

# **Systematic and Unsystematic Risk analysis of (Tata Motors, Mahindra, Maruti)**

Assignment 3  
Submitted in partial fulfillment  
of the requirements for the course of  
**ECON F355 Business Analysis and Valuation**

By  
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## ACKNOWLEDGEMENT

*We would like to express our sincere gratitude to Dr. Niranjana Swain, for giving us an opportunity to work under him for this assignment and taking his valuable time to provide us with the required guidance wherever required. His input proved to be very vital for the assignment. We would like to thank him for providing us with such a wonderful opportunity to apply our course knowledge on real-life data and get hands-on experience. We are indebted for all his help and guidance throughout the course and this assignment.*

## ABSTRACT

The purpose of this report is to calculate the cost of equity and the overall weighted average cost of capital (WACC) for our selected organizations: Tata, Mahindra and Maruti. To find WACC we formed an industry index through a specific procedure, and its beta is calculated using regression. The weighted average cost of capital (WACC) can be calculated in two ways: using the index and the implied expected return on the market (IERP), or using the capital asset pricing model (CAPM). The cost of equity is determined through either of these methods, and the cost of debt is also calculated. Risk analysis is performed using beta, the degree of leverage (DOL), and the degree of financial leverage (DFL).



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# **SECTION 1**

## **Company Introduction**

### **1.1 Tata Motors**

Tata Motors is an Indian multinational automotive company headquartered in Mumbai, Maharashtra, India. It is a part of Tata Group, an Indian conglomerate. Tata Motors is one of the leading manufacturers of commercial and passenger vehicles in India, with a significant presence in the global market as well. The company's product range includes cars, trucks, buses, and defense vehicles. Tata Motors also has a strong presence in the electric vehicle market, with its Tigor EV and Nexon EV models. In addition to its automotive operations, Tata Motors also provides engineering and automotive solutions, as well as financing services through its subsidiaries.

### **1.1 Maruti**

Maruti Suzuki India Limited, formerly known as Maruti Udyog Limited, is an Indian multinational automotive manufacturer headquartered in New Delhi, India. It is a subsidiary of Suzuki Motor Corporation, a Japanese automaker. Maruti Suzuki is the largest automobile manufacturer in India, with a market share of over 50% in the passenger vehicle segment. The company's product range includes a wide variety of vehicles, including hatchbacks, sedans, SUVs, and vans. Maruti Suzuki has a strong presence in the domestic market and exports its vehicles to several countries around the world. The company is known for its focus on quality, reliability, and affordability, and has a reputation for offering a wide range of models to suit the needs of different customers.

### **1.1 Mahindra**

Mahindra & Mahindra Limited, also known as M&M, is an Indian multinational conglomerate headquartered in Mumbai, Maharashtra, India. The company is involved in a wide range of industries, including automotive, aerospace, agribusiness, two wheelers, construction equipment, defense, energy, finance, healthcare, hospitality, information technology, leisure and hospitality, real

estate, retail, and telecommunications. In the automotive sector, Mahindra & Mahindra is a leading manufacturer of commercial and passenger vehicles, as well as tractors and other farm equipment. The company has a strong presence in the domestic market and exports its vehicles to several countries around the world. Mahindra & Mahindra is known for its focus on sustainability and innovation, and has a reputation for offering a wide range of models to suit the needs of different customers.

## **SECTION 2**

### **Industry Index**

#### **2.1 Procedure of forming the Index and Assumptions**

##### **Assumption**

We took a larger sample space of south asia inorder to avoid bias since our companies have the highest market capitalization in India.

##### **Methodology:**

To gather the necessary data, we accessed the Bloomberg terminal and found the top 15 companies in the South Asian region based on market capitalization.

For each of these companies, we obtained the quarterly returns and stock price for the last 5 years.

Now we calculated the weightage of each company in the index by dividing its market value of equity by the share price for each quarter.

Using the weightages and the quarterly returns of each company, we were able to calculate the market value of the index.

Now we use the following formula to calculate the Index Value of each quarter.

$$\text{Index}_t = \frac{\sum P_t Q_t}{\sum P_h Q_h} \times \text{Beginning Index Value}$$

where:

$\text{Index}_t$  = index value on day  $t$

$P_t$  = ending prices for stocks on day  $t$

$Q_t$  = number of outstanding shares on day  $t$

$P_h$  = ending price for stocks on base day

$Q_h$  = number of outstanding shares on base day

Finally, we calculated the index returns by comparing the current value of the index to a previous value.

Date	Index
2022-12-09	1047.713352
2022-09-30	992.5077062
2022-06-30	1031.695083
2022-03-31	1037.481921
2021-12-31	1057.831894
2021-09-30	1091.403764

Index Value for Recent Quarter's

## 2.2 Regression: Beta Calculation

Beta is a measure of a stock's volatility in relation to the overall market. It is commonly used to help investors understand the risk associated with a particular stock, as well as to assess the potential return on an investment. In this assignment, we used regression analysis to determine the beta of a company by regressing index returns with the company's quarterly results.

### Results:

We applied this process to a set of companies and determined the beta for each one. The results are presented below.

Company	Beta
Tata	2.21
Mahindra	1.15
Maruti	1.63



### Conclusion:

Using regression analysis, we were able to determine the beta for a set of companies by regressing index returns with their quarterly results. These beta values can be used to help investors understand the risk associated with each company's stock and assess the potential return on an investment.

## SECTION 3

### WACC Calculation

### 3.1 Cost of Equity

#### 3.1.1 Using Index and IERP

Type of Stock: When companies grow and earn no excess returns						
FY2022						
Company	EPS	Value of Stock	Cost of Equity	Rf	IERP	
Tata	-29.88	433.75	-6.89%	6.48%	-13.37%	
Mahindra	59.20	806.55	7.34%	6.48%	0.86%	
Maruti	128.43	7561.3	1.70%	6.48%	-4.78%	

From the Index calculations and the financial statements of the companies, we got the EPS and the value of stock adjacent to the same period in FY 2022.

Using the EPS and value of stock obtained from our Index, we calculated Cost of Equity for each of our companies for FY 2022. We used the formula,

$$\text{Cost of equity} = \text{Earnings} / \text{Value of stock}$$

Using Cost of Equity and Riskfree Rate, we calculated the Implied ERP from the formula,

$$\text{ERP} = \text{Earnings Yield} - \text{Risk free rate}$$

### Assumption:

This is the basis for the short cut that some analysts use for the cost of equity but it works only if there are no excess returns. (Source - A. Damodaran)

### 3.1.2 Using CAPM

Type of Stock: When companies grow and earn no excess returns				
FY2022				
Company	Beta	Rf	Index Return	Cost of Equity
Tata	2.21	6.48%	5.56%	4.45%
Mahindra	1.15	6.48%	5.56%	5.42%
Maruti	1.63	6.48%	5.56%	4.98%

From the Index, using regression we calculated Beta for our stocks v/s our index. Taking the Beta of our stocks, Risk Free Rate and Index Return, we have used one more method to calculate cost of Equity: CAPM. We have calculated the cost of equity from the formula below,

$$E(R_i) = R_f + \beta_i (E(R_m) - R_f)$$

$E(R_i)$  = capital asset expected return

$R_f$  = risk-free rate of interest

$\beta_i$  = sensitivity

$E(R_m)$  = expected return of the market

### 3.2 Cost of Debt

If interest coverage ratio is			
greater than	≤ to	Rating is	Spread is
-100000	0.499999	D2/D	14.34%
0.5	0.799999	C2/C	10.76%
0.8	1.249999	Ca2/CC	8.80%
1.25	1.499999	Caa/CCC	7.78%
1.5	1.999999	B3/B-	4.62%
2	2.499999	B2/B	3.78%
2.5	2.999999	B1/B+	3.15%
3	3.499999	Ba2/BB	2.15%
3.5	3.999999	Ba1/BB+	1.93%
4	4.499999	Baa2/BBB	1.59%
4.5	5.999999	A3/A-	1.29%
6	7.499999	A2/A	1.14%
7.5	9.499999	A1/A+	1.03%
9.5	12.499999	Aa2/AA	0.82%
12.5	100000	Aaa/AAA	0.67%

COMPANY	EBIT	INTEREST EXP	INT COV RATIO	SPREAD	Risk Free Rate	COST OF DEBT
TATA MOTOR	369.2	24,872.60	0.01484364321	14.34%	6.48%	20.82%
MAHINDRA	111753.5	13,817	8.088116089	1.03%	6.48%	7.51%
MARUTI	29172	275	106.08	0.67%	6.48%	7.15%

Company	Rf	Spread	Cost of Debt
Tata	6.48%	14.34%	20.82%
Mahindra	6.48%	1.03%	7.51%
Maruti	6.48%	0.67%	7.15%

To find the cost of debt of each of our stock, we used the risk-free rate as a baseline and added it to spread.

### 3.3 WACC from IERP

To calculate the WACC we determined the proportion of each component (equity and debt) in the company's capital structure. Now we used the costs of each component (equity and debt) and the relative weights of each to arrive at the **WACC obtained from IERP method**.

$$WACC = \frac{E}{D + E} (r_e) + \frac{D}{D + E} (r_d)(1 - t)$$

Where:

E = market value of equity

D = market value of debt

$r_e$  = cost of equity

$r_d$  = cost of debt

t = corporate tax rate

#### WACC Formula

Company	WACC
Tata	-3.55%
Mahindra	4.07%
Maruti	1.70%

### 3.4 WACC from CAPM

To calculate the WACC we determined the proportion of each component (equity and debt) in the company's capital structure. Now we used the costs of each component (equity and debt) and the relative weights of each to arrive at the **WACC obtained from CAPM method**.

$$WACC = \frac{E}{D + E} (r_e) + \frac{D}{D + E} (r_d)(1 - t)$$

Where:

E = market value of equity

D = market value of debt

$r_e$  = cost of equity

$r_d$  = cost of debt

t = corporate tax rate

#### WACC Formula

Company	WACC
Tata	2.29%
Mahindra	3.01%
Maruti	4.97%

## SECTION 4

### Risk Analysis

#### REGRESSION ANALYSIS (BETA CALCULATION)

Beta ( $\beta$ ) is a measure of the volatility—or systematic risk—of a security or portfolio compared to the market as a whole. Stocks with betas higher than 1.0 can be interpreted as more volatile than the market.

SUMMARY OUTPUT							
Regression Statistics							
Multiple R	0.7089828296						
R Square	0.5026566527						
Adjusted R Square	0.4789736361						
Standard Error	0.1662741565						
Observations	23						
ANOVA							
	df	SS	MS	F	Significance F		
Regression	1	0.5867916475	0.5867916475	21.22435087	0.0001523313751		
Residual	21	0.5805889977	0.02764709513				
Total	22	1.167380645					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%
Intercept	0.0492240833	0.0347112023	1.418103668	0.1708300191	-0.02296181357	0.1214099802	-0.02296181357
X Variable 1	1.629042773	0.3536024613	4.60698935	0.00015233137	0.8936861991	2.364399347	0.8936861991

We regress the company's stock returns ( $r_i$ ) against the market's returns ( $r_m$ ). The beta ( $\beta$ ) is represented by the slope of the regression line. We found Beta of Maruthi to be 1.6290.

Similarly, for Mahindra and TATA we get Beta as 1.1536 and 2.2104 respectively.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.7280073							
R Square	0.5299947							
Adjusted R Square	0.5086308							
Standard Error	0.2086879							
Observations	24							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	1.0804045	1.0804045	24.807989	0.0000551969602			
Residual	22	0.9581146	0.0435506					
Total	23	2.0385192						
	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.0319398	0.0426532	0.7488258	0.4618938	-0.05651761542	0.1203973	-0.0565176	0.1203973
X Variable 1	2.2104175	0.4437910	4.9807619	0.0000551	1.290051274	3.1307838	1.2900512	3.1307838


SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.7420403355							
R Square	0.5506238595							
Adjusted R Square	0.5301976713							
Standard Error	0.104484644							
Observations	24							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	0.2942880	0.2942880	26.956760	0.0000331370132			
Residual	22	0.2401748	0.0109170					
Total	23	0.5344629						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.02682069502	0.0213553	1.2559214	0.2223191	-0.01746767733	0.07110906737	-0.01746767733	0.07110906737
X Variable 1	1.153632398	0.2221946	5.1919900	0.0000331	0.6928289003	1.614435897	0.6928289003	1.614435897

## UNSYSTEMATIC RISK (DOL & DFL)


Unsystematic risk refers to risks that are not shared with a wider market or industry. Unsystematic risks are often specific to an individual company, due to their management, financial obligations, or location. Unlike systematic risks, unsystematic risks can be reduced by diversifying one's investments.


## Degree of Operating Leverage (DOL)

The degree of operating leverage measures how much a company's operating income changes in response to a change in sales. The DOL ratio assists analysts in determining the impact of any change in sales on company earnings.



**Degree of  
Operating  
Leverage  
Formula**




$$\text{Degree of Operating Leverage} = \frac{\% \text{ Change in EBIT}}{\% \text{ Change in Sales}}$$


## Degree of Financial Leverage (DFL)


The degree of financial leverage is a leverage ratio that measures the sensitivity of a company's earnings per share to fluctuations in its operating income, as a result of changes in its capital structure. This ratio indicates that the higher the degree of financial leverage, the more volatile earnings will be.

**Degree of Financial Leverage Formula**




**Degree of  
Financial  
Leverage**

$$= \frac{\% \text{ Change in EPS}}{\% \text{ Change in EBIT}}$$



**Degree of  
Financial  
Leverage**

$$= \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}}$$



TATA MOTORS						MARUTI					
Year	EBIT	EPS	DFL	Net Sales	DOL	Year	EBIT	EPS	DFL	Net Sales	DOL
2016	215967.3	2016	34.24	2673200.8	8.08	2016	57950	2016	181.94	561286.9	10.27
2017	155938	2017	21.93	2639994.6	5.91	2017	77542	2017	248.61	674303.6	11.59
2018	87188.1	2018	26.45	2885960.9	3.02	2018	93945	2018	260.88	786898	12.03
2019	19796.1	2019	-84.89	2991905.9	0.66	2019	81608	2019	253.21	856057.6	9.83
2020	-10114.4	2020	-34.88	2585943.6	-0.39	2020	37842	2020	187.9	763692	5.28
2021	69237.6	2021	-36.99	2469721.7	2.8	2021	23175	2021	145.3	-	3.48
2022	-369.2	2022	-29.88	2752352.3	-0.01	2022	29172	2022	128.43	899129.2	3.48
Average:						Average:					
-0.00000154630						0.001059386836					
2.867142857						7.994285714					
MAHINDRA											
Year	EBIT	EPS	DFL	Net Sales	DOL						
2016	8141.5	2016	29.15	765855	1.21						
2017	6021.8	2017	34.17	837697.7	0.81						
2018	91821.1	2018	69.2	591785	11.21						
2019	112157.4	2019	48.91	1009038.5	12.13						
2020	98248.9	2020	1.15	850783	15.8						
2021	102984.4	2021	16.33	572956.5	16.95						
2022	111753.5	2022	59.22	836280	14.49						
Average:											
0.001428796597											
10.37142857											

We need to compare this DFL and DOL with the Industry average, which can be found [here](#)

As we can see, the Industry DOL average is -9.459328416 while the DFL average for the Industry is -0.0000001246340973. On comparing it with our companies, we get:

Company	DFL	DOL
TATA Motors	-0.000001546302611	2.867142857
Mahindra	0.001428796597	10.37142857
Maruti	0.001059386836	7.994285714

## SECTION 5

## Conclusion

The purpose of this report is to calculate the cost of equity and the overall weighted average cost of capital (WACC) for our selected organizations: Tata, Mahindra and Maruti. We have



broken down and explained the method of calculation at each step of the process through this report. We designed our own industry index for the Asian Automobile industry and regressed our organizations' returns against this index to calculate the beta, or systematic risk.

The unsystematic risk of the organization was calculated using the diversifiable operating leverage (DOL) and diversifiable financial leverage (DFL). Both systematic and unsystematic risks were analyzed in this report to provide a comprehensive understanding of the organization's overall risk profile.

Once the cost of equity and the organization's overall risk profile have been determined, the WACC has been calculated by taking into account the organization's debt financing and equity financing. The WACC represents the average cost of all the capital invested in the organization and is an important factor in determining the feasibility of new projects and investments. Overall, this report will provide valuable insights into our selected organization's cost of capital and risk profile, which can be used to inform future financial decision making.