RMSE confirms its superior predictive accuracy.

Thus, the above four statistical methods help in identifying the best valuation method for company analysis. Nevertheless, whatever method being used, it has some prediction error. So, Researcher aims to find out the variable over & above company which affect the movement of share price. E-I-C framework believes that not only company, but related industry & country's Economy also affects the movement of market price. So, the next step is industry analysis followed by Economy analysis.

3.2.2 Step 2: Industry Analysis

This study forecasts the future trajectory of selected industries using trend analysis, which, combined with regression analysis, pinpoints key industrial factors for lay investors to consider when investing. Industry analysis can be carried out using industry life cycle analysis, SWOT analysis, PEST analysis, PESTEL analysis, Michael Porter's Five Forces analysis, and trend analysis. A review of the literature on industry analysis indicates that different studies employ different methods according to their specific needs and convenience.

Chosen Method: Trend analysis as well as regression analysis is applied for industry analysis, reason being, its effectiveness identifying the related industrial factors in tracking movement of share market price. To be noted, market prices have been adjusted for stock splits, eliminating any distortions caused by such events while carrying out Analysis.

Period for Industry Analysis: Financial year 2011-12 to 2022-23

Industries Selected:

- Information Technology Industry: Representing the service sector.
- Automobile Industry: Representing the manufacturing sector.

Variable Studied: Literature review reveals the mostly studied variables for selected industry. Based on literature review the study has identified the following variables for industry analysis.

Information Technology:

- Size of Information Technology Industry in terms of revenue
- Domestic Sales of Information Technology Industry
- Exports of Information Technology Industry

Automobile Industry:

- Industrial Production (in numbers)
- Domestic Sales (in numbers)
- Exports (in numbers)

This methodology ensures a detailed understanding of the critical drivers within these industries, aiding investors in making well-informed investment decisions. Last, part of analysis is Economic analysis.

3.2.3 Step 3: Economic Analysis

Economic analysis assesses the economic environment to understand the factors that impact the broader economy, specific industries, and individual businesses. It examines a range of macroeconomic variables and their effects on market performance, business operations, and investment decisions. This analysis provides stakeholders with a comprehensive understanding of the economic landscape, facilitating informed decision-making based on both current and anticipated economic conditions.

Chosen Method: Trend analysis as well as regression analysis is applied for Economy analysis, reason being, its effectiveness identifying the related economy's factors in tracking movement of share market price.

Period for Economy Analysis: Financial year 2011-12 to 2022-23

Economy Selected: Indian Economy

Variable Studied: The literature review on economic analysis reveals that various macroeconomic variables have been the focus of numerous studies. This review identifies six key macroeconomic variables that are frequently examined:

- Gross Domestic Product (GDP)
- Index of Industrial Production (IIP)
- Wholesale Price Index (WPI)
- Exchange Rate (Constant price)
- Crude Oil Prices per barrel for the Indian Basket (at Constant Price).

This section aims to determine the impact of these six variables on the market price of the company. To ensure accuracy, market prices have been adjusted for stock splits, eliminating any distortions caused by such events while carrying out Economy Analysis. Next step of the study is to track the market price using all three sectors simultaneously it is represented by E-I-C framework.

3.2.4 Step 4: E-I-C Framework Analysis

This segment of the study integrates economic, industry, and company-specific variables, employing regression analysis to evaluate the efficacy of the E-I-C framework. Given that companies operate within industries and industries within the economy, many variables under consideration exhibit high collinearity and potential complementarities. To mitigate multicollinearity and overlapping influences, a series of regressions are conducted in Excel, systematically refining the model to isolate key determinants. The study ultimately distills a concise set of critical factors, which serve as reliable indicators for making informed investment decisions. The findings suggest that investors can effectively track these essential variables,

thereby facilitating substantial equity returns without the necessity of engaging in comprehensive valuation procedures.

After discussing the E-I-C framework & methodology of study, the next move is to start with case study of all the four companies one by one. The study undertakes a comprehensive analysis of four companies, starting with Tata Consultancy Services (TCS), employing the E-I-C framework. Recognizing that a company's performance profoundly affects its share prices, the analysis initiates an exhaustive evaluation of the company itself. This is succeeded by a meticulous assessment of macroeconomic variables and industry dynamics. This rigorous analytical approach is uniformly applied to all the four companies in the study, ensuring a consistent and robust evaluation.

3.3 CASE STUDY 1: TATA Consultancy Limited (TCS)

Tata Consultancy Services Limited (TCS), a prominent Indian multinational corporation in the IT services and consulting sector, was originally founded as Tata Computer Systems in 1968 as part of Tata Sons Limited. In 1980, TCS pioneered the establishment of India's first dedicated software research and development facility, the Tata Research Development and Design Centre (TRDDC), located in Pune. Currently, TCS boasts a global presence, employing over 601,000 highly skilled consultants across 54 countries. Ranked by Brand Finance as the second most valuable IT services brand, TCS experienced an 11.5% increase in brand value, reaching US\$19.2 billion, with a notable US\$2 billion growth—the highest among the top 25 IT firms worldwide.

3.3.1 Step 1: Company Analysis of Tata Consultancy Limited

Company analysis is carried out using three methods i.e. 1) Dividend Discount Model, 2) Discounted cashflow Method and 3) Residual Income Method. The next move is to first discuss common inputs of TCS for company analysis through Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM).

Common Inputs for Company Analysis of TCS:

1. WACC, Perpetual Growth Rate & Number of Equity Shares

The Following table indicated common inputs of TCS for all the three methods.

Table 3. 6: WACC, Perpetual Growth Rate, No. of Eq. Shares of TCS from 2014-15 to 2018-19

Year	WACC	Perpetual growth rate	Number of equity shares
2014-15	11.99%	8.00%	195.87
2015-16	12.43%	8.26%	197.04
2016-17	11.38%	7.04%	197.04
2017-18	10.61%	6.12%	191.43
2018-19	10.25%	6.12%	375.24

(Source: WACC self-calculated, perpetual growth rate from RBI & No. of equity shares from Annual Reports TCS)

The table above outlines the common inputs for Tata Consultancy Limited (TCS) used in calculating the intrinsic value through the Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM). The first column lists the financial years for which the intrinsic value is calculated. The third column shows the perpetual growth rate applied in each respective year to calculate the Terminal Value of TCS. The fourth column indicates the number of equity shares at the end of each year, noting a considerable increase in the number of shares to 375.24 crores. Typically, such an increase in share supply affects the share price, causing it to fall according to the law of demand. The second column presents the Weighted Average Cost of Capital (WACC), which is used for discounting dividends, cash flows, and residual income to determine their present value. The WACC ranges from 10.25% to 12.43%. It is crucial to note that TCS is a debt-free company, so its cost of capital is the same as its WACC. The calculation of Cost of Equity, as per the Capital Asset Pricing Model (CAPM), is shown in the table below.

Table 3. 7: Cost of Equity Calculations of TCS as Per CAPM Model.

Year	Risk Free Rate	Beta	Risk Premium	Cost of Equity
2014-15	7.74%	8.40%	0.5057	11.99%
2015-16	7.47%	8.10%	0.6127	12.43%
2016-17	6.50%	8.50%	0.5743	11.38%
2017-18	6.80%	8.50%	0.4482	10.61%
2018-19	6.50%	8.30%	0.4517	10.25%
2019-20	4.80%	7.00%	0.6054	9.04%
2020-21	5.60%	7.30%	0.7269	10.91%
2021-22	5.60%	6.90%	0.6715	10.23%
2022-23	7.10%	8.50%	0.5973	12.18%
2023-24	7.20%	8.40%	0.8595	14.42%

(Source: Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024)

The table above shows the calculations for the cost of equity. The formula applied to calculate the cost of equity using the Capital Asset Pricing Model (CAPM) is: $R_f + \beta \times \text{Risk premium}$. Here, R_f is the risk-free rate of return, β (beta) represents the systematic risk faced by the company, and the risk premium indicates the excess return earned by the market over the risk-free rate of return. The values for R_f and R_m are sourced from the article titled 'Market Risk Premium and Risk-Free Rate used for 96 countries in 2024'. This article includes survey results of R_f and Risk Premium used by experts, industrialists, and authors across 96 countries, including India. The article also provides information about the survey of R_f and Risk Premium from 2008 to 2023 (Fernández, Garza, & Acín, 2024). Conversely, the beta for each year is calculated using a formula that measures the sensitivity of the stock return relative to the market return. The formula is:

$$\text{Formula } \beta = \frac{\text{Cov}(j, m)}{\delta^2 m}$$

Here, $\text{Cov}(j, m)$ = Covariance between the security's return and the market & $\delta^2 m$ Indicates Market Variance.

2. TATA Consultancy Limited's Growth Rate to be Used for Projections

In this study, actual data are taken up to the financial year 2023-24 during super normal growth rate period instead of multiplying the past data with expected supernormal growth rate because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future dividends, Cashflow & Residual Income are calculated using Revenue CAGR for past 5 years i.e. from 2019-20 to 2023-24. For prediction purposes, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily as compared to dividends, free cash flow, and residual income.

Table 3. 8: CAGR of TCS Based on Past 5 Year's Revenue

Revenue of TCS					(Rs. In crores)
	2019-20	2020-21	2021-22	2022-23	2023-24
Revenue	131306	135963	160341	190354	202359
5 YEARS CAGR	0.114190595				

(Source: Revenue from Annual Reports TCS & other things self-calculated)

The above table indicates the calculation of CAGR. Here, revenue for past 5 years is considered and then CAGR is calculated using the formula: $\left(\frac{\text{value at the end}}{\text{value at the beginning}} \right)^{(1/n)} - 1$

Calculation Dividend, Free Cashflow & Residual Income for TCS

One can easily get the dividend figures from Annual reports of company, so no calculations required for getting the dividend figures.

Nevertheless, free Cashflow & Residual incomes are calculated using the formula discussed in the introduction of the chapter.

The first discussion is on the calculation of free cashflow.

Table 3. 9: Calculation of Free Cash Flow to Firm for TCS

Year	Total Operating Rev.	Total Operating Exp.	Operating Profit (EBIT)	NOPAT = EBIT(1-T)	Dep. & Amort.	Cap. Exp.	Change in Net Working Capital	FCFF
2014-15	73578	54023	19555	12908	1394	3120	-2539	13721
2015-16	85864	60487	25377	16751	1459	1476	29798	-13064
2016-17	92693	67195	25498	16674	1575	1563	19163	-2477
2017-18	97356	71228	26128	17086	1647	1617	-5748	22864
2018-19	123170	90092	33078	21630	1716	1372	559	21415
2019-20	131306	97397	33909	22060	2701	8937	-892	16716
2020-21	135963	99243	36720	23889	3053	2828	1149	22965
2021-22	160341	118104	42237	27478	3522	3120	-8894	36774
2022-23	190354	143992	46362	30161	3940	2816	6318	24967
2023-24	202359	151072	51287	33365	3887	3398	-3659	37513

(source: FCFF self-Calculated using Annual Reports of TCS)

The above table indicates the calculation of FCFF using the mentioned formula in the same chapter in introductory part. The table shows the working of FCFF from 2014-15 to 2023-24.

The next discussion is on the calculations of residual Income.

Table: 3. 10: Calculation of Residual Income for TCS

Year	Profit for the Year	Cost of Equity	Book Value at the Beginning of the Year	Equity Charge	Residual Income
2014-15	19257	0.1199	44052	5280.85	13976.11
2015-16	23075	0.1243	45416	5646.66	17428.34
2016-17	23653	0.1138	65013	7399.55	16253.45
2017-18	25241	0.1061	78022	8275.51	16965.50
2018-19	30065	0.1025	75866	7775.46	22289.54
2019-20	33260	0.0904	78898	7130.40	26129.60
2020-21	30960	0.1091	74368	8110.86	22849.14
2021-22	38187	0.1023	74794	7653.89	30533.11
2022-23	39106	0.1218	77173	9397.69	29708.31
2023-24	43559	0.1442	74538	10748.33	32810.67

(Source: Self-Calculated)

The above table indicates the calculation of Residual income using the mentioned formula in the same chapter in introductory part. The table shows the working of Residual Income from 2014-15 to 2023-24.

Now, next move is to track the movement of All these three variables using their growth Rate

Table 3. 11: Dividend, Free Cashflow, Residual Income and Their Growth Rates of TCS

Year	Dividend	Growth Rate of Dividend	FCFF	Growth rate of FCFF	Residual Income	Growth Rate in Residual Income
2015-16	7993	-48.34%	-13064	-195.21%	17428.3	24.70%
2016-17	9162	14.62%	-2477	-81.04%	16253.5	-6.74%
2017-18	9284	1.33%	22864	1022.91%	16965.5	4.38%
2018-19	10085	8.62%	21415	-6.33%	22289.5	31.38%
2019-20	31896	216.27%	16716	-21.94%	26129.6	17.23%
2020-21	10850	-65.98%	22965	37.38%	22849.1	-12.56%
2021-22	13317	22.74%	36774	60.13%	30533.1	33.63%
2022-23	41347	210.48%	24967	-32.11%	29708.3	-2.70%
2023-24	25137	-39.20%	37513	50.25%	32810.7	10.44%

(Source: Self-Calculated)

The examination of the growth rate highlights the following key points.

Dividend Discount Model (DDM): The table illustrates TCS's dividend payments from 2014-15 to 2023-24, reflecting considerable fluctuations in growth rates ranging from -65.98% to 216.27%. Despite these variations, dividends generally increased, with notable peaks in 2019-20 and 2022-23. As an illustration, TCS issued a special dividend of ₹40 per share in Q2 2019-20, which considerably boosted the total dividend payout. Likewise, a special dividend of ₹67 per share in Q3 2022-23 led to a substantial increase in the total dividend for that year. These spikes are attributed to the company's surplus cash reserves and its decision to enhance shareholder value during these periods.

Discounted Cash Flow (DCF): FCFF data from 2015-16 to 2023-24 shows volatile performance with periods of both positive and negative growth rates. Free cashflow available in the years 2015-16, 2016-17, 2019-20 & 2022-23 is negative. Nevertheless, the highest FCFF was recorded in 2017-18, it was because of sudden rise in free cashflow available with TCS. Thus, the peak growth rate of FCFF occurred in 2017-18, indicating a strong year for cash flow generation. The variability in FCFF is influenced by factors as an illustration capital expenditures, operational efficiency, and revenue changes.

Residual Income Valuation (RIV): Residual income for TCS from 2015-16 to 2023-24 demonstrates a generally upward trend, with considerable increases in 2018-19 and 2021-22. Notably, the peak growth rate of 33.63% was achieved in 2021-22, and the highest residual income was recorded in 2023-24. Conversely, negative residual income occurred in 2016-17, 2020-21, and 2022-23, indicating periods when returns did not exceed the cost of capital. These fluctuations reflect varying degrees of performance relative to the company's cost of equity.

Intrinsic value of TCS for the period of 5 years from 2014-15 to 2018-19

The table given below illustrates the derivation of the total value of Tata Consultancy Services (TCS) for the fiscal year 2014-15 using three valuation methods: the Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This study covers a 10-year period, culminating in 2024-25. The analysis incorporates actual dividends, free cash flows, and residual income from TCS over nine years (2015-16 to 2023-24), while the figures for

2024-25 are projections based on a five-year Compound Annual Growth Rate (CAGR) of 11.42% in revenue, reflecting the company's overall growth trajectory.

Table 3. 12: Intrinsic Value of TCS For the Year 2014-15 Using DDM, DCF & RIV:

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2015-16	7993	7137.38	-13063.70	-11665.30	17428.34	15562.70
2016-17	9162	7305.48	-2477.35	-1975.36	16253.45	12960
2017-18	9284	6610.33	22863.62	16279.19	16965.50	12079.70
2018-19	10085	6411.99	21415.37	13615.78	22289.54	14171.60
2019-20	31896	18108.51	16715.84	9490.18	26129.60	14834.70
2020-21	10850	5500.54	22964.56	11642.17	29113.35	14759.40
2021-22	13317	6028.53	36773.70	16647.24	32437.82	14684.40
2022-23	41347	16713.92	24967.26	10092.65	36141.91	14609.80
2023-24	25137	9073.54	37513.27	13540.93	40268.98	14535.60
2024-25	28007 (P)	9027.46	41796.93(P)	13472.16	44867.32(P)	14461.80
Terminal value		244487		364860.90		391663
Total value of TCS		336404.71		456000.50		534323
No. of Eq. Shares		195.87 crores				
Intrinsic Value Per Share		1717.49 per share		2328.08 per share		2727.95 per share

(Source: Dividend from Annual Reports TCS & other things self-calculated)

Columns 3, 5, and 7 of the table display the present value of the dividend, free cash flow, and residual income streams, respectively, for each year, discounted using the Weighted Average Cost of Capital (WACC) of 11.99% from 2014-15. In addition to this, the terminal value is calculated for the year 2024-25 for each method, applying a perpetual growth rate of 8% along with the WACC of 11.99%. The firm's values for 2014-15, as determined by each method, are Rs. 336,404.71 crores (DDM), Rs. 456,000.5 crores (DCF), and Rs. 534,323 crores (RIV).

To ascertain the firm's value on a per-share basis, the total firm value is divided by the number of equity shares outstanding in that year, which is consistently 195.87 crores across all three methods. This calculation yields an intrinsic value of Rs. 1,717.49 per share for DDM, Rs. 2,328.08 per share for DCF, and Rs. 2,727.95 per share for RIV. Notably, the residual income stream is

considerably larger compared to the dividend and free cash flow streams, resulting in a higher intrinsic value under the RIV method relative to the others.

Likewise, the next move is to calculate intrinsic value of TCS for the year 2015-16.

Table 3. 13 : Intrinsic value of TCS for the year 2015-16 using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2016-17	9162	8148.85	-2477.4	-2203.4	16253.5	14456.1
2017-18	9284	7344.24	22863.6	18086.6	16965.5	13420.8
2018-19	10085	7095.67	21415.4	15067.6	22289.5	15682.6
2019-20	31896	19960.00	16715.8	10460.5	26129.6	16351.5
2020-21	10850	6038.92	22964.6	12781.7	22849.1	12717.4
2021-22	13317	6592.38	22964.6	11368.3	25458.3	12602.7
2022-23	41347	18204.80	24967.3	10992.9	28365.4	12489.1
2023-24	25137	9843.76	37513.3	14690.4	31604.5	12376.4
2024-25	28007 (P)	9754.98	41796.93(P)	14557.9	35213.39 (P)	12264.8
2025-26	31206 (P)	9667	46569.75 (P)	14426.6	39234.43(P)	12154.2
Terminal value		250786		374261		315311
Total value of TCS		353437		494490		449826
Number of Eq. Shares		197.04 crores				
Intrinsic Value Per Share		1793.73 per share		2509.59 per share		2282.92 per share

(Source: Dividend from Annual Reports TCS & other things self-calculated)

The above table indicates the calculation of Tata Consultancy Services (TCS) total firm value for the fiscal year 2015-16 using three valuation methods: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). The study spans a decade, concluding in 2025-26, and incorporates both historical data and forecasts. Exclusively, it employs actual dividends, free cash flows, and residual income for eight years (2016-17 to 2023-24) and forecasts for the subsequent two years (2024-25 and 2025-26). These forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 11.42%, reflective of revenue growth as a proxy for TCS's overall expansion.

Key financial parameters include a Weighted Average Cost of Capital (WACC) of 12.43% and a perpetual growth rate of 8.26%, crucial for calculating the terminal value at the end of the projection period in 2025-26. The resulting firm values for 2015-16 are Rs. 3,53,436.69 crores using DDM, Rs. 4,94,490 crores using DCF, and Rs. 4,49,826 crores through RIV. The intrinsic value per share is determined by dividing the firm's total value by the 197.04 crores outstanding equity shares, yielding intrinsic values of Rs. 1793.73 per share in DDM, Rs. 2509.59 per share in DCF, and Rs. 2282.92 per share in RIV. The analysis reveals that just like 2014-15, the intrinsic value derived in 2015-16 from the RIV method is consistently higher than that from DDM and DCF. Likewise, the next move is to calculate the intrinsic value of TCS for the year 2016-17.

Table 3. 14: Intrinsic Value of TCS for the Year 2016-17 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2017-18	9284	8335.31	22863.6	20527.3	16965.5	15231.9
2018-19	10085	8129.22	21415.4	17262.3	22289.5	17966.9
2019-20	31896	23083.20	16715.8	12097.3	26129.6	18910.0
2020-21	10850	7049.78	22964.6	14921.2	22849.1	14846.2
2021-22	13317	7768.52	22964.6	13396.5	30533.1	17811.6
2022-23	41347	21655.20	24967.3	13076.4	34019.7	17817.6
2023-24	25137	11820	37513.3	17639.6	37904.4	17823.6
2024-25	28007(P)	11824	41796.93(P)	17645.6	42232.77 (P)	17829.6
2025-26	31206(P)	11828	46569.75(P)	17651.5	47055.35(P)	17835.6
2026-27	34769(P)	11831.90	51887.58(P)	17657.4	52428.63(P)	17841.5
Terminal value		291708		435331		439870
Total value of TCS		415033		597206		613785
Number of Eq. Shares		197.04 crores				
Intrinsic Value Per Share		2106.33 per share		3030.88 per share		3115.02 per share

(Source: Dividend from Annual Reports TCS & other things self-calculated)

The table above demonstrates the methodology used to determine the total firm value of Tata Consultancy Services (TCS) for the financial year 2016-17 through three valuation models: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade, incorporates TCS's actual dividends, free

cash flows, and residual income for seven years (2017-18 to 2023-24), along with projections for the subsequent three fiscal years (2024-25 to 2026-27). The projections are based on a Compound Annual Growth Rate (CAGR) of 11.42% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is detailed in the 3rd, 5th, and 7th columns, discounted at the WACC of 11.38%. The terminal value, calculated at the end of the analysis period in 2026-27, employs the same WACC of 11.38% and assumes a perpetual growth rate of 7.04%.

The firm values for 2016-17 are calculated as Rs. 4,15,033 crores under DDM, Rs. 5,97,206 crores under DCF, and Rs. 6,13,785 crores under RIV. To determine the intrinsic value per share for 2016-17, the total firm value is divided by the number of equity shares, which is 197.04 crores. This yields intrinsic values of Rs. 2,106.33 per share using DDM, Rs. 3,030.88 per share using DCF, and Rs. 3,115.02 per share using RIV. It is Remarkable that, consistent with the previous years (2014-15 & 2015-16), the intrinsic value derived from the RIV method is higher compared to the DDM and DCF methods. Likewise, the next move is to calculate the intrinsic value of TCS for the year 2017-18.

Similar calculations for the year 2017-18 are presented in the next table. The table given below demonstrates a comprehensive analysis of the total firm value of Tata Consultancy Services (TCS) for the fiscal year 2017-18, employing three valuation methods: the Dividend Discount Model (DDM), the Discounted Cash Flow (DCF) model, and the Residual Income Valuation (RIV) approach. This analysis covers a ten-year period. It includes actual dividends, free cash flows, and residual income data for six years (2018-19 to 2023-24), along with forecasts for the subsequent four years (2024-25 to 2027-28). The forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 11.42% in revenue over the past five years, which serves as a proxy for the company's overall growth trajectory.

The present values of dividends, free cash flows, and residual income are detailed in the 3rd, 5th, and 7th columns of the table, each discounted using the Weighted Average Cost of Capital (WACC) of 10.61% as of 2017-18. The terminal value, calculated at the conclusion of the ten-year period in 2027-28, is derived using the same WACC and a perpetual growth rate of 6.12%.

Table 3. 15 Intrinsic Value of TCS for the Year 2017-18 Using DDM, DCF & RIV

(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2018-19	10085	9117.65	21415.37	19361.20	22289.54	20151.5
2019-20	31896	26070.53	16715.84	13662.86	26129.60	21357.3
2020-21	10850	8017.71	22964.56	16969.87	22849.14	16884.6
2021-22	13317	8896.79	36773.7	24567.70	30533.11	20398.5
2022-23	41347	24973.41	24967.26	15080.12	29708.31	17943.7
2023-24	25137	13726.32	37513.27	20484.51	33100.72	18075
2024-25	28007.41(P)	13826.76	41976.31(P)	20722.96	36880.51(P)	18207.3
2025-26	31205.59(P)	13927.93	46970.33(P)	20964.18	41091.91 (P)	18340.5
2026-27	34768.98(P)	14029.85	52558.5(P)	21208.21	45784.22(P)	18474.7
2027-28	38739.27(P)	14132.51	58811.51(P)	21455.08	51012.35 (P)	18609.9
Terminal value		334040.5		507119.28		439869
Total value of TCS		480760		701596		628312
Number of Eq. Shares		191.43 crores				
Intrinsic Value Per Share		2511.41 per share		3665.03 per share		3282.20 per share

(Source: Dividend from Annual Reports TCS & other things self-calculated)

The calculated firm values for 2017-18 are Rs. 4,80,760 crores using DDM, Rs. 7,01,596 crores using DCF, and Rs. 6,28,312 crores using RIV. To ascertain the intrinsic value per share for 2017-18, the total firm value is divided by the number of equity shares, which were 191.43 crores in that year. This computation yields intrinsic values of Rs. 2,511.41 per share for DDM, Rs. 3,665.03 per share for DCF, and Rs. 3,282.20 per share for RIV. The analysis reveals that the DCF method produces the highest intrinsic value per share for 2017-18, surpassing the values obtained using DDM and RIV.

Likewise, the next move is to calculate intrinsic value of TCS for the year 2018-19. The table below details the methodology for calculating the total firm value of Tata Consultancy Services (TCS) for the fiscal year 2018-19 using three valuation techniques: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade and includes both historical and forecasted data.

Specifically, it encompasses actual dividends, free cash flows, and residual income from TCS for 5 years (2019-20 to 2023-24) and projections for the subsequent 5 years (2024-25 to 2028-29).

Table 3. 16: Intrinsic Value of TCS for the Year 2018-19 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2019-20	31896	28930.9	16715.8	15161.9	26129.6	23700.5
2020-21	10850	8926.49	22964.6	18893.4	22849.1	18798.4
2021-22	13317	9937.64	36773.7	27441.9	30533.1	22784.9
2022-23	41347	27986.40	24967.3	16899.5	29708.3	20108.5
2023-24	25137	15432.70	37513.3	23031	32810.7	20143.9
2024-25	28007.41(P)	15596.50	41976.31(P)	23375.3	36557.3(P)	20357.7
2025-26	31205.59(P)	15762.0	46970.33(P)	23724.8	40731.8(P)	20573.7
2026-27	34768.98(P)	15929.3	52558.5(P)	24079.5	45383(P)	20792.1
2027-28	38739.27(P)	16098.4	58811.51(P)	24439.5	50565.4(P)	21012.8
2028-29	43162.93(P)	16269.2	65808.46(P)	24804.9	56339.4(P)	21235.8
Terminal value		418143		637523		545791
Total value of TCS		589012		859374		755299
Number of Eq. Shares		375.24 crores				
Intrinsic Value Per Share of TCS		1569.69 per share		2290.20 per share		2012.84 per share

(Source: Dividend from Annual Reports TCS & other things self-calculated)

The projections are based on a Compound Annual Growth Rate (CAGR) of 11.42% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is presented in the 3rd, 5th, and 7th columns of the table, discounted using the Weighted Average Cost of Capital of 10.25%.

The terminal value is calculated at the end of the 10-year period in 2028-29 using a WACC of 10.25% and a perpetual growth rate of 6.12%. This provides the total firm value for 2018-19 as Rs. 589,012.3 crores using DDM, Rs. 859,374.17 crores using DCF, and Rs. 755,299.2 crores using RIV.

To ascertain the intrinsic value per share for 2018-19, the total firm value is divided by the number of equity shares, which stands at 375.24 crores. This results in intrinsic values of Rs. 1,569.69 per share for DDM, Rs. 2,290.20 per share for DCF, and Rs. 2,012.84 per share for RIV. Among the three valuation methods, the DCF method yields the highest intrinsic value per share for the financial year 2018-19.

Table 3. 17: Market Value Per Share & Intrinsic Value Per Share as Per DDM, DCF & RIV of TATA Consultancy Limited

Year	Market price (Nifty 50)	Intrinsic Value		
		DDM	DCF	RIV
2014-15	2,553.95	1717.49	2328.08	2727.95
2015-16	2,520.30	1793.73	2509.59	2282.91
2016-17	2,431.80	2106.34	3030.89	3115.03
2017-18	2,849.15	2511.41	3665.03	3282.20
2018-19	2,001.65	1569.69	2290.20	2012.84

(Source: Self-Calculated)

The above table shows that the market price generally resembles the trends in intrinsic values, indicating that market participants may rely on similar valuation methods as the intrinsic value models provide a reasonable estimate of market value. Nevertheless, short-term fluctuations in market prices can arise from diverse factors. In 2018-19, both intrinsic values and market prices experienced a notable decline across all three valuation approaches. This decline is partly attributed to a bonus issue that increased the number of outstanding shares from 191.43 crores in 2017-18 to 375.24 crores in 2018-19, temporarily diluting per-share values. This analysis underscores the importance of considering capital structure changes, as an illustration bonus issues, in financial analysis and investment decision-making, as these can considerably impact shareholder value. Otherwise,

- DDM consistently shows lower intrinsic values compared to market prices, particularly in years with increased equity shares, highlighting potential undervaluation.
- DCF tends to provide intrinsic values that are close to or exceed market prices, indicating a more optimistic valuation perspective.
- RIV also shows higher intrinsic values compared to market prices, suggesting it may overestimate the stock's worth in certain years.

Upon thorough examination, it can be derived that DDM, DCF, and RIV yield different intrinsic values owing to their unique Main variables. Nonetheless, there is a quest to determine the superior method among these approaches. The preferred method is one that closely approximates the market price as its intrinsic value. In simpler terms, the method that exhibits minimal prediction error is regarded as the most effective.

Statistical Tools Applied for Selecting Best Valuation Method For TCS

In statistics, various methods are available to measure the prediction errors. Mentioned below are some of such the methods used in this part of the study.

- i. Mean Absolute Error (MAE)
- ii. Mean Absolute Percentage Error (MAPE)
- iii. Mean Squared Error (MSE)
- iv. Root Mean Squared Error (RMSE)

Mean Absolute Error (MAE)

Table 3. 18: Mean Absolute Error (MAE) of Market price With Intrinsic Value as Per DDM, DCF & RIV for TCS

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference
2014-15	2553.95	1717.49	836.46	2328.08	225.87	2727.95	173.99
2015-16	2520.30	1793.73	726.57	2509.59	10.71	2282.92	237.38
2016-17	2431.80	2106.34	325.46	3030.89	599.09	3115.03	683.23
2017-18	2849.15	2511.41	337.74	3665.03	815.88	3282.20	433.05
2018-19	2001.65	1569.69	431.95	2290.20	288.55	2012.84	11.19
MAE			531.64		388.02		307.77

(Source: Self-Calculated)

The table displays the Mean Absolute Error (MAE) between market prices and intrinsic values calculated using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods from 2014-15 to 2018-19. Comparing MAE values across these methods helps identify which one more accurately estimates real-world market conditions over time. A lower MAE indicates predictions closer to actual values, implying higher method accuracy. RIV consistently shows the smallest MAE values, indicating its estimates closely align

with actual market prices compared to DDM and DCF. Therefore, RIV is considered the optimal method for making informed investment decisions regarding TCS.

Mean Absolute Percentage Error (MAPE)

Table 3. 19: Mean Absolute Percentage Error (MAPE) of Market Price with Intrinsic Value as Per DDM, DCF & RIV for TCS

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error
2014-15	2553.95	1717.49	32.75%	2328.08	8.84%	2727.95	6.81%
2015-16	2520.30	1793.73	28.83%	2509.59	0.42%	2282.92	9.42%
2016-17	2431.80	2106.34	13.38%	3030.89	24.64%	3115.03	28.10%
2017-18	2849.15	2511.41	11.85%	3665.03	28.64%	3282.20	15.20%
2018-19	2001.65	1569.69	21.58%	2290.20	14.42%	2012.84	0.56%
MAPE			21.68%		15.39%		12.02%

(Source: Self-Calculated)

The table illustrates the Mean Absolute Percentage Error (MAPE) between actual market prices and forecasted intrinsic values using DDM, DCF, and RIV methods for TCS across five years (2014-15 to 2018-19). MAPE quantifies prediction errors in percentage terms, where lower values indicate greater accuracy. With MAPE values of 21.68%, 15.39%, and 12.02% for DDM, DCF, and RIV respectively, RIV emerges as the most accurate method for predicting TCS's market prices over the five-year period. This indicates that RIV provides more reliable estimates, making it preferable for informed investment decisions for TCS.

Mean Squared Error (MSE)

Table 3. 20: Mean Squared Error (MSE) of Market price With Intrinsic Value as Per DDM, DCF & RIV for TCS

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2553.95	1717.49	699,665.77	2328.08	51,018.44	2727.95	30,275.25
2015-16	2520.30	1793.73	527,903.00	2509.59	114.63	2282.92	56,350.15
2016-17	2431.80	2106.34	105,925.39	3030.89	358,905.04	3115.03	466,797.59
2017-18	2849.15	2511.41	114,065.56	3665.03	665,654.20	3282.20	187,532.65
2018-19	2001.65	1569.69	186,585.35	2290.20	83,260.37	2012.84	125.28
MSE			326,829		231,790		148,216

(Source: Self-Calculated)

The table presents the Mean Squared Error (MSE) between the actual market prices and forecasted intrinsic values using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods for TCS across five years (2014-15 to 2018-19). MSE measures the average squared difference between predicted and actual values. Lower MSE values indicate that the predictions are closer to the actual market prices, suggesting higher accuracy of the forecasting method. As indicated by the above table MSE is 326829, 231,790 & 148,216 for DDM, DCF & RIV respectively. Here, RIV demonstrates the lowest MSE indicating RIV is the optimal method among DDM, DCF, and RIV for predicting TCS's market prices

Root Mean Squared Error (RMSE)

Table 3. 21: Root Mean Squared Error (RMSE) of Market price With Intrinsic Value as Per DDM, DCF & RIV for TCS

Year	MKT Price	DDM		DCF		RIV	
		Intrinsic Value	Squared Difference	Intrinsic Value	Squared Difference	Intrinsic Value	Squared Difference
2014-15	2553.95	1717.49	699,665.77	2328.08	51,018.44	2727.95	30,275.25
2015-16	2520.30	1793.73	527,903.00	2509.59	114.63	2282.92	56,350.15
2016-17	2431.80	2106.34	105,925.39	3030.89	358,905.04	3115.03	466,797.59
2017-18	2849.15	2511.41	114,065.56	3665.03	665,654.20	3282.20	187,532.65
2018-19	2001.65	1569.69	186,585.35	2290.20	83,260.37	2012.84	125.28
MSE			326,829.01		231,790.54		148,216.18
RMSE			571.69		481.45		384.99

(Source: Self-Calculated)

The table above shows Root Mean Squared Error (RMSE) values for the DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods in forecasting TCS's market prices from 2014-15 to 2018-19. The lower digit of RMSE for RIV (384.99) compared to DDM (571.69) and DCF (481.45) confirms its superior predictive accuracy. Thus, RIV is indeed the best method for predicting TCS's market prices

The outcomes from each of the four statistical tools are compiled in the table shown in the below. The summary table of all tests conducted to identify the most accurate valuation method indicates that the Residual Income Valuation (RIV) method is the most effective for predicting the market price of TCS. Nevertheless, despite its superiority over the other three methods, RIV cannot perfectly capture the fluctuations in market price. This limitation arises because a company's

market price is influenced by a complex interplay of factors, categorized into company-specific, economic, industry-specific, and other factors.

Table 3. 22: Summary of Results for MAE, MAPE, MSE & RMSE

Test For Measuring Prediction Error	Error Test Results for:			Best Method
	DDM	DCF	RIV	
MAE	531.64	388.02	307.77	RIV
MAPE	21.68%	15.39%	12.02%	RIV
MSE	326,829	231,790	148,216	RIV
RMSE	571.69	481.45	384.99	RIV
Overall Best Method	(Residual Income Valuation) RIV			

(Source: Self-Calculated)

Researchers have made strides in identifying which industry-specific and macroeconomic factors considerably affect TCS's market price movements. Nevertheless, it is crucial to acknowledge that other factors, as an illustration rumors, news, announcements, and market sentiments, also play a crucial role. These factors are inherently difficult to quantify.

After completing the company analysis, the next move is to carry out the industry analysis.

3.3.2 Step 2: Industry Analysis of TATA Consultancy Limited

Industry analysis aims to forecast the future trajectory of the industry under review. There are various methods available to conduct such an analysis, including industry life cycle analysis, SWOT analysis, PEST analysis, PESTEL analysis, Michael Porter's Five Forces analysis, and trend analysis. A review of the literature on industry analysis indicates that different studies employ different methods according to their specific needs and convenience. The present study has applied trend analysis, as the objective of the study is to advise lay investors on the industrial factors to be considered when investing. Trend analysis, combined with regression analysis, can help identify the key industrial factors that should be considered when purchasing company shares in the secondary market.

Indian Information Technology Industry Analysis

The literature review of the Indian IT industry indicates that the Main trends studied are the size of the IT sector, domestic IT sales and IT exports. For this analysis, a 12-year period from 2011-

12 to 2022-23 has been chosen, mirroring the economic analysis timeframe. This study aims to pinpoint the industrial factors that influence the market prices of TCS and Infosys.

Indian Information Technology Industry's Analysis & Market Price of TCS

H_0 = Market price of TCS is not affected by Industrial factors i.e. Size of IT sector, Domestic Sales of IT and Exports by IT

H_1 = Market price of TCS is affected by Industrial factors i.e. Size of IT sector, Domestic Sales of IT and Exports by IT

Table 3. 23: Market Price of TCS & IT Industry Variables

Year	Mkt price of TCS (Per Share)	Size (Rs. in crores)	Domestic Sales (Rs. in crores)	Exports (Rs. in crores)
2011-12	584.40	100000	31200	68800
2012-13	787.88	108000	31900	76100
2013-14	1,051.05	118000	32000	86000
2014-15	1,282.07	146000	48000	98000
2015-16	1,244.75	133000	25000	108000
2016-17	1,220.50	154000	37000	117000
2017-18	1,424.57	167000	41000	126000
2018-19	2,000.30	181000	45000	136000
2019-20	1,778.50	191000	41000	150000
2020-21	3,158.55	194000	43000	15100
2021-22	3,731.55	227000	49000	178000
2022-23	3,138.90	245000	51000	194000

(Source: Compiled from NASSCOM & Yahoo finance)

Regression is run in Excel on the above variables. Here the market price of TCS (adjusted for stock split) is a dependent variable and Industrial factors were considered as independent variables. The following results are obtained:

Table 3. 24: Multiple R & R Square of Industry Analysis for TCS

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variable. Multiple R of 0.9470 indicates there is strong positive relationship between Market price of TCS IT Industry Variables.
Multiple R	0.9470	
R Square	0.8969	
Adjusted R Square	0.8582	
Standard Error	385.37	
Observations	12	
(Source: Calculated using Excel)		

R square of 0.8969 indicates that 89.68% variations in Market price of TCS are being explained by listed industrial variables.

Table 3. 25: ANOVA Results of Industry Analysis for TCS

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	10334760	3444920	23.19609	0.000266
Residual	8	1188104	148513		
Total	11	11522864			

(Source: Regression Results Generated using Excel)

ANOVA table shows that the significance F indicates that P value is 0.000266 which is less than alpha value of 0.05. Therefore, null hypothesis is rejected, and it is concluded that Industrial factors i.e. Size of IT sector, Domestic Sales of IT and Exports by IT have impact on the movement of Adjusted market price of TCS.

3.3.3 Step 3: Economic Analysis of Tata Consultancy Limited

The literature review on economic analysis reveals that various macroeconomic variables have been the focus of numerous studies. This review identifies five key macroeconomic variables that are frequently examined: Gross Domestic Product (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), and Crude Oil Prices per barrel for the Indian Basket (at Constant Price). This section aims to determine the impact of these five variables on the market price of TCS. To ensure accuracy, market prices have been adjusted for stock splits, eliminating any distortions caused by such events. The analysis covers a period of 12 years, from 2011-12 to 2023-24, as the year 2011-12 marks the latest revised base year for most macroeconomic variables.

Market Price of Tata Consultancy & Macroeconomic Variables

H_0 = Market price of TCS is not affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

H_1 = Market price of TCS is affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

Table 3. 26: Market Price of TCS & Macroeconomic Variables

Year	TCS	GDP	IIP	WPI	Exchange Rate	crude oil prices
2011-12	584.40	92130170	100.00	100.0	97.81	111.89
2012-13	787.88	87363290	103.30	106.9	94.73	107.97
2013-14	1,051.05	98013700	106.70	112.5	91.11	105.52
2014-15	1,282.07	105276740	111.00	113.9	97.09	84.16
2015-16	1,244.75	113694930	114.70	109.7	99.98	46.17
2016-17	1,220.50	123081930	120.00	111.6	102.63	47.56
2017-18	1,424.57	131445820	125.30	114.9	106.52	56.43
2018-19	2,000.30	139929140	130.10	119.8	100.29	69.88
2019-20	1,778.50	145346410	129.00	121.8	103.56	60.47
2020-21	3,158.55	136871180	118.10	123.4	101.84	44.82
2021-22	3,731.55	149258400	131.60	139.4	102.22	79.18
2022-23	3,138.90	160064250	138.50	152.5	101.90	93.15

(Sources: Compiles from Handbook of RBI)

Regression is run in Excel on the above variables. Here the market price of TCS (adjusted for stock split) is a dependent variable and macroeconomic factors were considered as independent variables. The following results are obtained:

Table 3. 27: Multiple R & R Square of Economic Analysis For TCS

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.9505 indicates there is strong positive relationship between Market price of TCS and macroeconomic variables.
Multiple R	0.9505	
R Square	0.9035	
Adjusted R Square	0.8232	
Standard Error	430.41	
Observations	12	
(Source: Calculated using Excel)		

R square of 0.9035 indicates that 90.35% variations in Market price of TCS are being explained by listed macroeconomic variables.

Table 3. 28: ANOVA Results of Economic Analysis For TCS

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	10411360.87	2082272	11.2403	0.00526
Residual	6	1111503.095	185250.5		
Total	11	11522863.97			

(Source: Regression Results Generated using Excel)

ANOVA table shows that the significance F indicates that P value is 0.00526 which is less than Alpha of 0.05. thus, null hypothesis is rejected and it is concluded that macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Whole Sale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price) have impact on the movement of Adjusted market price of TCS. Thus, the economic analysis reveals that macroeconomic factors have impact on the movement of Adjusted market price of TCS.

3.3.4 Step 4: E-I-C Framework for Tata Consultancy Limited

Up to this point the researcher has tried to find out the impact of company Variables, industry variable and Macroeconomic variables individually on market price per Share of TCS. This part of the study attempts to combine all the sectors and test whether it is possible to track market price using all Economy- Industry- Company variables simultaneously.

Table 3. 29: Variables Considered to Test the Efficiency of E-I-C Framework to Track Market Price of TCS

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP)	6. Size of IT industry	9. Residual Income of TCS
2. Index of Industrial Production (IIP)	7. Domestic Sales of IT industry	
3. Wholesale Price Index (WPI)	8. Exports by IT Industry	
4. Exchange Rate (Constant price)		
5. Crude Oil Prices per barrel for Indian Basket (at Constant Price)		

(Source: Finalized based on above Results)

The table above presents a list of variables from the economy, industry, and company levels, which are being evaluated to determine their combined ability to track the market price of TCS from 2011-12 to 2023-24. Given that tracking 9 variables for a single stock can be a complex task and recognizing that these 9 factors (5 from the economy, 3 from the industry, and 1 from the company) influence each other, it is practical to eliminate redundant variables. By doing so, we can focus on the key representative variables essential for tracking TCS's market price.

To streamline this process, various regressions were conducted in Excel. The goal was to identify the key variables that considerably impact TCS's market price, thus facilitating a more straightforward and effective analysis. Consequently, the following key factors were finalized and included in the E-I-C (Economy-Industry-Company) framework for monitoring TCS's market price movements and guiding investment decisions:

Table 3. 30: Factors finalized for E-I-C Framework to Track Market Price of TCS

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP) 2. Wholesale Price Index (WPI)	3. Size of IT industry	4. Residual Income of TCS

(Source: Finalized based on multiple regressions' Results)

The next move is to see the regression results which support the finalization of the above stated 5 variables for tracking Market Price Movement of TCS.

E-I-C Framework & Market Price of TCS

H_0 = Market price of TCS is not affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of TCS.

H_1 = Market price of TCS is affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of TCS.

Table 3. 31 Market Price of TCS and E-I-C Variables for TCS

Year	MPS of TCS	GDP (Rs.)	WPI	Size of IT industry (Revenue in Rs.)	Residual Income
2011-12	584.40	92130170	100.0	100000	7880.82
2012-13	787.88	87363290	106.9	108000	9790.04
2013-14	1,051.05	98013700	112.5	118000	14288.57
2014-15	1,282.07	105276740	113.9	146000	13976.11
2015-16	1,244.75	113694930	109.7	133000	17428.34
2016-17	1,220.50	123081930	111.6	154000	16253.45
2017-18	1,424.57	131445820	114.9	167000	16965.50
2018-19	2,000.30	139929140	119.8	181000	22289.54
2019-20	1,778.50	145346410	121.8	191000	26129.60
2020-21	3,158.55	136871180	123.4	194000	22849.14
2021-22	3,731.55	149258400	139.4	227000	30533.11
2022-23	3,138.90	160064250	152.5	245000	29708.31

(Sources: Handbook of RBI, NASSCOM, Annual Reports of TCS)

Regression is run in Excel on the above variables. Here the market price of TCS (adjusted for stock split) is a dependent variable and other variables from Economy, Industry & Company were considered as independent variables. The following results are obtained:

Table 3. 32 Multiple R & R Square of E-I-C Framework for TCS

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.95539 indicates there is strong positive relationship between Market price of TCS and listed variables.
Multiple R	0.9554	
R Square	0.9128	
Adjusted R Square	0.8629	
Standard Error	378.93	
Observations	12	
(Source: Generated in Excel)		

R square of 0.91277 indicates that 91.28% variations in Market price of TCS are being explained by listed macroeconomic variables.

Table 3. 33: ANOVA Results of E-I-C Framework for TCS

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	10517723	2629431	18.31188	0.000822
Residual	7	1005141	143591.5		
Total	11	11522864			

(Source: Regression Results Generated using Excel)

ANOVA table shows that the significance F indicates that P value is 0.000822 which is less than Alpha of 0.05. Thus, null hypothesis is rejected, and it is concluded that Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of TCS have impact on the movement of Adjusted market price of TCS. Thus, the Study endorses the E-I-C Frameworks central idea that while carrying out valuation not only Company's, but related industry's & Economy's variable should also be considered.

Findings of Case Study 1 of TATA Consultancy Limited

The following are the main findings from the TATA Consultancy Limited case study.

- The company analysis indicated that, among the methods assessed—namely the Dividend Discount Method (DDM), the Discounted Cashflow Method (DCF), and the Residual Income model (RIV)- the Residual Income model (RIV) is found to be the most accurate in predicting the market price of TATA Consultancy Limited.
- According to Industry analysis, the size, domestic sales, and exports of the IT sector have significant impacts on how the price of TCS shares changes.
- As per Economic analysis Gross Domestic Product (GDP), the Index of Industrial Production (IIP), the Wholesale Price Index (WPI), the Exchange Rate (at a constant price), and the price of crude oil per barrel for the Indian Basket (at a constant price) all have a big effect on how the share price of TCS changes.

The most effective methods for determining a company's intrinsic value were identified through a review of 12 studies that examined a variety of valuation techniques. The sample sizes of these studies varied from 10 to 25,843 companies, with a significant number of them concentrating on equity analysts' reports for data analysis. The Residual Income Valuation (RIV) and Discounted Cash Flow (DCF) models, which are absolute valuation methods, necessitated a significant amount of information regarding the company, industry, and economy, which frequently limited the sample size. In contrast, relative valuation measures, such as price-to-earnings (PE) and enterprise value ratios, necessitated fewer variables, which allowed for the analysis of larger samples.

The accuracy of these valuation models was frequently assessed using statistical tools such as multiple regression, Average Absolute Prediction Error (APE), and Signed Prediction Error (SPE). It is important to note that the application of absolute valuation methods, such as the Dividend Discount Model (DDM) and RIV, required a consistent history of dividend payments, which restricted their applicability to specific companies. Additionally, the distinctive financial structures of financial companies frequently resulted in their exclusion from studies that utilised extensive datasets. In the end, RIV and DCF were recognized as robust absolute valuation methods, while PE and enterprise value ratios were acknowledged as effective relative valuation measures that were extensively used.

Lastly, The E-I-C framework identified four primary variables out of the initial nine that significantly impact TCS's share price. Upon compiling the findings from Economy, Industry, and Company analyses within this framework, it was found that TCS's share price is predominantly influenced by Gross Domestic Product (GDP), the Wholesale Price Index (WPI), the Size of the IT Industry (in Rs.), and TCS's Residual Income

3.4 CASE STUDY 2: Infosys Limited

Infosys Limited, founded in 1981 and headquartered in Bengaluru, India, is a leading global player in next-generation digital services and consulting. As the second-largest IT services firm in India by revenue, trailing only Tata Consultancy Services (TCS), Infosys maintains a significant foothold in the Indian IT outsourcing market, with an estimated market share of 8% to 9%. This robust market position underscores its global competitiveness. For the fiscal year ending March 31, 2024, Infosys reported a revenue of approximately \$18.56 billion, and as of March 2024, the company employed around 317,240 individuals worldwide, showcasing its vast human capital and operational scale.

3.4.1 Step 1: Company Analysis of Infosys Limited

Company analysis of Infosys is carried out using three methods i.e. 1) Dividend Discount Model, 2) Discounted cashflow Method and 3) Residual Income Method. First discussion is on common inputs of Infosys for company analysis for carrying out valuation using Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM).

Common Inputs for Company Analysis of Infosys:

1. WACC, Perpetual Growth Rate & Number of Equity Shares

The following table indicates common inputs of Infosys for all the three inputs.

Table 3. 34: WACC, Perpetual Growth Rate and No. of Eq. Shares of Infosys from 2014-15 to 2018-19

Year	WACC	Perpetual growth rate	Number of equity shares
2014-15	11.59%	8.00%	114.85
2015-16	14.19%	8.26%	229.64
2016-17	12.19%	7.04%	229.69
2017-18	12.73%	6.12%	218.41
2018-19	11.51%	6.12%	435.63

(Source: WACC self-calculated, perpetual growth rate from RBI & No. of equity shares from Annual Reports Infosys)

The table above outlines the common inputs for Infosys used in calculating the intrinsic value through the Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM). The first column lists the financial years for which the intrinsic value is calculated. The third column shows the perpetual growth rate applied in each respective year to calculate the Terminal Value of Infosys. The fourth column indicates the number of equity shares at the end of each year, noting a considerable increase in the number of shares to 229.64 crores in 2015-16 & 435. 63 crores in 2018-19. Typically, such an increase in share supply affects the share price, causing it to fall according to the law of demand. The second column presents the Weighted Average Cost of Capital (WACC), which is used for discounting dividends, cash flows, and residual income to determine their present value. The WACC ranges from 14.19% to 11.51%. It is crucial to note that Infosys is a debt-free company, so its cost of capital is the same as its WACC.

The calculation of Cost of Equity, as per the Capital Asset Pricing Model (CAPM), is shown in the table below. The table above shows the calculations for the cost of equity. Similar to TCS, the formula applied to calculate the cost of equity using the Capital Asset Pricing Model (CAPM) is: $R_f + \beta \times \text{Risk premium}$.

Table 3. 35: Calculations of Cost of Equity for Infosys as Per CAPM Model.

Year	Risk Free Rate	Risk Premium	Beta	Cost of Equity
2014-15	7.74%	8.40%	0.4586	11.59%
2015-16	7.47%	8.10%	0.8302	14.19%
2016-17	6.50%	8.50%	0.6692	12.19%
2017-18	6.80%	8.50%	0.6979	12.73%
2018-19	6.50%	8.30%	0.6031	11.51%
2019-20	4.80%	7.00%	0.7583	10.11%
2020-21	5.60%	7.30%	0.7822	11.31%
2021-22	5.60%	6.90%	0.7304	10.64%
2022-23	7.10%	8.50%	1.2223	17.49%
2023-24	7.20%	8.40%	1.1857	17.16%

(Source: Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024)

2. Infosys' growth rate to be used for projections

In this study, actual data are taken up to financial year 2023-24 during super normal growth rate period because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future dividends, Cashflows & Residual Incomes are calculated using Revenue CAGR for past 5 years i.e. from 2019-20 to 2023-24. For prediction purpose, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily as compared to dividends, free cash flow, and residual income.

Table 3. 36: CAGR of Infosys Based on Past 5 Year's Revenue

Revenue of Infosys					(Rs. In crores)
	2019-20	2020-21	2021-22	2022-23	2023-24
Revenue	79,047	85,912	103,940	124,014	128,933
5 YEARS CAGR	0.130107283				

(Source: Revenue from Annual Reports TCS & other things self-calculated)

The above table indicates the calculation of CAGR. Here, revenue for past 5 years is considered and then CAGR is calculated using the formula: $\left(\frac{\text{value at the end}}{\text{value at the beginning}} \right)^{(1/n)} - 1$

Calculation Dividend, Free Cashflow & Residual Income for Infosys Limited

One can easily get the dividend figures from Annual reports of company, so no calculations required for getting the dividend figures.

Nevertheless, free Cashflow & Residual incomes are calculated using the formula discussed in the introduction of the chapter. The first discussion is on the calculation of free cashflow for Infosys.

Table 3. 37: Calculation Free Cash Flow to Firm of Infosys Limited

Year	Total Operating Rev.	Total Operating Exp.	Operating Profit (EBIT)	NOPAT= EBIT(1-T)	Dep. & Amort.	Cap. Exp.	Change in Net Working Capital	FCFF
2014-15	47300	34251	13049	8613.65	913	2343	-3566	10749.64
2015-16	53983	39389	14594	9633.50	1115	2181	4018	4549.50
2016-17	59289	43413	15876	10381.63	1331	2001	11410	-1698.37
2017-18	61941	46052	15889	10390.13	1408	2014	-1085	10869.13
2018-19	73107	56032	17075	11165.68	1599	2709	-416	10471.68
2019-20	79047	61270	17777	11565.01	2144	5354	-204	8559.01
2020-21	85912	63902	22010	14318.83	2321	2715	-1990	15914.83
2021-22	103940	78669	25271	16440.3	2429	2229	2143	14497.30
2022-23	124014	96230	27784	18075.16	2753	3110	2915	14803.16
2023-24	128933	100397	28536	18564.38	2944	2330	17569	1609.38

(source: FCFF self-Calculated using Annual Reports of Infosys)

The above table indicates the calculation of FCFF using the mentioned formula in the same chapter in introductory part. The table shows the working of FCFF from 2014-15 to 2023-24. One can observe that FCFF in 2023-24 is only 1609.38 which is extremely rare for Infosys. So, the researcher has made one rational adjustment in for the year 2023-24, instead of multiplying with CAGR of 13.01%, average of past 9 years' FCFF is taken into account. For other years, projection are done as usual by multiplying the previous year's FCFF with Rev CAGR of 13.01%.

The next discussion is on the calculations of residual Income:

The next table indicates the calculation of Residual income using the mentioned formula in the same chapter in introductory part. The table shows the working of Residual Income from 2014-15 to 2023-24.

Table 3. 38: Calculation Residual Income of Infosys Limited

Year	Profit for the Year	Cost of Equity	Book Value at the Beginning of the Year	Equity Charge	Residual Income
2014-15	12164	0.1159	42092	4879.34	7284.66
2015-16	12693	0.1419	48068	6822.90	5870.11
2016-17	13818	0.1219	61082	7444.59	6373.41
2017-18	16155	0.1273	68017	8659.66	7495.34
2018-19	14702	0.1151	63502	7306.26	7395.75
2019-20	15543	0.1011	62711	6339.03	9203.97
2020-21	18048	0.1131	62234	7038.60	11009.40
2021-22	21235	0.1064	71531	7610.63	13624.37
2022-23	23268	0.1749	69306	12124.12	11143.88
2023-24	27234	0.1716	67745	11624.71	15609.29

(Source: Self-Calculated)

Now, the next move is to track the movement of All these three variables using their growth Rate

Table 3. 39: Dividend, Free Cashflow, Residual Income and Their Growth Rates of Infosys

Year	Dividend	Growth Rate of Dividend	FCFF	Growth rate of FCFF	Residual Income	Growth Rate in Residual Income
2015-16	5570	8.98%	4549.50	-57.68%	5870.11	-19.42%
2016-17	6980	25.31%	-1698.37	-137.33%	6373.41	8.57%
2017-18	5623	-19.44%	10869.13	739.98%	7495.34	17.60%
2018-19	13768	144.85%	10471.68	-3.66%	7395.75	-1.33%
2019-20	9553	-30.61%	8559.01	-18.27%	9203.97	24.45%
2020-21	9158	-4.13%	15914.83	85.94%	11009.40	19.62%
2021-22	12700	38.68%	14497.30	-8.91%	13624.37	23.75%
2022-23	13675	7.68%	14803.16	2.11%	11143.88	-18.21%
2023-24	14733	7.74%	1609.38	-89.13%	15609.29	40.07%

(Source: Self-Calculated)

Key pint observed while tracking the fluctuations in growth rates.

Dividend Discount Model (DDM): The dividend growth rate for Infosys over the analyzed period demonstrates considerable volatility, with fluctuations ranging from -30.61% to 144.85%. This reflects instability in dividend payouts. A notable surge occurred in 2018-19, driven by Infosys's strategic decision to declare a special dividend of ₹4 per share in January 2019 as part of its capital allocation policy. This decision aligned with the company's commitment to returning 70% of its

free cash flow to shareholders. Consequently, the number of equity shares increased considerably from 218.41 crores to 435.63 crores, impacting the overall dividend dynamics. Nevertheless, this was followed by a sharp decline in dividend growth in 2019-20, highlighting the temporary nature of the special dividend impact.

Discounted Cash Flow (DCF): The free cash flow to the firm (FCFF) growth rate exhibits pronounced volatility, with values ranging from -137.33% to 85.94%. The sharp declines observed, particularly in 2016-17 and 2023-24, can be attributed to operational challenges or strategic investments that curtailed free cash flow. The substantial growth in FCFF during 2017-18 is primarily due to the base year effect, increased revenue, and the release of funds from working capital. Conversely, the considerable dip in growth rate in 2020-21 is linked to a reduction in capital expenditures, enhancing cash flow. The sudden fall in FCFF in 2023-24 is attributable to substantial investments made during the year, reflecting the company's strategic focus on growth opportunities.

Residual Income Valuation (RIV): The residual income growth rate shows moderate fluctuations, generally maintaining positive growth across most years except for slight declines in 2018-19 and 2021-22. The range of growth rates, from -18.21% to 40.07%, suggests relatively stable profitability with variations likely influenced by changes in net income or adjustments in the cost of capital. This stability indicates consistent value creation, despite some periodic fluctuations.

Intrinsic value of Infosys for the period of 5 years from 2014-15 to 2018-19 using DDM, DCF & RIV.

The table below illustrates the derivation of the total value of Infosys for the fiscal year 2014-15 using three valuation methods: the Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This study covers a 10-year period, culminating in 2024. The analysis incorporates actual dividends, free cash flows, and residual income from Infosys over nine years (2015-16 to 2023-24), while the figures for 2024-25 are projections based on a five-year Compound Annual Growth Rate (CAGR) of 13.01% in revenue, reflecting the company's overall growth trajectory.

Table 3. 40: Intrinsic Value of Infosys for the Year 2014-15 Using DDM, DCF & RIV:

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2015-16	5570	4991.39	4549.50	4076.90	5870.11	5260.32
2016-17	6980	5605.17	-1698.37	-1363.84	6373.41	5118.06
2017-18	5623	4046.39	10869.13	7821.58	7495.34	5393.76
2018-19	13768	8878.45	10471.68	6752.78	7395.75	4769.23
2019-20	9553	5520.43	8559.01	4946.02	9203.97	5318.73
2020-21	9158	4742.42	15914.83	8241.41	11009.40	5701.16
2021-22	9158	4249.78	14497.30	6727.49	13624.37	6322.41
2022-23	13675	5686.70	14803.16	6155.84	11143.88	4634.14
2023-24	14733	5490.23	1609.38	599.73	15609.29	5816.78
2024-25	16650 (P)	5560.02	8841.73(P)	2952.59	17640.18(P)	5890.72
Terminal value		167167.80		88772.69		177110.69
Total value of Infosys		221938.80		135683.19		231336
No. of Eq. Shares		114.85 crores				
Intrinsic Value Per Share		1932.42 per share		1181.39 per share		2014.24 per share

(Source: Dividend from Annual Reports Infosys & other things self-calculated)

Columns 3, 5, and 7 of the table display the present value of the dividend, free cash flow, and residual income streams, respectively, for each year, discounted using the Weighted Average Cost of Capital (WACC) of 11.59% from 2014-15. In addition to this, the terminal value is calculated for the year 2024-25 for each method, applying a perpetual growth rate of 8% along with the WACC of 11.59%. The firm's values for 2014-15, as determined by each method, are Rs. 2,21,938.80 crores (DDM), Rs. 1,35,683.19 crores (DCF), and Rs. 2,31,336 crores (RIV).

To ascertain the firm's value on a per-share basis, the total firm value is divided by the number of equity shares outstanding in that year, which is consistently 114.85 crores across all three methods. This calculation yields an intrinsic value of Rs. 1932.42 per share for DDM, Rs. 1,181.39 per share for DCF, and Rs. 2014.24 per share for RIV. Notably, the residual income stream is considerably larger compared to the dividend and free cash flow streams, resulting in a higher intrinsic value under the RIV method relative to the others.

Likewise, the next move is to calculate intrinsic value of Infosys for the year 2015-16.

Table 3. 41: Intrinsic Value of Infosys for The Year 2015-16 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2016-17	6980	6112.39	-1698.37	-1487.26	6373.41	5581.20
2017-18	5623	4312.01	10869.13	8335.02	7495.34	5747.82
2018-19	13768	9245.66	10471.68	7032.08	7395.75	4966.49
2019-20	9553	5617.75	8559.01	5033.22	9203.97	5412.50
2020-21	9158	4716.06	15914.83	8195.60	11009.40	5669.47
2021-22	12700	5727.15	14497.30	6537.65	13624.37	6144.00
2022-23	13675	5400.30	14803.16	5845.81	11143.88	4400.75
2023-24	14733	5094.92	1609.38	556.55	15609.29	5397.96
2024-25	16650(P)	5042.11	8841.74 (P)	2677.56	17640.18(P)	5342.01
2025-26	18816(P)	4989.86	9992.11(P)	2649.81	19935.29(P)	5286.64
Terminal value		91031.08		48341.08		96445.45
Total value of Infosys		147289.28		93717.12		150394.28
Number of Eq. Shares		229.64 crores				
Intrinsic Value Per Share		641.39 per share		408.10 per share		654.91 per share

(Source: Dividend from Annual Reports Infosys & other things self-calculated)

The above table indicates the calculation of Infosys total firm value for the fiscal year 2015-16 using three valuation methods: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). The study spans a decade, concluding in 2024, and incorporates both historical data and forecasts. Specifically, it employs actual dividends, free cash flows, and residual income for eight years (2016-17 to 2023-24) and forecasts for the subsequent two years (2024-25 and 2025-26). These forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 13.01%, reflective of revenue growth as a proxy for Infosys' overall expansion.

Key financial parameters include a Weighted Average Cost of Capital (WACC) of 14.19% and a perpetual growth rate of 8.26%, crucial for calculating the terminal value at the end of the projection period in 2025-26. The resulting firm values for 2015-16 are Rs. 1,47,289.28 crores using DDM, Rs. 93,717.12 crores using DCF, and Rs. 1,50,394.28 per share through RIV. The intrinsic value per share is determined by dividing the firm's total value by the 229.64 crores outstanding equity shares, yielding intrinsic values of Rs. 641.39 per share in DDM, Rs. 408.10

per share in DCF, and Rs. 654.91 per share in RIV. The analysis reveals that just like 2014-15, the intrinsic value derived in 2015-16 from the RIV method is consistently higher than that from DDM and DCF.

Likewise, the next move is to calculate the intrinsic value of Infosys for the year 2016-17.

Table 3. 42: Intrinsic Value of Infosys for The Year 2016-17 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2017-18	5623	5012.13	10869.13	9688.33	7495.34	6681.06
2018-19	13768	10939.04	10471.68	8320.03	7395.75	5876.11
2019-20	9553	6765.54	8559.01	6061.58	9203.97	6518.35
2020-21	9158	5781.19	15914.83	10046.59	11009.40	6949.92
2021-22	9158	5153.13	14497.30	8157.52	11009.40	6194.90
2022-23	13675	6858.86	14803.16	7424.71	11143.88	5589.35
2023-24	14733	6586.74	1609.38	719.51	15609.29	6978.50
2024-25	16650 (P)	6635.05	8841.74(P)	3523.47	17640.18 (P)	7029.69
2025-26	18816(P)	6683.71	9992.11(P)	3549.32	19935.29(P)	7081.25
2026-27	21264(P)	6732.74	11292.16(P)	3575.35	22529.02(P)	7133.19
Terminal value		139994.58		74342.62		148321.22
Total value of Infosys		207142.71		135409.02		214353.55
Number of Eq. Shares		229.69 crores				
Intrinsic Value Per Share		901.84 per share		589.53 per share		933.22 per share

(Source: Dividend from Annual Reports Infosys & other things self-calculated)

The table above demonstrates the methodology used to determine the total firm value of Infosys for the financial year 2016-17 through three valuation models: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade, incorporates Infosys' actual dividends, free cash flows, and residual income for seven years (2017-18 to 2023-24), along with projections for the subsequent three fiscal years (2024-25 to 2026-27).

The projections are based on a Compound Annual Growth Rate (CAGR) of 13.01% in revenue over the past five years, reflecting the company's consistent growth. The present value of

dividends, free cash flows, and residual income for each year is detailed in the 3rd, 5th, and 7th columns, discounted at the 2016-17 Weighted Average Cost of Capital (WACC) of 12.19%. The terminal value, calculated at the end of the analysis period in 2026-27, employs the same WACC of 12.19% and assumes a perpetual growth rate of 7.04%.

The firm values for 2016-17 are calculated as Rs. 2,07,142.71 crores under DDM, Rs. 1,35,409.02 crores under DCF, and Rs. 2,14,353.55 crores under RIV. To determine the intrinsic value per share for 2016-17, the total firm value is divided by the number of equity shares, which is 229.69 crores. This yields intrinsic values of Rs. 901.84 per share using DDM, Rs. 589.53 per share using DCF, and Rs. 933.22 per share using RIV. It is Remarkable that, consistent with the previous years (2014-15 & 2015-16), the intrinsic value derived from the RIV method is higher compared to the DDM and DCF methods.

Likewise, the next move is to calculate the intrinsic value of Infosys for the year 2017-18. The table below provides a comprehensive analysis of the total firm value of Infosys for the fiscal year 2017-18, employing three valuation methodologies: the Dividend Discount Model (DDM), the Discounted Cash Flow (DCF) model, and the Residual Income Valuation (RIV) approach. This analysis covers a ten-year period. It includes actual dividends, free cash flows, and residual income data for six years (2018-19 to 2023-24), along with forecasts for the subsequent four years (2024-25 to 2027-28). The forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 13.01% in revenue over the past five years, which serves as a proxy for the company's overall growth trajectory.

Table 3. 43: Intrinsic Value of Infosys for The Year 2017-18 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2018-19	13768	12213.08	10471.68	9289.04	7395.75	6560.49
2019-20	9553	7517.07	8559.01	6734.91	9203.97	7242.42
2020-21	9158	6392.39	15914.83	11108.74	11009.40	7684.69
2021-22	12700	7863.59	14497.30	8976.45	13624.37	8435.95
2022-23	13675	7511.02	14803.16	8130.66	11143.88	6120.80
2023-24	14733	7178.22	1609.38	784.12	15609.29	7605.17
2024-25	16650(P)	7196.00	8841.74 (P)	3821.36	17640.18(P)	7624.00
2025-26	18816(P)	7213.81	9992.11 (P)	3830.82	19935.29(P)	7642.88
2026-27	21264(P)	7231.68	11292.16 (P)	3840.30	22529.02(P)	7661.80
2027-28	24031(P)	7249.58	12761.35 (P)	3849.81	25460.21(P)	7680.77
Terminal value		116359.82		61791.64		123280.71
Total value of Infosys		193926.25		122157.85		197539.68
Number of Eq. Shares		218.41 crores				
Intrinsic Value Per Share		887.90 per share		559.31 per share		904.44 per share

(Source: Dividend from Annual Reports Infosys & other things self-calculated)

The present values of dividends, free cash flows, and residual income are detailed in the 3rd, 5th, and 7th columns of the table, each discounted using the Weighted Average Cost of Capital (WACC) of 12.73% as of 2017-18. The terminal value, calculated at the conclusion of the ten-year period in 2027-28, is derived using the same WACC and a perpetual growth rate of 6.12%.

The calculated firm values for 2017-18 are Rs. 1,93,926.25 crores using DDM, Rs. 1,22,157.85 crores using DCF, and Rs. 1,97,539.68 crores using RIV. To ascertain the intrinsic value per share for 2017-18, the total firm value is divided by the number of equity shares, which were 218.41 crores in that year. This computation yields intrinsic values of Rs. 887.90 per share for DDM, Rs. 559.31 per share for DCF, and Rs. 904.44 per share for RIV. The analysis reveals that the RIV method produces the highest intrinsic value per share for 2017-18 also for Infosys Limited, surpassing the values obtained using DDM and DCF.

Likewise, the next move is to calculate intrinsic value of Infosys for the year 2018-19.

Table 3. 44: Intrinsic Value of Infosys for The Year 2018-19 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2019-20	9553	8567.29	8559.01	7675.86	9203.97	8254.27
2020-21	9158	7365.59	15914.83	12799.97	11009.40	8854.63
2021-22	12700	9160.40	14497.30	10456.77	13624.37	9827.14
2022-23	13675	8845.89	14803.16	9575.65	11143.88	7208.59
2023-24	14733	8546.90	1609.38	933.63	15609.29	9055.26
2024-25	16650(P)	8662.28	8841.74(P)	4600.01	17640.18(P)	9177.49
2025-26	18816(P)	8779.20	9992.11(P)	4662.10	19935.29(P)	9301.38
2026-27	21264(P)	8897.71	11292.16(P)	4725.04	22529.02(P)	9426.93
2027-28	24031(P)	9017.82	12761.35(P)	4788.82	25460.21(P)	9554.18
2028-29	27158(P)	9139.55	14421.69(P)	4853.46	28772.77(P)	9683.15
Terminal value		180090.93		95635.36		190802.44
Total value of Infosys		267073.55		160706.67		281145.46
Number of Eq. Shares		435.63 crores				
Intrinsic Value Per Share		613.07 per share		368.90 per share		645.37 per share

(Source: Dividend from Annual Reports Infosys & other things self-calculated)

The table above details the methodology for calculating the total firm value of Infosys Limited for the fiscal year 2018-19 using three valuation techniques: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade and includes both historical and forecasted data. Specifically, it encompasses actual dividends, free cash flows, and residual income from Infosys Limited for five years (2019-20 to 2023-24) and projections for the subsequent five years (2024-25 to 2028-29).

The projections are based on a Compound Annual Growth Rate (CAGR) of 13.01% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is presented in the 3rd, 5th, and 7th columns of the table, discounted using the Weighted Average Cost of Capital of 11.51%.

The terminal value is calculated at the end of the 10-year period in 2028-29 using a WACC of 11.51% and a perpetual growth rate of 6.12%. This provides the total firm value for 2018-19 as

Rs. 2,67,073.55 crores using DDM, Rs. 1,60,706.67 crores using DCF, and Rs. 2,81,145.46 crores using RIV.

To ascertain the intrinsic value per share for 2018-19, the total firm value is divided by the number of equity shares, which stands at 435.63 crores. This results in intrinsic values of Rs. 613.07 per share for DDM, Rs. 368.90 per share for DCF, and Rs. 645.37 per share for RIV. Among the three valuation methods, the DCF method yields the highest intrinsic value per share for the financial year 2018-19.

Table 3. 45: Market value per share & Intrinsic Value per share of Infosys as per DDM, DCF & RIV

Year	Market price (Nifty 50)	Intrinsic Value		
		DDM	DCF	RIV
2014-15	2,218.35	1932.42	1181.39	2014.24
2015-16	1,218.30	641.39	408.10	654.91
2016-17	1,022.25	901.84	589.53	933.23
2017-18	1,131.80	887.90	559.31	904.44
2018-19	743.85	613.07	368.91	645.38

(Source: Self-Calculated)

The above table shows that the market price generally resembles the trends in intrinsic values, indicating that market participants may rely on similar valuation methods as the intrinsic value models provide a reasonable estimate of market value. Nevertheless, short-term fluctuations in market prices can arise from diverse factors. In 2015-16 & 2018-19, both intrinsic values and market prices experienced a notable decline across all three valuation approaches. This decline is partly attributed to a bonus issue that increased the number of outstanding shares. The increase in Infosys Limited's shares during 2015-16 and 2018-19 resulted from 1:1 bonus share issue. In June 2015, Infosys Limited doubled its shares by issuing one bonus share per existing share. A similar 1:1 bonus was declared in April 2018 that became effective in September 2018, marking Infosys Limited's 25th stock market anniversary. These actions aimed at enhancing market liquidity and broadening investor access.

This analysis underscores the importance of considering capital structure changes, As an illustration bonus issues, in financial analysis and investment decision-making, as these can considerably impact shareholder value. Otherwise,

- The RIV method consistently provides intrinsic values closer to market prices compared to DDM and DCF, indicating its potential effectiveness in capturing market realities.
- Conversely, DCF tends to yield the lowest intrinsic value mainly because of the extremely low free cash flow available with Infosys during the selected period.

Upon thorough examination, it can be derived that DDM, DCF, and RIV yield different intrinsic values owing to their unique Main variables. Nonetheless, there is a quest to determine the superior method among these approaches. The preferred method is one that closely approximates the market price as its intrinsic value. In simpler terms, the method that exhibits minimal prediction error is regarded as the most effective.

Statistical Methods Applied for Selecting Best Valuation Method for Infosys Limited

In statistics, various methods are available to measure the prediction errors. Mentioned below are some of such the methods used in this part of the study.

- Mean Absolute Error (MAE)
- Mean Absolute Percentage Error (MAPE)
- Mean Squared Error (MSE)
- Root Mean Squared Error (RMSE)

Mean Absolute Error (MAE)

Table 3. 46 : Mean Absolute Error (MAE) of Market Price with Intrinsic Value of Infosys as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference
2014-15	2,218.35	1932.42	285.93	1181.39	1036.96	2014.24	204.11
2015-16	1,218.30	641.39	576.91	408.10	810.20	654.91	563.39
2016-17	1,022.25	901.84	120.41	589.53	432.72	933.23	89.02
2017-18	1,131.80	887.90	243.90	559.31	572.49	904.44	227.36
2018-19	743.85	613.07	130.78	368.91	374.94	645.38	98.47
MAE			271.58		645.46		236.46

(Source: Self-Calculated)

The table displays the Mean Absolute Error (MAE) between market prices and intrinsic values calculated using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods from 2014-15 to 2018-19. Comparing MAE values across these methods helps identify which one more accurately estimates real-world market conditions over time. A lower MAE indicates closer predictions of actual values, implying higher method accuracy. RIV consistently shows the smallest MAE values, indicating its estimates closely align with actual market prices compared to DDM and DCF. Therefore, RIV is considered the optimal method for making informed investment decisions regarding Infosys.

Mean Absolute Percentage Error (MAPE)

Table 3. 47: Mean Absolute Percentage Error (MAPE) of Market price with Intrinsic Value of Infosys as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error
2014-15	2,218.35	1932.42	12.89%	1181.39	46.74%	2014.24	9.20%
2015-16	1,218.30	641.39	47.35%	408.10	66.50%	654.91	46.24%
2016-17	1,022.25	901.84	11.78%	589.53	42.33%	933.23	8.71%
2017-18	1,131.80	887.90	21.55%	559.31	50.58%	904.44	20.09%
2018-19	743.85	613.07	17.58%	368.91	50.41%	645.38	13.24%
MAPE			22.23%		51.31%		19.50%

(Source: Self-Calculated)

The table illustrates the Mean Absolute Percentage Error (MAPE) between actual market prices and forecasted intrinsic values using DDM, DCF, and RIV methods for Infosys across five years (2014-15 to 2018-19). MAPE quantifies prediction errors in percentage terms, where lower values indicate greater accuracy. With MAPE values of 22.23%, 51.31%, and 19.50% for DDM, DCF, and RIV respectively, RIV emerges as the most accurate method for predicting Infosys's market prices over the five-year period. This indicates that RIV provides more reliable estimates, making it preferable for informed investment decisions for Infosys.

Mean Squared Error (MSE)

Table 3. 48: Mean Squared Error (MSE) of Market Price with Intrinsic Value of Infosys as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,218.35	1932.42	81,754.16	1181.39	1,075,276.08	2014.24	41,659.03
2015-16	1,218.30	641.39	332,822.73	408.10	656,416.76	654.91	317,404.62
2016-17	1,022.25	901.84	14,499.53	589.53	187,247.06	933.23	7,924.59
2017-18	1,131.80	887.90	59,487.16	559.31	327,750.27	904.44	51,690.61
2018-19	743.85	613.07	17,102.29	368.91	140,582.74	645.38	9,696.98
MSE			1,01,133		4,77,455		85,675

(Source: Self-Calculated)

The table presents the Mean Squared Error (MSE) between the actual market prices and forecasted intrinsic values using DDM, DCF and RIV methods for Infosys across five years (2014-15 to 2018-19). MSE measures the average squared difference between predicted and actual values. Lower MSE values indicate that the predictions are closer to the actual market prices, suggesting higher accuracy of the forecasting method. As indicated by the above table MSE is 1,01,133 in DDM, 4,77,455 in DCF & 85,675 in RIV. Here, RIV demonstrates the lowest MSE indicating RIV is the optimal method among DDM, DCF, and RIV for predicting Infosys's market prices

Root Mean Squared Error (RMSE)

Table 3. 49: Root Mean Squared Error (RMSE) of Market Price with Intrinsic Value of Infosys as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,218.35	1932.42	81,754.16	1181.39	1,075,276.08	2014.24	41,659.03
2015-16	1,218.30	641.39	332,822.73	408.10	656,416.76	654.91	317,404.62
2016-17	1,022.25	901.84	14,499.53	589.53	187,247.06	933.23	7,924.59
2017-18	1,131.80	887.90	59,487.16	559.31	327,750.27	904.44	51,690.61
2018-19	743.85	613.07	17,102.29	368.91	140,582.74	645.38	9,696.98
MSE			101,133.18		477,454.58		85,675.17
RMSE			318.01		690.98		292.70

(Source: Self-Calculated)

The table above shows Root Mean Squared Error (RMSE) values for the DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods in forecasting Infosys's market prices from 2014-15 to 2018-19. The lower digit of RMSE for RIV (318.01) compared to DDM (690.98) and DCF (292.70) confirms its superior predictive accuracy. Thus, RIV is indeed the best method for predicting Infosys' market prices

The table below presents a summary of the results for MAE, MAPE, MSE, and RMSE for Infosys

Table 3. 50: Summary of results of MAE, MAPE, MSE & RMSE For Infosys

Test For Measuring Prediction Error	Error Test Results for:			Best Method
	DDM	DCF	RIV	
MAE	271.58	645.46	236.46	RIV
MAPE	22.23%	51.31%	19.50%	RIV
MSE	1,01,133	4,77,455	85,675	RIV
RMSE	318.01	690.98	292.70	RIV
Overall Best Method	(Residual Income Valuation) RIV			

(Source: Self-Calculated)

The summary table of all tests conducted to identify the most accurate valuation method indicates that the Residual Income Valuation (RIV) method is the most effective for predicting the market price of Infosys. Nevertheless, despite its superiority over the other three methods, RIV cannot perfectly capture the fluctuations in market price. This limitation arises because a company's market price is influenced by a complex interplay of factors, categorized into company-specific, economic, industry-specific, and other factors.

The present study has made strides in identifying which industry-specific and macroeconomic factors considerably affect Infosys's market price movements. Nevertheless, it is crucial to acknowledge that other factors, such as rumors, news, announcements, and market sentiments, also play a crucial role.

3.4.2 Step 2: Industry Analysis for Infosys Limited

Like Tata Consultancy Services (TCS), Infosys is a major entity in the information technology (IT) industry. So, for Industry Analysis of Infosys also, the variables studied are the size of the IT sector, domestic IT sales and IT exports. For this analysis, a 12-year period from 2011-12 to 2023-24 has

been chosen, mirroring the economic analysis timeframe. This study aims to pinpoint the industrial factors that influence the market prices of TCS and Infosys.

Indian Information Technology Industry's Analysis & Market Price of Infosys

H_0 = Market price of Infosys is not affected by Industrial factors i.e. Size of IT sector in terms of Revenue, Domestic Sales of IT and Exports by IT.

H_1 = Market price of Infosys is affected by Industrial factors i.e. Size of IT sector in terms of Revenue, Domestic Sales of IT and Exports by IT.

Table3. 51: Market Price of Infosys & IT Industry Variable

Year	Mkt price of Infosys (Per Share)	Size (Rs. in crores)	Domestic Sales (Rs. in crores)	Exports (Rs. in crores)
2011-12	358.29	100000	31200	68800
2012-13	361.17	108000	31900	76100
2013-14	407.83	118000	32000	86000
2014-15	557.00	146000	48000	98000
2015-16	602.97	133000	25000	108000
2016-17	512.75	154000	37000	117000
2017-18	565.90	167000	41000	126000
2018-19	737.80	181000	45000	136000
2019-20	626.70	191000	41000	150000
2020-21	1,385.30	194000	43000	15100
2021-22	1,903.95	227000	49000	178000
2022-23	1,383.55	245000	51000	194000

Regression is run on the above variables. Here, the market price of Infosys (adjusted for stock split) is a dependent variable, and Industrial factors were considered as independent variables. The following results were obtained.

Table 3. 52: Multiple R & R Square of Industry Analysis for Infosys

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.8728 indicates there is strong positive relationship between Market price of Infosys and IT industry variables.
Multiple R	0.8728	
R Square	0.7617	
Adjusted R Square	0.6724	
Standard Error	284.06	
Observations	12	
(Source: Generated in Excel)		

R square of 0.7617 indicates that 76.17% variations in Market price of Infosys are being explained by listed industrial variables.

Table 3. 53: ANOVA Results of Industry Analysis for Infosys

	df	SS	MS	F	Significance F
Regression	3	2063613.632	687871.2106	8.524662504	0.0071
Residual	8	645535.1965	80691.89956		
Total	11	2709148.828			

ANOVA table shows that the significance F indicates that P value is 0.0071 which is less than 0.05. thus, null hypothesis is rejected, and it is concluded that Industrial factors i.e. Size of IT sector, Domestic Sales of IT and Exports by IT industry have impact on the movement of Adjusted market price of Infosys

3.4.3 Step 3: Economic Analysis for Infosys Limited

Referring to the literature review on economic analysis and following the example of TCS, the present part of the study identifies five key macroeconomic variables that are frequently examined: Gross Domestic Product (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), and Crude Oil Prices per barrel for the Indian Basket (at Constant Price) be considered for economic analysis of Infosys. This section aims to determine the impact of these six variables on the market price of Infosys. To ensure accuracy, market prices have been adjusted for stock splits, eliminating any distortions caused by such events. The analysis covers a period of 12 years, from 2011-12 to 2022-23, as the year 2011-12 marks the latest revised base year for most macroeconomic variables.

Market Price of Infosys & Macroeconomic Variables

H_0 = Market price of Infosys is not affected by macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

H_1 = Market price of Infosys is affected by macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price).

Table 3. 54: Market price of Infosys & Microeconomic Variables

Year	Mkt Price of Infosys	GDP	IIP	WPI	Exchange Rate	Crude Oil Prices
2011-12	358.29	92130170	100	100	97.81	111.89
2012-13	361.17	87363290	103.3	106.9	94.73	107.97
2013-14	407.83	98013700	106.7	112.5	91.11	105.52
2014-15	557.00	105276740	111	113.9	97.09	84.16
2015-16	602.97	113694930	114.7	109.7	99.98	46.17
2016-17	512.75	123081930	120	111.6	102.63	47.56
2017-18	565.90	131445820	125.3	114.9	106.52	56.43
2018-19	737.80	139929140	130.1	119.8	100.29	69.88
2019-20	626.70	145346410	129.0	121.8	103.56	60.47
2020-21	1,385.30	136871180	118.1	123.4	101.84	44.82
2021-22	1,903.95	149258400	131.6	139.4	102.22	79.18
2022-23	1,383.55	160064250	138.5	152.5	101.9	93.15

(Source: Handbook of RBI)

Regression is run on the above variables. Here the market price of TCS (adjusted for stock split) is dependent variable and macroeconomic c factors were considered as independent variables. The following results are obtained:

Table 3. 55: Multiple R & R Square of Economy Analysis for Infosys

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.9117 indicates there is strong positive relationship between Market price of Infosys and macroeconomic variables.
Multiple R	0.9117	
R Square	0.8313	
Adjusted R Square	0.6907	
Standard Error	276.01	
Observations	12	

(Source: Generated in Excel)

R square of 0.8313 indicates that 83.13% variations in Market price of Infosys are being explained by listed macroeconomic variables.

Table 3. 56: ANOVA Results of Economy Analysis for Infosys

	df	SS	MS	F	Significance F
Regression	5	2252068.403	450413.7	5.912487	0.0257
Residual	6	457080.4255	76180.07		
Total	11	2709148.828			

ANOVA table shows that the significance F indicates that P value is 0.0257 which is less than 0.05. Thus, null hypothesis is rejected and it is concluded that macroeconomic factors i.e. Gross

Domestic Production (GDP), Index of Industrial Production (IIP), Whole Sale Price Index (WPI), Exchange Rate(Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price) have impact on the movement of Adjusted market price of Infosys

3.4.4 Step 4: E-I-C Framework for Infosys Limited

Up to this point the researcher has tried to find out the impact of company Variables, industry variable and Macroeconomic variables individually on market price per Share of Infosys. This part of the study attempts to combine all the sectors and test whether it is possible to track market price using all Economy- Industry- Company variables simultaneously.

Table 3. 57: Factors Considered to Test the efficiency of E-I-C Framework to Track Market Price of Infosys

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP)	6. Size of IT industry	9. Residual
2. Index of Industrial Production (IIP)	7. Domestic Sales of IT industry	Income of Infosys
3. Wholesale Price Index (WPI)	8. Exports by IT Industry	
4. Exchange Rate (Constant price)		
5. Crude Oil Prices per barrel for Indian Basket (at Constant Price)		

(Source: Finalized based on company, industry & economy analysis)

The table above presents a list of variables from the economy, industry, and company levels, which are being evaluated to determine their combined ability to track the market price of Infosys from 2011-12 to 2023-24. Given that tracking 9 variables for a single stock can be a complex task and recognizing that these 9 factors (5 from the economy, 3 from the industry, and 1 from the company) influence each other, it is practical to eliminate redundant variables. By doing so, we can focus on the key representative variables essential for tracking Infosys's market price.

To streamline this process, various regressions were conducted in Excel. The goal was to identify the key variables that considerably impact Infosys's market price, thus facilitating a more straightforward and effective analysis. Consequently, the following key factors were finalized and

included in the E-I-C (Economy-Industry-Company) framework for monitoring market price movements and guiding investment decisions:

Table 3. 58: Variable Under E-I-C Framework

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP)	3. Size of IT industry	4. Residual Income of TCS
2. Wholesale Price Index (WPI)		

(Source: Finalized based on E-I-C Framework's Regression Results)

The next move is to see the regression results which support the finalization of the above stated 4 variables for tracking Market Price Movement of Infosys.

E-I-C Framework and Market Price of Infosys

H_0 = Market price of Infosys is not affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of Infosys.

H_1 = Market price of Infosys is affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of Infosys.

Table 3. 59: Market Price of Infosys and E-I-C Framework for Infosys

Year	Mkt Price of Infosys	GDP (Rs.)	WPI	Size (Revenue in Rs.)	Residual Income
2011-12	358.29	92130170	100	100000	4623.25
2012-13	361.17	87363290	106.9	108000	4783.40
2013-14	407.83	98013700	112.5	118000	5637.95
2014-15	557.00	105276740	113.9	146000	7284.66
2015-16	602.97	113694930	109.7	133000	5870.11
2016-17	512.75	123081930	111.6	154000	6373.41
2017-18	565.90	131445820	114.9	167000	7495.34
2018-19	737.80	139929140	119.8	181000	7395.75
2019-20	626.70	145346410	121.8	191000	9203.97
2020-21	1,385.30	136871180	123.4	194000	11009.40
2021-22	1,903.95	149258400	139.4	227000	13624.37
2022-23	1,383.55	160064250	152.5	245000	11143.88

(Sources: Handbook of RBI, NASSCOM, Annual Reports of Infosys)

Regression is run in Excel on the above variables. Here the market price of Infosys (adjusted for stock split) is a dependent variable and other variables from Economy, Industry & Company were considered as independent variables.

The following regression results are obtained.

Table 3. 60: Multiple R & R Square of E-I-C Framework for Infosys

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.96202 indicates there is strong positive relationship between Market price of Infosys and listed variables.
Multiple R	0.96202	
R Square	0.92549	
Adjusted R Square	0.88292	
Standard Error	169.806	
Observations	12	
(Source: Generated in Excel)		

R square of 0.92549 indicates that 92.55% variations in Market price of Infosys are being explained by listed macroeconomic variables.

Table 3. 61: ANOVA Results of E-I-C Framework for Infosys

	df	SS	MS	F	Significance F
Regression	4	2507310	626827.4	21.73906	0.000479
Residual	7	201839.1	28834.16		
Total	11	2709149			

(Source: Regression Results Generated using Excel)

ANOVA table shows that the significance F indicates that P value is 0.000479 which is less than Alpha of 0.05. Thus, null hypothesis is rejected, and it is concluded that Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of IT industry in terms of Revenue & Residual Income of Infosys have impact on the movement of Adjusted market price of Infosys. Thus, the Study endorses the E-I-C Framework's central idea that while carrying out valuation not only Company's, but related industry's & Economy's variables should also be considered.

Findings of Case study 2 of Infosys:

The following are the main findings from the Infosys Limited case study.

- The company analysis indicated that, among the methods assessed—namely the Dividend Discount Method (DDM), the Discounted Cashflow Method (DCF), and the Residual Income model (RIV)- the Residual Income model (RIV) was found to be the most accurate in predicting the market price of Infosys Limited.
- According to Industry analysis, the size, domestic sales, and exports of the IT sector have significant impacts on how the price of Infosys Limited shares changes.
- As per Economic analysis Gross Domestic Product (GDP), the Index of Industrial Production (IIP), the Wholesale Price Index (WPI), the Exchange Rate (at a constant price), and the price of crude oil per barrel for the Indian Basket (at a constant price) all have a big effect on how the share price of Infosys Limited changes.

Lastly, The E-I-C framework identified four primary variables out of the initial nine that significantly impact Infosys Limited's share price. Upon compiling the findings from Economy, Industry, and Company analyses within this framework, it was found that Infosys Limited's share price is predominantly influenced by Gross Domestic Product (GDP), the Wholesale Price Index (WPI), the Size of the IT Industry (in Rs.), and Infosys Limited's Residual Income

3.5 CASE STUDY 3: Bajaj Auto Limited

Bajaj Auto, founded in 1945 and headquartered in Pune, India, is a significant player in the global automotive industry, particularly recognized for its motorcycles and three-wheelers. Over the years, it has established itself as one of the world's leading manufacturers. For the fiscal year 2024, Bajaj Auto reported a revenue of ₹461.6 billion and employed over 10,000 people. The company holds a prominent position in the global motorcycle market, ranking as the third-largest manufacturer worldwide, with a strong presence in both domestic and international markets.

3.5.1 Step 1: Company Analysis of Bajaj Auto Limited

Company analysis is carried out using three methods i.e. 1) Dividend Discount Model, 2) Discounted cashflow Method and 3) Residual Income Method. The next move is to discuss common inputs of TCS for company analysis through Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM).

Common Inputs for Company Analysis of Bajaj Auto:

1. WACC, Perpetual Growth Rate & Number of Equity Shares

The following table indicates common inputs of Bajaj Auto Limited for all the three inputs.

Table 3. 62: WACC, Perpetual Growth Rate, No. of Eq. Shares of Bajaj Auto Limited From 2014-15 To 2018-19

Year	WACC	Perpetual growth rate	Number of equity shares
2014-15	11.92%	8.00%	28.94
2015-16	14.82%	8.26%	28.94
2016-17	14.52%	7.04%	28.94
2017-18	15.93%	6.12%	28.94
2018-19	13.77%	6.12%	28.94

(Source: WACC self-calculated, perpetual growth rate from RBI & No. of equity shares from Annual Reports Bajaj Auto)

The table above outlines the common inputs for Baja Auto Limited used in calculating the intrinsic value through the Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM).

Here, The first column lists the financial years for which the intrinsic value is calculated. The third column shows the perpetual growth rate applied in each respective year to calculate the Terminal Value of Baja Auto. The fourth column indicates the number of equity shares at the end of each year which is the same for all the years under the study period. The second column presents the Weighted Average Cost of Capital (WACC), which is used for discounting dividends, cash flows, and residual income to determine their present value. The WACC ranges from 11.92 % to 15.93%. It is crucial to note that Bajaj Auto is a debt-free company, so its cost of capital is the same as WACC. The calculation of Cost of Equity, as per the Capital Asset Pricing Model (CAPM), is shown in the table below.

Table 3. 63: Calculations of Cost of Equity for Bajaj Auto as Per CAPM Model.

Year	Risk Free Rate	Risk Premium	Beta	Cost of Equity
2014-15	7.74%	8.40%	0.4972	11.92%
2015-16	7.47%	8.10%	0.9069	14.82%
2016-17	6.50%	8.50%	0.9433	14.52%
2017-18	6.80%	8.50%	1.0742	15.93%
2018-19	6.50%	8.30%	0.8756	13.77%
2019-20	4.80%	7.00%	0.7381	9.97%
2020-21	5.60%	7.30%	0.8979	12.15%
2021-22	5.60%	6.90%	0.7471	10.76%
2022-23	7.10%	8.50%	0.5971	12.17%
2023-24	7.20%	8.40%	0.6353	12.54%

(Source: Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024)

The table above shows the calculations for the cost of equity. The formula applied to calculate the cost of equity using the Capital Asset Pricing Model (CAPM) is: $R_f + \beta \times \text{Risk premium}$. The values for R_f and R_m are sourced from the article titled ‘Market Risk Premium and Risk-Free Rate used for 96 countries in 2024’. while the beta for each year is calculated using a formula that measures the sensitivity of the stock return relative to the market return. The formula is:

$$\text{Formula } \beta = \frac{\text{Cov}(j,m)}{\delta^2 m}$$

Here, $\text{Cov}(j, m)$ = Covariance between the security’s return and the market & $\delta^2 m$ Indicates Market Variance.

2. Bajaj Auto Limited’s Growth Rate to Be Used for Projections.

In this study, actual data are taken up to the financial year 2023-24 during super normal growth rate period instead of multiplying the past data with expected supernormal growth rate because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future dividends, Cashflow & Residual Income are calculated using Revenue CAGR for past 5 years i.e. from 2019-20 to 2023-24. For prediction purposes, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily as compared to dividends, free cash flow, and residual income.

Table 3. 64: CAGR Of Bajaj Auto Based on Past 5 Year's Revenue

Revenue of Bajaj Auto					(Rs. In crores)
	2019-20	2020-21	2021-22	2022-23	2023-24
Revenue	29,111.54	27,132.90	32,135.98	35,359.15	43,578.87
5 Years CAGR	0.106121				

(Source: Revenue from Annual Reports TCS & other things self-calculated)

The above table indicates the calculation of CAGR. Here, revenue for past 5 years is considered

and then CAGR is calculated using the formula: $\left(\frac{\text{value at the end}}{\text{value at the beginning}}\right)^{(1/n)} - 1$

Calculation Dividend, Free Cashflow & Residual Income for Bajaj Auto Limited.

One can easily get the dividend figures from Annual reports of company, so no calculations required for getting the dividend figures.

Nevertheless, free Cashflow & Residual incomes are calculated using the formula discussed in the introduction of the chapter. The first discussion is on the calculation of free cashflow.

Table 3. 65: Calculation Free Cash Flow to Firm for Bajaj Auto Limited

Year	Total Operating Rev.	Total Operating Exp.	Operating Profit (EBIT)	NOPAT = EBIT(1-T)	Dep. & Amort.	Cap. Exp.	Change in Net Working Capital	FCFF
2014-15	21104	17769	3335	2201	267	248	4072	-1852
2015-16	22152	18113	4039	2666	307	207	-3379	6145
2016-17	21374	17653	3721	2433	307	209	4800	-2269
2017-18	24700	20698	4003	2617	315	193	-1539	4278
2018-19	29567	25538	4029	2635	266	123	-3080	5858
2019-20	29112	25072	4040	2628	246	181	769	1924
2020-21	27133	23079	4054	2638	259	166	5969	-3239
2021-22	32136	28164	3972	2584	269	498	-3288	5643
2022-23	35359	30200	5159	3356	282	1296	-1330	3673
2023-24	43579	36266	7313	4758	350	611	-2292	6788

(source: FCFF self-Calculated using Annual Reports of Bajaj Auto)

The above table indicates the calculation of FCFF using the mentioned formula in the same chapter in introductory part. The table shows the working of FCFF from 2014-15 to 2023-24.

The next discussion is on the calculations of residual Income.

Table 3. 66: Calculation Residual Income for Bajaj Auto Limited

Year	Profit for the Year	Cost of Equity	Book Value at the Beginning of the Year	Equity Charge	Residual Income
2014-15	2813.74	0.1192	9608.02	1144.94	1668.80
2015-16	3929.67	0.1482	10692.15	1584.17	2345.50
2016-17	3827.56	0.1452	13266.55	1926.04	1901.52
2017-18	4068.10	0.1733	17034.13	2951.47	1116.63
2018-19	4675.18	0.1377	19103.86	2630.17	2045.01
2019-20	5099.98	0.0997	21779.90	2170.78	2929.21
2020-21	4554.59	0.1216	19925.49	2421.94	2132.65
2021-22	5018.87	0.1076	25202.26	2710.57	2308.30
2022-23	5627.6	0.1218	26668.8	3246.92	2380.68
2023-24	7478.79	0.1254	25425.86	3187.45	4291.35

(Source: Self-Calculated)

The above table indicates the calculation of Residual income using the mentioned formula in the same chapter in introductory part. The table shows the working of Residual Income from 2014-15 to 2023-24.

Now, the next move is to track the movement of all these three variables using their growth Rate.

Table 3. 67: Dividend, Free Cashflow, Residual Income and Their Growth Rates for Bajaj Auto Limited

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2015-16	2893.68	100.00%	6145	431.87%	2345.50	40.55%
2016-17	144.68	-95.00%	-2269	-136.92%	1901.52	-18.93%
2017-18	1591.52	1000.03%	4278	288.55%	1116.63	-41.28%
2018-19	1736.20	9.09%	5858	36.93%	2045.01	83.14%
2019-20	5208.60	200%	1924	-67.15%	2929.20	43.24%
2020-21	08.73	-99.83%	-3239	-268.29%	2132.65	-27.19%
2021-22	4051.14	46304.81%	5643	274.24%	2308.30	08.24%
2022-23	4051.14	0%	3673	-34.91%	2380.68	03.14%
2023-24	3961.40	-2.22%	6788	84.80%	4291.35	80.26%

(Source: Self-Calculated)

The next move involves examining the insights derived from growth rate trends.

Dividend Discount Model (DDM): The table illustrates Bajaj Auto dividend payments from 2014-15 to 2023-24, reflecting considerable fluctuations in growth rates ranging from -99.83% to 46304.81%. The sudden high growth rate in dividend in the year 2017-18 & 2021-22 is because of base year effect, in other words it's because of extremely small dividends in their respective previous years. Bajaj auto declares special dividends from time to time. It had given special dividends of ₹60 per share in July 2019, ₹90 per share in July 2021, ₹140 per share in June 2022, ₹140 per share in April 2023.

Discounted Cash Flow (DCF): From 2015-16 to 2023-24, FCFF data exhibits considerable volatility, with growth rates ranging from 431.87% to -268.29%. The peak FCFF was observed in 2015-16, indicating strong operational performance and effective cash flow management. In addition to this, a notable growth rate of 288.55% 274.24% in FCFF was recorded in 2017-18 & 2021-22 respectively, reflecting a particularly strong year for cash flow generation. The pronounced fluctuations in both FCFF and its growth rates suggest considerable instability in the firm's cash flow performance and overall growth trajectory.

Residual Income Valuation (RIV): The Residual Income (RI) data for Bajaj Auto demonstrates considerable volatility, with growth rates fluctuating between -41.28% and 80.26%. This variability underscores periods of both substantial declines and notable growth, reflective of changing operational and market conditions. Given that the company's share capital remains consistent over the years, these fluctuations in Residual Income can be attributed to variations in profit after tax and the cost of equity. The recent performance for the year 2023-24 indicates a positive trend, suggesting an enhancement in financial health and operational efficiency.

Intrinsic value of Bajaj Auto for the period of 5 years from 2014-15 to 2018-19 Using DDM, DCF & RIV.

The table below illustrates the derivation of the total value of Bajaj Auto for the fiscal year 2014-15 using three valuation methods: the Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This study covers a 10-year period, culminating in 2024. The analysis incorporates actual dividends, free cash flows, and residual income from Bajaj Auto over nine years (2015-16 to 2023-24), while the figures for 2024-25 are projections based on

a five-year Compound Annual Growth Rate (CAGR) of 10.61% in revenue, reflecting the company's overall growth trajectory.

Table 3. 68: Intrinsic Value of Bajaj Auto for The Year 2014-15 Using DDM, DCF & RIV:

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2015-16	2893.68	2585.57	6145.01	5490.71	2345.50	2095.76
2016-17	144.68	115.51	-2268.80	-1811.37	1901.52	1518.14
2017-18	1591.52	1135.35	4277.75	3051.64	1354.50	966.26
2018-19	1736.2	1106.68	5857.57	3733.71	2045.01	1303.52
2019-20	5208.6	2966.55	1924.38	1096.02	2929.21	1668.32
2020-21	8.73	4.44	-3238.60	-1648.13	2132.65	1085.31
2021-22	4051.14	1842.13	5642.83	2565.89	2308.30	1049.63
2022-23	4051.14	1645.98	3673.04	1492.36	2380.68	967.27
2023-24	3960.20	1437.71	6787.91	2464.28	4291.35	1557.93
2024-25	4380.46(P)	1420.95	7508.25(P)	2435.56	4746.75(P)	1539.77
Terminal value		39183.95		67162.50		42460.44
Total value of Bajaj Auto		53444.82		86033.16		56212.37
No. of Eq. Shares		28.94 crores				
Intrinsic Value Per Share		1846.96 per share		2973.15 per share		1942.60 per share

(Source: Dividend from Annual Reports Bajaj Auto & other things self-calculated)

Further, Columns 3, 5, and 7 of the table display the present value of the dividend, free cash flow, and residual income streams, respectively, for each year, discounted using the Weighted Average Cost of Capital (WACC) of 11.92% from 2014-15. In addition to this, the terminal value is calculated for the year 2024-25 for each method, applying a perpetual growth rate of 8% along with the WACC of 11.92%. The firm's values for 2014-15, as determined by each method, are Rs. 53,444.82 crores (DDM), Rs. 86,033.16 crores (DCF), and Rs. 56,212.37 crores (RIV).

To ascertain the firm's value on a per-share basis, this total firm value is divided by the number of equities shares outstanding in that year, which is consistently 28.94 crores across all three methods. This calculation yields an intrinsic value of Rs. 1,846.96 per share for DDM, Rs. 2,973.15 per share for DCF, and Rs. 1942.60 per share for RIV. Notably, the Free Cashflow stream is considerably

larger compared to the dividend and Residual income streams, resulting in a higher intrinsic value under the DCF method relative to the others.

Likewise, the next move is to calculate intrinsic value of Bajaj Auto for the year 2015-16.

Table 3. 69: Intrinsic Value of Bajaj Auto for The Year 2015-16 Using DDM, DCF & RIV:
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2016-17	144.68	126.01	-2268.8	-1976.03	1901.52	1656.14
2017-18	1591.52	1207.27	4277.75	3244.96	1354.50	1027.48
2018-19	1736.20	1,147.07	5857.57	3,869.97	2045.01	1,351.09
2019-20	5208.60	2997.15	1924.38	1107.33	2929.21	1685.53
2020-21	8.73	4.38	-3238.60	-1623.08	2132.65	1068.82
2021-22	4051.14	1768.31	5642.83	2463.08	2308.31	1007.57
2022-23	4051.14	1540.12	3673.04	1396.38	2380.68	905.06
2023-24	3960.20	1311.27	6787.91	2247.56	4291.35	1420.92
2024-25	4380.46(P)	1263.26	7508.25(P)	2165.26	4746.75(P)	1368.89
2025-26	4845.32(P)	1217.00	8305.03(P)	2085.98	5250.48(P)	1318.77
Terminal value		20095.91		34445.01		21776.30
Total value of Bajaj Auto		32677.76		49426.42		34586.56
Number of Eq. Shares		28.94 crores				
Intrinsic Value Per Share		1129.28 per share		1708.08 per share		1195.25 per share

(Source: Dividend from Annual Reports Bajaj Auto & other things self-calculated)

The above table indicates the calculation of Bajaj Auto total firm value for the fiscal year 2015-16 using three valuation methods: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). The study spans a decade, concluding in 2024, and incorporates both historical data and forecasts. Specifically, it employs actual dividends, free cash flows, and residual income for eight years (2016-17 to 2023-24) and forecasts for the subsequent two years (2024-25 and 2025-26). These forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 10.61%, reflective of revenue growth as a proxy for Bajaj Auto's overall expansion.

Key financial parameters include a Weighted Average Cost of Capital (WACC) of 14.82% and a perpetual growth rate of 8.26%, crucial for calculating the terminal value at the end of the projection period in 2025-26. The resulting firm values for 2015-16 are Rs. 32677.76 crores using DDM, Rs. 49426.42 crores using DCF, and Rs. 34586.56 Crores through RIV. The intrinsic value per share is determined by dividing the firm's total value by the 28.94 crores outstanding equity shares, yielding intrinsic values of Rs. 1129.28 per share in DDM, Rs. 1708.08 per share in DCF, and Rs. 1195.25 per share in RIV. The analysis reveals that just like 2014-15, the intrinsic value derived in 2015-16 from the DCF method is consistently higher than that from DDM and RIV.

Likewise, the next move is to calculate the intrinsic value of Bajaj Auto for the year 2016-17.

Table 3. 70: Intrinsic Value of Bajaj Auto for The Year 2016-17 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2017-18	1591.52	1389.76	4277.75	3735.43	1354.50	1182.78
2018-19	1736.20	1323.89	5857.57	4466.52	2045.01	1559.36
2019-20	5208.60	3468.16	1924.38	1281.35	2929.21	1950.42
2020-21	8.73	5.08	-3238.60	-1883.05	2132.65	1240.01
2021-22	4051.14	2056.88	5642.83	2865.02	2308.30	1171.99
2022-23	4051.14	1796.12	3673.04	1628.48	2380.68	1055.50
2023-24	3960.20	1533.20	6787.91	2627.96	4291.35	1661.41
2024-25	4380.46(P)	1480.91	7508.25(P)	2538.33	4746.75(P)	1604.74
2025-26	4845.32(P)	1430.40	8305.03(P)	2451.75	5250.48(P)	1550.01
2026-27	5359.51(P)	1381.61	9186.37(P)	2368.13	5807.67(P)	1497.14
Terminal value		19776.32		33897.23		21429.99
Total value of Bajaj Auto		35642.33		55977.16		35903.34
Number of Eq. Shares		28.94 crores				
Intrinsic Value Per Share		1231.73 per share		1934.47 per share		1240.75 per share

(Source: Dividend from Annual Reports Bajaj Auto & other things self-calculated)

The table above demonstrates the methodology used to determine the total firm value of Bajaj Auto for the financial year 2016-17 through three valuation models: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This

comprehensive analysis spans a decade, incorporates Bajaj Auto's actual dividends, free cash flows, and residual income for seven years (2017-18 to 2023-24), along with projections for the subsequent three fiscal years (2024-25 to 2026-27).

The projections are based on a Compound Annual Growth Rate (CAGR) of 10.61% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is detailed in the 3rd, 5th, and 7th columns, discounted at the 2016-17 Weighted Average Cost of Capital (WACC) of 14.52%. The terminal value, calculated at the end of the analysis period in 2026-27, employs the same WACC of 14.52% and assumes a perpetual growth rate of 7.04%.

The firm values for 2016-17 are calculated as Rs.35,642.33crores under DDM, Rs. 55,977.16 crores under DCF, and Rs. 35,903.34crores under RIV. To determine the intrinsic value per share for 2016-17, the total firm value is divided by the number of equity shares, which is 28.94 crores. This yields intrinsic values of Rs. 1231.73 per share using DDM, Rs. 1,934.47per share using DCF, and Rs. 1240.75 per share using RIV. It is Remarkable that, consistent with the previous years (2014-15 & 2015-16), the intrinsic value derived from the RIV method is higher compared to the DDM and DCF methods.

Likewise, the next move is to calculate the intrinsic value of Bajaj Auto for the year 2017-18. The table below provides a comprehensive analysis of the total firm value of Bajaj Auto for the fiscal year 2017-18, employing three valuation methodologies: the Dividend Discount Model (DDM), the Discounted Cash Flow (DCF) model, and the Residual Income Valuation (RIV) approach. This analysis covers a ten-year period. It includes actual dividends, free cash flows, and residual income data for six years (2018-19 to 2023-24), along with forecasts for the subsequent four years (2024-25 to 2027-28). The forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 10.61% in revenue over the past five years, which serves as a proxy for the company's overall growth trajectory.

Table 3. 71: Intrinsic value of Bajaj Auto for the year 2017-18 using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2018-19	1736.20	1497.62	5857.57	5052.66	2045.01	1763.99
2019-20	5208.60	3875.49	1924.38	1431.84	2929.20	2179.49
2020-21	8.73	5.60	-3238.60	-2078.57	2132.65	1368.76
2021-22	4051.14	2242.79	5642.83	3123.97	2308.30	1277.92
2022-23	4051.14	1934.60	3673.04	1754.04	2380.68	1136.88
2023-24	3960.20	1631.30	6787.91	2796.09	4291.35	1767.70
2024-25	4380.46(P)	1556.46	7508.25(P)	2667.82	4746.75(P)	1686.61
2025-26	4845.32(P)	1485.06	8305.03(P)	2545.44	5250.48(P)	1609.24
2026-27	5359.51(P)	1416.93	9186.37(P)	2428.67	5807.67(P)	1535.41
2027-28	5928.27(P)	1351.93	10161.24(P)	2317.25	6423.98(P)	1464.98
Terminal value		14623.96		25065.93		15846.79
Total value of Bajaj Auto		31621.74		47105.13		31637.78
Number of Eq. Shares		28.94 crores				
Intrinsic Value Per Share		1092.79 per share		1627.86 per share		1093.34 per share

(Source: Dividend from Annual Reports Bajaj Auto & other things self-calculated)

The present values of dividends, free cash flows, and residual income are detailed in the 3rd, 5th, and 7th columns of the table, each discounted using the Weighted Average Cost of Capital (WACC) of 15.93% as of 2017-18. The terminal value, calculated at the conclusion of the ten-year period in 2027-28, is derived using the same WACC and a perpetual growth rate of 6.12%.

The calculated firm values for 2017-18 are Rs. 31,621.74crores using DDM, Rs. 47,105.13 crores using DCF, and Rs. 31,637.78crores using RIV. To ascertain the intrinsic value per share for 2017-18, the total firm value is divided by the number of equity shares, which were 28.94 crores in that year. This computation yields intrinsic values of Rs. 1,092.79 per share for DDM, Rs. 1,627.86 per share for DCF, and Rs. 1,093.34 per share for RIV. The analysis reveals that the DCF method continues to produce the highest intrinsic value per share for 2017-18, surpassing the values obtained using DDM and RIV.

Likewise, the next move is to calculate intrinsic value of Bajaj Auto for the year 2018-19.

Table 3. 72: Intrinsic Value of Bajaj Auto for The Year 2018-19 Using DDM, DCF & RIV
(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2019-20	5208.60	4578.27	1924.38	1691.50	2929.20	2574.72
2020-21	8.73	6.74	-3238.60	-2502.18	2132.65	1647.71
2021-22	4051.14	2751.18	5642.83	3832.12	2308.30	1567.60
2022-23	4051.14	2418.25	3673.04	2192.55	2380.68	1421.10
2023-24	3960.20	2077.88	6787.91	3561.56	4291.35	2251.63
2024-25	4380.46(P)	2020.25	7508.25(P)	3462.77	4746.75(P)	2189.18
2025-26	4845.32(P)	1964.21	8305.03(P)	3366.72	5250.48(P)	2128.45
2026-27	5359.51(P)	1909.73	9186.37(P)	3273.33	5807.67(P)	2069.42
2027-28	5928.27(P)	1856.76	10161.24(P)	3182.54	6423.98(P)	2012.02
2028-29	6557.38(P)	1805.25	11239.56(P)	3094.26	7105.70(P)	1956.21
Terminal value		25050		42936		27144
Total value of Bajaj Auto		46438		68091		46962
Number of Eq. Shares		28.94 crores				
Intrinsic Value Per Share		1604.82 per share		2353.10 per share		1622.93 per share

(Source: Dividend from Annual Reports Bajaj Auto & other things self-calculated)

The table above details the methodology for calculating the total firm value of Bajaj Auto for the fiscal year 2018-19 using three valuation techniques: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade and includes both historical and forecasted data. Specifically, it encompasses actual dividends, free cash flows, and residual income from Bajaj Auto for five years (2019-20 to 2023-24) and projections for the subsequent five years (2024-25 to 2028-29).

The projections are based on a Compound Annual Growth Rate (CAGR) of 10.61% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is presented in the 3rd, 5th, and 7th columns of the table, discounted using the Weighted Average Cost of Capital of 13.77%.

The terminal value is calculated at the end of the 10-year period in 2028-29 using a WACC of 13.77% and a perpetual growth rate of 6.12%. This provides the total firm value for 2018-19 as Rs. 46,438 crores using DDM, Rs. 68,091 crores using DCF, and Rs. 46,962 crores using RIV.

To ascertain the intrinsic value per share for 2018-19, the total firm value is divided by the number of equity shares, which stands at 28.94 crores. This results in intrinsic values of Rs. 1,604.82 per share for DDM, Rs. 2,353.10 per share for DCF, and Rs. 1,622.93 per share for RIV. Among the three valuation methods, the DCF method yields the highest intrinsic value per share for the financial year 2018-19.

Table 3. 73: Market Value Per Share & Intrinsic Value Per Share as Per DDM, DCF & RIV of Bajaj Auto Limited

Year	Market price (Nifty 50)	Intrinsic Value		
		DDM	DCF	RIV
2014-15	2,016.60	1846.96	2973.15	1942.60
2015-16	2405.95	1129.28	1708.08	1195.25
2016-17	2805.45	1231.73	1934.47	1240.75
2017-18	2744.70	1092.79	1627.86	1093.34
2018-19	2911.10	1604.82	2353.10	1622.93

(NSE & self-calculated)

The above table shows that the market price generally resembles the trends in intrinsic values, indicating that market participants may rely on similar valuation methods as the intrinsic value models provide a reasonable estimate of market value, Nevertheless, short-term fluctuations in market prices can arise from diverse factors.

It is observed that The Discounted Cash Flow (DCF) method provides intrinsic values that are consistently closer to market prices compared to DDM and RIV. This alignment suggests that market valuations might be more in line with future cash flow projections, which are integral to the DCF approach. Investors may be placing considerable weight on expected cash flows, viewing them as a more reliable indicator of the company's potential performance. The closer alignment of DCF values with market prices could indicate that market participants are factoring in cash flow growth and sustainability as Main drivers of value.

Upon thorough examination, it can be derived that DDM, DCF, and RIV yield different intrinsic values owing to their unique Main variables. Nonetheless, there is a quest to determine the superior method among these approaches. The preferred method is one that closely approximates the market price as its intrinsic value. In simpler terms, the method that exhibits minimal prediction error is regarded as the most effective.

Statistical Tools Applied for Selecting Best Valuation Method for Bajaj Auto Limited

In statistics, various methods are available to measure the prediction errors. Mentioned below are some of such the methods used in this part of the study.

- i. Mean Absolute Error (MAE)
- ii. Mean Absolute Percentage Error (MAPE)
- iii. Mean Squared Error (MSE)
- iv. Root Mean Squared Error (RMSE)

Mean Absolute Error (MAE)

Table 3. 74: Mean Absolute Error (MAE) Of Market Price with Intrinsic Value as Per DDM, DCF & RIV For Bajaj Auto Limited

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference
2014-15	2016.60	1846.96	169.64	2973.15	956.55	1942.60	74.00
2015-16	2405.95	1129.28	1276.67	1708.09	697.86	1195.25	1210.70
2016-17	2805.45	1231.73	1573.72	1934.47	870.98	1240.75	1564.70
2017-18	2744.70	1092.79	1651.91	1627.87	1116.83	1093.34	1651.36
2018-19	2911.10	1604.82	1306.28	2353.10	558.00	1622.93	1288.17
MAE			1195.64		840.04		1157.78

(Source: Self-Calculated)

The table displays the Mean Absolute Error (MAE) between market prices and intrinsic values calculated using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods from 2014-15 to 2018-19. Comparing MAE values across these methods helps identify which one more accurately estimates real-world market conditions over time. A lower MAE indicates closer predictions to actual values, implying higher method accuracy. DCF consistently shows the smallest MAE values, indicating its estimates closely align

with actual market prices compared to DDM and RIV. Therefore, DCF is considered the optimal method for making informed investment decisions regarding Bajaj Auto.

Mean Absolute Percentage Error (MAPE)

Table 3. 75: Mean Absolute Percentage Error (MAPE) of Market price with Intrinsic Value as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error
2014-15	2016.60	1846.96	8.41%	2973.15	47.43%	1942.60	3.67%
2015-16	2405.95	1129.28	53.06%	1708.09	29.01%	1195.25	50.32%
2016-17	2805.45	1231.73	56.09%	1934.47	31.05%	1240.75	55.77%
2017-18	2744.70	1092.79	60.19%	1627.87	40.69%	1093.34	60.17%
2018-19	2911.10	1604.82	44.87%	2353.10	19.17%	1622.93	44.25%
MAPE			44.53%		33.47%		42.84%

(Source: Self-Calculated)

The table illustrates the Mean Absolute Percentage Error (MAPE) between actual market prices and forecasted intrinsic values using DDM, DCF, and RIV methods for Bajaj Auto across five years (2014-15 to 2018-19). MAPE quantifies prediction errors in percentage terms, where lower values indicate greater accuracy. With MAPE values of 44.53%, 33.47%, and 42.84% for DDM, DCF, and RIV respectively- DCF emerges as the most accurate method for predicting Bajaj Auto's market prices over the five-year period. This indicates that DCF provides more reliable estimates, making it preferable for informed investment decisions for Bajaj Auto.

Mean Squared Error (MSE)

The table presents the Mean Squared Error (MSE) between the actual market prices and forecasted intrinsic values using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods for Bajaj Auto across five years (2014-15 to 2018-19).

Table 3. 76: Mean Squared Error (MSE) of Market Price with Intrinsic Value as Per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,017	1,847	28,779	2,973	914,988	1,943	5,476
2015-16	2,406	1,129	1,629,876	1,708	487,012	1,195	1,465,797
2016-17	2,805	1,232	2,476,581	1,934	758,608	1,241	2,448,272
2017-18	2,745	1,093	2,728,806	1,628	1,247,313	1,093	2,726,975
2018-19	2,911	1,605	1,706,371	2,353	311,362	1,623	1,659,379
MSE			1,714,083		743,857		1,661,180

(Source: Self-Calculated)

Here, MSE measures the average squared difference between predicted and actual values. Lower MSE values indicate that the predictions are closer to the actual market prices, suggesting higher accuracy of the forecasting method. As indicated by the above table MSE is 1,714,083 for DDM, 743,857 for DCF & 1,661,180 for RIV. Here, DCF demonstrates the lowest MSE indicating DCF is the optimal method among DDM, DCF, and RIV for predicting Bajaj Auto's market prices.

Root Mean Squared Error (RMSE)

Table 3. 77 : Root Mean Squared Error (RMSE) of Market price with DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,016.60	1,846.96	28,779	2,973.15	914,988	1,942.60	5,476
2015-16	2,405.95	1,129.28	1,629,876	1,708.09	487,012	1,195.25	1,465,797
2016-17	2,805.45	1,231.73	2,476,581	1,934.47	758,608	1,240.75	2,448,272
2017-18	2,744.70	1,092.79	2,728,806	1,627.87	1,247,313	1,093.34	2,726,975
2018-19	2,911.10	1,604.82	1,706,371	2,353.10	311,362	1,622.93	1,659,379
MSE			1,714,083		743,857		1,661,180
RMSE			1,309		862		1,289

(Source: Self-Calculated)

The table above shows Root Mean Squared Error (RMSE) values for the DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods in forecasting TCS's market prices from 2014-15 to 2018-19. The lower digit of RMSE for DCF

(862) compared to DDM (1309) and RIV (1289) confirms its superior predictive accuracy. Thus, RIV is indeed the best method for predicting Bajaj Auto's market prices

Table 3. 78: Summary Table of MAE, MAPE, MSE & RMSE for Bajaj Auto Limited

Test For Measuring Prediction Error	Error Test Results for:			Best Method
	DDM	DCF	RIV	
MAE	1195.64	840.04	1157.78	DCF
MAPE	44.53%	33.47%	42.84%	DCF
MSE	1714082.73	743856.77	1661179.89	DCF
RMSE	1309.23	862.47	1288.87	DCF
Overall Best Method	(Residual Income Valuation) DCF			

(Source: Self-Calculated)

The summary table of all tests conducted to identify the most accurate valuation method indicates that the Discounted Free Cashflow Method (DCF) is the most effective for predicting the market price of Bajaj Auto. Nevertheless, despite its superiority over the other three methods, DCF cannot perfectly capture the fluctuations in market price. This limitation arises because a company's market price is influenced by a complex interplay of factors, categorized into company-specific, economic, industry-specific, and other factors.

Researchers have made strides in identifying which industry-specific and macroeconomic factors considerably affect Bajaj Auto's market price movements. Nevertheless, it is crucial to acknowledge that other factors, as an illustration rumors, news, announcements, and market sentiments, also play a crucial role. These factors are inherently difficult to quantify and have not been addressed in the present study.

3.5.2 Step 2: Industry Analysis for Bajaj Auto

Industry analysis aims to forecast the future trajectory of the industry under review. There are various methods available to conduct such an analysis, including industry life cycle analysis, SWOT analysis, PEST analysis, PESTEL analysis, Michael Porter's Five Forces analysis, and trend analysis. A review of the literature on industry analysis indicates that different studies employ different methods according to their specific needs and convenience. This study will utilize trend analysis, as its objective is to advise lay investors on the industrial factors to consider when

investing. Trend analysis, combined with regression analysis, can help identify the key industrial factors that should be considered when purchasing company shares in the secondary market.

Indian Information Automobile Industry Analysis

Literature review of Indian Automobile industry analysis revealed that the mostly studied trends are production of Automobile(units), Domestic Sales of Automobile(units) and Exports of Automobile industry(units). Like the Economy analysis period selected for industry analysis is 12 years i.e. from 2011-12 to 2022-23. An attempt has been made to identify industrial factors having an impact on the movement of market price of Bajaj Auto and market price of Hero MotoCorp.

Automobile Industry's analysis & Market Price of Bajaj Auto

H_0 = Market price of Bajaj Auto is not affected by Industrial factors i.e. Production(units), Domestic Sales(units) & Exports(units).

H_1 = Market price of Infosys is affected by Industrial factors i.e. Production(units)n, Domestic Sales(units) & Exports(units).

Table 3. 79: MPS of Bajaj Auto and Industry Variables for Bajaj Auto

Year	Market Price Bajaj Auto	Production (Units)	Domestic Sales (Units)	Exports (Units)
2011-12	1,678.80	20,382,026	17,361,769	2,937,905
2012-13	1,799.55	20,647,611	17,793,701	2,898,907
2013-14	2,058.00	21,500,165	18,423,223	3,110,584
2014-15	2,028.00	23,358,047	19,724,371	3,573,346
2015-16	2,422.45	24016068	20468971	3643494
2016-17	2,822.85	25330967	21863281	3480725
2017-18	2,744.70	29075605	24972788	4041777
2018-19	2,948.80	30914874	26266179	4629049
2019-20	1,986.70	26353293	21545551	4748738
2020-21	3,666.70	22655609	18620233	4134047
2021-22	3,674.10	23040066	17617606	5617359
2022-23	3,879.30	25931867	21204162	4761487

Regression is run on the above variables. Here, the market price of Bajaj Auto (adjusted for stock split) is dependent variable, and Industrial factors were considered as independent variables. The following results are obtained:

Table 3. 80 Multiple R And R Square of Industry Analysis for Bajaj Auto Limited

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.8181 indicates there is strong positive relationship between Market price of Bajaj Auto and Automobile industry variables.
Multiple R	0.8181	
R Square	0.6693	
Adjusted R Square	0.5453	
Standard Error	522.99	
Observations	12	
(Source: Generated in Excel)		

R square of 0.6693 indicates that 66.93% variations in Market price of Bajaj Auto are being explained by listed industrial variables.

Table 3. 81: ANOVA Results of Industry Analysis for Bajaj Auto Limited

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	4428556.175	1476185.392	5.397088	0.0252
Residual	8	2188121.453	273515.1816		
Total	11	6616677.627			

ANOVA table shows that the significance F indicates that P value is 0.0252 which is less than 0.05. Thus, null hypothesis is rejected, and it is concluded that Industrial Production (in numbers), Domestic Sales (in numbers) & Exports (in numbers) have impact on the movement of Adjusted market price of Bajaj Auto.

3.5.3 Step 3: Economic Analysis for Bajaj Auto

The literature review on economic analysis reveals that various macroeconomic variables have been the focus of numerous studies. This review identifies six key macroeconomic variables that are frequently examined: Gross Domestic Product (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), and Crude Oil Prices per barrel for the Indian Basket (at Constant Price). This section aims to determine the impact of these six variables on the market price of Bajaj Auto. To ensure accuracy, market prices have been adjusted for stock splits, eliminating any distortions caused by such events. The analysis covers a period of

12 years, from 2011-12 to 2023-24, as the year 2011-12 marks the latest revised base year for most macroeconomic variables.

The next move is to see the result of economic analysis of Bajaj Auto.

Market Price of Bajaj Auto & Macroeconomic Variables

H_0 = Market price of Bajaj Auto is not affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

H_1 = Market price of Bajaj Auto is affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Whole Sale Price Index (WPI) , Exchange Rate(Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

Table 3. 82: Market Price of Bajaj Auto and Macroeconomic Variable

Year	MKT price of Bajaj Auto	GDP	IIP	WPI	Exchange Rate	Crude Oil Prices
2011-12	1,678.80	92130170	100.0	100.0	97.81	111.89
2012-13	1,799.55	87363290	103.3	106.9	94.73	107.97
2013-14	2,058.00	98013700	106.7	112.5	91.11	105.52
2014-15	2,028.00	105276740	111.0	113.9	97.09	84.16
2015-16	2,422.45	113694930	114.7	109.7	99.98	46.17
2016-17	2,822.85	123081930	120.0	111.6	102.63	47.56
2017-18	2,744.70	131445820	125.3	114.9	106.52	56.43
2018-19	2,948.80	139929140	130.1	119.8	100.29	69.88
2019-20	1,986.70	145346410	129.0	121.8	103.56	60.47
2020-21	3,666.70	136871180	118.1	123.4	101.84	44.82
2021-22	3,674.10	149258400	131.6	139.4	102.22	79.18
2022-23	3,879.30	160064250	138.5	152.5	101.90	93.15

Regression is run on the above variables. Here the market price of Bajaj Auto (adjusted for stock split) is a dependent variable, and macroeconomic factors were considered as independent variables. The following results are obtained.

Table 3. 83: Multiple R And R Square of Economy Analysis for Bajaj Auto Limited

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.8992 indicates there is strong positive relationship between Market price of Bajaj Auto and macroeconomic variables.
Multiple R	0.8992	
R Square	0.8085	
Adjusted R Square	0.6489	
Standard Error	459.53	
Observations	12	
(Source: Generated in Excel)		

R square of 0.8085 indicates that 80.85% variations in Market price of Bajaj Auto are being explained by listed macroeconomic variables.

Table 3. 84: ANOVA Results of Economy Analysis for Bajaj Auto Limited

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	5349649.906	1069930	5.066645	0.0365
Residual	6	1267027.721	211171.3		
Total	11	6616677.627			

ANOVA table shows that the significance F indicates that P value is 0.0365 which is less than 0.05. Thus, null hypothesis is rejected, and it is concluded that macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price) have impact on the movement of Adjusted market price of Bajaj Auto.

3.5.4 Step 4: E-I-C Framework for Bajaj Auto Limited

Up to this point the researcher has tried to find out the impact of company Variables, industry variable and Macroeconomic variables individually on market price per Share of Bajaj Auto Limited. This part of the study attempts to combine all the sectors and test whether it is possible to track market price using all Economy- Industry- Company variables simultaneously.

The next table presents a list of variables from the economy, industry, and company levels, which are being evaluated to determine their combined ability to track the market price of Bajaj Auto from 2011-12 to 2023-24. Given that tracking 9 variables for a single stock can be a complex task and recognizing that these 9 factors (5 from the economy, 3 from the industry, and 1 from the company) influence each other, it is practical to eliminate redundant variables. By doing so, we can focus on the key representative variables essential for tracking Bajaj Auto's market price.

Table 3. 85 Factors Considered to Test the efficiency of E-I-C Framework to Track Market Price of Bajaj Auto Limited

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP) 2. Index of Industrial Production (IIP) 3. Wholesale Price Index (WPI) 4. Exchange Rate (Constant price) 5. Crude Oil Prices per barrel for Indian Basket (at Constant Price)	6. Production(units) of Indian Automobile Industry. 7. Domestic Sales(units) of Indian Automobile Industry. 8. Exports(units) of Indian Automobile Industry.	9. Free Cashflow of Bajaj Auto Limited.

(Source: Finalized based on company, industry & economy analysis)

To streamline this process, various regressions were conducted in Excel. The goal was to identify the key variables that considerably impact Infosys's market price, thus facilitating a more straightforward and effective analysis. Consequently, the following key factors were finalized and included in the E-I-C (Economy-Industry-Company) framework for monitoring Bajaj Auto Limited's market price movements and guiding investment decisions:

Table 3. 86: Variables Of E-I-C Framework for Bajaj Auto Limited

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP) 2. Wholesale Price Index (WPI)	3. Production (unit) of Indian Automobile Industry	4. Free Cashflow of Bajaj Auto Limited.

(Source: Finalized based on E-I-C Framework's Regression Results)

The next move is to see the regression results which support the finalization of above stated 4 variables for tracking Market Price Movement of Bajaj Auto.

E-I-C Framework and Market Price of Bajaj Auto

H_0 = Market price of Bajaj Auto Limited is not affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of Automobile industry in terms of Production in Unit & Free Cashflow of Bajaj Auto.

H₁ = Market price of Bajaj Auto Limited is affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of Automobile industry in terms of Production in Unit & free Cashflow of Bajaj Auto.

Table 3. 87: Market Price of Bajaj Auto and E-I-C Variables for Bajaj Auto Limited

Year	Bajaj Auto	GDP (Rs.)	WPI	Size (Production in Unit)	Free Cashflow
2011-12	1,678.80	92130170	100	20,382,026	2154.838
2012-13	1,799.55	87363290	106.9	20,647,611	-1011.31
2013-14	2,058.00	98013700	112.5	21,500,165	3589.658
2014-15	2,028.00	105276740	113.9	23,358,047	-1584.23
2015-16	2,422.45	113694930	109.7	24016068	6407.531
2016-17	2,822.85	123081930	111.6	25330967	-2006.15
2017-18	2,744.70	131445820	114.9	29075605	4547.896
2018-19	2,948.80	139929140	119.8	30914874	6112.735
2019-20	1,986.70	145346410	121.8	26353293	2156.737
2020-21	3,666.70	136871180	123.4	22655609	-3004.94
2021-22	3,674.10	149258400	139.4	23040066	5888.036
2022-23	3,879.30	160064250	152.5	25931867	3923.149

(Sources: Handbook of RBI, SIAM, Annual Reports of Bajaj Auto)

Regression is run in Excel on the above variables. Here the market price of Bajaj Auto (adjusted for stock split) is a dependent variable and other variables from Economy, Industry & Company were considered as independent variables. The following results are obtained:

Table 3. 88: Multiple R & R Square of E-I-C Variables for Bajaj Auto Limited

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.8549 indicates there is strong positive relationship between Market price of Bajaj Auto and listed variables.
Multiple R	0.8549	
R Square	0.7309	
Adjusted R Square	0.5772	
Standard Error	504.32	
Observations	12	

(Source: Generated in Excel)

R square of 0.7309 indicates that 73.09% variations in Market price of Bajaj Auto are being explained by listed macroeconomic variables.

Table 3. 89: ANOVA Results of E-I-C Variables for Bajaj Auto Limited

	df	SS	MS	F	Significance F
Regression	4	4836286	1209071	4.753728098	0.03596
Residual	7	1780392	254341.7		
Total	11	6616678			

(Source: Regression Results Generated using Excel)

The ANOVA table shows that the significance F indicates that P value is 0.03596 which is less than Alpha of 0.05. Thus, null hypothesis is rejected, and it is concluded that Gross Domestic Production (GDP), Wholesale Price Index (WPI), Production of Auto Industry in terms of unit & Free Cashflow of Bajaj Auto have impact on the movement of Adjusted market price of Bajaj Auto Limited. Thus, the Study endorses the E-I-C Frameworks central idea that while carrying out valuation not only Company's, but related industry's & Economy's variable should also be considered.

Findings of case study 3 of Bajaj Auto Limited:

- As per Company analysis, Out of Dividend Discount Method (DDM), Discounted Cashflow Method (DCF) & Residual Income model (RIV) - the Discounted Cashflow Method (DCF) is the best method for carrying out valuation of Bajaj Auto because DCF predicts the Market Price of Bajaj Auto Limited with least prediction error.
- As per Industry analysis, Size (production in Units), Domestic Sales and Exports of Indian Automobile Industry has significant influence on movement of share price of Bajaj Auto Limited.
- As per Economic analysis, Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price) has significant influence on movement of share price of Bajaj Auto Limited.

Lastly, The E-I-C framework identified four primary variables out of the initial nine that significantly impact Infosys Limited's share price. Upon compiling the findings from Economy, Industry, and Company analyses within this framework, it was found that Infosys Limited's share

price is predominantly influenced by Gross Domestic Product (GDP), the Wholesale Price Index (WPI), the Size of the IT Industry (in Rs.), and Infosys Limited's Residual Income

3.6 CASE STUDY 4: Hero MotoCorp Limited

Hero MotoCorp Limited is a prominent international company headquartered in New Delhi, India, specializing in the production of scooters and motorcycles. Originally established in 1984 as Hero Honda, the company became independent in 2011, rebranding as Hero MotoCorp. As a major global two-wheeler manufacturer, Hero MotoCorp is known for its commitment to quality and innovation, supported by a robust distribution network. Its diverse product lineup includes scooters, sports bikes, and commuter motorcycles.

For the fiscal year 2023–2024, Hero MotoCorp reported impressive sales of over ₹34,567 crore (approximately \$4.2 billion), demonstrating steady growth in a competitive market. The company employs more than 18,000 people across its manufacturing, research and development (R&D), sales, and support functions.

In the Indian two-wheeler market, Hero MotoCorp holds a leading market share of about 34%, supported by its extensive production capacity. The company operates multiple manufacturing plants across India, including locations in Haryana, Rajasthan, Gujarat, and Uttarakhand, with a total installed capacity exceeding 10 million units annually. Hero MotoCorp also ranks among the top global two-wheeler manufacturers by sales volume and has a considerable presence in over 40 countries, including markets in Africa, Latin America, and Southeast Asia. International sales are a crucial component of its overall revenue.

The company is actively expanding into new and emerging markets, having entered countries as an illustration Colombia, Bangladesh, and Kenya to tap into growth opportunities.

To bolster its global presence, Hero MotoCorp has formed several strategic alliances and partnerships:

- Honda Motor Co., Limited.: Originally a joint venture known as Hero Honda, this partnership was pivotal in establishing Hero MotoCorp's market presence. Nevertheless,

differing strategic goals led to the dissolution of this partnership in 2011, allowing Hero MotoCorp to pursue its own technological and market development independently.

- United Nations Environment Program (UNEP): Since 2012, Hero MotoCorp has collaborated with UNEP on environmental sustainability initiatives, focusing on reducing emissions and promoting green practices.
- Bharat Petroleum Corporation Limited (BPCL): Beginning in 2014, this partnership has aimed at creating a network of fuel stations offering exclusive benefits, As an illustration discounts and loyalty programs, to Hero MotoCorp customers.
- Ericsson: In 2017, Hero MotoCorp and Ericsson partnered to enhance digital infrastructure and manufacturing processes using advanced technologies like the Internet of Things (IoT), aiming for improved operational efficiency.
- Bajaj Auto Limited: Announced in 2020, this strategic collaboration focuses on developing new technologies and platforms, including electric vehicles and advanced engine technologies, to drive innovation in the two-wheeler industry.
- Gogoro Inc.: Partnering in 2021, Hero MotoCorp and Gogoro, a Taiwanese electric scooter manufacturer, are working together on electric mobility solutions and battery-swapping technology, with a focus on promoting electric two-wheelers.
- Zero Motorcycles: In 2022, Hero MotoCorp entered a partnership with Zero Motorcycles to explore the development and commercialization of electric motorcycles, further supporting its electric vehicle strategy.

3.6.1 Step 1: Company Analysis of Hero MotoCorp Limited

Company analysis is carried out using three methods i.e. 1) Dividend Discount Model, 2) Discounted cashflow Method and 3) Residual Income Method. The first discussion is on the common inputs of TCS for company analysis through Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM).

Common Inputs for Company Analysis of Hero MotoCorp:

1. WACC, Perpetual Growth Rate & Number of Equity Shares of Hero MotoCorp

The following table indicates common inputs of Hero MotoCorp Limited for all the three inputs.

Table 3. 90: WACC, Perpetual Growth Rate, No. of Eq. Shares of Hero MotoCorp From 2014-15 To 2018-19

Year	WACC	Perpetual Growth Rate	Number Of Equity Shares
2014-15	14.58%	8.00%	19.97 Crores
2015-16	14.49%	8.26%	19.97 Crores
2016-17	15.15%	7.04%	19.97 Crores
2017-18	14.21%	6.12%	19.97 Crores
2018-19	14.16%	6.12%	19.97 Crores

(Source: WACC self-calculated, perpetual growth rate from RBI & No. of equity shares from Annual Reports Hero MotoCorp)

The table above outlines the common inputs for Hero MotoCorp used in calculating the intrinsic value through the Dividend Discount Method (DDM), Discounted Cash Flow Method (DCF), and Residual Income Method (RIM). The first column lists the financial years for which the intrinsic value is calculated. The third column shows the perpetual growth rate applied in each respective year to calculate the Terminal Value of Hero MotoCorp. The fourth column indicates the number of equity shares at the end of each year which is the same for all the years under the study period. The second column presents the Weighted Average Cost of Capital (WACC), which is used for discounting dividends, cash flows, and residual income to determine their present value. The WACC ranges from 14.16% to 15.15%. It is crucial to note that Hero MotoCorp Limited is a debt-free company, so its cost of capital is the same as its WACC. The calculation of Cost of Equity, as per the Capital Asset Pricing Model (CAPM), is shown in the table below.

Table 3. 91: Calculations of Cost of Equity for Hero MotoCorp Limited. As Per CAPM Model.

Year	Risk Free Rate	Risk Premium	Beta	Cost of Equity
2014-15	7.74%	8.40%	0.8137	14.58%
2015-16	7.47%	8.10%	0.8670	14.49%
2016-17	6.50%	8.50%	1.0179	15.15%
2017-18	6.80%	8.50%	0.8713	14.21%
2018-19	6.50%	8.30%	0.9235	14.16%
2019-20	4.80%	7.00%	0.9308	11.32%
2020-21	5.60%	7.30%	0.9613	12.62%
2021-22	5.60%	6.90%	0.9688	12.29%
2022-23	7.10%	8.50%	0.7315	13.32%
2023-24	7.20%	8.40%	0.8866	14.65%

(Source: Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024)

The table above shows the calculations for the cost of equity. The formula applied to calculate the cost of equity using the Capital Asset Pricing Model (CAPM) is: $R_f + \beta \times \text{Risk premium}$. The values for R_f and R_m are sourced from the article titled ‘Market Risk Premium and Risk-Free Rate used for 96 countries in 2024’. while the beta for each year is calculated using a formula that measures the sensitivity of the stock return relative to the market return. The formula is:

$$\text{Formula } \beta = \frac{\text{Cov}(j, m)}{\delta^2 m}$$

Here, $\text{Cov}(j, m)$ = Covariance between the security’s return and the market & $\delta^2 m$ Indicates Market Variance.

2. Hero MotoCorp Limited’s Growth Rate to be Used for Projections

In this study, actual data are taken up to the financial year 2023-24 during super normal growth rate period instead of multiplying the past data with expected supernormal growth rate because actual data is available up to 2023-24. Nevertheless, after the financial year 2023-24 future dividends, Cashflow & Residual Income are calculated using Revenue CAGR for past 5 years i.e. from 2019-20 to 2023-24. For prediction purposes, the revenue compound annual growth rate (CAGR) is chosen for all the three methods since it is increasing steadily as compared to dividends, free cash flow, and residual income.

Table 3. 92 : CAGR Of Hero MotoCorp Limited. Based on Past 5 Year’s Revenue

Revenue of Hero MotoCorp Limited					(Rs. In crores)
	2019-20	2020-21	2021-22	2022-23	2023-24
Revenue	28,408	30,303	28,688	33,406	37,456
5 YEARS CAGR	0.07156				

(Source: Revenue from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

The above table indicates the calculation of CAGR. Here, revenue for past 5 years is considered and then CAGR is calculated using the formula: $\left(\frac{\text{value at the end}}{\text{value at the beginning}} \right)^{(1/n)} - 1$

Calculation of Dividend, Free Cashflow & Residual Income of Hero MotoCorp Limited

One can easily get the dividend figures from Annual reports of company, so no calculations required for getting the dividend figures. But free Cashflow & Residual incomes are calculated

using the formula discussed in the introduction of the chapter. The first discussion is on the calculation of free cashflow.

Table 3. 93: Calculation Free Cash Flow to Firm of Hero MotoCorp Limited

Year	Total Operating Rev.	Total Operating Exp.	Operating Profit (EBIT)	NOPAT= EBIT(1-T)	Dep. & Amort.	Cap. Exp.	Change in Net Working Capital	FCFF
2014-15	27518	24594	2924	1930	540	1051	224	1195
2015-16	28360	24596	3764	2485	441	862	515	1549
2016-17	28170	24364	3805	2488	493	1020	1468	493
2017-18	31590	27512	4077	2666	556	622	1140	1459
2018-19	33125	29331	3793	2481	602	678	-515	2920
2019-20	28408	25718	2690	1750	818	2068	222	279
2020-21	30304	27480	2823	1837	677	377	515	1622
2021-22	28688	26552	2135	1389	650	297	282	1460
2022-23	33406	30496	2910	1893	657	360	-1800	3990
2023-24	37456	32930	4526	2944	711	656	-424	3424

(Source: FCFF self-Calculated using Annual Reports of Hero MotoCorp Limited.)

The above table indicates the calculation of FCFF using the mentioned formula in the same chapter in introductory part. The table shows the working of FCFF from 2014-15 to 2023-24. The next discussion is on the calculations of residual Income:

Table 3. 94: Calculation Residual Income of Hero MotoCorp Limited

Year	Profit for the Year	Cost of Equity	Book Value at the Beginning of the Year	Equity Charge	Residual Income
2014-15	2385.64	14.58%	5599.87	816.18	1569.46
2015-16	3132.37	14.49%	6541.33	948.02	2184.35
2016-17	3377.12	15.15%	7944.75	1203.79	2173.33
2017-18	3697.36	14.21%	10111.29	1436.38	2260.98
2018-19	3384.87	14.16%	11768.88	1667.04	1717.83
2019-20	3633.26	11.32%	12857.12	1454.87	2178.39
2020-21	2964.20	12.62%	14136.40	1783.67	1180.53
2021-22	2473.02	12.29%	15198.43	1867.13	605.89
2022-23	2910.58	13.32%	15782.92	2101.94	808.64
2023-24	3967.96	14.65%	17986.18	2634.52	1333.44

(Source: Self-Calculated)

The above table indicates the calculation of Residual income using the mentioned formula in the same chapter in introductory part. The table shows the workings of Residual Income from 2014-15 to 2023-24. Now, next table tracks the movement of all the 3 variables and their growth Rate.

Table 3. 95 : Dividend, Free Cashflow, Residual Income & their Growth Rates of Hero MotoCorp Limited

Year	Dividend	Growth Rate of Dividend	FCFF	Growth rate of FCFF	Residual Income	Growth Rate in Residual Income
2015-16	1437.75	20.00%	1549	29.58%	2184.35	39.18%
2016-17	1737.34	20.84%	493	-68.15%	2173.33	-0.50%
2017-18	1697.5	-2.29%	1459	195.82%	2260.98	4.03%
2018-19	1897.35	11.77%	2920	100.10%	1717.83	-24.02%
2019-20	1937.44	2.11%	279	-90.46%	2178.39	26.81%
2020-21	1897.81	-2.05%	1622	482.28%	1180.53	-45.81%
2021-22	1898.13	0.02%	1460	-10.00%	605.89	-48.68%
2022-23	1998.33	5.28%	3990	173.30%	808.64	33.46%
2023-24	2698.67	35.05%	3424	-14.19%	1333.44	64.90%

(Source: Self-Calculated)

The next move involves examining the insights derived from growth rate trends.

Dividend Discount Model (DDM): The dividend growth rate has shown considerable fluctuations over the nine-year period. The growth rates range from -2.29% in 2017-18 to 35.05% in 2023-24. The dividend increased in six out of nine years, with substantial growth in 2016-17 (20.84%) and 2023-24 (35.05%). To be noted, during the financial year 2023-24, During the 2016-17 financial year, Hero MotoCorp issued a special dividend of ₹60 per share. Further, special dividend of ₹25 per share was given alongside an interim dividend of ₹75 per share in 2023-2024. Conversely, the dividend growth rate was negative in 2017-18(-2.29%) & 2020-21 (-2.05%). This negative growth rate was due to the base year effect. The dividend's growth pattern suggests a relatively volatile but generally upward trend.

Discounted Cash Flow (DCF): The FCFF growth rates vary considerably, with a wide range from -90.46% in 2020-21 to 482.28% in 2021-22. FCFF decreased drastically in 2017-18 (-68.15%) and 2020-21 (-90.46%). Considerable growth occurred in 2018-19 (195.82%) and 2021-22 (482.28%). Nevertheless, the extremely high growth rate in the years 2018-19 & 2021-22 was due to base year

effect because in the year 2017-18 & 2020-21 the free cash flow available to the firm was extremely small. While the growth rate in 2019-20 is due to double free cashflow available in the year 2019-20 as compared to previous year. The extreme fluctuations in FCFF growth rates underscore the challenges in applying the Discounted Cash Flow (DCF) model. Investors relying on DCF should be cautious of the variability and ensure that projections account for the business cycle's peaks and troughs.

Residual Income Valuation (RIV): The residual income growth rate presents a mixed picture, ranging from -48.68% in 2022-23 to 64.90% in 2023-24. Residual income declined in five years, with sharp drops in 2021-22 (-45.81%) and 2022-23 (-48.68%). Growth rates were positive but modest in other years, peaking at 64.90% in 2023-24. The Residual Income Valuation (RIV) model is sensitive to changes in residual income, which is inherently volatile. The observed growth rates suggest that residual income may not always be a reliable predictor of value, particularly during periods of economic stress or business downturns.

Table 3. 96: Intrinsic Value of Hero MotoCorp Limited. for the Year 2014-15 Using DDM, DCF & RIV

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2015-16	1438	1255	1,549	1,352	2184	1962
2016-17	1737	1323	493	376	2173	1753
2017-18	1698	1129	1,459	970	2261	1638
2018-19	1897	1101	2,920	1,694	1718	1118
2019-20	1937	981	279	141	2178	1273
2020-21	1898	839	1,622	717	1181	620
2021-22	1898	732	1,460	563	606	286
2022-23	1998	673	3,990	1,344	809	342
2023-24	2699	793	3,424	1,006	1333	507
2024-25	2892 (p)	742	3,669(P)	941	1429(P)	488
Terminal value		12198		15459		7957
Total value of Hero MotoCorp		21796		24563		17945
No. of Eq. Shares		19.97 crores				
Intrinsic Value Per Share		1089.31 per share		1230.08 per share		898.66 per share

(Source: Dividend from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

The table above illustrates the derivation of the total value of Hero MotoCorp Limited. for the fiscal year 2014-15 using three valuation methods: the Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This study covers a 10-year period, culminating in 2024-25. The analysis incorporates actual dividends, free cash flows, and residual income from Hero MotoCorp Limited. over nine years (2015-16 to 2023-24), while the figures for 2024-25 are projections based on a five-year Compound Annual Growth Rate (CAGR) of 7.16% in revenue, reflecting the company's overall growth trajectory.

Columns 3, 5, and 7 of the table display the present value of the dividend, free cash flow, and residual income streams, respectively, for each year, discounted using the Weighted Average Cost of Capital (WACC) of 14.58% from 2014-15. In addition to this, the terminal value is calculated for the year 2024-25 for each method, applying a perpetual growth rate of 8% along with the WACC of 14.58%. The firm's values for 2014-15, as determined by each method, are Rs. 21,796 crores (DDM), Rs. 24,563 crores (DCF), and Rs. 17,945 crores (RIV).

To ascertain the firm's value on a per-share basis, the total firm value is divided by the number of equity shares outstanding in that year, which is consistently 19.97 crores across all three methods. This calculation yields an intrinsic value of Rs. 1089.31 per share for DDM, Rs. 1230.08 per share for DCF, and Rs. 898.66 per share for RIV. Notably, the residual income stream is considerably larger compared to the dividend and free cash flow streams, resulting in a higher intrinsic value under the RIV method relative to the others.

Likewise, the next move is to calculate the intrinsic value of Hero MotoCorp Limited. for the year 2015-16. The below table indicates the calculation of Hero MotoCorp Limited. Total firm value for the fiscal year 2015-16 using three valuation methods: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). The study spans a decade, concluding in 2025-26, and incorporates both historical data and forecasts. Specifically, it employs actual dividends, free cash flows, and residual income for eight years (2016-17 to 2023-24) and forecasts for the subsequent two years (2024-25 and 2025-26). These forecasts are predicted on a

Compound Annual Growth Rate (CAGR) of 7.16%, reflective of revenue growth as a proxy for Hero MotoCorp Limited.'s overall expansion.

Table 3. 97: Intrinsic Value of Hero MotoCorp Limited. For The Year 2015-16 Using DDM, DCF & RIV

(Rs. in crores)						
Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2016-17	1737	1517	493	431	2173	1923
2017-18	1698	1295	1459	1113	2261	1769
2018-19	1897	1264	2920	1945	1718	1189
2019-20	1937	1127	279	162	2178	1334
2020-21	1898	965	1622	825	1181	639
2021-22	1898	843	1460	648	606	290
2022-23	1998	775	3990	1547	809	343
2023-24	2699	914	3424	1160	1333	500
2024-25	2892 (P)	855	3669 (P)	1085	1429 (P)	474
2025-26	3099(P)	801	3932(P)	1016	1531(P)	449
Terminal value		13906		17643		5529
Total value of Hero MotoCorp		24262		27575		14440
No. of Eq. Shares		19.97 crores				
Intrinsic Value Per Share		1214.97 per share		1380.90 per share		723.12 per share

(Source: Dividend from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

Key financial parameters include a Weighted Average Cost of Capital (WACC) of 14.49% and a perpetual growth rate of 8.26%, crucial for calculating the terminal value at the end of the projection period in 2025-26. The resulting firm values for 2015-16 are Rs. 24,262 crores using DDM, Rs. 27,575 crores using DCF, and Rs. 14,440 per share through RIV. The intrinsic value per share is determined by dividing the firm's total value by the 19.97 crores outstanding equity shares, yielding intrinsic values of Rs. 1214.97 per share in DDM, Rs. 1380.90 per share in DCF, and Rs. 723.12 per share in RIV. The analysis reveals that just like 2014-15, the intrinsic value derived in 2015-16 from the DCF method is consistently higher than that from DDM and RIV. The next is calculation of the intrinsic value of Hero MotoCorp Limited. for the year 2016-17.

Table 3. 98: Intrinsic Value of Hero MotoCorp Limited. for the Year 2016-17 Using DDM, DCF & RIV

(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2017-18	1698	1474	1459	1267	2261	1957
2018-19	1897	1431	2920	2202	1718	1287
2019-20	1937	1269	279	182	2178	1413
2020-21	1898	1079	1622	923	1181	663
2021-22	1898	937	1460	721	606	294
2022-23	1998	857	3990	1711	809	340
2023-24	2699	1005	3424	1275	1333	486
2024-25	2892 (P)	935	3669(P)	1187	1429 (P)	450
2025-26	3099(P)	870	3932(P)	1104	1531(P)	418
2026-27	3320(P)	810	4213(P)	1028	1641(P)	387
Terminal value		10688		13561		3366
Total value of Hero MotoCorp		21357		25162		11062
No. of Eq. Shares		19.97 crores				
Intrinsic Value Per Share		1069.47 per share		1260 per share		553.93 per share

(Source: Dividend from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

The table above demonstrates the methodology used to determine the total firm value of Hero MotoCorp Limited. for the financial year 2016-17 through three valuation models: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade, incorporates Hero MotoCorp Limited.'s actual dividends, free cash flows, and residual income for seven years (2017-18 to 2023-24), along with projections for the subsequent three fiscal years (2024-25 to 2026-27).

The projections are based on a Compound Annual Growth Rate (CAGR) of 7.16% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is detailed in the 3rd, 5th, and 7th columns, discounted at the 2016-17 Weighted Average Cost of Capital (WACC) of 15.15%. The terminal value, calculated at the end of the analysis period in 2026-27, employs the same WACC of 15.15% and assumes a perpetual growth rate of 7.04%.

The firm values for 2016-17 are calculated as Rs. 21,357 crores under DDM, Rs. 25,162 crores under DCF, and Rs. 11,062 crores under RIV. To determine the intrinsic value per share for 2016-17, the total firm value is divided by the number of equity shares, which is 19.97 crores. This yields intrinsic values of Rs. 1069.47 per share using DDM, Rs. 1260 per share using DCF, and Rs. 553.93 per share using RIV. It is Remarkable that, consistent with the previous years (2014-15 & 2015-16), the intrinsic value derived from the RIV method is higher compared to the DDM and DCF methods. Likewise, the next move is to calculate the intrinsic value of Hero MotoCorp Limited. for the year 2017-18.

Table 3. 99: Intrinsic Value of Hero MotoCorp Limited. for the Year 2017-18 Using DDM, DCF & RIV

(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2018-19	1897	1661	2920	2556	1718	1482
2019-20	1937	1485	279	214	2178	1621
2020-21	1898	1274	1622	1089	1181	758
2021-22	1898	1116	1460	858	606	335
2022-23	1998	1029	3990	2054	809	386
2023-24	2699	1216	3424	1543	1333	549
2024-25	2892(P)	1141	3669 (P)	1448	1429 (P)	507
2025-26	3099(P)	1071	3932 (P)	1359	1531 (P)	469
2026-27	3320(P)	1005	4213 (P)	1275	1641(P)	433
2027-28	3558(P)	943	4514 (P)	1196	1758(P)	401
Terminal value		12372		15697		3304
Total value of Hero MotoCorp		24312		29288		10245
No. of Eq. Shares		19.97 crores				
Intrinsic Value Per Share		1217.37 per share		1466.53 per share		512.99 per share

(Source: Dividend from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

The table above provides a comprehensive analysis of the total firm value of Hero MotoCorp Limited. for the fiscal year 2017-18, employing three valuation methodologies: the Dividend Discount Model (DDM), the Discounted Cash Flow (DCF) model, and the Residual Income Valuation (RIV) approach. This analysis covers a ten-year period. It includes actual dividends, free

cash flows, and residual income data for six years (2018-19 to 2023-24), along with forecasts for the subsequent four years (2024-25 to 2027-28). The forecasts are predicted on a Compound Annual Growth Rate (CAGR) of 7.16% in revenue over the past five years, which serves as a proxy for the company's overall growth trajectory.

The present values of dividends, free cash flows, and residual income are detailed in the 3rd, 5th, and 7th columns of the table, each discounted using the Weighted Average Cost of Capital (WACC) of 14.21% as of 2017-18. The terminal value, calculated at the conclusion of the ten-year period in 2027-28, is derived using the same WACC and a perpetual growth rate of 6.12%.

The calculated firm values for 2017-18 are Rs. 24,312 crores using DDM, Rs. 29,288 crores using DCF, and Rs. 10,245 crores using RIV. To ascertain the intrinsic value per share for 2017-18, the total firm value is divided by the number of equity shares, which were 19.97 crores in that year. This computation yields intrinsic values of Rs. 1217.37 per share for DDM, Rs. 1466.53 per share for DCF, and Rs. 512.99 per share for RIV. The analysis reveals that the DCF method produces the highest intrinsic value per share for 2017-18, surpassing the values obtained using DDM and RIV.

Likewise, the next calculation is of intrinsic value of Hero MotoCorp Limited for the year 2018-19.

The table below details the methodology for calculating the total firm value of Hero MotoCorp Limited. for the fiscal year 2018-19 using three valuation techniques: Dividend Discount Model (DDM), Discounted Cash Flow (DCF), and Residual Income Valuation (RIV). This comprehensive analysis spans a decade and includes both historical and forecasted data. Specifically, it encompasses actual dividends, free cash flows, and residual income from Hero MotoCorp Limited. for five years (2019-20 to 2023-24) and projections for the subsequent five years (2024-25 to 2028-29).

Table 3. 100 : Intrinsic Value of Hero MotoCorp Limited. for the Year 2018-19 Using DDM, DCF & RIV

(Rs. in crores)

Year (1)	Dividend (2)	PV of Dividend (3)	FCFF (4)	PV of FCFF (5)	Residual Income (6)	PV of Res. Income (7)
2019-20	1937	1697	279	244	2178	1923
2020-21	1898	1456	1622	1245	1181	920
2021-22	1898	1276	1460	981	606	417
2022-23	1998	1176	3990	2349	809	491
2023-24	2699	1392	3424	1766	1333	715
2024-25	2892(P)	1306	3669 (P)	1657	1429(P)	676
2025-26	3099(P)	1226	3932(P)	1555	1531(P)	640
2026-27	3320(P)	1151	4213(P)	1460	1641(P)	605
2027-28	3558(P)	1080	4514(P)	1370	1758(P)	572
2028-29	3813(P)	1014	4838(P)	1286	1884(P)	541
Terminal value		13372		16966		5889
Total value of Hero MotoCorp		26145		30880		13390
No. of Eq. Shares		19.97 crores				
Intrinsic Value Per Share		1309.04 per share		1546.09 per share		670.40 per share

(Source: Dividend from Annual Reports Hero MotoCorp Limited. & other things self-calculated)

The projections are based on a Compound Annual Growth Rate (CAGR) of 7.16% in revenue over the past five years, reflecting the company's consistent growth. The present value of dividends, free cash flows, and residual income for each year is presented in the 3rd, 5th, and 7th columns of the table, discounted using the Weighted Average Cost of Capital of 14.16%.

The terminal value is calculated at the end of the 10-year period in 2028-29 using a WACC of 14.16%.and a perpetual growth rate of 6.12%. This provides the total firm value for 2018-19 as Rs. 26,145 crores using DDM, Rs. 30,880 crores using DCF, and Rs. 13,390 crores using RIV.

To ascertain the intrinsic value per share for 2018-19, the total firm value is divided by the number of equity shares, which stands at 19.97 crores. This results in intrinsic values of Rs. 1309.04 per share for DDM, Rs. 1546.09 per share for DCF, and Rs. 670.40 per share for RIV. Among the three

valuation methods, the DCF method yields the highest intrinsic value per share for the financial year 2018-19.

Table 3. 101: Market Value Per Share & Intrinsic Value Per Share as Per DDM, DCF & RIV Of Hero MotoCorp Limited.

Year	Market price (Nifty 50)	Intrinsic Value		
		DDM	DCF	RIV
2014-15	2,639.80	1089.31	1230.08	898.66
2015-16	2,945.70	1214.97	1380.90	723.12
2016-17	3,221.95	1069.47	1260	553.93
2017-18	3,542.80	1217.37	1466.53	512.99
2018-19	2,553.15	1309.04	1546.09	670.40

(Source: Self-Calculated)

The above table shows that the market price generally resembles the trends in intrinsic values, indicating that market participants may rely on similar valuation methods as the intrinsic value models provide a reasonable estimate of market value, Nevertheless, short-term fluctuations in market prices can arise from diverse factors.

- DDM consistently shows lower intrinsic values compared to market prices, particularly in years with increased equity shares, highlighting potential undervaluation.
- DCF tends to provide intrinsic values that are relatively close to market prices as compared to DDM & RIV indicating a more optimistic valuation perspective.
- RIV shows intrinsic values extremely far from market prices, suggesting not to use RIV for valuing shares of Hero MotoCorp.

Upon thorough examination, it can be derived that DDM, DCF, and RIV yield different intrinsic values owing to their unique Main variables. Nonetheless, there is a quest to determine the superior method among these approaches. The preferred method is one that closely approximates the market price as its intrinsic value. In simpler terms, the method that exhibits minimal prediction error is regarded as the most effective.

Statistical Tools Applied for the Valuation of Hero MotoCorp Limited

In statistics, various methods are available to measure the prediction errors. Mentioned below are some of such the methods used in this part of the study.

- i. Mean Absolute Error (MAE)
- ii. Mean Absolute Percentage Error (MAPE)
- iii. Mean Squared Error (MSE)
- iv. Root Mean Squared Error (RMSE)

Mean Absolute Error (MAE)

Table 3. 102: Mean Absolute Error (MAE) Of Market Price with DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference	Intrinsic Value	Absolute Difference
2014-15	2,639.80	1089.31	1550.49	1230.08	1409.72	898.66	1741.14
2015-16	2,945.70	1214.97	1730.73	1380.90	1564.80	723.12	2222.58
2016-17	3,221.95	1069.47	2152.48	1260.00	1961.95	553.93	2668.02
2017-18	3,542.80	1217.37	2325.43	1466.53	2076.27	512.99	3029.81
2018-19	2,553.15	1309.04	1244.11	1546.09	1007.06	670.40	1882.75
MAE			1800.65		1603.96		2308.86

(Source: Self-Calculated)

The table displays the Mean Absolute Error (MAE) between market prices and intrinsic values calculated using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods from 2014-15 to 2018-19. Comparing MAE values across these methods helps identify which one more accurately estimates real-world market conditions over time. A lower MAE indicates the predictions closer to actual values, implying higher method accuracy. DCF consistently shows the smallest MAE values, indicating its estimates closely align with actual market prices compared to DDM and RIV. Therefore, RIV is considered the optimal method for making informed investment decisions regarding Hero MotoCorp Limited.

Mean Absolute Percentage Error (MAPE)

Table 3. 103: Mean Absolute Percentage Error (MAPE) of Market Price with Intrinsic Value of Hero MotoCorp Limited as per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error	Intrinsic Value	Absolute Percentage Error
2014-15	2,639.80	1089.31	58.73%	1230.08	53.40%	898.66	65.96%
2015-16	2,945.70	1214.97	58.75%	1380.90	53.12%	723.12	75.45%
2016-17	3,221.95	1069.47	66.81%	1260.00	60.89%	553.93	82.81%
2017-18	3,542.80	1217.37	65.64%	1466.53	58.61%	512.99	85.52%
2018-19	2,553.15	1309.04	48.73%	1546.09	39.44%	670.40	73.74%
MAPE			59.73%		53.09%		76.70%

(Source: Self-Calculated)

The table illustrates the Mean Absolute Percentage Error (MAPE) between actual market prices and forecasted intrinsic values using DDM, DCF, and RIV methods for Hero MotoCorp Limited. across five years (2014-15 to 2018-19). MAPE quantifies prediction errors in percentage terms, where lower values indicate greater accuracy. With MAPE values of 59.73%, 53.09 %, and 76.70% for DDM, DCF, and RIV respectively, DCF emerges as the most accurate method for predicting Hero MotoCorp Limited's market prices over the five-year period. This indicates that DCF provides more reliable estimates, making it preferable for informed investment decisions for Hero MotoCorp Limited.

Mean Squared Error (MSE)

Table 3. 104 : Mean Squared Error (MSE) Of Market Price with Intrinsic Value of Hero MotoCorp Limited as per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,639.80	1089	2404008	1230	1987318	899	3031572
2015-16	2,945.70	1215	2995410	1381	2448594	723	4939873
2016-17	3,221.95	1069	4633162	1260	3849246	554	7118321
2017-18	3,542.80	1217	5407640	1467	4310883	513	9179743
2018-19	2,553.15	1309	1547813	1546	1014171	670	3544730
MSE			33,97,607		27,22,042		55,62,848

(Source: Self-Calculated)

The table presents the Mean Squared Error (MSE) between the actual market prices and forecasted intrinsic values using DDM (Dividend Discount Model), DCF (Discounted Cash Flow), and RIV (Residual Income Valuation) methods for Hero MotoCorp Limited. across five years (2014-15 to 2018-19). MSE measures the average squared difference between predicted and actual values. Lower MSE values indicate that the predictions are closer to the actual market prices, suggesting higher accuracy of the forecasting method. As indicated in the above table MSE is 33,97,607 for DDM 27,22,042 for DCF & 55,62,848 for RIV. Here, DCF demonstrates the lowest MSE indicating DCF is the optimal method among DDM, DCF, and RIV for predicting Hero MotoCorp Limited's market prices

Root Mean Squared Error (RMSE)

Table 3. 105: Root Mean Squared Error (RMSE) of Market price with Intrinsic Value of Hero MotoCorp Limited as per DDM, DCF & RIV

Year	MKT price	DDM		DCF		RIV	
		Intrinsic Value	Squared difference	Intrinsic Value	Squared difference	Intrinsic Value	Squared difference
2014-15	2,639.80	1089	2404008	1230	1987318	899	3031572
2015-16	2,945.70	1215	2995410	1381	2448594	723	4939873
2016-17	3,221.95	1069	4633162	1260	3849246	554	7118321
2017-18	3,542.80	1217	5407640	1467	4310883	513	9179743
2018-19	2,553.15	1309	1547813	1546	1014171	670	3544730
MSE			33,97,607		27,22,042		55,62,848
RMSE			1,843.26		1,649.86		2,358.57

(Source: Self-Calculated)

The table above shows Root Mean Squared Error (RMSE) values for the DDM, DCF and RIV methods in forecasting Hero MotoCorp Limited's market prices from 2014-15 to 2018-19. The lower digit of RMSE for DCF (1,843.26) compared to DDM (1,649.86) and DCF (2,358.57) confirms its superior predictive accuracy. Thus, DCF is the most accurate method for predicting Hero MotoCorp Limited's market prices.

Table 3. 106: Summary of MAE, MAPE, MSE & RMSE for Hero MotoCorp Limited

Test For Measuring Prediction Error	Error Test Results for:			Best Method
	DDM	DCF	RIV	
MAE	1800.65	1603.96	2308.86	DCF
MAPE	59.73%	53.09%	76.70%	DCF
MSE	33,97,607	27,22,042	55,62,848	DCF
RMSE	1,843.26	1,649.86	2,358.57	DCF
Overall Best Method	(Discounted Cashflow) DCF			

(Source: Self-Calculated)

The summary table of all tests conducted to identify the most accurate valuation method indicates that the Discounted Free Cashflow (DCF) method is the most effective for predicting the market price of Hero MotoCorp Limited. Nevertheless, despite its superiority over the other three methods, DCF cannot perfectly capture the fluctuations in market price. This limitation arises because a company's market price is influenced by a complex interplay of factors, categorized into company-specific, economic, industry-specific, and other factors.

Next, Researcher has made strides in identifying which industry-specific and macroeconomic factors considerably affect Hero MotoCorp Limited's market price movements. Nevertheless, it is crucial to acknowledge that other factors, such as rumors, news, announcements, and market sentiments, also play a crucial role.

3.6.2 Step 2: Industry Analysis for Hero MotoCorp Limited

Industry analysis aims to forecast the future trajectory of the industry under review. There are various methods available to conduct such an analysis, including industry life cycle analysis, SWOT analysis, PEST analysis, PESTEL analysis, Michael Porter's Five Forces analysis, and trend analysis. A review of the literature on industry analysis indicates that different studies employ different methods according to their specific needs and convenience. This study will utilize trend analysis because the trend analysis, combined with regression analysis, can help identify the key industrial factors that should be considered when purchasing company shares in the secondary market.

Indian Information Automobile industry analysis

Literature review of Indian Automobile industry analysis revealed that the mostly studied trends are production (Units), Domestic Sales (Units) and Exports (Units) of Automobiles Industry. Alike

Economic analysis period selected for industry analysis is 12 years i.e. from 2011-12 to 2022-23. An attempt has been made to identify industrial factors having impact on movement of market price of Bajaj Auto and market price of Hero MotoCorp.

Automobile Industry's analysis & Market Price of Hero MotoCorp

H₀ = Market price of Hero MotoCorp is not affected by Industrial factors i.e. Production(units), Domestic Sales(units) & Exports(units).

H₁ = Market price of Hero MotoCorp is affected by Industrial i.e. Production(units), Domestic Sales(units) & Exports(units).

Table 3. 107: Market Price of Hero MotoCorp and Industry Variables for Hero MotoCorp

Year	Market Price of Hero MotoCorp	Production (Units)	Domestic Sales (Units)	Exports (Units)
2011-12	1,485.15	20,382,026	17,361,769	2,937,905
2012-13	1,140.20	20,647,611	17,793,701	2,898,907
2013-14	1,717.02	21,500,165	18,423,223	3,110,584
2014-15	2,089.10	23,358,047	19,724,371	3,573,346
2015-16	2,369.38	24016068	20468971	3643494
2016-17	2,685.84	25330967	21863281	3480725
2017-18	3,014.50	29075605	24972788	4041777
2018-19	2,214.82	30914874	26266179	4629049
2019-20	1,418.74	26353293	21545551	4748738
2020-21	2,735.19	22655609	18620233	4134047
2021-22	2,150.32	23040066	17617606	5617359
2022-23	2,266.30	25931867	21204162	4761487

(Source: SIAM)

Regression is run on the above variables. Here, the market price of Hero MotoCorp (adjusted for stock split) is dependent variable, and Industrial factors were considered as independent variables.

Table 3. 108: Multiple R and R Square of Industry Analysis for Hero MotoCorp

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.6425 indicates there is relative positive relationship between Market price of Hero MotoCorp and Automobile industry variables.
Multiple R	0.6425	
R Square	0.4128	
Adjusted R Square	0.1926	
Standard Error	514.65	
Observations	12	
(Source: Generated in Excel)		

Here, R square of 0.4128 indicates that only 41.28% variations in Market price of Hero MotoCorp are being explained by listed industrial variables. In other words, 63.41% movements in the market Prices of Hero MotoCorp are being affected by other than Production, Domestic Sales & Exports of Indian Automobile Industry.

Table 3. 109: ANOVA Results of Industry Analysis for Hero MotoCorp

	df	SS	MS	F	Significance F
Regression	3	1489506.359	496502.1197	1.874516	0.212259
Residual	8	2118955.596	264869.4495		
Total	11	3608461.955			

ANOVA table shows that the significance F indicates that P value is 0.2122 which is more than 0.05. Thus, null hypothesis is accepted, and it is concluded that Industrial Production (in numbers), Domestic Sales (in numbers) & Exports (in numbers) do not have combined impact on the movement of Adjusted market price of Hero MotoCorp. So, concluded that the industrial Factor do not affect the movement of Hero MotoCorp's share prices.

3.6.3 Step 3: Economic Analysis for Hero MotoCorp Limited

The literature review on economic analysis reveals that various macroeconomic variables have been the focus of numerous studies. This review identifies six key macroeconomic variables that are frequently examined: Gross Domestic Product (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Interest Rate, Exchange Rate (Constant price), and Crude Oil Prices per barrel for the Indian Basket (at Constant Price). This section aims to determine the impact of these six variables on the market price of Hero MotoCorp. To ensure accuracy, market prices have been adjusted for stock splits, eliminating any distortions caused by such events. The analysis covers a period of 12 years, from 2011-12 to 2023-24, as the year 2011-12 marks the latest revised base year for most macroeconomic variables.

Market Price of Hero MotoCorp & Macroeconomic Variables

A regression analysis was conducted between the market price of Hero MotoCorp and six selected macroeconomic variables. Nevertheless, the results indicated that these six variables did not collectively influence the market price of Hero MotoCorp.

H_0 = Market price of Hero MotoCorp is not affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price)

H_1 = Market price of Hero MotoCorp is affected by Macroeconomic factors i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price).

Table 3. 110: Market Price of Hero MotoCorp and Economy Variables for Hero MotoCorp

Year	Market price of Hero Moto Corp	GDP	IIP	WPI	Exchange Rate	crude oil prices
2011-12	1,485.15	92130170	100	100	97.81	111.89
2012-13	1,140.20	87363290	103.3	106.9	94.73	107.97
2013-14	1,717.02	98013700	106.7	112.5	91.11	105.52
2014-15	2,089.10	105276740	111	113.9	97.09	84.16
2015-16	2,369.38	113694930	114.7	109.7	99.98	46.17
2016-17	2,685.84	123081930	120	111.6	102.63	47.56
2017-18	3,014.50	131445820	125.3	114.9	106.52	56.43
2018-19	2,214.82	139929140	130.1	119.8	100.29	69.88
2019-20	1,418.74	145346410	129	121.8	103.56	60.47
2020-21	2,735.19	136871180	118.1	123.4	101.84	44.82
2021-22	2,150.32	149258400	131.6	139.4	102.22	79.18
2022-23	2,266.30	160064250	138.5	152.5	101.9	93.15

(Source: NSE & Handbook of RBI)

Regression is run on the above variables. Here, the market price of Hero MotoCorp (adjusted for stock split) is dependent variable, and macroeconomic factors were considered as independent variables. The following result are obtained as follows:

Table 3. 111: Multiple R And R Square of Economy Analysis for Hero MotoCorp

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.7876 indicates there is strong positive relationship between Market price of Hero MotoCorp and macroeconomic variables.
Multiple R	0.7876	
R Square	0.6204	
Adjusted R Square	0.3040	
Standard Error	477.83	
Observations	12	
(Source: Excel Generated)		

Nevertheless, R square of 0.6204 indicates that 62.04% variations in Market price of Hero MotoCorp are being explained by listed macroeconomic variables. In other words, 63.41% movements in the market Prices of Hero MotoCorp are being affected by other than Macroeconomic variables.

Table 3. 112 : ANOVA Results of Economy Analysis for Hero MotoCorp

	df	SS	MS	F	Significance F
Regression	5	2238528	447705.5	1.960848	0.218072
Residual	6	1369934	228322.4		
Total	11	3608462			

(Source: Excel Generated)

ANOVA table shows that the significance F indicates that P value is 0.359714 which is more than 0.05. thus, null hypothesis is accepted, and it is concluded that macroeconomic factors i.e. Wholesale Price Index (WPI) & Crude Oil Prices per barrel for Indian Basket (at Constant Price) do not have impact on the movement of Adjusted market price of Hero MotoCorp.

3.6.4 Step 4: E-I-C Framework for Hero MotoCorp Limited

Up to this point the researcher has tried to find out the impact of company Variables, industry variable and Macroeconomic variables individually on market price per Share of Hero MotoCorp Limited and found that selected economic variables or industry's variables can not track the movement in the market price of Hero MotoCorp. Further, DCF turns out to be best method for valuing equity shares of Hero Moto Corp. This part of the study attempts to apply E-I-C Variables for Hero MotoCorp Also.

Table 3. 113: Factors Considered to Test the efficiency of E-I-C Framework to Track Market Price of Hero MotoCorp

Macroeconomic Variables	Related Industry's Variables	Company Variable
1. Gross Domestic Production (GDP) 2. Wholesale Price Index (WPI)	3. Production (unit) of Indian Automobile Industry	4. Free Cashflow of Hero MotoCorp

(Source: Finalized based on company, industry & economy analysis)

The table above presents a list of variables from the economy, industry, and company levels, which are being evaluated to determine their combined ability to track the market price of Bajaj Auto so same are applied for Hero MotoCorp. So, the above 4 key factors were finalized and included in

the E-I-C (Economy-Industry-Company) framework for monitoring Hero MotoCorp 's market price movements.

E-I-C Factors & Market Price of Hero MotoCorp

H_0 = Market price of Hero MotoCorp is not affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Production of Auto Industry in terms of unit & Free Cashflow of Hero MotoCorp.

H_1 = Market price of Hero MotoCorp is affected by Gross Domestic Production (GDP), Wholesale Price Index (WPI), Production of Auto Industry in terms of unit & Free Cashflow of Hero MotoCorp.

Table 3. 114: Market Price of Hero MotoCorp and E-I-C variables

Year	Market Price of Hero	GDP	WPI	Production (Units)	FCFF
2011-12	1,485.15	92130170	100	20,382,026	1680.518
2012-13	1,140.20	87363290	106.9	20,647,611	1829.947
2013-14	1,717.02	98013700	112.5	21,500,165	1381.091
2014-15	2,089.10	105276740	113.9	23,358,047	1195.104
2015-16	2,369.38	113694930	109.7	24016068	1548.593
2016-17	2,685.84	123081930	111.6	25330967	493.2175
2017-18	3,014.50	131445820	114.9	29075605	1459.037
2018-19	2,214.82	139929140	119.8	30914874	2919.576
2019-20	1,418.74	145346410	121.8	26353293	278.6146
2020-21	2,735.19	136871180	123.4	22655609	1622.307
2021-22	2,150.32	149258400	139.4	23040066	1460.024
2022-23	2,266.30	160064250	152.5	25931867	3990.294

(Source: NSE, SIAM & Annual Reports of Hero MotoCorp)

Regression is run on the above variables. Here the market price of Hero MotoCorp (adjusted for stock split) is dependent variable, and macroeconomic factors were considered as independent variables. The following result are obtained:

Table 3. 115: Multiple R And R Square of E-I-C Framework Analysis For Hero MotoCorp

Regression Statistics		The Multiple R measures the magnitude and direction of the linear relationship between dependent & independent variables. Multiple R of 0.5625 indicates there is positive relationship between Market price of Hero MotoCorp and E-I-C variables.
Multiple R	0.5625	
R Square	0.3165	
Adjusted R Square	-0.0741	
Standard Error	593.60	
Observations	12	
(Source: Excel Generated)		

Furthermore, R square of 0.3165 indicates that only 31.65% variations in Market price of Hero MotoCorp are being explained by finalized E-I-C variables. In other words, 68.36% movements in the market Price of Hero MotoCorp are because of factors other than GDP, WPI, Production Auto Industry & FCFF of Hero MotoCorp.

Table 3. 116: ANOVA Results Of E-I-C Framework for Hero MotoCorp

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	1141922.203	285480.6	0.810189194	0.5565
Residual	7	2466539.753	352362.8		
Total	11	3608461.955			

(Source: Excel Generated)

The ANOVA table shows that the significance F indicates that P value is 0.5565 which is more than 0.05. Thus, null hypothesis is accepted, and it is concluded that E-I-C variables i.e. GDP, WPI, Production Auto Industry & FCFF of Hero MotoCorp collectively cannot track the movement in the market price of Hero MotoCorp.

Findings of Case Study 4 of Hero MotoCorp

- As per Company analysis, out of 3 methods i.e. Dividend Discount Method (DDM), Discounted Cashflow Method (DCF) & Residual Income model (RIV), considered for valuation of shares of Hero MotoCorp - the Discounted Cashflow Method (DCF) is found to be the best method for carrying out valuation of Hero MotoCorp it because predicts the Market Price of Hero MotoCorp with least prediction error.
- As per Industry analysis, suggested industrial variables i.e. Production(units), Domestic Sales(units) & Exports(units) of Automobile sector do not have significant influence on movement of share price of Hero MotoCorp.

- As per Economic analysis, suggested economic variables i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Exchange Rate (Constant price), Crude Oil Prices per barrel for Indian Basket (at Constant Price) do not have significant influence on movement of share price of Hero MotoCorp.
- As per E-I-C framework analysis, Gross Domestic Production (GDP), Wholesale Price Index (WPI), Size of Automobile industry (production in Units) and FCFF of Hero MotoCorp are not sufficient for tracking movement of share price of Hero MotoCorp. So, there are some external factors that need to be identified that are having super impacts on the market price of Hero.

Considering the above findings, the study tried to track movement in the market Price of Hero MotoCorp by combining company analysis & analysis of factors other such collaborations/partnerships/joint ventures of Hero MotoCorp, Global economic slowdown, change in international standards on emissions, India's shift from BS-IV to BS-VI. To be noted, impact of such factor have direct impact on investor psychology and market sentiment Nevertheless it is extremely difficult to quantify its direct or indirect impact on market price of the company. Their unpredictable nature makes them unreliable for systematic analysis or forecasting. Given these challenges, the researcher has tracked only directional change in the movement of share price of Hero MotoCorp.

3.6.5 Step 5: Identification of Other Factors Influencing Movement of Share Price of Hero MotoCorp

The following factors were analyzed to identify factors that affect Hero MotoCorp's market price during 2011-12 to 2022-23.

Key Factors to Analyze: FCFF, Number of Vehicles Sold, Operating Income, Profit for the Year, Earnings Per Share (EPS), Number of Units Sold & collaborations/ Mergers/joint ventures of Hero MotoCorp, global Economic slowdown in 2018-19, India's shift from BS-IV to BS-VI, Covid 19.

Table 3. 117: Company Specific Factors of Hero MotoCorp Limited

Year	Market Price of Hero MotoCorp	Revenue From Operations	Profit for The Period	No. Of Units Sold
2011-12	1485.15	25185.43	2378.13	6235205
2012-13	1140.20	25626.95	2118.16	6075583
2013-14	1717.02	27126.21	2109.08	6245960
2014-15	2089.10	29235.64	2385.64	6631826
2015-16	2369.38	30618.09	3132.37	66,32,000
2016-17	2685.84	30540.67	3377.12	66,64,000
2017-18	3014.50	32230.84	3697.36	75,90,000
2018-19	2214.82	33124.53	3384.87	78,21,000
2019-20	1418.74	28408.43	3633.26	63,98,000
2020-21	2735.19	30303.53	2964.20	58,00,000
2021-22	2150.32	28687.74	2473.02	49,00,000
2022-23	2266.30	33406.21	2910.58	53,00,000

(Source: NSE & Annual Reports of Hero MotoCorp)

The price of Hero MotoCorp has demonstrated considerable volatility over the analyzed 12-year period, with notable declines occurring in four specific fiscal years i.e. 2012-13, 2018-19, 2019-20, 2021-22. The next move is to discuss possible factors which resulted in volatility of hero's market Price.

- FY 2012-13: The decline in Hero MotoCorp's stock price during this period can be attributed to the rebranding from Hero Honda to Hero MotoCorp, following the dissolution of their joint venture in December 2010. This transition, combined with a decrease in sales from 6,235,205 units in FY 2011-12 to 6,075,583 units in FY 2012-13, likely had a compounded effect on the company's adjusted closing price.
- FY 2013-14 to FY 2017-18: This period witnessed steady growth in Hero MotoCorp's market price, driven by several strategic advancements. These included partnerships as an illustration the collaboration with Erik Buell Racing (EBR), a strategic alliance with Magneti Marelli, and entry into the electric vehicle (EV) market through a partnership with Ather Energy. Such initiatives bolstered the company's technological capabilities and positively influenced its market valuation.
- FY 2018-19: The global automotive industry experienced contraction in 2019, influenced by disruptions related to new emission standards in the euro area and China, which had lasting effects on the market. In addition to this, global trade volume growth reached its

lowest point since 2012 during the first half of 2019. These international policy changes negatively impacted Hero MotoCorp's market price during FY 2018-19.

- FY 2019-20 to FY 2022-23: This period was marked by high volatility in Hero MotoCorp's stock price due to several factors which affected sales, profit & Units Sold of the company also. The next move is to discuss some possible factors
 - The implementation of BS-VI emission norms from April 1, 2020, required considerable upgrades in engine designs and exhaust systems. The transition led to the discontinuation and revamping of models. As an illustration, the Karizma ZMR and updates to the Splendor iSmart and Passion Pro.
 - Sales volumes declined by 9% in FY 2020-21 and by 14.8% in FY 2021-22, primarily due to disruptions caused by the COVID-19 pandemic, lockdowns, and the sluggish recovery of the Indian economy.
 - On a positive note, Hero MotoCorp became the exclusive distributor for Harley-Davidson in India and embarked on developing a new range of motorcycles under the Harley-Davidson brand. In addition to this, strategic partnerships with Gogoro and Bharat Petroleum Corporation Limited (BPCL) aimed at introducing battery-swapping technology and establishing EV charging infrastructure in India contributed to an upward trend in the company's market price in FY 2021-22 and FY 2022-23, which has continued into the present.

In summary, analyzing the price movements of Hero MotoCorp necessitates a comprehensive understanding of various factors, including global economic conditions, national and international policy changes, and the company's strategic collaborations and ventures along with the FCFF of the company. Investors must monitor these elements closely to navigate the complexities of equity investments in Hero MotoCorp.

The following summary lists out the minimum number of factors to be studied to track the Market price Movement of the respective company.

3.7 Summary of Variables Identified for Efficient Valuation & Accurate Tracking of Share Prices of Company

Following are Summary tables indicting variables identified for efficient valuation & accurately tracking movement in share price of company:

Table 3. 118: Summary of Regression Results: Economy Analysis

Company	Company Analysis	Industry Analysis	Economy Analysis
TATA Consultancy Limited (TCS)	Residual Income Valuation Method	Following factors of Indian Information Technology Industry: 1. Size (Revenue) 2. Domestic Sales 3. Export Revenue	Market price of Company gets affected by all 5 macroeconomic variables: 1. Gross Domestic Production (GDP), 2. Index of Industrial Production (IIP), 3. Wholesale Price Index (WPI), 4. Exchange Rate (Constant price), 5. Crude Oil Prices per barrel for Indian Basket (at Constant Price)
Infosys			
Bajaj Auto	Discounted Free Cash Flow Method	Following factors of Indian Auto Mobile Industry (in Units): 1. Size (Production) 2. Domestic Sales. 3. Exports.	Null Hypothesis accepted. So above macroeconomic factors can not affect the price of Hero Moto Corp.
Hero MotoCorp		Null Hypothesis accepted. So above industrial factors can not affect the price of Hero Moto Corp.	

(source: summarize based on results of 4 case studies)

The table gives the summary of factors to be considered for economic analysis, industry analysis & company analysis:

- Results indicated that while carrying out economic analysis, for 3 out of 4 companies the selected model of economic analysis works. Thus, as per results of economic analysis, Market price of Company gets affected by 5 macroeconomic variable i.e. Gross Domestic Production (GDP), Index of Industrial Production (IIP), Whole Sale Price Index (WPI), Exchange Rate (Constant price) and Crude Oil Prices per barrel for Indian Basket (at Constant Price)
- Results of industry analysis indicates that, for 3 out of 4 companies the selected model of industry analysis works. Thus, related industry's Size (in terms of Production or revenue),

Domestic Sales & Exports are 3 variables which have significant movement on share price movement of company.

- Results of company analysis indicates that for information technology industry which taken as representative of service sector, residual income valuation method is most accurate as it predicts the intrinsic value of service sector industry with the least prediction error. On the other hand, for Automobile industry, which is taken as representative as manufacturing sector, Discounted cashflow valuation method is most accurate as it predicts the intrinsic value of manufacturing sector industry the least prediction error.

Table 3. 119: E-I-C Framework & Other Variables:

Company	E-I-C Variables	Other variables
TATA Consultancy Limited (TCS)	Four variables: 1. Gross Domestic Production (GDP), 2. Wholesale Price Index (WPI), 3. Size (Revenue) of Indian Information Technology Industry.	Not Needed
Infosys	4. Residual Income of Company.	
Bajaj Auto	Four variables: 1. Gross Domestic Production (GDP), 2. Wholesale Price Index (WPI), 3. Size (Units Sold) By India Automobile Industry. 4. Free Cashflow to firm of Company.	
Hero MotoCorp	Only Free Cashflow to firm is usefully in addition to other factors.	Global economic conditions, National and international policy changes, Exchange rate, Strategic collaborations/Partnerships/Joint ventures of Company & Extra ordinary factors like Covid 19 Pandemic.

(Source: summarize based on results of 4 case studies)

The key findings from all the 4-case study can be used to generalize the list of suggested variables that should be tracked by a common investor for taking well guided and profitable investment decisions. The results can be generalized as follows:

Applicability of Suggested E-I-C Framework

E-I-C FRAMEWORK For Service Industry

The Share price movement of service sector companies can be tracked accurately by tracking following 4 variables:

1. Gross Domestic Production (GDP),
2. Wholesale Price Index (WPI),
3. Size (Revenue) of Indian Information Technology Industry.
4. Residual Income of Company.

E-I-C FRAMEWORK for Manufacturing Industry

The Share price movement of manufacturing sector companies can be tracked accurately by tracking following 4 variables:

1. Gross Domestic Production (GDP),
2. Wholesale Price Index (WPI),
3. Size (Revenue) of Indian Information Technology Industry.
4. Free cashflow of Company.

It is observed, for Hero MotoCorp also the Discounted Free Cash Flow Method, which the ‘suggested valuation method’ for manufacturing company is found the most accurate. However, the suggested E-I-C Framework is not sufficient for tracking the movement of share price of Hero MotoCorp. It indicated that Hero MotoCorp is ‘Acyclical’ and ‘Sector-Agnostic’ company that neither rise nor fall in tandem with the general economic cycles or sector specific variables. It is observed that the share price of Hero MotoCorp is highly affected by variables such as Global economic conditions, National and international policy changes, Strategic collaborations/Partnerships/Joint ventures of Company & Extra ordinary factors like Covid 19 Pandemic. Thus, it is suggested that manufacturing companies like Hero MotoCorp, who are

extremely influenced by external variables, identify and track the movement of external factor also, for efficient tracking of movement of stock price.

Hence, it is concluded that except for companies like Hero MotoCorp, which is highly affected by extraordinary factors, the suggested E-I-C framework is useful to common investor for taking profitable investment decisions.

Works Cited

- Damodaran, A. (2006). *Damodaran on Valuation: Security Analysis for Investment and Corporate Finance* (2nd ed.). Wiley.
- Fernández, P., Garza, D. G., & Acín, L. F. (2024, March 11). Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024. *SSARN*, 1-17. doi:<https://dx.doi.org/10.2139/ssrn.4754347>
- Graham, B., & Dodd, D. (2008). *Security Analysis* (6th Edition ed.). McGraw-Hill Education.
- Pinto, J. E., Henry, E., Robinson, T. R., Stowe, J. D., & Rath, R. D. (2010). *EQUITY ASSET VALUATION*. New Jersey: John Wiley & Sons.
- Ross, S. A., Westerfield., R. P., & Jaffe, J. (2010). *Corporate Finance* (9th ed.). Singapore.: McGraw-Hill.
- Vipond, T. (n.d.). *Terminal Growth Rate*. Retrieved from Corporate Finance Institute: <https://corporatefinanceinstitute.com/resources/valuation/what-is-terminal-growth-rate/>
- www.tata.com. (n.d.). *Tata Consultancy Services*. Retrieved from www.tata.com: <https://www.tata.com/business/tcs>