CHAPTER – 3
RESEARCH METHODOLOGY

“Research is to see what everybody else has seen and to think what nobody else has thought”

Albert Szent Gyorgyi

3.1 Introduction

In the present competitive business environment, market volatility level has been increased across all the business segments. The profitability of firm has become fragile due to decrease in product life cycle; very frequent changes in taste of consumers; fluctuation in sales and capital employed return etc. Due to globalization, trend of corporate restructuring has been popularized since last one and a half decade. Calculating the true value of firm has been remained a big challenge in front of financial analysts. It has been observed that the scope of operating efficiency in calculating valuation of firms has been increased in today’s business scenario.

3.2 Gaps in Literature

The discussion that has been made in the previous chapter on the basis of the literature reviewed brings out the fact that the past studies have been confined to banking sector only and no such attempt has been made in context of other economic sectors to examine the impact of operating efficiency on firm value. The role of equity multiples in calculation of valuation of firms has been gradually replaced by enterprise multiples. The core focus of present research is to determine the significance of operating efficiency in valuation of firms. True valuation of firms is very crucial during corporate restructuring, IPOs and other corporate scenarios. Banking sector has been remained the main focus in previous research studies. In the current research study, the scope of research has been widened. The focus has been intended to identify variables of operating efficiency that may have impact on valuations of firms across different sectors. Moreover in the present research, an attempt has been made to use Enterprise value as proxy of firm value as compared to stock price which has been used as proxy of firm value in previous researches reviewed. In the recent financial literature, the use of
Enterprise value is advocated because of its inherent theoretical superiority. Keeping this fact in mind, Enterprise value has been considered as dependent variable instead of stock price in the present research paper. Considering these gaps in literature the objectives were framed, for the current research, which are discussed in the following section.

3.3 Objectives for Research

In the present study, an attempt has been made to bridge the gap as discussed in previous section. The present study is aimed to fulfill the following objectives that are very significant to know the impact of operating efficiency on valuation of firm.

a) To identify various variables of operating efficiency which may have probable effect on valuation of firm
   This research objective mainly focuses to identify various variables of operating efficiency in terms of financial ratios. Such variables (financial ratios) have been considered in this research which represent the operating efficiency of firm and are expected to affect the valuation of firm.

b) To verify, if identified variables have any effect on the valuation of firm
   An analysis has been made to examine the impact of identified variables on valuation of firm. To fulfill this objective, Null hypothesis was set and tested using time series regression analysis.

c) To verify, if effect of identified variables on valuation of firms vary in various industries under study
   The aim of this research objective was to measure the impact of identified variables on valuation of firm across six sectors. This objective has been achieved by performing panel data regression analysis. The research objective provides a platform to look into the second hypothesis of the study.

d) To examine and suggest which variable of operating efficiency can be considered for increasing value of firm
   To meet this objective, a study has been made to examine which variable has significant impact on valuation of firm across all the sectors. On the basis of the analysis performed in second and third objective, a matrix has been formulated to find the most significant variable across all the sectors.
3.4 Variables under study

Various dependent variables and independent variables have been identified through literature survey and discussion with experts. In the present study, Enterprise value multiples have been preferred over Equity multiples as the variables. Suozzo Peter, Cooper Stephen, Sutherland Gillian and Deng Zhen (2001)\(^1\) state the following advantages of Enterprise value multiples over equity multiples -

a) Enterprise value multiples focus on statistics where accounting policy differences can be minimized (EBITDA)

b) Enterprise value multiples avoid the influence of capital structure on equity value multiples. It helps the analysts to exclude non-core assets.

3.4.1 Dependent Variable

Enterprise value of firm has been considered as the dependent variable and thus it represents the firm value in the research study. Enterprise value provides the economic measure of real market value of firm as a whole business.

Enterprise Value \((EV) = \) Equity Value \((\text{Market Capitalization}) + \text{Net Debt} + \text{Preferred Stock} + \text{Minority Interest}\)

Where

- Equity Value = Equity value of firm is also known as Market capitalization of a firm.
- Market Capitalization = Total no. of outstanding share \(\times\) Current share price
- Net Debt = Total Debt – Cash & Cash equivalents (Marketable securities etc.)
- Minority Interest = Interest on Non – Controlling shareholders
- Preferred stock = It is not convertible into common stock.

\(\ast\)Minority interest is the percentage of the subsidiary’s book value of equity that the parent firm does not own
3.4.1.1 Enterprise Value vs Stock Price

Stock price has been used as a proxy for firm value by many researchers during their study. But in modern world of finance, researchers and financial experts have started considering the Enterprise value as firm value rather than stock price. Firm value calculated on the basis of stock price tells only about the total market price of all the shares of company and it does not consider the debt, cash and cash equivalents and other major factors related to value of company. The management of acquirer company has to pay following during the acquisition of firm –

a) Equity value of firm
b) Debt of company
c) Preferred stocks etc.

The acquirer company gets the cash and cash equivalents from the target company during the deal. This can be illustrated through a caselet, which can be referred to in Annexure.

Caselet

Suppose company C wants to buy either company A or Company B. The particulars of Company A and Company B are as follows

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Equity Shares</td>
<td>1, 00, 000</td>
<td>1, 50, 000</td>
</tr>
<tr>
<td>Market Price Per Share (in Rs)</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>Debt</td>
<td>NIL</td>
<td>75, 00, 000</td>
</tr>
<tr>
<td>Cash (in Rs)</td>
<td>20, 00, 000</td>
<td>30, 00, 000</td>
</tr>
<tr>
<td>Preferred Stocks</td>
<td>10, 000</td>
<td>15, 000</td>
</tr>
</tbody>
</table>
### Enterprise value of Company A and Company B

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Enterprise value of Company A</th>
<th>Enterprise value of Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Cap (MPS*No.of Shares)</td>
<td>100000*150 = 1, 50, 00, 000</td>
<td>150000*100 = 1, 50, 00, 000</td>
</tr>
<tr>
<td>Net Debt (in Rs) (Total Debt – Cash &amp; Cash Equivalents)</td>
<td>= 0-20, 00, 000</td>
<td>= 75, 00, 000</td>
</tr>
<tr>
<td></td>
<td>= -20, 00, 000</td>
<td>= -30, 00, 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>= 45, 00, 000</td>
</tr>
<tr>
<td>Preferred Stocks</td>
<td>10,000 * 150 = 15, 00, 000</td>
<td>15,000 * 100 = 15, 00, 000</td>
</tr>
<tr>
<td>Enterprise Value (in Rs)</td>
<td>= 1, 50, 00, 000</td>
<td>= 1, 50, 00, 000</td>
</tr>
<tr>
<td></td>
<td>-20, 00, 000</td>
<td>+45, 00, 000</td>
</tr>
<tr>
<td></td>
<td>+15, 00, 000</td>
<td>+15, 00, 000</td>
</tr>
<tr>
<td></td>
<td>=1, 45, 00, 000</td>
<td>= 2, 10, 00, 000</td>
</tr>
</tbody>
</table>

If we calculate the value of firm from stock price point of view then both the companies have same value of 1, 50, 00, 000. But that is not practically correct because the acquirer of company also has to pay the debt of the target company. From Enterprise value point of view, Company B has high value than company A. This is practically correct.

After keeping the above factors in mind stock price has been replaced by enterprise value of firm as Dependent variable as well as representative of firm value. Enterprise value justifies more accurately to the firm value as compared to the stock price.

**3.4.2 Independent Variables (Predictors)**

After reviewing the previous research studies and on the basis of current business scenario, following variables have been used as predictors (independent variables) in the research study and their impact has been studied on the dependent variable.
Figure 3.1 – Independent Variables

1) Enterprise Value/Earnings before Interest, Tax, Depreciation and Amortization (EV/EBITDA) -

This ratio represents the relationship between gross profit and enterprise value (value of firm). It is the most important ratio for valuation of firm. Aswath Damodaran (2011)\(^2\) states that EV/EBITDA multiple is a function of same variables that determine the operating earnings multiples.

Enterprise Value = Equity Value + Net Debt + Preferred Stock + Minority Interest

or

Enterprise Value = Equity Value + Total Debt – Cash & Cash Equivalent + Preferred Stock + Minority Interest

Equity Value = Equity value of firm is also known as Market capitalization of firm

Where

Market Capitalization = Total no. of outstanding share*Current share price

Net Debt = Total Debt – Cash & Cash equivalents (Marketable securities, Treasury bills)

Minority Interest = Interest on Non – Controlling shareholders

\(^*\text{Minority interest is the percentage of the sub’s book value of equity that the parent firm does not own.}\)
Preferred stock = It is not convertible into common stock.

**Rational of using EV/EBITDA over P/E**

In the recent past, analysts preferred EV/EBITDA to P/E for the valuation of firms. Some of the main reasons behind this are as follows -

EV/EBITDA is preferred to P/E for comparing companies with different financial leverage as EBITDA is before tax earnings whereas EPS is post tax earnings.

EV/EBITDA considers debt and Cash position on the balance sheet of company whereas P/E does not consider cash position on the balance sheet of company.

*A detailed case presenting rationale of using EV/EBITDA over other approaches can be referred to in Appendix A.*

2) Return On Capital Employed (ROCE)

Return on Capital Employed represents the efficiency of company in terms of profitability of a firm expressing its operating profit as a percentage of capital employed.

\[
ROCE = \frac{\text{Operating Profit}}{\text{Capital Employed}}
\]

Where,

Capital Employed = Total Assets – Current Liabilities

High value of return on capital employed represents that firm is highly efficient to generate more revenue per rupee of capital employed.

3) Enterprise Value/Sales (EV/S)

It shows the total value of firm to its sales. It represents the cost of buying a firm’s sales. This ratio is very useful during corporate restructuring of firm

\[
\frac{EV}{S} = \frac{\text{Equity Value + Net Debt + Preferred Stock + Minority Interest}}{\text{Sales}}
\]

or

\[
\frac{EV}{S} = \frac{\text{Equity Value + (Total Debt - Cash/Cash Equivalents) + Preferred Stock + Minority Interest}}{\text{Sales}}
\]

\[
EV/ S = (\text{EBIT (1-T)/Sales})(1-\text{Reinvestment Rate}) / \text{Cost f Capital } - g_n
\]
The EV/Sales ratio is determined by after-tax operating margins, reinvestment rates and the cost of capital. Firms with higher operating margins, lower reinvestment rates (for any given growth rate) and lower costs of capital will trade at higher value to sales multiples.

**Rational of using EV/Sales over Price/Sales**

In the recent past, EV/Sales has been preferred over Price/Sales ratio by financial analysts. Aswath Damodaran (2011)\(^3\) stated that because of internally consistency, EV/EBITDA has been considered as more robust multiple than Price/Sales ratio. The price to sales ratio divides an equity value by revenues that are generated for the firm. Consequently, it will yield lower values for more highly levered firms and may lead to misleading conclusions when price to sales ratios are compared across firms in a sector with different degrees of leverage.

4) Quality of Income (Cash Flow from Operating Activities/ Net Income)
   Quality of Income ratio measures the portion of income that was generated from cash. Libby/Libby/Short (2011)\(^4\), states that higher the quality of income ratio, higher is the firm’s ability to generate cash from operating activities.

\[
CFOA = \frac{\text{Net Cash Flow from Operating Activities}}{\text{Sales}}
\]

5) Fixed Asset Turnover Ratio (FATO)
   Fixed Asset turnover ratio is measure of operating efficiency of firm. Libby/Libby/Short (2011)\(^5\) revealed that FATO represents the firm’s operating efficiency in terms of converting fixed assets into sales. High fixed asset turnover ratio represents that company’s ability to effectively utilize its fixed assets to generate revenue.

\[
FATO = \frac{\text{Net Sales}}{\text{Total Fixed Assets}}
\]
6) Net Profit Margin (NPM)

Libby/Libby/Short (2011)\textsuperscript{6} revealed that Net Profit Margin is a good measure of operating efficiency. This ratio shows the efficiency of company in converting its sales into profitability.

\[
NPM = \frac{\text{Profit after Tax}}{\text{Sales}} \times 100
\]

A higher net profit margin ratio represents that a company is more efficient at converting sales into actual profit. Net Profit margin has direct relationship with shareholder’s value. Higher the net profit margin of company, greater will be the shareholders return on any given sale.

To fulfill the aforesaid objectives, Null hypotheses were framed which are shown as below.

*The calculated values of all financial variables can be referred to in Appendix C.*

### 3.5 Hypotheses Design

Hypotheses are the primary assumptions that are to be tested during the research study. Under Null hypothesis (H\textsubscript{0}) no difference has been expected between population parameters and sample statistics that are being compared. Null hypothesis (H\textsubscript{0}) is designed in such a way that its rejection leads to the acceptance of the desired results. Under Alternate hypothesis (H\textsubscript{1}), a difference has been expected between population parameters and sample statistics that are being compared. Acceptance of Alternate hypothesis means rejection of Null hypothesis.

To meet the different objectives of research study, following hypotheses have been formulated

#### 3.5.1 Hypotheses for Second Objective

The following Null and Alternative hypotheses have been formulated to achieve the second objective.

- H\textsubscript{0} – Operating efficiency variables have no significant effect upon Enterprise Value.
- H\textsubscript{1} – Operating efficiency variables have significant effect upon Enterprise Value
To test the above hypotheses, six sub hypotheses have been formulated.

- \( H_{011} \): EV/EBITDA has no significant effect upon Enterprise Value.
- \( H_{012} \): Return on Capital Employed (ROCE) has no significant effect upon Enterprise Value
- \( H_{013} \): EV/Sales has no significant effect upon Enterprise Value
- \( H_{014} \): Quality of Earnings (Cash Flow from Operating Activities (CFOA)/Net Income) has no significant effect upon Enterprise Value
- \( H_{015} \): Fixed Asset Turnover Ratio (FATO) has no significant effect upon Enterprise Value
- \( H_{016} \): Net Profit Margin has no significant effect upon Enterprise Value

3.5.2 Hypotheses for Third Objective

To achieve the third objective of the research study, following hypotheses have been formulated.

- \( H_0 \) – Operating efficiency variables have no significant effect on Enterprise value across different sectors
- \( H_1 \) – Operating efficiency variables have significant effect on Enterprise value across different sectors

Six sub hypotheses have been formulated to test the above hypothesis.

- \( H_{021} \): Predictors have no effect on Enterprise value in Automobile Sector
- \( H_{022} \): Predictors have no effect on Enterprise value in Banking Sector
- \( H_{023} \): Predictors have no effect on Enterprise value in FMCG Sector
- \( H_{024} \): Predictors have no effect on Enterprise value in IT Sector
- \( H_{025} \): Predictors have no effect on Enterprise value in Infrastructure Sector
- \( H_{026} \): Predictors have no effect on Enterprise value in Pharmaceutical Sector

3.6 Time Frame

The research study has been conducted from the time period of 8 years (2005-2012). The reason behind considering 8 years (2005-2012) as cut off for selection criteria is that this period faced the headwinds of major business cycles. In post liberalization era, business
cycles and economic cycles have become shorter than before. Between this time period of 8 years, sectors are fancied and sectors are stunned. Up to the end of 2007, global economies went through secular bull run but when the bust came in the form of global meltdown in 2008, many sectors like IT, Real Estate, Financial Services etc. lost their glory and investors jettisoned the stocks of those sectors like dead weight. Before 2007, these sectors were considered as darling of markets. Year 2008’s global meltdown has been considered the worst since 1930’s Great Depression. Lastly 8 years long term study helps in plotting a fair idea of long term performance.

3.7 Sector Frame

The following 6 economic sectors have been selected for the study, the rationale for which is given in the ensuing paragraphs

![Sector Frame]

**Figure – 3.2 Sectors under study**

3.7.1 Sector Rationale

Six economic sectors have been considered for the research study. The sectors have been selected on the basis of their importance in Indian Economy.

a) **Automobile Sector** – From FY1992 – 2012, Indian GDP as expanded at a CAGR of around 7 percent, the auto sales has been grown at a CAGR of around 12 percent at same time. During the same period, CAGR of 11 percent, 10 percent and 14 percent has been recorded in two wheeler, passenger vehicle and commercial
vehicle respectively. Two wheelers cover around 70 percent of market share of Indian automobile industry. Bright spots have been witnessed in the growth of Indian automobile sector due to technological advancements, entrance of low cost cars, rise in export volumes etc. By 2020, Indian automobile industry will be the third largest automobile industry across the globe. Healthy monsoon and festival mood of consumers has been considered as significant factors in boosting the sales of automobiles in India. Increase in price of crude oil, strict credit regulation, fall of rupee against dollar, volatile raw material cost etc. is the key challenges to Indian automobile sector. The factors helps in growth of automobile sector are following –

- Increasing affluence of rural and urban consumers
- Better Infrastructure development
- Favorable demographics
- Intense competition among domestic and global players
- Entry of global players
- Easy availability of finance
- Increasing population
- Increasing margin for manufacturers

b) **Banking Sector** - The market size of Indian banking industry is more than $1.3 trillion. Over 60 percent of Indian banking sector is dominated by Public sector banks. India has 87 commercial banks out of which 26 are Public sector banks, 20 are private banks and 41 are foreign banks. Over the last one decade, Indian banking sector’s transformation has been witnessed due to liberalization of financial sector coupled with growth in Indian economy. Niche customer segments have been identified and innovative products have been developed to cater their specific needs. Positive growth has been witnessed in financing automobiles (Cars, LCV, SUV), consumer durables etc. Significant section of Indian population is still unbanked. Rural and low income socially excluded segment of society has been considered very important in growth of financial sector. CAGR of around 25 percent has been offered by Private banks like Axis Bank, ICICI Bank, HDFC Bank etc as compared to CAGR of 14 percent has been offered by Sensex.
Inorganic growth has been witnessed in Indian banking sector through mergers and acquisitions of foreign banks. Achieving high operating efficiency and developing risk assessment tools are major challenges to banking industry. The growth in Indian banking sector has been seen due to following reasons –

- Prudent lending
- Better risk management practices
- Focused strategy
- Advanced technological platforms
- Superior Management
- Emerging middle class purchasing power
- Expected boom in retail credit
- Low perception of risk

c) **FMCG Sector** - FMCG sector has been considered as the fourth largest economic sector in Indian economy. FMCG sector covers market size of more than $13.1 billion. Exponential growth has been seen in FMCG sector companies since last one decade. Companies of FMCG sector outperformed with 20percent CAGR during time period. In 2015, FMCG sector is expected to cross $33.4 billion. Surge in personal disposable income, changing consumer preferences, increase in consumption and attractions toward western trend leads to growth in FMCG companies. The key drivers for the growth of FMCG industry in India are following –

- Urbanization
- Increase in per capita income
- Young Population
- Well established distribution network
- Low Working age Population
- Entry of foreign players in Indian Market
- Low operational cost
- Competition between organized and unorganized segment

d) **IT Sector** - As a proportion to national GDP, the revenue of IT sector has grown from 1.2percent in FY1998 to 7.5percent in FY 2012. In FY013, Indian IT
industry has been expanded in size to USD 95 billion. Today IT sector has grown to an export to US $ 70 billion and around 2.8 million employees. The contribution of exports in total revenue of IT industry is around 80 percent. It is around 25 percent of India’s total export. The key areas of IT sector are Consulting, Application development and maintenance, Research and Development, testing, Infrastructure management services, Technical support, system integration etc. This sector has significant exposure to foreign currency. Realizing the growth potential of IT sector, Sector has been supported by central and state governments through providing infrastructural support and framing policies to encourage the foreign investments. It has been considered as one of the most value creating sector for stakeholders. The growth has been seen due to following reasons –

- Create differentiated business cycles
- Focus on managing IT cost
- Focus on IT investment on business processes
- Off shoring IT services
- Vendor consolidation
- High quality delivery and service excellence

e) Infrastructure Sector - Indian economy is considered as the fastest emerging economy of 21st century. The demand for infrastructure has been raised to support the development in other economic sectors like IT sector, FMCG sector, Automobile sectors etc. To sustain the prevalent economic growth momentum, Infrastructure sector plays a crucial role. It has become important economic sector which grew impeccably. Government initiatives through their policies to invite private companies in infrastructure space. For most public infrastructure, Public private Partnership has been adopted as a preferred route. Government’s focus on new infrastructure acts as catalyst for the growth propulsion of infrastructure sector. 100 percent FDI has been permitted to Infrastructure sector in India. Following are the key drivers for the growth of Infrastructure industry –

- Other Economic Sector growth
- Urbanization
- Increasing trend of nuclear family
- Increasing income
- Decrease in interest rate
- Rise in number of white collar professionals
- Raising need of better transportation system (roads & highways, aviation) as business areas widened

f) **Pharmaceutical Sector** – Indian Pharmaceutical industry is the 3rd largest in volume and 13th largest in value across the globe. Indian Pharmaceutical industry has been growing at a CAGR of 21.5 percent from year 2005 to year 2012. The revenue from this sector constituting 5 percent of Indian GDP. Indian Pharmaceutical industry is ranked third globally in terms of manufacturing by volume of pharma products. Till 2015, Indian Pharmaceutical industry is expected to grow at around 9.5 percent. By 2020, Pharmaceutical sector sale is expected to reach US $74 billion. By 2025, Indian Population is expected to touch a figure of 1.4 billion with 45 percent population of age 15+. To cater the need of Indian population, sector must have to expand to $100 billion. It must constitute of around 10 percent of Indian GDP. India has been becoming an attractive destination for clinic trials. Lifestyle drugs like Cardiovascular, Hypertension, Anti depressants, Anti Cancer, Asthma, Anti Diabetes etc. will remain an attractive market for Indian Companies. Contract Manufacturing and CRAMS will also be a high investment area in India. The key drivers for growth in Indian pharmaceutical industry are as following –
  - Large Population affected from various diseases
  - Increase in research orientation approach
  - Availability of low cost talented Doctors and Scientists
  - Follow of International Quality Standards
  - Acquisition of technical strong foreign companies by Indian companies
  - High investment scope in pharmaceutical research & development
  - Expanding health insurance coverage facilities
  - Increasing life expectancy in Indian Population
3.8 Selection of sample companies

Companies have been selected from each of above mentioned sector, being a stratum for the sample selection. 15 companies from each stratum have been identified. Total 90 companies have been studied for the research work.

*List of sample companies can be referred to in Appendix B.

3.8.1 Selection Criteria

The 90 companies from 6 sectors have been selected on the basis of the highest market cap in the sector. Some major companies have been left deliberately from the study because of the following reasons –

a) Only those companies have been considered whose financial year ends on 31st March. To avoid any anomalies, companies whose financial year ends either in June or in December have been ignored.

b) Only those companies have been selected in the sample which have complete financial record from 2005 to 2012 or which are listed before 2005. To avoid any anomalies that may have cropped up due to imbalance of data, companies which are listed after 2005 have been ignored.

3.9 Data Source

The data of 90 companies related to research has been obtained mainly from secondary sources. To examine the impact of operating efficiency on firm value, annual reports and financial reports have been referred from year 2005 to year 2012. CAPITALINE software has been used for downloading all the required financial data related to the companies. Annual reports of companies, reference books related to financial accounting and analysis, corporate finance, financial management, Valuation and other major issues of finance have been studied. Financial magazines like Capital market, Business Standard, Dalal Street etc. have been referred to equip the present research with latest business scenario.
3.10 Research Data Analysis

The present research is based upon the historical financial data of 90 companies from year 2005 - 2012.

![Image](image.png)

**Figure 3.2 – Classification of Research Data**

<table>
<thead>
<tr>
<th>Cross Sectional Data</th>
<th>Time Series Data</th>
<th>Panel Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under cross sectional data, data is collected across the individual entity (person, company, village, country, department etc.) over a given point of time. Sample units may differ at every time when data is collected</td>
<td>Under time series data, data is collected over time for a given individual entity (person, company, village, country, department etc.). Sample units remain the same at every time when data is collected.</td>
<td>Under panel data, repeated observations are recorded on the same set of individual entity (person, company, village, country). Under panel data, one can find some factors which can’t be analyzed through pure time series data and through pure cross sectional data.</td>
</tr>
</tbody>
</table>

In the present research **Time series data** and **Panel data** has been used.

3.10.1 Analysis of Time Series Data

Multiple regression has been used as a statistical technique to measure the influence of
independent variables on dependent variables. Aswath Damodaran (2011)\textsuperscript{7} states that reasons for using sector regression –

a) The regression output describes the strength of association between multiple and variable being used.

b) If the relationship comes out as non-linear relationship, regression can be modified.

c) Differences can be controlled for more than one variable and for cross effects across the variables.

The general OLS model can be used to study the effect of identified independent variables (ratios) on the dependent variable \(EV\): 

\[ EV_i = \alpha + \sum_{j=1}^{J} \beta_j R_{j,i} + \epsilon_i \]

Where

- \(EV_i\) = Enterprise value of the \(i^{th}\) entity
- \(R_j\) = Various operating efficiency ratios

Software Used

Statistical softwares have been used for applying Multiple Regression on the data pertaining to study variables. Time series analysis has been performed by applying SPSS software and Panel Data analysis has been performed by applying STATA software.

Normalization of Data

The data has been normalized by taking natural logarithm after taking square of all the values of ratios. All the statistical tests, in SPSS and STATA softwares, have been performed only after normalizing the data.

3.10.1.1 Important tests under Multiple Regression

During execution of final results under Multiple regression, some critical tests have been executed to ensure the reliability and accuracy of data as well as results. These tests are as follows

3.10.1.1 Multi – Collinearity

Multi – Collinearity has been considered as a critical factor while execution of Multiple
regression analysis. Correlation among independent variables is considered as the main reason behind existence of Multi – Collinearity. Results of the analysis would be biased if we ignore the multi collinearity in the research data. VIF (Variance Inflation Factor) has been used as a Multi –Collinearity diagnostic technique. VIF indicates whether independent variables have any correlation among themselves or not.

3.10.1.1.2 VIF Criteria

<table>
<thead>
<tr>
<th>Cases</th>
<th>VIF Values</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>VIF &gt; 10</td>
<td>Multi Collinearity exist</td>
</tr>
<tr>
<td>2.</td>
<td>VIF &lt; 10</td>
<td>Multi Collinearity does not exist</td>
</tr>
</tbody>
</table>

3.10.1.1.3 R² - (R Square)
Andy Field (2013)\(^8\) states that R² represents the percentage of variance in the outcome that is explained by the independent variables or predictors.

3.10.1.1.4 F- Test
Richard I. Levin and David S. Rubin (2005)\(^9\) states that in multiple regression, F-test explains the level of influence of independent variable on dependent variable

<table>
<thead>
<tr>
<th>Cases</th>
<th>F- Test</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Significance F &lt; Significance Level</td>
<td>Independent variable has influence on dependent variable</td>
</tr>
<tr>
<td>2</td>
<td>Significance F &gt; Significance Level</td>
<td>Independent variable has no influence on dependent variable</td>
</tr>
</tbody>
</table>

3.10.1.1.5 Residual Normality
Reliability of regression test comes under question if the residuals in the regression output are not normally distributed. Residual normality test is performed to analyze the existence of normality in residuals under regression. Andy field (20013)\(^10\) state that Normal P-P plots of regression standardized residual have been used to test the normal distribution of residuals. The distribution of data along straight line defines the normal distribution of residuals.
3.10.1.6 P-P Plot Criteria

The following table describes on what criteria P-P plots have been used to explain the normal distribution of residuals.

<table>
<thead>
<tr>
<th>Cases</th>
<th>P-P Plots Shape</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Actual values coincide or near to coincide with straight line</td>
<td>Residuals are normally distributed. Results are reliable</td>
</tr>
<tr>
<td>2.</td>
<td>Actual values do not coincide or not near to coincide with straight line</td>
<td>Residuals are not normally distributed. Results are not reliable.</td>
</tr>
</tbody>
</table>

3.10.2 Analysis of Panel Data

Panel Data is a repeated measure of one or more variables on one or more entities. A panel data set contains n entities. Each entity includes m observations measured through time period from 1 to t. Total number of observation will be (m*n). Gujarati N Damodar, Porter Dawn C and Gunasekar Sangeeta (2012)\(^1\) state that Panel data are measured after regular interval of time. In balanced panel data, all the entities have measurements in all time periods. Panel data is also known as longitudinal data.

STATA Software has been used for applying Panel Data Regression on data under study. STATA is considered to be more reliable than SPSS in performing Panel data analysis. Panel data regression can be categorized into following two types –
### 3.10.2.1 Difference between Random effect regression and Fixed effect regression

Gujarati N Damodar, Porter Dawn C and Gunasekar Sangeeta (2012)\(^{12}\) state the following differences between Random effect regression and Fixed effect regression.

**Table 3.5 – Difference between Random effect model and Fixed effect model**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Random Effect</th>
<th>Fixed Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter Estimation</td>
<td>It estimates K parameters</td>
<td>It estimates (K-1) + N parameters</td>
</tr>
<tr>
<td>Coefficients of Time variant Models</td>
<td>It estimates coefficients of time variant variables like gender and ethnicity</td>
<td>It can control time variant variables but can’t estimate them directly</td>
</tr>
<tr>
<td>Biasness</td>
<td>The output is biased if component error and regressors are correlated</td>
<td>The output is unbiased if component error and regressors are correlated.</td>
</tr>
</tbody>
</table>

### 3.10.2.2 Important Tests under Panel Data Regression

Following statistical tests were used, while applying Panel Data regression, to choose between Fixed and Random effect model, data normality and Co-efficient significance.

**3.10.2.2.1 Hausman Test**

Hausman test has been used to know whether fixed effect model (fe) or Random effect model (re) should be used for the data set under consideration. Gujarati N Damodar, Porter Dawn C and Gunasekar Sangeeta (2012)\(^{13}\), state the following criteria for selection of fixed effect model (fe) or Random effect model (re) on the basis of Hausman test.
Table 3.6 – Hausman Test Output Interpretation

<table>
<thead>
<tr>
<th>Cases</th>
<th>Values</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P value &lt; 0.05</td>
<td>Use Fixed Effect Regression</td>
</tr>
<tr>
<td>2</td>
<td>P value &gt; 0.05</td>
<td>Use Random Effect Regression</td>
</tr>
</tbody>
</table>

3.10.2.2.2 Shapiro Wilk Test

Shapiro Wilk test has been used to check whether the data under consideration is normally distributed or not.

Table 3.7 – Shapiro Wilk Test Output Interpretation

<table>
<thead>
<tr>
<th>Cases</th>
<th>Values</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P value &gt; 0.05</td>
<td>Data is normally distributed</td>
</tr>
<tr>
<td>2</td>
<td>P value &lt; 0.05</td>
<td>Data is not normally distributed</td>
</tr>
</tbody>
</table>

3.10.2.2.3 P>Z

The value of the parameter P>Z, is used to decide if the regression coefficient of a particular independent variable is significant in its relationship with the dependent variable. The variables for which the value of P>Z is less than 0.05 have significant effect upon the independent variable whereas the variable which has value more than 0.05 have no significant effect upon dependent variable.
3.10.3 Concluding Remarks

The chapter explains in detail about the gap in literature, Objectives of research, Selection of dependent and independent variables and rationale behind their selection and design of hypotheses. A detail discussion has been made about selection of companies and various sectors. Selection about methodology, statistical techniques and software has been explained elaborately. Implementation of statistical tools and softwares and interpretation of output has been explained in ensuing chapters.
REFERENCES

6. Libby, Robert, Patricia A. Libby, and Daniel G. Short, Ibid1
7. Damodaran, Aswath Ibid1
13. Damodar, Gujarati N., Dawn C. Porter and Gunasekar, Sangeeta Ibid1