

**Value Relevance of Degree of Leverages and its Impact on Systematic Risk:  
An empirical study on Indian manufacturing firms**

A Thesis submitted for the award of a degree of  
**DOCTOR OF PHILOSOPHY**

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# Value Relevance of Degree of Leverages and its Impact on Systematic Risk: An empirical study on Indian manufacturing firms

## **ABSTRACT**

The inquiry, do investors value the accounting numbers in the marketplace, is always of considerable interest for the scholars and the practitioners in the context of developed and emerging markets. However, many research studies on this topic have not been examined in the Indian context; therefore the present study claims the inquisitiveness of this inquiry to be explored in the context of India. India is one of the biggest ten emerging markets (Garten, 1997) and the structures of business organizations in the emerging or developing markets are different from those in developed markets (Sarkar et al. 2008). A relationship between earnings, an accounting number, and the value of common stock was extensively hypothesized by valuation theory (Beaver, 1968). The valuation theory and the theory of decomposition of systematic risk explicitly into the degrees of operating and financial leverage are the bases of this study. This valuation theory takes the point of view of equity investors to empirically examine the value relevance of accounting information (Beisland, 2009). Mandelker and Rhee (1984) presented an alternative theory of decomposition of systematic risk by explicitly introducing the degrees of operating and financial leverage to the theory of systematic risk decomposition of Hamada and Rubinstein. The present study also takes theory of the capital asset pricing model (CAPM) developed by Sharpe (1964), Lintner (1965), and Black (1972); theory of decomposition of systematic risk developed by Hamada (1972) and Rubinstein (1973); and the capital structure theory developed by Modigliani and Miller (1958). Although, there is an extensive research available on the value relevance of accounting information; however limited work is done on the value relevance of the degrees of leverage, particularly in the Indian context.

The degrees of leverage in financial literature are of two types, the degree of operating leverage (hereafter DOL) and the degree of financial leverage (hereafter DFL). With the use of the concept of elasticity Mandelker and Rhee (1984) and Ang and Peterson (1984) initially established a time-series regression approach to estimate DOL and DFL. DOL is defined as the percentage change in profit or earnings before and tax (hereafter PBIT or EBIT) relative to a given percentage change in sales (Prezas, 1987; Elangkumaran and Nimalathasan, 2013). DFL is defined as the percentage change in profit after tax (hereafter PAT) relative to a given percentage change in EBIT (Mandelker and Rhee, 1984). The primary objective of this study is to empirically examine the value relevance of DOL and DFL, the important accounting numbers, for 230 manufacturing firms listed on National Stock Exchange (NSE) of India over the period of ten years from the financial year 2001-2002 to 2010-11 including the recessionary period. In other words, the combined effects of DOL and DFL on stock returns, systematic risk, and firm value are to be empirically investigated for the sample listed manufacturing firms in India over the period under study. The standard ordinary least square regression models at the levels of individual firms and portfolio of firms are employed to present the empirical findings for achieving the stated objectives of this study.

The empirical findings support the hypothesis that the degrees of operating and financial leverage are value-relevant. Thus, the accounting numbers or focus variables of this study, DOL, and DFL, do significantly affect the stock returns over long windows. However, controlling for firm size and ROA does not influence the conclusion of an impact of degrees of leverage on the stock returns. The results also indicate that the investors historically earn higher returns if the firms operate at high DOL and DFL and vice-versa. This means the principle 'higher the risk, higher the possibility of earning returns' holds good. The findings partially support the

hypotheses that DOL and DFL do influence the systematic risk and the firm value. DFL is found positively related with the systematic risk, and an insignificant negative relationship is found between DOL and the systematic risk. DOL significantly positively affects the firm value over the long-window; however, DFL and the firm value are not associated. This means that the firm value is independent of its financial risk. Moreover, controlling for firm size and return on assets (hereafter, ROA) does improve the relationship of DOL and DFL with the firm value since the statistical significance of firm size is found in explaining the firm value. However, ROA has no influence on the firm value. In other words, the findings of the present study suggest that high DOL and DFL leads to high returns to the firms. Also, high DFL leads to high systematic or market risk to the firms and high DOL leads to high firm value. These results indicate that DOL and DFL are relevant accounting numbers for the shareholders' value. Though, leverage is considered to be a two-edged sword – just as a firm's profits can be magnified, so too can the firm's losses (vanHorne and Wachowicz, 2010). The implications of value relevance of DOL and DFL do not suggest the firms to just increase the level of DOL and DFL so as to fetch higher returns to the firms. The findings simply suggest the consideration of usefulness of DOL and DFL for optimizing the financing and investment decisions of the firms.

The above empirical findings of this study are not only considerably worthy of scholarly attention but also relevant for various interested participants using accounting numbers for decision-making in the marketplace. There are several indications pointing towards the need for this study. **First**, the value relevance of the degrees of leverage found in the present study is the enrichment to the value relevance literature in the Indian context. **Second**, the studies in the Indian context examined the value relevance of several independent variables (e.g. earnings, accrual earnings, book value per share, earnings per share, cash flows from an operation, changes

in earnings and book value). However, there is a lack of research in the context of India that takes two important accounting numbers, DOL and DFL, as independent variables to examine their value relevance. Therefore, these two accounting numbers, DOL and DFL, of this study are added to the list of variables explored empirically in the previous research studies. **Third**, this study finds that the firms operating with the high degrees of leverage historically earn higher returns than the firms with small degrees of leverage. This means high risks are compensated. **Fourth**, the applicability of various well-published theories established in the developed markets has been reexamined in the context of an emerging market, called India. **Fifth**, stock returns and firm value across industries are statistically not significant. However, systematic risk is statistically found significant across industries. This indicates the different industries are exposed to different market risk depending upon their business models, investment and financing decisions. **Sixth**, the present study provides an important insight to the practitioners, the researchers, the finance managers and the investors for the significance of accounting numbers in the context of India, one of the fastest growing emerging markets in the world. The firms may include the importance of the degrees of leverage in its annual reports. Moreover, this study can also be useful for corporate or security valuation in case of mergers and acquisitions. However, it is to ensure the key sources of valuable accounting information to the investors who can influence the process of security valuation (Fiador, 2013).

Further, this study is limited to the NSE-listed manufacturing firms in India for a period from 2001-2002 to 2010-2011 including the recessionary period that could affect the empirical results. Moreover, the sample firms under this study are 230 only. The present study is limited to an emerging market, the India. The changes in DOL and DFL over time are not discussed as the estimation of year-wise DOL and DFL is not attempted in this study. The application of a panel

data or pooled regression method is possible to test the proposed hypotheses if year-wise DOL and DFL are available. However, the usefulness of this study cannot be undermined due to the above limitations since the present study extends the efficacy of well-established theories (e.g. valuation theory; theory of risk decomposition; capital asset pricing model theory; capital structure theory) developed previously in the literature. Since this study is based on these well-accepted theories and reliable methodologies; hence its findings are considered relevant in the Indian context. Further, these limitations are not so critical that could significantly jeopardize the results of the present study. Finally, this study is summarized below.

### THESIS SUMMARY

<p><b>Research Inquiry:</b> Value Relevance Research with a focus on leverage effects, both operating and financial</p>	
<p><b>Research Question</b> Are the degrees of leverage value-relevant in the Indian context?</p> <p><b>Aim</b> To explore the impact of degrees of leverage, operating and financial, on Stock Returns, Systematic Risk and Firm Value of listed Indian firms</p> <p><b>Approach/Method</b></p> <ul style="list-style-type: none"> <li>- Portfolio-grouping approach</li> <li>- Time Series Regression and Point-to-Point approaches</li> <li>- Multiple Regression, Oneway Anova and Post Hoc Test</li> </ul> <p><b>Theories</b> Valuation Theory; Theory of Risk Decomposition; Theory of Capital Asset Pricing Model; and Capital Structure Theory</p> <p><b>Finding and Implications</b></p> <ul style="list-style-type: none"> <li>- Degrees of leverage, operating and financial, are found value-relevant in the Indian context</li> <li>- Addition to the literature of Value Relevance Research and Capital Market-based Accounting Research (CMBAR) in Indian context</li> <li>- Usefulness of degrees of leverage, operating and financial, for firms in reporting these accounting numbers in its annual report and also in valuing themselves at the marketplace</li> </ul>	

## DECLARATION

I certify that this thesis is my original research work. I have not previously submitted this research work to any University or Institute for the award of a degree or diploma. Any material previously published or written by another author or person included in the text is well acknowledged and referenced in my thesis.

A handwritten signature in blue ink, appearing to read 'Pradeep Gupta', with a horizontal line underneath the name.

Signed: Pradeep Kumar Gupta  
Regn. No. 950913008

Date: October 17, 2016

## CERTIFICATE

This is certified that **Mr. Pradeep Kumar Gupta, Regn. No. 950913008**, has completed his Ph. D. thesis titled as **“Value Relevance of Degree of Leverages and its Impact on Systematic Risk: An empirical study on Indian manufacturing firms”** under our supervision. This Ph.D. thesis is an authentic research study carried out by him and it is being submitted to **L M Thapar School of Management, Thapar University, Patiala**, for the award of a degree of **Doctor of Philosophy (Ph.D.)**. To the best of our knowledge, this research work has not been submitted to any University or Institute for the award of any degree or diploma.

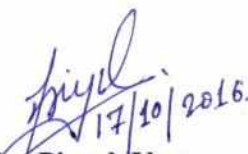
  
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## **ABBREVIATIONS**

**CMBAR:** Capital Market-Based Accounting Research

**NSE:** National Stock Exchange

**DOL:** Degree of Operating Leverage

**DFL:** Degree of Financial Leverage

**TA:** Total Assets

**NFATA:** Net Fixed Assets to Total Assets

**TDTA:** Total Debt to Total Assets

**BETA:** Systematic Risk

**PE:** Price-earnings ratio

**PBIT/EBIT:** Profit/Earnings before Interest and Tax

**PAT:** Profit after Tax

**NOPAT:** Net Operating Profit after Tax

**ROA:** Return on Assets

# CHAPTER 1

## INTRODUCTION

Investment is often recognized as one of the important aspects of growth process and development of the economies (Salari, 2015). The firms seek to attract investments from the investors by communicating them the financial statements or reports that are considered the main medium of communication with the stakeholders (Parera & Thrikawala, 2010). The most important external source of information on companies is the financial statements which are widely used and updated continuously (UO & UI, 2015) and the main concentration of financial statements is to make investments in equity (Barth et al. 2001). In making useful investment decisions and reducing the informational asymmetry problem between firms' managers and investors, the availability of financial information is desired (Hossain et al. 2004). More than a historic viewpoint is provided by the financial statements as evidenced in the study of Ou and Penman (1989). These financial statements are of no value if they show no relationship with the firm value (Chandrapala, 2013). The most important users and decision-makers are the groups of investors to whom the quality accounting information is to be provided for facilitating them in making the useful investment decisions (Sharma et al. 2012). These groups of investors generally use the quality of accounting information provided in the financial reports of the firms to look for their risk-adjusted returns on their investments and they value the firms in the marketplace largely based upon the quality of accounting information.

Further, one of the fundamental attributes of quality of the financial reports is value relevance (Francis et al. 2004) reported by the study of Sharma (2014). Relevance and reliability are the basic parameters of defining and measuring the effectiveness of accounting information published by the firms in their financial statements (Barth et al. 2001; Francis et al. 2004; Nayeri

et al. 2012; Chandrapala, 2013; Sharma, 2014; Pervan & Bartulović, 2014). Therefore, it becomes important to provide the empirical evidence on the use of accounting numbers by the investors for market valuation of the firms. For this purpose, it is extremely important for the users of accounting information to receive the best accounting information from financial reports of the firms (Kargin, 2013). There are numerous well-published empirical studies which find the real determinants of stock returns, stock risk and firm value (e.g. Ball & Brown, 1968; Gahlon & Gentry, 1982; Mandelker & Rhee, 1984; Bhandari, 1988; Sharma, 2006; Dimitrov & Jain, 2008; Garcia & Jorgensen, 2010; Trabelsi, 2013; Azmat, 2014) in the developed and emerging markets. However, the study of Ball and Brown (1968) is often observed as the beginning of modern Capital market-based accounting research (hereafter, CMBAR).

Under CMBAR, one of the main groups of literature is the literature on value relevance that examines the relationship of stock price with accounting information and this relationship should be valued as relevant to investors (Beisland, 2009). Moreover, various empirical studies of value relevance to financial variables and non-financial variables have been found in the extensive literature on value relevance or accounting literature (Carnevale et al. 2009). To provide relevant information to the active stock investors for the estimation of the value of the firms is the prime objective of the financial reporting. Is the reporting of financial data associated with the estimation of the market value of the firms, or is another source of information important to estimate the market value of the firms? (Beisland, 2009). To seek the answers to these questions, many studies in accounting literature have examined the association of accounting values with the market value of the firms over a period of five decades.

According to the study of Barth (2000), the term 'value-relevance' (an accounting value is defined as value-relevant if it has a predicted association with the market value of the firms) has

been used first time by the study of Amir et al. (1993) who studied the association between accounting numbers and stock prices or market-based stock indicators. This means the inquiry; do investors value the accounting numbers at the marketplace? is always of considerable interest for the scholars and the practitioners in the context of developed and emerging markets.

However, there are usually two goals of value relevance studies in emerging markets; one is to investigate the effectiveness of accounting numbers in the stock markets of these emerging economies and the other one is to compare the results of value relevance studies of the developed markets with the emerging markets in explaining the inferences from the results of each emerging market (Klimczak, 2008). Since limited research studies on this topic have been explored in the Indian context, therefore this topic of the study claims the inquisitiveness to be explored in India, one of big 10 emerging markets Garten (1997). Thus, the purpose of this study is to find an empirical evidence of whether investors value the accounting numbers in the context of India as the structures of business organizations in the emerging or developing markets are different from those in developed markets (Sarkar et al. 2008).

Several previous studies identified and explored two important accounting numbers, earnings per share (hereafter EPS) and book value per share, for explaining their value relevance as reported by Khanna (2014). However, various financial variables tested in the literature differ significantly in explaining their value relevance or firm value (Dawar, 2012). This study takes two types of the degrees of leverage, degree of operating leverage and degree of financial leverage, as the important accounting variables to empirically examine the value relevance of the degrees of leverage for 230 manufacturing firms listed on National Stock Exchange (hereafter NSE) of India over the period of ten years from 2001-2002 to 2010-2011 including the recessionary period. In other words, the purpose is to find empirical evidence for the effects of

degrees of operating and financial leverage on the stock returns, the systematic risk, and the firm value for the period from 2001-2002 to 2010-2011. This suggests the following objectives under this study:

- i. To examine the impact of degrees of operating and financial leverage on the stock returns of listed Indian manufacturing firms.
- ii. To investigate the impact of degrees of operating and financial leverage on the systematic risk of common stock of listed Indian manufacturing firms.
- iii. To examine the impact of degrees of operating and financial leverage on the firm value of listed Indian manufacturing firms.

Further, it is important to discuss the India, an emerging market, and its economic growth with respect to the growth and investment opportunities in manufacturing sector. The major driver of overall economic growth of developing nations has been the manufacturing sector for last 15 years as reported by Industrial Statistics 2010 International Yearbook of the United Nations Industrial Development Organization (UNIDO). The strength of every economy is its manufacturing base. Undoubtedly, India, an emerging manufacturing power, is on its way to turning out to be a preferred manufacturing location for the firms around the world. The sound manufacturing base of India growing at the rate of 6-7% per year accounts for 25% of Gross Domestic Product (hereafter GDP). However, Indian manufacturing sector cannot rule out a number of challenges as an evolving manufacturing leader and some similar issues faced by other developing and developed economies (A report by Indian School of Business, New York University, Purdue University, and Deloitte Research, 2005, pp. 1 & 11). Therefore, the conditions of Indian manufacturing sector for its development in realizing the growth and trade potential are to be improved (Kowalski and Dihel, 2009).

Further, the manufacturing sector of India has to grow at a faster rate than GDP growth rate in order to realize its true potential and capture improved share in GDP as per the report of KPMG published in 2014. India has a share of approximately 2.2% of the world's total manufacturing output in 2014 and also has a potential to contribute almost 30% of India's GDP by 2025 as reported by KPMG in its report on 'Manufacturing- An Engine for Growth'(www.kpmg.com/in). So, the Government of India has planned to set up the National Investment and Manufacturing Zones (NIMZ) under National Manufacturing Policy for increasing the growth of manufacturing activities in India (KPMG Report, 2014, pp. 6). The report 'A Brief Overview on Indian Manufacturing Industry' prepared by BDB India Private Limited in 2014 has mentioned that more than 10% growth on an average in Indian manufacturing sector have occurred during 2004-05 to 2007-08. This growth has brought a robust growth in corporate firms' profits, savings, and investments particularly registered manufacturing firms. However, growth in manufacturing sector remained relatively low during 2008-09 to 2012-13 despite increased share of registered firms. Therefore, the Indian manufacturing industries producing capital goods, highly employment intensive and have strategic significance were largely targeted under National Manufacturing Policy of Government of India in order to push the projected 25% of overall GDP share of manufacturing sector (Report of BDB India Private Limited, 2014). This will bring the huge amount of investments in manufacturing firms, hence increased operating and financial activities of the firms. India ranked in 9<sup>th</sup> position among the top 10 world manufacturers as per Industrial Statistics 2010 International Yearbook, a yearly book on major indicators of manufacturing activity (<http://www.unido.org/news/press/unido-statistics-1.html>), of the United Nations Industrial Development Organization (UNIDO).

The growth pace of Indian manufacturing and the overall economy has almost been same for last 20 years. During this period, the growth from 0.9 to 2.0 percent in the share of Indian manufacturing in global manufacturing has been observed (The Boston Consulting Group and Confederation of Indian Industry 13<sup>th</sup> Manufacturing Summit, 2014). The Indian manufacturing firms have to realize the importance and sensitivity of leverages with respect to the stock returns in the marketplace since the leverage causes a change in the volatility of stock returns (Christie, 1982; French et al. 1987; Cheung & Ng, 1992; Nishat, 2000). This means the leverage is the most important factor which determines the firms' risk premium (Zimmer, 1990). Also attaining overall competitiveness with the limited amount of capital would entail the Indian manufacturing firms to reduce the overall cost of their operations including financing costs (Sharma, 2006). Therefore, planning and designing cost structure and capital structure of the manufacturing firms in this globally competitive environment are critical and this is explained by the leverage in many financial textbooks and literature. Furthermore, India is going to be a big manufacturing hub in next decade due to the Indian government's 'Make in India' campaign which aims to enhance the investments in the manufacturing sector of India.

The study of Merchant and Allen-Ford (2012, pp.369) lists India as one of the emerging markets defined by Dow Jones (2010), Economist (2009), FTSE (2010), MSCI (2010) and Hoskisson, et al. (2000). India is one of big 10 emerging markets (Garten, 1997) and the structures of business organizations in the emerging or developing markets are different from those in developed markets (Sarkar et al. 2008). The study of Tripathy (2015) in the stock market integration of BRIC countries concludes that the countries' own shocks explain the movements of stock market return. Indian stock market witnessed a large investments flow from foreign investors over a period of time; hence the value relevance of accounting information becomes

crucial for a big emerging market, named India (Srinivasan & Narasimhan, 2012). There are increasing numbers of studies investigating the usefulness of accounting numbers which take the context of emerging and transition economies (Klimczak, 2009). Besides, Bekaert and Harvey (1997) reported that returns in emerging markets have four distinctive features: (i) the sample average returns are high; (ii) the correlations with returns in developed markets are low; (iii) the returns are more predictable; and (iv) volatility of the returns is high. Liquidity, taxation, stock market benchmarks, and different transactions and accounting methods are some of the parameters where international stock markets differ [1] and due to these different operational parameters, there is a difference of relevance of accounting data between developed and developing countries (Modi, 2015). One of the well-known characteristics of emerging stock markets is high volatility of the returns caused by global and local events (Aggarwal et al. 1999). Across emerging markets, the volatility of the returns was found different (Bekaert & Harvey, 1997). Moreover, a large difference in equities and its returns between emerging and developed equity markets was found (Bekaert & Harvey, 1995). Moreover, Ali and Hwang (as cited in Srinivasan & Narasimhan, 2012) has reported the factors; economic development, cultural and historical influences, legal and political environments, institutional arrangements, which affect the reporting of financial information. Therefore, the results of the studies on the value relevance of accounting data cannot be generalized due to these country-specific factors influencing the relevance of accounting information and its reporting (Ali & Hwang, 2000).

The regular integration with the global market is the prime emerging feature of the equity market of India (Kishor, 1997). The process of integration of emerging markets into world markets is incomplete though correlations between developed and emerging markets have increased (Bekaert & Harvey, 2013). Moreover, it is very difficult to replicate the depth of

institutional liquidity, the kind of infrastructure and pools of human capital built by the developed markets organically [2]. Further, emerging markets are heterogeneous in their level of development and environmental surroundings (Bianchi, 2014). This suggests that 'developed' and 'emerging' markets are realistically different in many aspects including the structures of business organizations. An enormous scale of scholarly interest in emerging market phenomenon in management discipline is found in a casual review of academic literature on emerging markets (Merchant & Allen-Ford, 2012) and the literature of value relevance in emerging markets such as India has been growing over time (Srinivasan & Narasimhan, 2012; Modi, 2015). The extensive studies on the relationship between stock returns and fundamental variables available in the United States have been explored; hence examining this relationship in other countries has also been started by many scholars (Sandip et al. 1997). However, many empirical studies in measuring the value relevance of degrees of leverage for explaining the market value in Indian context have not been explored. Therefore, the purpose of this study is to empirically explore the value relevance of degrees of leverage.

An extensive review of literature is carried for exploring the relevance of variables to be studied in the particular context and period to support the rationale and the objectives of the present study. The data of the variables considered for this study have been collected from the reliable and acceptable database, Prowess database of the Center for Monitoring Indian Economy (CMIE), for the manufacturing firms listed on the National Stock Exchange (NSE) of India. The relevant sample of listed firms representing the population of the listed firms in NSE and the period of study from 2001-02 to 2010-11 are considered for the collection of data. Further, the hypotheses are being developed based on extensive theoretical foundations and literature relevant to the topic of the present study. The appropriate models and techniques proposed and

used in the previous studies have been employed to test these developed hypotheses which in turn lead to achieving the stated objectives of this study.

Event study and return regression are two empirical tests of value relevance. The use of return regression, a linear valuation formula, in value relevance research, is more common than event study since return regression extends added flexibility to include additional variables in the regression equation, configuration with valuation methods and ease of estimation relatively (Klimczak, 2008). However, Kothari (as cited in Klimczak, 2008) has mentioned that causality is not tested with the use of return regression. The present study takes the standard ordinary least square (hereafter OLS) multiple regression models at the levels of individual firm and portfolio of firms to present the empirical results. Several previously published studies on value relevance used OLS for finding their respective empirical results and Muradoglu and Shivprasad (2009) analyzed their results at the levels of individual firm and portfolio of firms. The value relevance study of Sharma et al. (2012) in Indian context also used OLS multiple regression models on the data of 71 non-financial CNX100 firms listed in NSE for the period from 2000-2008. Thus, the OLS multiple regression models for this study can be employed for the empirical findings. The present empirical study is based on valuation theory which takes the point of view of equity investors to empirical examine the value relevance of accounting information (Beisland, 2009). Further, DOL and DFL are estimated by using a time-series regression approach pioneered by Mandelker and Rhee (1984) and Ang and Peterson (1984). Correlation technique presents the direction and relationship among variables. ANOVA model, a specific form of the regression model, is used to study the mean differences of the variables of the sample firms across industries and risk level. Further, this study also establishes one of its regression models on the

basis of the portfolio-grouping approach proposed and used by Mandelker and Rhee (1984) in their study.

The focus variables, DOL and DFL, are value-relevant for return model since they significantly positively affect the stock returns from the empirical findings of the present study. However, DOL shows no significant impact on the systematic risk (Beta) but a positive association with the price-earnings ratio, proxy of firm value. Likewise, DFL shows a significant positive association with the systematic risk (Beta) but no relationship with the price-earnings ratio, a proxy of firm value. The present study and its findings are significant for various reasons. **First**, there are limited empirical studies in the context of India (e.g. Vishnani & Shah, 2008; Mohan & John, 2011; Sharma et al. 2012; Srinivasan & Narasimhan, 2012; Sharma, 2014; Modi & Pathak, 2014; Khanna, 2014; Modi, 2015; Mulenga & Tanzania, 2015) that empirically investigate the usefulness of accounting information. Therefore, this study is the enrichment to the value relevance literature in an Indian context. **Second**, there is a lack of study in the Indian context that takes the value relevance of degrees of leverage and the way the degrees of leverage are estimated. **Third**, it is evidenced from this study that the firms operating with the high degree of leverages historically earn higher returns than the firms with the low degrees of leverage. This means high risks are compensated. **Fourth**, this study revisits various well-published theories established in the developed markets and examines their applicability in the context of an emerging market, named India. **Fifth**, stock returns, systematic risk and firm value have also been analyzed across industries of manufacturing firms. **Sixth**, the present study provides the valuable insights to the managers of the firms and various market participants for the usefulness of accounting numbers in the marketplace.

After the discussions of the value relevance of accounting numbers, objectives, context, rationale, methodology, findings and contributions of this study, the limitations of the present study are equally important to discuss. For instance, only listed manufacturing firms of India is considered for a period from 2001-2002 to 2010-2011 including the recessionary period and the effects of the recessionary period on the empirical results, if any, have not been explored. The data were taken for analysis ended in 2011; however it might be extended until 2015. Moreover, the present study is limited to one country such as India. The discussion about the changes in DOL and DFL over time cannot be presented as the year-wise DOL and DFL are not found in this study. Also, non-availability of year-wise DOL and DFL, the panel data or pooled regression model cannot be applied to test the hypotheses of this study. Moreover, with panel data, one could have possibly controlled for some types of omitted variables even without observing them, by observing changes in the dependent variable over time. However, the usefulness of this study cannot be undermined due to the above limitations since the present study extends the efficacy of well-established theories (e.g. valuation theory; theory of risk decomposition; capital asset model theory; capital structure theory) developed earlier in the literature.

The remaining part of the thesis is organized as follows. The next **Chapter 2** takes the related literature review on the degrees of leverage and value relevance. Basically, the concept and the approaches for estimating the degrees of leverage and the concept, the approaches and the research of value relevance will be described over a period of five decades. Finally, the literature on stock returns, systematic risk, and price-earnings ratio have been done to recognize the importance of these variables as dependent variables for this study.

Further, **Chapter 3** provides the theoretical background and proposes the hypotheses emerged from this theoretical framework. **Chapter 4** sets the empirical test and design for

collecting data, estimating variables, establishing models for finding empirical results. The results and discussion of the study are presented in **Chapter 5**. After the findings, analysis, and discussions, this study is concluded in **Chapter 6**. Finally, **Chapter 7** gives the details about the limitations, the implications and the direction of future research.

## CHAPTER 2

### REVIEW OF LITERATURE

#### 2.1 Degrees of Leverage: Concept and Approaches

In simple term, the advantage of using debt together with equity is referred as ‘leverage’ (Babcock, 1970). The common interpretation of leverage is derived from the use or manipulation of a tool or device termed as Lever. In other words, the action or use of lever is termed as ‘leverage’. The lever is used to magnify a force applied at one point into a larger force at some other point. The extent of use of the lever is called as the degree of leverage. In a business context, leverage refers to the use of fixed costs (operating and financial) in an attempt to lever up profitability [3]. Moreover, leverage is a two-edged sword – just as a firm’s profits can be magnified, so too can the firm’s losses (vanHorne and Wachowicz, 2010). Leverages, operating leverage, and financial leverage, affect the level and variability of the firm’s after-tax earnings, and hence the firm’s overall risk and return (vanHorne and Wachowicz, 2010) and the extent to which both these leverages affect the firm’s overall risk and return are called its degrees of leverage. DFL is defined as the percentage change in earnings per share (hereafter EPS) that results from a given percentage change in earnings before interest and taxes (hereafter EBIT) (Prezas, 1987; Alaghi, 2011; Elangkumaran and Nimalathan, 2013). Likewise, DOL is defined as the percentage change in the EBIT relative to a given percentage change in sales (Prezas, 1987; Elangkumaran and Nimalathan, 2013).

Further, leverage is defined as the ratio of long-term debt to the total long-term capital in the study of Murphy (1968). Petersen (1964) provided three measures of leverage. Leverage was measured first by the ratio of senior to junior capital at book value, then by the ratio of senior to junior capital at market value, and finally by the ratio of fixed charges to earning power. Yoon

and Jang (2005) have measured financial leverage as long-term debt to total asset ratio. Lord (1996) takes operating risk and financial risk as DOL and DFL, respectively. There are two approaches, time-series regression approach, and point-to-point approach, of estimating DOL and DFL used in the literature and the studies proceed to use one of two approaches (Garcia and Jorgensen, 2010). With the use of the concept of elasticity Mandelker and Rhee (1984) and Ang and Peterson (1984) originally establish a time-series regression approach to estimate DOL and DFL. However, O'Brien and Vanderheiden (1987) recommended to detrending the time-series data for an adjustment of growth before estimating DOL. In the case of point-to-point approach, Net Fixed Assets to Total Assets ratio (hereafter NFATA) (Ferri and Jones, 1979; Mandelker and Rhee, 1984) is used for measuring DOL and Total Debt to Total Assets ratio (hereafter TDTA) (Mandelker and Rhee, 1984) for measuring DFL.

Further, the time-series regression approach was pioneered by Mandelker and Rhee (1984) and Ang and Peterson (1984), and has been used extensively by researchers [e.g., DeYoung and Roland (2001); Griffin and Dugan (2003); Ho, Xu, and Yap (2004); Garcia and Jorgensen (2010)]. Mandelker and Rhee (1984) also used point-to-point approach for estimating DOL and DFL in order to use them as instrumental variables. However, Garcia and Jorgensen (2010) used time-series regression approach as a main empirical method but the point-to-point approach was employed as a robustness check. Dugan and Shriver (1989) found the time-series regression approach more suitable theoretically. However, both approaches are deficient with similar biases (Lord, 1998) as reported in the study of Garcia and Jorgensen (2010).

## **2.2 Value Relevance: Concept, Approaches, and Research<sup>1</sup>**

An accounting number is termed as "value relevant" if it is significantly related to the dependent variable (Beaver, 2002) based on the closely related formal definitions given by Beaver (1998,

p.116), Ohlson (1995), and Barth (2000) and the key commonality is that an accounting amount is deemed value relevant if it is significantly associated with equity market value. An accounting number can be considered to be value relevant if it is helpful in explaining value or returns over long windows (Holthausen and Watts, 2001). An accounting amount will be value relevant only if the amount reflects relevant and reliable information to investors in valuing the firms (Barth, 2000). One of the four interpretations of Francis and Schipper (1999) indicates that the value relevance is measured by a statistical association between financial information and stock prices or returns. Consistent with Francis and Schipper's fourth interpretation of value relevance, Beisland (2009) defines value relevance as the ability of financial statement information to capture and summarize information that determines the firm's value. The extensive studies on the value relevance of accounting data assess the usefulness of financial information to investors (Papadaki and Siougle, 2007). Aboody et al. (2002) define value relevance as a mapping from accounting information to 'intrinsic value'.

Further, there are four alternative interpretations of value relevance identified by Francis and Schipper (1999) in their study and these interpretations were considered and explained by Mortensen (2009) as approaches or views to value relevance studies. These are as follows: the Fundamental View, the Prediction View, the Information View and the Measurement View. However, the study of Francis and Schipper (1999) used only the information view for their analyses. The interpretations of Francis and Schipper (1999) and the explanations of Mortensen (2009) are blended below.

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<sup>1</sup>Gupta, P.K., & Kumar, S. (2012). Value Relevance Research: A review. *Proceedings of National Conference on Changing perspectives and paradigms in Business and Behavioural Sciences*, pp. 270-275. Patiala, India: Thapar University. (Appendix 1)

- (I) The fundamental view measures return earned by implementing a trading strategy based upon the use of accounting information. Generally, the portfolios are formed with the use of accounting information and this accounting information is value-relevant if these portfolios are associated with abnormal returns. Fundamental analysis research in accounting takes the fundamental view that explains the movement in stock prices by capturing intrinsic values towards which stock prices drift, occur due to accounting information derived from financial statements.
- (II) The variables derived from financial information and used in the valuation model can further be predicted. Then this financial information is said to be value-relevant. A particular valuation model may be useful in measuring the value relevance of various accounting variables.
- (III) The information content rather than value relevance of accounting amounts is adopted by the researchers under the information view of value relevance studies. In other words, do investors actually use accounting information in setting stock prices or returns or making investment decisions at the marketplace? If yes, the accounting information is considered value-relevant. However, the concepts of timeliness and formation of expectations are also studied to analyze the information view.
- (IV) Under measurement view, an accounting number is considered value-relevant if a statistical relationship between this accounting number and stock prices or returns is found. This assumes that the investors use that accounting number in determining prices or returns at the marketplace. However, as per the study of Barth et al. this accounting number can be outdated due to more timely information, hence it cannot be considered a decision relevant for the investors (as cited in Mortensen, 1999)

The literature on value relevance, large and diverse, deals with the equity valuation (Mortensen, 1999). The financial reports are unable to fulfill one of their primary objectives if no association between accounting information and the market value of the company is found (Beisland, 2009). The study of Ohlson (1995) proposed a most relevant model of value relevance analysis and value relevance analysis assumes that information is value-relevant if it affects the market value of the firm (Carnevale et al. 2009). Ball and Brown (1968) presented that earnings and earnings-based measures are associated with stock returns and, therefore, such measures are considered value-relevant. The study of Beisland (2009) is exclusively devoted to equity investment which takes the value relevance research as the measurement of the usefulness of accounting information from the point of view of equity investors. There is a positive relationship between expected common stock returns and debt to equity ratio of the firms (Bhandari, 1988). A significant relationship between debt to equity ratios and their risk-adjusted common equity returns of the 37 restaurant firms is found in the empirical study of Sheel and Wattanasuttiwong (1998). Thus, debt to equity ratio is considered to be value-relevant.

The relationship between accounting amounts and market values of equity are investigated in value relevance research (Barth, 2000) and in what way the information reflected by accounting amounts and used by the equity investors is assessed by value relevance research (Barth et al. 2001). Venkatachalam (1999) reported that the market valuation of accounting numbers in the case of sample foreign firms listed in US market was interestingly presented by Harris and Mullar (1999) who studied the comparative value relevance (i.e. International Accounting Standards and US-GAAP) by examining which set of accounting numbers are more value-relevant. One of the main groups of literature within the modern CMBAR, originated from the study of Ball and Brown (1968), is the value relevance literature that examines the stock

price impact of accounting information that should be valued as relevant to investors (Beisland, 2009). The empirical examination of Beaver (1968) determined the extent to which the equity investors perceive the informational value of earnings announcement. Habib (2004) investigates the quality of accounting information with respect to stock price. However, the value relevance of accounting information can invariably be affected by the accounting practices which have not kept pace with the rapid economic and high technology changes (UO & UI, 2015).

The value relevance of financial crisis was examined by Devalle, (2012) in the case of Europe since the relevance of accounting information may also be affected by the period of financial crisis. Nayeri et al. (2012) empirically studied the effects of four factors; profitability, firm size, earnings stability and firm growth on the relevance of accounting information and they found these factors are value-relevant. The value relevance study of Sharma et al. (2012) in Indian context found that Return on Net Worth (RoNW), a good measure for investment decision, was value-relevant while the financial statements themselves were found value-relevant insignificantly (Vishnani & Shah, 2008; Sharma et al. 2012). Srinivasan and Narasimhan, (2012) indeed mentioned that accounting information is value-relevant in the context of India, a big emerging market. Kargin (2013) has found the increased relevance in accounting information during the period of adoption of International Financial Reporting Standards (IFRS) by Turkish listed firms. The main purpose of the study of Takacs (2012) was to examine the deviation in value relevance of accounting data over a period from 2005 to 2010 in Romanian Stock Market and found significant variations in value relevance across years using time-series analysis. Pervan and Bartulović (2014) has analyzed the value relevance of earnings and book value for 97 firms listed in Ljubljana, Zagreb, Sarajevo, Banja Luka and Belgrade Stock Exchanges from

South Eastern European countries over the period from 2005 to 2010. Moreover, no rise in the explanatory power of these accounting numbers was found during the observed period.

### **2.3 Stock Returns, Systematic Risk, and Price-Earnings Ratio**

The purpose of the study of Murphy (1968) was to investigate the real effect of leverage on profitability, growth, and market valuation and the extent of association was measured by computing coefficient of correlation. The results of the study of Murphy (1968) showed that the higher the portion of debt in firms' total capital, more likely the possibility of earning a high return on equity, recording greater growth of earnings, achieving superior price appreciation and price-earnings multiple at the marketplace. Wilcox (1984) established an equity valuation model, called the P/B-ROE valuation model, which presented interesting inferences from the relations among stock price and earnings stability, dividend policy, leverage and beta. Muradoglu and Shivprasad (2009) empirically investigated the impact of firm's leverage on stock returns for Utilities and other sectors and their result, a positive association between leverage and stock returns, support the results of Modigliani and Miller (1958) and Bhandari (1988) for Utilities and the result, a negative relationship of leverage with stock returns, for other sectors support the results of Korteweg (2004), Dimitrov and Jain (2006) and Penman et al. (2007). The study of Korteweg (2004) reexamined Modigliani-Miller Proposition 2, the relationship of financial leverage and expected stock returns, by using a different measure of financial leverage and a time-series approach.

Further, using return model for 18 industrial firms of Jordan for the period from 1993-2002, Shamki (2012) found a significant positive effect of earnings on returns and an insignificant effect of the book value of equity on returns at the individual level. Therefore, earnings were found value-relevant indicating more trust of investors on earnings than book

value. Moreover, the combined effects of earnings and book value of equity and changes in earnings and book value were also not value-relevant. Almilia (2011) used Error Correction Model (ECM) for finding the usefulness of accounting numbers and found the important role of this model in measuring the value relevance of accounting information for the manufacturing firms listed in Indonesian Stock Exchange. AL-Qudah and Laham (2013) showed a significant association between financial leverage and stock returns for 48 industrial companies listed in Amman Stock Exchange for the period between January 2000 and December 2009. The studies of Acheampong et al. (2014) and Abdullah et al. (2015) established a significantly negative relationship between financial leverage and stock return for select stocks of manufacturing firms listed in Ghana Stock Exchange and Dhaka Stock Exchange, respectively. The findings of Koseoglu (2014) provide evidence for the negative effect of leverage on excess stock returns in case of Exchange Istanbul.

Obreja (2006) found that the relationship between financial leverage and equity returns indicates that leveraged firms tend to have higher equity returns and higher book-to-market equity ratios. Mohanty (2002) found that size, price-to-book value, earnings-to-price ratio and market leverage are related to stock returns by using Fama and Macbeth (1973) regression. Operating leverage predicts returns in the cross-section, and that firms with “levered” assets earn significantly higher average returns than firms with “unlevered” assets (Novy-Marx, 2011). De Medeiros et al. (2006) empirical support a positive association between operating leverage and stock returns. Lee and Park (2014) also found a strong positive relationship between operating leverage and returns and operating leverage and book-to-market equity ratio. A significant effect of leverage on returns is found in the study of Naranjo et al. (2015) in the case of cross-country analysis of public real estate markets. The study of Nguyen and Schüßler (2013) showed a

significant negative relation between leverage and stock returns for the German and the UK markets whereas for the US market the results are mixed. The difference in their results at three markets may be the efficiency of the US market with respect to size and international investor participation. Tabari et al. (2011) empirically investigated the impact of firm's leverage on stock returns for 102 companies listed in Tehran Stock Exchange for the period of 2003-2009 and found a negative and linear relation of leverage with stock returns at the levels of the firm and the portfolio of firms.

Mandelkar and Rhee (1984) reported in their study that “in the capital market pricing model, beta as an index of systematic risk is only security-specific parameter that affects the equilibrium return on a risky security”. Leverage is a considerable variable in association assessments on risk found by countless empirical investigations (Bowman, 1980). The association between market-determined and accounting-determined risk measures investigated by a number of empirical studies (Ball & Brown, 1969; Beaver, Kettler & Scholes, 1970; Gonedes, 1973; Beaver & Manegold, 1975; Thompson, 1976; Myers, 1977; Hill & Stone, 1980; Mandelkar and Rhee, 1984) has contributed towards explaining the correlations and relationships between betas of common stock and various accounting variables. Alaghi (2011, 2013) found a significant positive effect of financial leverage on the systematic risk of listed companies in Tehran Stock Exchange. Tan, Chua, and Salamanca (2015) presented a significant association of financial leverage with systematic risk with the use of Fixed Effects Model, Random Effects Model, and Pooled OLS Balanced Panel Data Regression on 50 non-financial listed companies in the Philippine Stock Exchange (PSE) from years 2007 to 2013. Houmes, MacArthur and Stranahan (2012) examined the effect of DOL on Betas when managers have discretion over firms' cost structures by using panel data for publicly listed trucking firms over years 1994-2006

and showed a positively significant association between DOL and Betas. Ramadan, Zeyad S. (2012) explained that the financial leverage is a leading factor in estimating the systematic risk and increase in financial leverage leads to increase the risk also for 30 Jordanian industrial firms in the years 2001-2011. One of the objectives of the study of Voulgaris and Rizonaki (2011) was to examine the effect of DOL and DFL on the systematic risk for Greek listed firms and found a negative effect of DOL and DFL on systematic risk with the sensitivity of time in this examined relationship.

PE ratio, first introduced in the literature by Graham and Dodd (1934) as a benchmark for equity valuation, has the application based on the idea that earnings are related to value (Stefanis, 2005). PE ratio is relatively found a good indicator of predicting future earnings and the transitory feature of current earnings (Ou & Penman, 1989). PE ratio is calculated as the ratio of current price to the most current actual earnings reported commonly and PE ratio is a measure of valuation of stocks in the Indian stock market (Sinha, 1994). Basu (1975) hypothesized to empirically examine the usefulness of PE ratio as an analytical instrument of stock selection and an indicator of potential investment performance of stocks. Pringle (1973) reported the PE ratio as an important consideration cited extensively in the financial press for investment and financial decisions and PE ratio is also found an important indicator of the rate of growth of earnings expected by the market. However, the size of PE ratio is not relevant in most situations (Pringle, 1973). Moreover, the study of Penman (1996) has reported the various interpretations of PE ratio suggested and evidenced by different authors. The interpretations of PE ratio (as cited by Penman,1996) are: an earnings growth indicator (Litzen-berger & Rao, 1971; Cragg & Malkiel, 1982), a risk measure (Ball,1978), an earnings capitalization rate (Graham, Dodd, & Cottle, 1962; Boatsman & Baskin, 1981; Alford, 1992), a transitory earnings (Beaver & Morse, 1978),

the mispriced stocks (Basu, 1977; Jaffee, Keim, & Westerfield, 1989) and a product of accounting principles (Craig, Johnson, & Joy, 1987).

Further, Elangkumaran and Nimalathan (2013) empirically investigated the relation between leverage and earnings per share (EPS) and share price (SP) for 20 companies listed on Colombo Stock Exchange for the period from year 2007-08 to 2011-12 and presented the results of no significant association of DOL and DFL with earnings per share (EPS) and share price (SP). Bhadu and Warne (2009) showed two most significant parametric determinants, variability in market price and corporate size, of PE ratio in the context of Indian capital market. Anderson and Brooks (2006) found that the size of the firm, the year in which PE ratio is measured and the industry effect is the most influencing factors of firms' PE ratios. There is a maintained popularity of using PE approach to security/equity valuation among practitioners and academics due to its simplicity (Pari, Carvell & Sullivan, 1989; Lie & Lie, 2002). In the value relevance study of Modi and Pathak (2014) in Indian stock market, PE ratio was found the most important variable for their study.

In the above literature review, several previous studies conducted in different context and periods indicate the expected relationships among the variables of this study. These reported relationships emerged from the above literature review are being presented in Table 1 given in next page. Further, these reported relationships among variables lead to the development of hypotheses for this study which are also supported by the theoretical foundations discussed in the next Chapter 3. This chapter 3 provides a detailed discussion of the various theories developed in the literature and the empirical results of various studies over a period. This review drives for developing hypotheses to achieve the objectives of this study.

**Table 1: SUMMARY OF REPORTED RELATIONSHIPS AMONG VARIABLES**

S. No.	Relevant Studies	Type of variables showing relationship		Relationship (Positive or Negative)
		Independent Variable	Dependent Variable	
1.	Murphy (1968)	Debt to Total Capital ratio	Return on Equity	Positive
2.	Muradoglu and Shivprasad (2009); Bhandari (1988); Modigliani and Miller (1958)	Leverage	Stock Returns	Positive (Utilities sector firms)
3.	Muradoglu and Shivprasad (2009); Penman et al. (2007); Dimitrov and Jain (2006); Korteweg (2004)	Leverage	Stock returns	Negative (other sector firms)
4.	Shamki (2012)	Earnings	Stock returns	Positive
5.	AL-Qudah and Laham (2013)	Financial Leverage	Stock returns	Positive
6.	Acheampong et al. (2014) and Abdullah et al. (2015)	Financial Leverage	Stock returns	Negative
7.	Koseoglu (2014)	Leverage	Excess stock returns	Negative
8.	Obreja (2006)	Leverage	Equity returns and Price-to-book value ratio	Positive
9.	Medeiros et al. (2006)	Operating Leverage	Stock returns	Positive
10.	Novy-Marx (2011)	Operating Leverage	Average returns	Positive
11.	Lee and Park (2014)	Operating Leverage	Stock returns and Book-to-market equity ratio	Positive
12.	Naranjo et al. (2015)	Leverage	Returns	Positive
13.	Nguyen and Schüßler (2013)	Leverage	Stock returns	Negative
14.	Salamanca (2015); Alaghi (2011, 2013); Ramadan, Zeyad S. (2012);	Financial Leverage	Systematic risk	Positive
15.	Houmes, MacArthur and Stranahan (2012);	DOL	Systematic risk	Positive
16.	Voulgaris and Rizonaki (2011)	DOL and DFL	Systematic risk	Negative
17.	Mandelkar and Rhee (1984)	DOL and DFL	Systematic risk	Positive
18.	Stefanis (2005)	Earnings	Equity Value	Positive

## CHAPTER 3

### THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

There are several empirical studies which have explored various accounting variables which impact the stock returns (Ball and Brown, 1968; Gahlon and Gentry, 1982; Bhandari, 1988; Habib, 2004; Dimitrov and Jain 2008; Gomes and Schmid, 2010; Garcia and Jorgensen, 2010). A relationship between earnings and the value of common stock was extensively hypothesized by the valuation theory (Beaver, 1968). The present study is also based on the valuation theory which takes the point of view of equity investors to empirically examine the value relevance of accounting information (Beisland, 2009). Ball and Brown (1968) show that changes in earnings are associated with stock returns and, therefore, earnings are considered value relevant. Gahlon and Gentry (1982) model the presentation of DOL and DFL as real-asset risk measures that assess the risk and rewards from operating and financial decisions. There is a positive relationship between stock returns and debt to equity ratio of the firms (Bhandari, 1988). Thus, debt to equity ratio is considered to be value relevant. Habib (2004) investigates the quality (value relevance) of accounting information by taking the explanatory power of accounting earnings and book values as well as the explanatory power of earnings alone with respect to stock price. Dimitrov and Jain (2008) find that annual stock returns are significantly associated with contemporaneous changes in financial leverage and, hence, changes in financial leverage are value relevant. The relationship between financial leverage and stock returns in a dynamic world is more complex than static textbook examples as suggested by Gomes and Schmid (2010). Garcia and Jorgensen (2010) found a positive relation between DOL and average stock returns in cross-section which supported the theoretical models of Carlson, Fisher, and Giammarino (2004), Zhang (2005), and Cooper (2006). Garcia and Jorgensen (2010) also found

a positive, but weak, relation between DFL and stock returns. Obreja (2006) found that financially leveraged firms tend to have higher equity returns. Novy-Marx (2011) reported a positive relation between operating leverage and stock returns. The studies of Acheampong et al. (2014) and Abdullah et al. (2015) established a significantly negative relationship between financial leverage and stock return for selected stocks of manufacturing firms. The findings of Koseoglu (2014) provide evidence for the negative effect of leverage on excess stock returns. The returns in cross-section can be predicted by operating leverage and average returns are significantly higher for the firms with “levered” assets (Novy-Marx, 2011). De Medeiros et al. (2006) and Lee and Park (2014) empirically found a positive association between operating leverage and stock returns. Tabari et al. (2011) empirically found a negative and linear relation of leverage with stock returns at the levels of the firm and the portfolio of firms. AL-Qudah and Laham (2013) showed a significant association between financial leverage and stock returns for 48 industrial companies listed in Amman Stock Exchange for the period between January 2000 and December 2009.

The previously well-published empirical studies explored the two types of leverage (DOL and DFL) as important accounting information that impacts the stock risk and returns in the context of different economies. I also take these two types of leverage (DOL and DFL) as the important candidates for value relevance to empirically examine the value relevance of DOL and DFL for the NSE listed manufacturing firms in India. Therefore, a statistical relationship between DOL and DFL and returns on the common stock of the firms over a period of ten years is established on the supposition that the degrees of operating and financial leverage are value-relevant. Based on the above theoretical arguments and mixed empirical results in various markets, it is hypothesized to examine the value relevance of degrees of operating and financial

leverage in the Indian context. In other words, do the degrees of operating and financial leverage impact the stock returns of the sample firms under study?

***Hypothesis 1:** The degrees of operating and financial leverage positively impact the stock returns of the firms.*

Since risk and return go hand in hand, therefore it is imperative to find the association between systematic risk of the common stocks and DOL and DFL. The equity risk increases with the outsized use of borrowed fund (high financial leverage) and high levels of operating risk (Penman et al. 2007). The association between market-determined and accounting-determined risk measures investigated by a number of empirical studies (Ball and Brown, 1969; Beaver, Kettler and Scholes, 1970; Gonedes, 1973; Beaver and Manegold, 1975; Thompson, 1976; Myers, 1977; Mandelkar and Rhee, 1984) has contributed towards explaining the correlations and relationships between betas of common stock and various accounting variables. Gahlon and Gentry (1982) construct the models that enhance the presentation of DOL and DFL as real-asset risk measures affecting systematic risk (beta) of common stocks. They demonstrate "how the degrees of operating and financial leverage, along with the coefficient of variation of revenue and a cash flow correlation coefficient, affect a security's systematic risk, expected return, and value". The capital asset pricing model (CAPM) developed by Sharpe (1964), Lintner (1965), and Black (1972) hypothesizes that investors value only systematic risk, measured by beta. Hamada (1972) and Rubinstein (1973) decompose systematic risk into operating risk and financial risk. Lev (1974) empirically finds operating leverage as one of the real determinants of systematic risk. The decomposition of systematic risk into operating risk and financial risk by Hamada and Rubinstein is further refined by Hill and Stone (1980) and Chance (1982) to examine the combined effects of operating risk and financial risk on the systematic risk. The

study of Rubinstein (1973) is extended by Brenner and Schmidt (1978) to test the relationship between assets characteristics and systematic risk.

Further, Mandelkar and Rhee (1984) provide an alternate formula to the risk decomposition of Hamada and Rubinstein by explicitly introducing DOL and DFL to empirically examine the joint impact of DOL and DFL on systematic risk. They find a positive association between DOL and DFL and systematic risk. They also hypothesize and find the negative correlation between DOL and DFL. Huffman (1989) replicates and updates the study of Mandelkar and Rhee but is found inconsistent results, a negative relationship between DOL and systematic risk and positive correlation between DOL and DFL. However, Huffman (1989) reports the empirical result of the studies by Beaver, Kettler, and Scholes (1970), Pettit and Westerfield (1972), Logue and Merville (1972) and Breen and Lerner (1973) which find a positive relationship between financial leverage and risk. Lord (1996) has taken DOL and DFL to explain their impact on total, systematic and unsystematic risks of the equity. Lord (1996) found a positive association between DOL and systematic risk but failed to support the positive association between DFL and systematic risk. The empirical evidence of Melicher (1974) and Thompson (1976) also fail to support the positive relationship between financial leverage and risk. Lee and Park (2014) found that DOL and the systematic risk are positively associated. Alaghi (2011, 2013) found a significant effect of DFL on the systematic risk of listed companies in Tehran Stock Exchange. Tan, Chua, and Salamanca (2015) presented a significant association of financial leverage with systematic risk for 50 non-financial listed companies in the Philippine Stock Exchange from years 2007 to 2013. Houmes, MacArthur, and Stranahan (2012) depicted positively significant association between DOL and Betas when the cost structures of publicly listed trucking firms over years 1994-2006 were controlled by the managers. Ramadan, Zeyad S.

(2012) explained that the financial leverage is a leading factor in estimating the systematic risk and increase in financial leverage leads to increase the risk also for 30 Jordanian industrial firms listed in ASE in the years 2001-2011. The analysis of the study of Voulgaris and Rizonaki (2011) for Greek listed firms found a negative effect of DOL and DFL on systematic risk with the sensitivity of time in this examined relationship. The results, an impact of DOL and DFL on the systematic risk, of well-published empirical studies are mixed. Therefore, it is appropriate to reexamine the combined effect of DOL and DFL on the systematic risk in Indian context due to the inconsistent results of well-published empirical studies in the developed and developing markets. Therefore, an alternate hypothesis that DOL and DFL impact the systematic risk of common stock of the sample firms is framed.

***Hypothesis 2:** The degrees of operating and financial leverage positively impact the systematic risk of common stock of the firms.*

Debt and Equity are the principal sources of funding for a business. The mix of these two sources of funding depends on how a firm decides to divide its cash flow between debt capital providers and equity-holders (Rayan, 2008). According to Ward and Price (2006), a profitable business will experience a higher Return on Equity (ROE) as borrowings increase because a profitable firm is able to earn at a higher rate than it is paying for its borrowed funds. This information could lead to an assumption that firms' capital structures are highly weighted towards a higher level of debt. However, there is a limit to the amount of debt a firm should take on (De Wet, 2006). The idea of employing the borrowed capital in the capital structure directly increases the risk of the cash flows to equity holders and thus raises the required rate of return on equity as proposed by the standard financial textbooks. The rate of return on equity is levered with some combination of debt and equity in the total capital (Babcock, 1970). Many researchers and practitioners have examined this extremely powerful and remarkably simple idea by linking

expected returns on equity with varying capital structures across and within firms (Gomes & Schmid, 2010). Therefore, a firms' financial leverage affects the firm value (Sharma, 2006) and a relationship between financial leverage and firm value has become a key issue (Rayan, 2008).

Over a period of *five* decades, empirical investigation of the relationship between leverage and firm value has always been of great interest for the scholars and practitioners around the world. Modigliani and Miller (1958) found that the value of any firm does not depend on its capital structure in perfect capital markets. In other words, the firm value is independent of its leverage. Sarma and Rao (1969) employed the model of Merton H. Miller and Franco Modigliani (hereafter, MM) to a non-regulated industry and test the MM hypothesis on the influence of debt on the value of a firm and found the results in support of their hypothesis that, after allowing for the tax advantage from the interest paid on debt, the value of a firm is independent of its capital structure. Cheng and Tzeng (2011) explored the effect of leverage on firm value and how this effect is influenced by the firm financial quality? They find the positive relationship between leverage and firm value when the firm financial quality is better. Moreover, the leverage becomes an important factor in designing the structures of cost and capital to entail reducing the overall cost of operations including financing costs to attaining overall competitiveness by the firms operating in the manufacturing sector of India (Sharma, 2006). This study measures the firm value as one of the market-based performance indicators, called price-earnings (hereafter, PE) ratio. PE ratio is one of the most common market-based performance measures (Aliabadi et al. 2013). Moreover, PE ratio (as cited by Penman,1996) is considered as an earnings growth indicator (Litzen-berger & Rao, 1971; Cragg & Malkiel, 1982), a risk measure (Ball,1978), an earnings capitalization rate (Graham, Dodd, & Cottle, 1962; Boatsman & Baskin, 1981; Alford, 1992), transitory earnings indicator (Beaver & Morse, 1978), an

indicator of mispriced stocks (Basu, 1977; Jaffee, Keim, & Westerfield, 1989) and a product of accounting principles (Craig, Johnson, & Joy, 1987). PE ratio is a measure of valuation of stocks in the Indian stock market (Sinha, 1994). Therefore, PE ratio can be considered an important informative variable to be studied in value relevance research. Bhadu and Warne (2009) find two most significant parametric determinants, variability in market price and corporate size, of PE ratio in the context of Indian capital market. Anderson and Brooks (2006) find that the size of the firm, the year in which PE ratio is measured and the industry effect is the most influencing factors of firms' PE ratios. Sharma (2006) finds a significant correlation between firms' value and financial leverage. A significant portion of the variations in PE ratios is explained by the selection of firms based upon industry (Alford, 1992).

PE ratio, first introduced in the literature by Graham and Dodd (1934) as a benchmark for equity valuation, has the application based on the idea that earnings are related to value (Stefanis, 2005). When making equity valuation decisions investors consider firms' fundamentals as reflected in financial statements. However, which line item is more important for equity valuation is an important consideration (Habib, 2010). There is of considerable interest to be known about the behaviour of PE ratio over time and the relative importance of the factors influencing its behaviour (Beaver and Morse, 1978). This study takes the values of DOL and DFL by using time-series regression approach to investigate their influence on PE ratio in valuing the firms as there is a maintained popularity of using PE approach to security/equity valuation among practitioners and academics due to its simplicity (Pari, Carvell, and Sullivan, 1989; Lie and Lie, 2002). An accurate measure of equity valuation is the PE ratio found in the study of Alford (1992). Lee and Park (2014) also found a strong positive relationship between operating leverage and book-to-market equity ratio. Elangkumaran and Nimalathan (2013)

empirically presented the results of no significant association of DOL and DFL with earnings per share (EPS) and share price (SP). Murphy (1968) used the financial leverage to examine its effect on PE ratio for market valuation of the firms. However, few studies in Indian context have taken DOL as a determinant of PE ratio; therefore this study takes DOL for establishing its relationship with PE ratio. With the above arguments, an alternative hypothesis is being proposed.

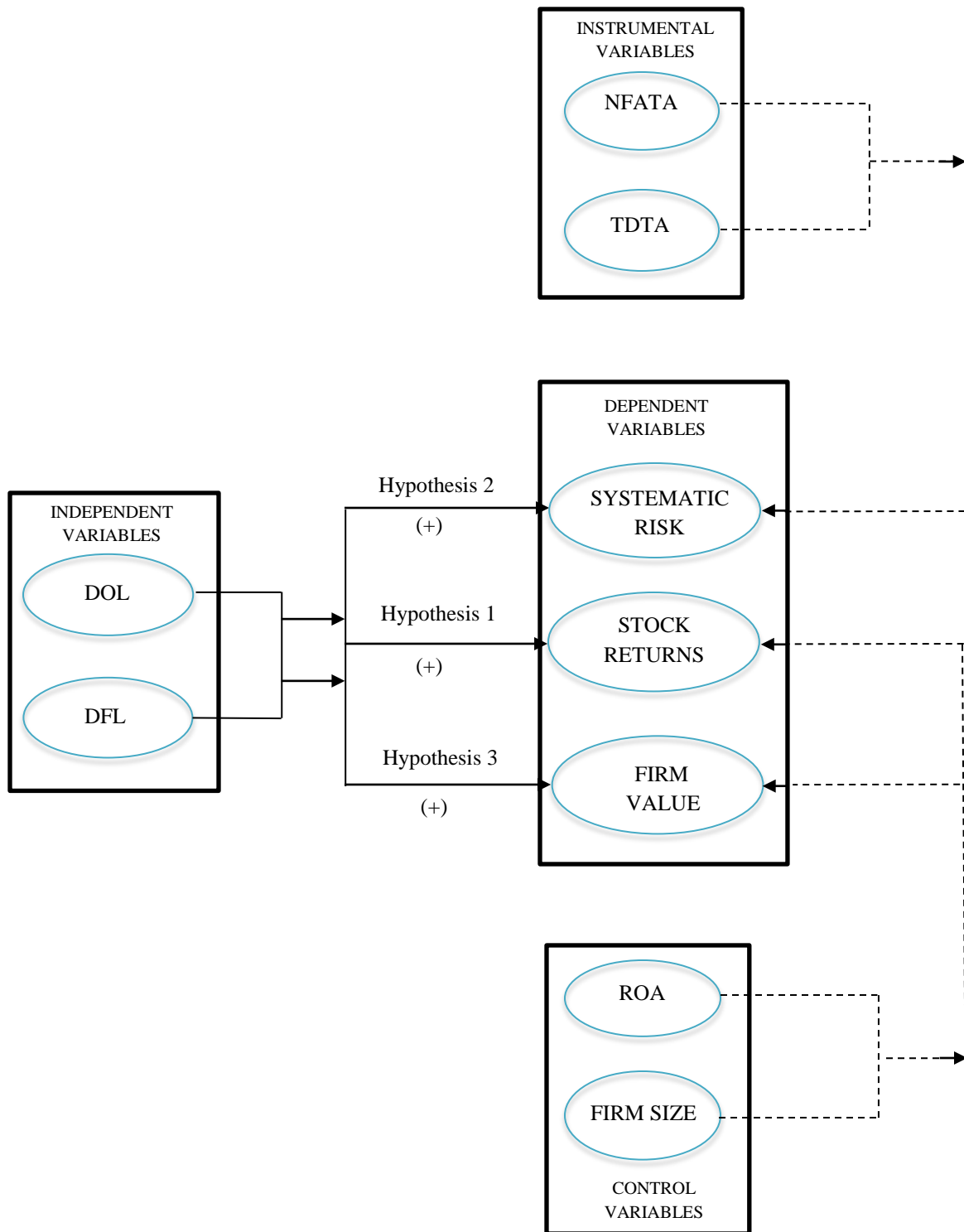
***Hypothesis 3:** The degrees of operating and financial leverage positively impact the price-earnings ratio, representing firm value.*

Other than the main interest variables (DOL and DFL), there are some other firm-level factors which could influence the firm value and these firm-level factors are to be controlled to improve the explanatory power of interest variables. The study of Chandrapala (2013) has mentioned that the larger firms could have higher value relevance of accounting information than the smaller firms. A significant higher equity returns are earned by larger firms (Yoon & Jang, 2005). This suggests the present study is to examine the relevance of firm size. An essential aspect of a research into a business activity must include the firm size (Zadeh & Eskandari, 2012). Al-Khazali and Zoubi (2005) report that accounting studies have used firm size to explain differences across firms in their accounting method and corporate disclosure decisions (Jensen & Meckling, 1978; Deakin, 1979, Collins, Rozeff, & Dhaliwal, 1981; Zmijewski & Hagerman, 1981; Zimmerman, 1983; Hughes & Ricks, 1984; Shehata, 1991). For example, Shehata (1991) has used the total sales as firm size. However, others used the value of total assets (hereafter TA) as firm size. Thus, it is important to include firm size as a control variable in the study. Moreover, this study also includes return on assets (hereafter ROA) (Flatt & Kowalczyk, 2008; Lee & Swenson, 2012) as a control variable which could impact the stock returns and the firm

value. ROA is the most pertinent accounting measure (Aliabadi et al. 2013). Many previous well-published studies (e.g. Beaver et al. 1970; Sarkar et al. 2008; Harforda et al. 2008; Hasan & Butt, 2009; Li, 2011; Lee & Swenson, 2012; Ramadan, 2012) have used return on assets (ROA) and firm size as control variables for their respective studies. Based upon the above discussion on the theoretical background and proposed hypotheses, a framework of proposed hypotheses of this study is displayed in **Figure 1** in the next page.

Now it is important to discuss the empirical research design to test the above-proposed hypotheses. Thus, Chapter 4 on Empirical Test Design is presented to explain the procedure of data collection, estimation of variables and the frame of regression models. Chapter 4 also provides a detailed description of the type of data, the source of data, selection procedure, the sample of select listed Indian manufacturing firms across industry, time period, methods of estimating variables and regression models at firm-level and portfolio of firms level.

**FIGURE 1: FRAMEWORK OF VALUE RELEVANCE OF DOL AND DFL**



## CHAPTER 4

### EMPIRICAL TEST DESIGN

#### 4.1 Data Selection and Estimation of Variables

This study takes two types of the degrees of leverage, degrees of operating and financial leverage, as the important accounting variables to empirically examine the value relevance of the degrees of leverage for 230 manufacturing firms listed on National Stock Exchange (hereafter NSE) of India over the period from 2001-02 to 2010-11 including the recessionary period. The financial data of the manufacturing firms listed in NSE has been extracted from the Prowess database created by the Center for Monitoring Indian Economy (CMIE) and the manufacturing firms having the complete financial data (monetary value of all required data as on March 31 for every financial year) for the period of 10 years from 2001-02 to 2010-11 have been considered for this study<sup>2</sup>. The financial year in India is from April 1 to March 31 of the following year (Sarkar, Sarkar & Sen, 2008). The Prowess database has formed the basis of several published empirical studies on the Indian corporate sector (e.g., Khanna & Palepu, 1999; Sarkar & Sarkar, 2000; Bertrand, Mehta, & Mullainathan, 2002) as reported by Sarkar, Sarkar and Sen, (2008).

The NSE-listed manufacturing firms from CMIE Prowess database with the values of required accounting variables (Annual Sales, Profit before interest and tax, Profit after tax, Total Assets and Stock Prices) as on March 31 every year for the period from 2001-02 to 2010-11 have been considered and all those firms which have incomplete or missing values of required accounting variables have been ignored.

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<sup>2</sup>The data taken for this study ended in 2011 since the listed firms started to prepare its annual financial statements in a new format prescribed by the Companies Act of India from 2011-12 onward.

Finally, the complete set of data (the value of each required accounting variables as on March 31 every year from 2001-2002 to 2010-2011) for this study for the total sample of 230 firms with the distribution by industry and their percentage in total sample is taken and presented below in **Table 2**.

**Table 2: SAMPLE OF FIRMS WITH DISTRIBUTION BY INDUSTRY**

Industry Description	SAMPLE	
	N	%
Chemical	85	36.96
Diversified	08	3.48
Food & Beverage	24	10.43
Machinery	27	11.74
Metal & Metal products	13	5.65
Miscellaneous	13	5.65
Non-metalic mineral products	35	15.22
Textiles	11	4.78
Transport Equipment	14	6.09
Total	230	100.00

The sample of 230 listed firms is fairly good sample for the representation of manufacturing firms of India for this study since there were 1484 listed companies including service sector companies at the end of March 2011 as per NSE fact book 2015 [4] available for trading in NSE while there were 1030 listed companies including service sector companies at the end of May 2001 as per NSE news 2001 [5].

The estimation of dependent variables is represented in equations (1), (2) and (3), respectively. The equations (1), (2) and (3) measure the cumulative return of each firm's stock, the beta value of each firm's stock and the 10-year average value of PE ratio of each firm, respectively. In equation (2), the estimation of systematic risk (beta), one of the dependent variables, is based on the market model used in the studies of Mandelker and Rhee (1984) and

Huffman (1989). A commonly used formula of continuously compounded returns is applied for the estimation of cumulative returns of each firm's stock (<http://faculty.washington.edu/ezivot/econ424/returnCalculations.pdf>, accessed 13 September 2016). Since this study has only one value of each independent variable over a period of ten years, therefore only one value of each dependent variable is required to test the proposed hypotheses.

$$(1) \quad R_j = [\Sigma \ln (P_t / P_{t-1})], t = 2002-2011 \quad j = 1-230$$

Where,  $R_j$  = Firm j's 10 years cumulative return;  
 $P$  = Closing Price of the Stock of firm j at the end of year t and t-1.

$$(2) \quad R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \quad i = 1-230, t=1-120$$

Where,  $R_i$  and  $R_m$  = Monthly rates of return in month  $t$  on a common stock and an Market Index (NSE Nifty 50);  
 $\alpha_i$  = Intercept,  
 $\beta_i$  = Slope coefficient representing the Systematic Risk (hereafter Beta) of a common stock

$$(3) \quad PE_i = [\Sigma(PE_{it})/10], t = 2002-2011 \quad i = 1-230$$

Where,  $PE_i$  = Firm i's 10 year average PE ratio;  
 $PE$  = Closing Value of PE ratio of firm i at the end of each year.

The independent variables, DOL and DFL, are estimated in equations (4), (5), (6) and (7). DOL and DFL are measured in the equations (4) and (5) that are based on the time-series regression approach to be used for testing proposed ***hypotheses 1, 2 and 3***. The equations (6) and (7) are used to calculate the ***ten*** years average values of instrumental variables, NFATA and TDTA, for DOL and DFL, respectively. These calculated values of NFATA and TDTA are also called the book values of DOL and DFL, respectively by using the point-to-point approach of estimating DOL and DFL. These values of instrumental variables are to be used in creating a portfolio of firms based on the size of NFATA and TDTA in testing ***hypothesis 2***.

$$(4) \quad \ln X_{jt} = a_j + c_j \ln S_{jt} + u \quad j = 1-230, t = 2002-2011$$

Where,  $c_j$  = DOL,  $X$  = PBIT,  $S$  = Annual Sales and  $u$  = Disturbance term

If PBIT is negative, the regression is run without logarithmic transformation, then

$$X_{jt} = \varphi_1 + \varphi_2 S_{jt} + \delta \quad j = 1-230, t = 2002-2011$$

After  $\varphi_2$  is estimated,  $c_j$  in Eqn. (1) is approximated by  $\varphi_2 (\hat{S}_j/\hat{X}_j)$

where,  $\hat{S}_j$  and  $\hat{X}_j$  denote the 10 - year average values of  $S_{jt}$  and  $X_{jt}$ .

$$(5) \quad \ln E_{jt} = b_j + d_j \ln X_{jt} + v \quad j = 1-230, t = 2002-2011$$

Where,  $d_j$  = DFL,  $E$  = PAT,  $X$  = PBIT and  $v$  = Disturbance term.

If PAT is negative, the regression is run without logarithmic transformation, then

$$E_{jt} = \psi_1 + \psi_2 X_{jt} + \epsilon \quad j = 1-230, t = 2002-2011$$

After  $\psi_2$  is estimated,  $d_j$  in Eqn. (2) is approximated by  $\psi_2 (\hat{X}_j/\hat{E}_j)$

where,  $\hat{X}_j$  and  $\hat{E}_j$  denote the 10-year average values of  $X_{jt}$  and  $E_{jt}$ .

$$(6) \quad NFATA_i = [\Sigma(NFATA_{it})/10], t = 2002-2011 \quad i = 1-230$$

Where,  $NFATA_i$  = Firm i's 10 year average NFATA ratio;

NFATA = Value of NFATA ratio of firm i at the end of each year.

$$(7) \quad TDTA_i = [\Sigma(TDTA_{it})/10], t = 2002-2011 \quad i = 1-230$$

Where,  $TDTA_i$  = Firm i's 10 year average TDTA ratio;

TDTA = Value of TDTA ratio of firm i at the end of each year.

The control variables used in this study are also required to be measured. The firm size is measured as logarithm [6] of TA. ROA is measured as Net operating profit after tax (hereafter NOPAT) divided by TA. Table 3 is presented in next page for summarizing the sample of data, variables, and methods considered in the present study.

**TABLE 3: SUMMARY OF SAMPLE OF DATA, VARIABLES AND METHODS**

<b>S. No.</b>	<b>Particular</b>	<b>Description</b>
1.	Context	India, an emerging market
2.	Industry	Manufacturing
3.	Classification of Industry	Nine
4.	Type of Firms	Listed on National Stock Exchange (NSE) of India
5.	Number of Sample Firms	230
6.	Method of Sampling	Purposive/Judgmental Sampling
7.	Period of Study	Ten Years from 2001-02 to 2010-11
8.	Financial Year	1 <sup>st</sup> April – 31 <sup>st</sup> March
9.	Database	Prowess database of the Center for Monitoring Indian Economy (CMIE)
10.	Independent Variables	Degree of Operating Leverage (DOL); Degree of Financial Leverage (DFL)
11.	Dependent Variables	Stock Returns; Systematic Risk (Beta); Firm Value [Price-earnings (PE) ratio]
12.	Instrumental Variables	Net Fixed Assets to Total Assets (NFATA); Total Debt to Total Assets (TDTA)
13.	Control Variables	Return on Assets (ROA); Firm size (Total Assets)
14.	Measurement of Independent and Instrumental variables	DOL and DFL: Time-series regression approach NFATA and TDTA: Point-to-point approach
15.	Measurement of Dependent Variables	Stock returns: Continuously compounded return method Systematic Risk (Beta): Market model Firm Value: Price-earnings (PE) ratio
16.	Measurement of Control Variables	ROA: [Net operating profit after tax (NOPAT) / total assets] Firm Size: Logarithms of Total Assets
17.	Statistical/Research Methods	Descriptive Statistics; Correlation; ANOVA; Post-hoc Test; Regression.

## 4.2 Regression Models

Event study and return regression are two empirical tests of value relevance. The use of return regression, a linear valuation formula, in value relevance research, is more common than event study since return regression extends added flexibility to include additional variables in the regression equation, configuration with valuation methods and ease of estimation relatively (Klimczak, 2008). However, Kothari (as cited in Klimczak, 2008) has mentioned that causality is not tested with the use of return regression. The present study uses the standard ordinary least square (hereafter OLS) multiple regression models at the levels of individual firm and portfolio of firms are employed to present the empirical results. Several previously published studies on value relevance used OLS for finding their respective empirical results and Muradoglu and Shivprasad (2009) analyzed their results at the levels of individual firm and portfolio of firms. Two types of valuation models, price model, and return model, have commonly been used to examine the relationship between market values and different accounting numbers. However, both the models are sourced from the theoretical foundations of Ohlson (1995) informational model (Ota, 2001). Moreover, Ye (2007) discussed in detail the applications and the problems of both price model and return model.

To test all three framed hypotheses, the three regression models are framed at the levels of individual firm and portfolio of firms. **Model 1** and **Model 3** are cross-sectional regression models to be performed at the individual firm level to test proposed **hypothesis 1** and **hypothesis 3**, respectively. Based on the empirical studies of Gahlon and Gentry (1982), Mandelker and Rhee (1984), Huffman (1989) and Lord (1996), **Model 2** is being set up to investigate the impact of DOL and DFL on the systematic risk of the common stock of the 230 sample firms to test proposed **hypothesis 2**. To reduce the error- in- variables bias, a portfolio grouping [7] approach

is adopted to test the combined effects of both leverages on the systematic risk in a logarithmic transformation [8] of *Model 2*. The common stocks of the 230 sample firms are ranked in ascending order on the basis of the size of NFATA (the instrumental variable for DOL) ratio and TDTA (the instrumental variable for DFL) ratio. The instrumental variables are used to correct a potential selection bias [9]. However, it is appropriate to create portfolios based upon the rankings of the size of NFATA and TDTA when these instrumental variables, NFATA and TDTA, are significantly correlated with the dependent variable, Beta (refer Table 5). We take the 10 year average of NFATA ratio and average of TDTA ratio as the instrumental variables for DOL and DFL, respectively. Every five stocks from above rank order are grouped together to form a portfolio [10]. This means we put the first five stocks in portfolio number 1, the next five in portfolio number 2 and the last five in portfolio number 46. The cross-sectional regression models at portfolio-level for two data sets created based upon the rankings of the size of NFATA and TDTA are performed to find the empirical results. It is important to mention that portfolio grouping approach based upon the ranking of the size of NFATA and TDTA is not appropriate in case of *Model 1* and *Model 3* since these instrumental variables, NFATA and TDTA, are not significantly correlated with the dependent variables, Returns and PE Ratio (refer Table 5 of correlation matrix).

$$\mathbf{Model 1:} \quad R_j = \lambda_0 + \lambda_1 \ln(\text{DOL})_j + \lambda_2 \ln(\text{DFL})_j + \epsilon_j, \quad (j=1-230)$$

Where,  $R_j$ , DOL and DFL are cumulative stock returns, degree of operating leverage and degree of financial leverage, respectively and  $\epsilon_j$  = Error term.

$$\mathbf{Model 2:} \quad \ln \text{BETA}_p = \hat{\alpha}_0 + \hat{\alpha}_1 \ln \text{DOL}_p + \hat{\alpha}_2 \ln \text{DFL}_p + \mathcal{Y}_p, \quad (p=1-46)$$

Where,  $\text{BETA}_p$ ,  $\text{DOL}_p$  and  $\text{DFL}_p$  are the portfolios (p) means of each portfolio respectively and  $\mathcal{Y}_p$  = Error term. Portfolios are formed on the basis of the size of TDTA and NFATA.

**Model 3:**  $\ln (PE)_i = \omega_0 + \omega_1 \ln (DOL)_i + \omega_2 \ln (DFL)_i + e_i , \quad (i=1-230)$

Where, PE, DOL and DFL are the price-earnings ratio, degree of operating leverage and degree of financial leverage, respectively and  $e_i$  = Error term.

The present study also takes two control variables, ROA, and firm size, to find their association with stock returns and firm value. Therefore, these two control variables are added to **Model 1** and **Model 3** to form **Model 4** and **Model 5**, respectively. In addition, a cross-sectional regression **Model 6** is formed to find a relationship between systematic risk (Beta) and the book values of DOL and DFL at firm level instead of portfolio level. An another regression **Model 7** is formed with increased number of portfolios, 58 portfolios from 232 firms, by putting only four firms' stocks in one portfolio in order to check the robustness of **Model 2**. Thereafter, these 58 portfolios are divided into two sub-portfolios of 29 firms' stocks in each sub-portfolio based upon the rankings of the size of Beta, DFL, and DOL. The next chapter 5 is presented to discuss the results of descriptive statistics, correlation matrix, the difference in returns of the firms at relative levels of risk, difference in variables across nine industries, regression coefficients and fitness of models and finally the inclusion of control variables in regression equations. Chapter 5 provides the details about the testing of proposed hypotheses and the discussions about the inferences drawn from the empirical results.

## CHAPTER 5

### RESULTS AND DISCUSSION

In the below Table 4, the descriptive statistics of all types of variables (Dependent, Independent, Instrumental, and Control) taken in the present study have been presented for the total 230 sample firms under study.

**TABLE 4: DESCRIPTIVE STATISTICS OF TOTAL SAMPLE FIRMS**

S.No.	Variable	Total Sample Firms: 230						
		Type of variable	Range	Minimum	Maximum	Mean	Standard deviation	Variance
1	Return	Dependent	9.30	-3.75	5.55	1.34	1.36	1.87
2	Beta	Dependent	1.18	0.24	1.42	0.76	0.23	0.05
3	PE Ratio	Dependent	121.34	1.00	122.34	15.39	14.82	219.65
4	DOL	Independent	5.79	0.09	5.88	1.20	0.57	0.32
5	DFL	Independent	4.84	0.06	4.90	1.33	0.58	0.33
6	NFATA	Instrumental	0.69	0.02	0.71	0.35	0.15	0.02
7	TDTA	Instrumental	1.43	0.00	1.43	0.28	0.18	0.03
8	ROA	Control	0.88	0.01	0.89	0.11	0.08	0.01
9	TA	Control	1416132	365	1416497	33411	123416	15231449436

The above Table 4 shows that the range of minimum and maximum values of each variable is relatively high among the sample firms; hence a reasonably high variance is evident. However, the variation in the case of ROA, NFATA, TDTA and Beta among the firms under study is found small. Further, the mean values of DOL and DFL of the sample firms are more

than one. These high values of DOL and DFL indicate that the NSE-listed manufacturing firms internally operate at a high level of operating and financial risks; hence their average return also looks reasonably high. Further, the sample manufacturing firms taken in the present study realistically varies regarding size (total assets) and firm value (PE ratio). However, the systematic risk or beta of the firms under study ranges from 0.24 to 1.18 with a mean value of 0.76 which could be considered an optimum level in the marketplace.

Table 5 presents the correlation matrix among all dependent and independent variables used in this study. The value relevance of accounting numbers exists if there is a positive correlation of these accounting numbers with market values (Takacs, 2012). The relationship of accounting numbers with market values is obligatory for determining the value relevance of accounting numbers (Pervan & Bartulović, 2014). There is a significant positive correlation between stock return and DOL and DFL. However, no significant correlation between stock returns and NFATA and TDTA is found. This means using the time-series approach is more appropriate than the point-to-point approach (book values of DOL and DFL) in calculating DOL and DFL and their association with stock returns.

Beta, the systematic risk, has a significant positive correlation with DFL, NFATA, and TDTA but an insignificant correlation with DOL. This means the market risk level of the listed manufacturing firms is exposed to high financial risk but reflects compensation in terms of high average stock returns. This also indicates the firm-level investment decisions have no impact on the systematic risk because of no correlation between DOL and Beta. However, how these investments are financed is important for the market? Interestingly, there is a significant positive correlation between DOL and PE ratio representing firm value. Thus, the investment decisions of the manufacturing firms certainly have an impact on the firm value irrespective of the level of

financial risk of the firms operating in the manufacturing sector of India. The next section will discuss the mean difference of all dependent variables (Stock return, Beta, and Price-earnings ratio) used in this study based on the values of DOL and DFL of the firms under study.

**TABLE 5: CORRELATION (PEARSON) MATRIX**

<b>Variables</b> ↓ →	Stock returns	Beta	PE ratio	DOL	DFL	NFATA	TDTA
Stock returns	1.000	0.026	-0.106***	0.217*	0.108**	0.032	0.067
Beta		1.000	-0.032	0.010	0.109**	0.148**	0.276*
PE ratio			1.000	0.098***	-0.028	-0.082	-0.002
DOL				1.000	0.068	-0.078	-0.074
DFL					1.000	0.311*	0.316*
NFATA						1.000	0.486*
TDTA							1.000

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent.

Table 6 defines the four different treatments and their overall relative risk levels based on the dummy values of both DOL and DFL. If the values of DOL and DFL are less than or equal to 1.00, the dummy value for DOL and DFL is '0' (zero). If the values of DOL and DFL are more than 1.00, the dummy value for DOL and DFL is '1' (one). The following are the description of treatment numbers:

- Treatment No.: **One**, if dummy values of both DOL and DFL are zero.
- Treatment No.: **Two**, if dummy values of DOL and DFL are zero and one, respectively.
- Treatment No.: **Three**, if dummy values of DOL and DFL are one and zero, respectively.
- Treatment No.: **Four**, if dummy values of both DOL and DFL are one.

**TABLE 6: FOUR TREATMENTS AND THEIR RISK LEVELS**

Value of DOL	Value of DFL	Dummy value (DOL)	Dummy value (DFL)	Treatment No.	Overall Level of Risk (Level with type of risk)
Less than or equal to one	Less than or equal to one	0	0	one	Low (both operating and financial risks)
Less than or equal to one	Greater than one	0	1	two	Moderate (low operating risk and high financial risk)
Greater than one	Less than or equal to one	1	0	three	Moderate (high operating risk and low financial risk)
Greater than one	Greater than one	1	1	four	High (both operating and financial risks)

Oneway ANOVA and Post Hoc tests are applied to compare the different treatments for dependent variables used in this study. The results of Table 7 indicate that the defined treatments for dependent variables, Stock returns, and Beta, are statistically significantly different ( $F=5.276$ ,  $p<.01$  for Return and  $F=2.615$ ,  $p<.10$  for Beta) at 1% and 10% significance levels, respectively. In other words, the mean Return difference and the average Beta difference between groups (four treatments) are statistically significant. However, the defined treatments for dependent variable, Price-earnings (PE) ratio, are insignificant ( $F=1.644$ ) at different significance levels. This signifies that the Return and the systematic risk (Beta) are entirely different for the firms operating at low and high values of DOL and DFL. However, the firm value (PE ratio) does not depend on the risk levels, low or high, of the firms. It means there is no change in the firm value with the change in the risk levels of the firms. Also, the average return difference (1.23756) between treatments 1 and 4 is significantly different at 1% significance level as per Table 7.1. Hence, it appears that the firms with high (more than 1.00) values of DOL and DFL historically

earned a high return on the stocks than the firms with low (less than or equal to 1.00) values of DOL and DFL over a long window. Moreover, investors perceive DFL more important accounting number than DOL as mean return difference (0.91521) between treatments 1 and 2 in Table 7.1 are significant at 5% significance level. In other words, the investors earn a higher return if the firms operate at a high level of DOL and DFL and vice-versa. This means the principle 'higher the risk, higher the possibility of earning returns' holds good. Besides, when DFL is high (more than one), and DOL is small (less than or equal to one), the possibility of earning return is high as the investors perceive DFL more critical than DOL as far as the riskiness of the firms is concerned. Similarly, there is a statistically significant difference at 10% significance level in the mean Beta between treatment 2 and treatment 3 as per Table 7.2. This statistically significant difference in the average Beta between treatment 2 and treatment 3 indicates that the firms operate at moderate risk levels of DOL and DFL do significantly have the different systematic risk (Beta).

**TABLE 7: ONEWAY ANOVA AND POST-HOC TESTS BASED ON FOUR TREATMENTS OF RISK LEVEL**

**Anova**

		<b>Sum of Squares</b>	<b>Df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Stock returns	Between Groups	28.020	3	9.340	5.276	.002*
	Within Groups	400.056	226	1.770		
	Total	428.076	229			
ln (Beta)	Between Groups	.879	3	0.293	2.615	.052***
	Within Groups	25.332	226	0.112		
	Total	26.211	229			
ln (PE)	Between Groups	2.421	3	0.807	1.644	.180
	Within Groups	110.968	226	0.491		
	Total	113.389	229			

\* significance level at the 01 percent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent.

## Post Hoc Tests

**Table 7.1:** Multiple Comparisons for Dependent variable (Return)

### Tukey HSD

I(trt) J(trt)		Mean difference (I-J)	Std. Error	Sig.	95 % Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.91521**	.34021	.038	-1.7957	-.0347
	3	-.81544	.39252	.164	-1.8314	.2005
	4	-1.23756*	.32173	.001	-2.0703	-.4048
2	1	.91521**	.34021	.038	.0347	1.7957
	3	.09977	.30462	.988	-.6887	.8882
	4	-.32235	.20551	.399	-.8543	.2096
3	1	.81544	.39252	.164	-.2005	1.8314
	2	-.09977	.30462	.988	-.8882	.6887
	4	-.42212	.28384	.447	-1.1568	.3125
4	1	1.23756*	.32173	.001	.4048	2.0703
	2	.32235	.20551	.399	-.2096	.8543
	3	.42212	.28384	.447	-.3125	1.1568

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent.

**Table 7.2:** Multiple Comparisons for Dependent variable (Beta)

### Tukey HSD

I(trt) J(trt)		Mean difference (I-J)	Std. Error	Sig.	95 % Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.04957	.08561	.938	-.2711	.1720
	3	.13603	.09877	.515	-.1196	.3917
	4	.06613	.08096	.846	-.1434	.2757
2	1	.04957	.08561	.938	-.1720	.2711
	3	.18560***	.07665	.076	-.0128	.3840
	4	.11571	.05171	.116	-.0181	.2496
3	1	-.13603	.09877	.515	-.3917	.1196
	2	-.18560***	.07665	.076	-.3840	.0128
	4	-.06990	.07142	.762	-.2548	.1150
4	1	-.06613	.08096	.846	-.2757	.1434
	2	-.11571	.05171	.116	-.2496	.0181
	3	.06990	.07142	.762	-.1150	.2548

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent.

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The next section will discuss the difference of all dependent variables (stock return, Beta and Price-earnings ratio) and the instrument variables (NFATA and TDTA) used in this study

across industries of the sample manufacturing firms. All sample 230 manufacturing firms have been divided into nine industries and are assigned the codes from one to nine. Table 4 depicts the results of the difference of variables across industries.

From the Table 8 presented in next page, it appears that the stock returns are not significantly different across industries. Thus, the stock returns do not depend on in which business or industry the firms operate in rather which level of risk (operating and financial) they run matters for differentiating the stock returns. However, the systematic risk (Beta) of the sample manufacturing firms across industries is significantly different. This significant difference in beta across industries indicates that the market perceives the risk level of the firms differently depending upon in which industry or business they operate in. The study of Tan, Chua, and Salamanca (2015) also shows the difference in beta appetites across industry sectors owing to the differences in the business model of industry sectors. Since PE ratio is also not significantly different across industries, therefore the market does not value the firms based on the type of business of the firms. The present study also uses NFATA and TDTA as the instrumental variables in creating the portfolios of firms based on their size. These NFATA and TDTA are significantly different across industries as per Table 8. This significant difference in NFATA and TDTA signifies the usefulness of instrumental variables used as a basis for ranking in creating portfolios of firms.

**TABLE 8: ONEWAY ANOVA TEST ACROSS NINE INDUSTRIES OF SAMPLE MANUFACTURING FIRMS**

		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Return	Between Groups	21.221	8	2.653	1.441	.181
	Within Groups	406.855	221	1.841		
	Total	428.076	229			
ln Beta	Between Groups	2.073	8	0.259	2.372	.018**
	Within Groups	24.138	221	0.109		
	Total	26.211	229			
ln PE	Between Groups	3.803	8	0.475	.959	.469
	Within Groups	109.586	221	0.496		
	Total	113.389	229			
ln DOL	Between Groups	2.489	8	0.311	1.474	.168
	Within Groups	46.655	221	0.211		
	Total	49.144	229			
ln DFL	Between Groups	.684	8	0.086	.556	.813
	Within Groups	33.990	221	0.154		
	Total	34.675	229			
NFATA	Between Groups	.587	8	0.073	3.511	.001*
	Within Groups	4.618	221	0.021		
	Total	5.205	229			
TDTA	Between Groups	.526	8	0.066	2.209	.028**
	Within Groups	6.577	221	0.030		
	Total	7.103	229			
ROA	Between Groups	.450	8	0.056	10.197	.000*
	Within Groups	1.219	221	0.006		
	Total	1.669	229			
ln TA	Between Groups	24.910	8	3.114	1.623	.119
	Within Groups	424.044	221	1.919		
	Total	448.954	229			

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent

In the next section of this chapter, the empirical results as depicted in Table 9 are discussed and analyzed for the hypotheses developed in the Chapter 3.

***Hypothesis 1: The degrees of operating and financial leverage positively impact the stock returns of the firms.***

This study takes the combined effects of DOL and DFL on the stock returns in the Indian context and finds a statistically significant impact of both the degrees of leverage on the stock returns. Any accounting number of interest in explaining value or returns (over long windows) given other specified variables is typically deemed to be value relevant if its estimated regression coefficient is significantly different from zero (Holthausen and Watts, 2001). The accounting numbers, DOL and DFL, of my interest, are value-relevant since regression coefficients of DOL (0.709,  $p < .01$ ) and DFL (0.601,  $p < .01$ ) in ***Model 1*** from Table 9 are statistically significantly different from zero over long windows. Therefore, the empirical findings of present study fully support the ***hypothesis 1*** that the degrees of operating and financial leverage have a significant positive impact on the stock returns. This important positive impact of DOL and DFL on the stock returns leads to higher stock returns, and this also indicates that the market reflects compensation for operating risk as well as financial risk.

However, Garcia and Jorgensen (2010) found a positive association between DOL and average stock returns but a weak positive relation between DFL and average stock returns at the firm level. In other words, they concluded that DOL leads to higher average stock returns. Obreja (2006) found that financially leveraged firms tend to have higher equity returns. A positive relation between operating leverage and stock returns was reported by Novy-Marx (2011). The studies of Acheampong et al. (2014) and Abdullah et al. (2015) established a significantly negative relationship between financial leverage and stock return for selected stocks of manufacturing firms. Their studies suggest that higher DFL leads to low stock returns. The findings of Koseoglu (2014) provide evidence for the adverse effect of leverage on excess stock

returns. Novy-Marx, (2011) concluded that the operating leverage predicts the returns in cross-section and average returns are significantly higher for the firms with “levered” assets. De Medeiros et al. (2006) and Lee and Park (2014) empirically found a positive association between operating leverage and stock returns. Tabari et al. (2011) empirically found a negative and linear relation of leverage with stock returns at the levels of the firm and the portfolio of firms. AL-Qudah and Laham (2013) showed a significant association between financial leverage and stock returns for 48 industrial companies listed on Amman Stock Exchange for the period between January 2000 and December 2009. The studies of Korteweg (2004), Dimitrov and Jain (2006) and Penman et al. (2007) (as cited in Muradoglu and Shivprasad, 2009) showed a negative relationship between leverage and stock returns for the firms other than utilities. It shows that there are mixed empirical results of an association between degrees of leverage and the stock return and the impact of both degrees of leverage on the stock returns including the empirical results of this study in the context of India. However, the present study depicts significant combined effects of DOL and DFL on stock returns for listed manufacturing firms of Indian which probably happens due to an increased size and participation of international investors (Nguyen and Schüßler, 2013) in the Indian stock market. This increased size and participation of international investors in the Indian stock market suggests that the interest variables, DOL and DFL, of this study are value-relevant for the listed manufacturing firms in India and the accounting numbers undoubtedly consider being useful for the stock market participants.

***Hypothesis 2:** The degrees of operating and financial leverage positively impact the systematic risk of common stock of the firms.*

The statistically significant differences among group means of NFATA and TDTA from Table 4 across nine industries support the usefulness of the instrumental variables (NFATA for DOL and TDTA for DFL) for forming portfolio based upon the ranking of the size of NFATA

and TDTA. The empirical findings of present study from Table 9, *Model 2.1* and *Model 2.2*, partially support the *hypothesis 2*. Based upon the ranking of size of TDTA and NFATA, there is a significant positive impact of DFL on the systematic risk due to a positive correlation of DFL with Beta, NFATA and TDTA as per Table 5 of the correlation matrix. This positive association and impact of DFL lead to higher systematic risk or beta. Also, DFL explains a significant portion of the variation in the beta of the common stocks. However, based upon the ranking of the size of TDTA and NFATA, there is an insignificant adverse impact of DOL on the systematic risk due to no correlation of DOL with Beta, NFATA and TDTA as per Table 5 of the correlation matrix. The result of an association between DFL and systematic risk of this study is consistent with the findings of Beaver, Kettler, and Scholes (1970), Pettit and Westerfield (1972), Logue and Merville (1972), Breen and Lerner (1973) and Huffman (1989). But this association between DFL and systematic risk contradicts with the empirical evidence of Melicher (1974), Thompson (1976), Lord (1996) and Garcia and Jorgensen (2010) which indicate no or very weak association between DFL and systematic risk. However, Gahlon and Gentry (1982) constructed the models that enhance the presentation of DOL and DFL as real-asset risk measures affecting systematic risk (beta) of common stocks and Lev (1974) empirically found operating leverage as one of the real determinants of systematic risk. Mandelkar and Rhee (1984) addressed the contribution of combined effect of DOL and DFL in explaining the systematic risk of common stocks and are found a positive association between DOL and DFL and systematic risk. They also hypothesize the negative correlation between DOL and DFL.

Further, Huffman (1989) replicates and updates the study of Mandelkar and Rhee (1984) but found inconsistent results, a negative relationship between DOL and systematic risk and positive correlation between DOL and DFL. Moreover, the investors are more sensitive to the

financial risk of the firms than operating risk since DOL has no significant contribution in explaining the systematic risk. Lee and Park (2014) found that DOL and the systematic risk are positively associated. Alaghi (2011, 2013) found a significant effect of DFL on the systematic risk of listed companies in Tehran Stock Exchange. Tan, Chua and Salamanca (2015) presented a significant association of financial leverage with systematic risk for 50 non-financial listed companies in the Philippine Stock Exchange from years 2007 to 2013. Houmes, MacArthur, and Stranahan (2012) depicted positively significant association between DOL and Betas when the managers control the cost structures of publicly listed trucking firms over years 1994-2006. Ramadan, Zeyad S. (2012) explained that the financial leverage is a leading factor in estimating the systematic risk and increase in financial leverage leads to increase the risk also for 30 Jordanian industrial firms listed in ASE in the years 2001-2011. The analysis of the study of Voulgaris and Rizonaki (2011) for Greek listed firms found an adverse effect of DOL and DFL on systematic risk with the sensitivity of time in this examined relationship.

The above discussion on the several previously published studies shows the mix result, an impact of DOL and DFL on the systematic risk, of well-published empirical studies including the empirical results of this study. Reexamining the combined effect of DOL and DFL on the systematic risk in Indian context due to the inconsistent results of well-published empirical studies in the developed and developing markets is appreciable. The present study also helps predicts the corporate behaviour in taking corporate investment and financial decisions since any capital investment decision may not contribute to explaining a large portion of the variation in the beta of the common stocks. However, financial decisions are important in predicting the change in beta as DFL explains a significant part of the change in beta. Also, there is no correlation between DOL and DFL; therefore the finance managers need not sacrifice more time

in offsetting the risk from higher DOL to lower DFL and vice-versa. In other words, the firms should not engage in the trade-off between DOL and DFL since they are not correlated.

***Hypothesis 3:** The degrees of operating and financial leverage positively impact the price-earnings ratio, representing firm value.*

Table 5 of the correlation matrix depicts that DOL and the firm value are positively correlated, but there is an insignificant relationship between DFL and the firm value. Also, no significant difference in PE ratio, a proxy of firm value, of 230 sample firms distributed over *nine* industries is found as per the results of Table 8 while they are significantly different regarding the systematic risk and the size of NFATA and TDTA. The positive impact of DOL and DFL on the firm value, a *hypothesis 3*, is partially accepted from the results of *Model 3* of Table 9. There is a significant positive impact of DOL on the firm value over long-window. However, DFL does not significantly affect the firm value. Thus, the investors consider DOL a critical accounting number in evaluating the firms at the marketplace, but DFL is not valued. No effect of DFL on the firm value signifies that the value of the firms is independent of its financial leverage (Modigliani & Miller, 1958; Sarma & Rao, 1969). However, this result is inconsistent with the empirical study of Sharma (2006) who found a significant and direct relationship between firms' value and financial leverage for the firms operating in the manufacturing sector of India. The empirical study of Murphy (1968) found a significant correlation between financial leverage (long-term debt to total long-term capital) and PE ratio which suggested the higher the portion of debt in the total capital, greater is the possibility of high market valuation by achieving the high value of PE multiples at the marketplace. Lee and Park (2014) also found a strong positive relationship between operating leverage and book-to-market equity ratio.

Further, Elangkumaran and Nimalathan (2013) empirically presented the results of no significant association of DOL and DFL with EPS and share price (SP). Since EPS is the

denominator in PE ratio, this may influence the results as both DFL and EPS are calculated based upon the firms' profit after tax (PAT) or earnings that may be affected by the adoption of different accounting methods and practices of the firms. This different accounting methods and practices of the firms might be a reason that DFL and PE ratio show no significant relationship. However, DOL may be an indicator of the performance of investment decisions taken by the firms since it shows a positive association with PE ratio, representing the firm value. The firms assess the extent of leverage which produces higher stock returns and firm value by generating greater stock prices and PE ratio at the marketplace in appraising the usefulness of leverage (Murphy, 1968). However, the relevance of the size of PE ratio is not seen under most situations (Pringle, 1973). Also, one of the reasons of not finding a relationship between DFL and PE ratio is that increase in DFL, replacement of debt for equity (Pringle, 1973), reduces PE ratio due to the negative correlation between them as shown in Table 5, however statistically insignificant.

In Model 1 and Model 3 of Table 9, a low  $R^2$  is acceptable when the predictor(s) is/are statistically significant because of small p-value at 1% and 10% significance levels, respectively. Both models have fit the regression models because of the low p-value of F-test of overall significance level at 1% and 10% significance levels, respectively. Moreover, high or low  $R^2$  of a model indicates the same interpretations for significant variables. Therefore, all statistically significant predictors can produce predictions for the response variables in regression models and can be considered relevant for the study. The changes in stock prices or returns of the listed firms at marketplace depend on the type and time of information available to the investors and also the investors' behavior and perception which are difficult to predict precisely. This unpredictable behavior and perception of the investors could also be one of the reasons of low  $R^2$ . Further, the

scope of this study is not to produce the precise predictions of DOL and DFL for the response variables (Stock returns, systematic risk, and firm value).

**TABLE 9: HYPOTHESES TESTING - EMPIRICAL RESULTS FROM THE REGRESSION MODELS**

Models	Results				
<b>Model 1:</b>	$R_j = \lambda_0 + \lambda_1 \ln(DOL)_j + \lambda_2 \ln(DFL)_j + \epsilon_j, (j=1-230)$				
	$\lambda_0$	$\lambda_1$	$\lambda_2$	$R^2$	F-statistic
	1.149	0.709	0.601	0.091	11.429*
	(11.53)*	(3.79)*	(2.70)*		
	VIF	1.003	1.003		
				Durbin-Watson	2.038
<b>Model 2:</b>	$\ln \beta_p = \partial_0 + \partial_1 \ln DOL_p + \partial_2 \ln DFL_p + \Upsilon_p, (p=1-46)$				
<b>Portfolio</b>	$\partial_0$	$\partial_1$	$\partial_2$	$R^2$	F-statistic
2.1 Based upon the ranking of size of TDTA.	-0.401	-0.007	0.429	0.213	5.807*
	(-8.74)*	(-0.05)	(3.41)*		
	VIF	1.004	1.004		
				Durbin-Watson	1.591
2.2 Based upon the ranking of size of NFATA.	-0.378	0.078	0.311	0.197	5.275*
	(-10.52)*	(0.65)	(3.14)*		
	VIF	1.001	1.001		
				Durbin-Watson	1.715
<b>Model 3:</b>	$\ln(PE)_i = \omega_0 + \omega_1 \ln(DOL)_i + \omega_2 \ln(DFL)_i + e_i, (i=1-230)$				
	$\omega_0$	$\omega_1$	$\omega_2$	$R^2$	F-statistic
	2.481	0.191	-0.174	0.024	2.751***
	(46.65)*	(1.91)***	(-1.46)		
	VIF	1.003	1.003		
				Durbin-Watson	1.857

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent. Figures in parentheses are t-values.

Since DFL is found significantly correlated with NFATA and TDTA in Table 5 and DFL is also found statistically significant in *Model 1* and *Model 2* of Table 9, it leads to the existence of multicollinearity problem in the regression models. A value of variance inflation factor (hereafter, VIF) is used to address the issue of multicollinearity in multiple regression. A maximum value of 10 is the acceptable value of VIF recommended and published in the literature (e.g., Hair, Anderson, Tatham, & Black, 1995; Kennedy, 1992; Marquardt, 1970; Neter, Wasserman, & Kutner, 1989). *Model 1* and *Model 2* of Table 9 have the values of VIF within the recommended value of VIF. Therefore, the statistical significance of regression models presented in Table 9 holds good since there is no problem of multicollinearity discovered in these models.

The present study also takes some firm-level factors which could also influence stock returns and firm value, and these firm-level factors help in improving the explanatory power of the model. Therefore, the control variables, firm size, and profitability, are included in cross-section regression models, *Model 1* and *Model 3*, to form *Model 4* and *Model 5*. Firm size and profitability of the firms are represented by total assets (TA) and return on assets (ROA) of the firms, respectively. The empirical result of *Model 4* of Table 10 depicts that both the control variables, firm size, and ROA, are not associated with the stock returns but the firm size significantly affects the firm value from the *Model 5* of Table 10. However, the interest variables, DOL and DFL, of my study remain the significant accounting numbers for empirically explaining their usefulness in Indian context due to no or slight increase in explanatory power ( $R^2$ ) of the regression models after inclusion of control variables.

**TABLE 10: INCLUSION OF CONTROL VARIABLES - RESULTS FROM THE REGRESSION MODELS**

Models	Results						
<b>Model 4:</b>	$R_j = \mu_0 + \mu_1 \ln(DOL)_j + \mu_2 \ln(DFL)_j + \mu_3 (ROA)_j + \mu_4 \ln(TA)_j + \epsilon_j,$ $(j=1-230)$						
	$\mu_0$	$\mu_1$	$\mu_2$	$\mu_3$	$\mu_4$	$R^2$	F-statistic
	1.015 (1.71)***	0.726 (3.82)*	0.598 (2.67)*	-0.755 (-0.74)	0.024 (0.37)	0.094	5.847*
<b>Model 5:</b>	$\ln(PE)_i = \omega_0 + \omega_1 \ln(DOL)_i + \omega_2 \ln(DFL)_i + \omega_3 (ROA)_i + \omega_4 \ln(TA)_i + \xi_i,$ $(i=1-230)$						
	$\omega_0$	$\omega_1$	$\omega_2$	$\omega_3$	$\omega_4$	$R^2$	F-statistic
	1.649 (5.28)*	0.236 (2.37)**	-0.155 (-1.32)	-0.228 (-0.426)	0.093 (2.81)*	0.057	3.416*

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent. Figures in parentheses are t-values.

This study also runs **Model 6** of Table 11 at individual firm-level in place of the level of a portfolio of firms to explore the combined impact of DOL and DFL on the systematic risk. No individual or combined impact of DOL and DFL at firm-level is found when the time-series values of DOL and DFL are used. Therefore, it is recommended to run the regression **Model 6** of Table 11 based on the book values of DOL and DFL. Since portfolios of firms are formed by the size of NFATA and TDTA, then the book values of DOL and DFL as represented by the values of NFATA and TDTA of each firm have been used in **Model 6** to find the results of the cross-sectional regression model. The results of Table 11 indicate that the explanatory power ( $R^2 = 9.3\%$ ) of regression **Model 6** is 9.3% which is quite less than the explanatory power ( $R^2 = 9.3\%$ ) of regression **Model 6**.

=21.3% and  $R^2 = 19.7\%$ ) of regression *Model 2.1* and *Model 2.2* of Table 9, respectively. Therefore, using portfolio-grouping approach (Mandelkar and Rhee, 1984) of determining the combined effects of DOL and DFL on the systematic risk (Beta) for the sample manufacturing firms is more appropriate than individual firm-level approach.

**TABLE 11: SYSTEMATIC RISK AT INDIVIDUAL FIRM-LEVEL**

Models	Results				
<b>Model 6:</b>	$\ln \text{BETA}_i = \partial_0 + \partial_1 \text{NFATA}_i + \partial_2 \text{TDTA}_i + \varepsilon_i,$				$(i=1-230)$
	$\partial_0$	$\partial_1$	$\partial_2$	$R^2$	F-statistic
	-0.507	0.047	0.566	0.093	11.677*
	(-9.23)*	(.289)	(4.07)*		

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent. Figures in parentheses are t-values.

To further check the *Model 2* the present study has added two more firms to make total sample of 232 firms and then 58 portfolios from 232 firms by putting four stocks of firms in each portfolio [10] based upon the rankings of the size of TDTA and NFATA are created. The results from this regression equation are presented in Table 12 which shows that the *Model 7.1* and *Model 7.2* are well fitted due to the significance levels of F-statistic at 1%. Now both the *Model 2* and *Model 7* can be compared to the extent that the explanatory power of a significant portion of the variation of systematic risk of common stocks is concerned.

**TABLE 12: PORTFOLIOS FORMED BASED UPON THE RANKINGS OF THE SIZE OF TDTA AND NFATA**

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**Model 7:**  $\ln \text{BETA}_p = \hat{\partial}_0 + \hat{\partial}_1 \ln \text{DOL}_p + \hat{\partial}_2 \ln \text{DFL}_p + \varepsilon_p, \quad (p=1-58)$

<b>Portfolios</b>	$\hat{\partial}_0$	$\hat{\partial}_1$	$\hat{\partial}_2$	$R^2$	F-statistic
7.1 Based upon the ranking of the size of TDTA	-0.411 (-11.41)*	-0.108 (-1.21)	0.509 (5.05)*	0.328	13.475*
7.2 Based upon the ranking of the size of NFATA	-0.369 (-10.27)*	0.016 (0.16)	0.289 (3.09)*	0.148	4.789*

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\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent. Figures in parentheses are t-values.

Table 13 presents the values of means, cross-sectional standard deviations and correlation coefficients for the portfolios formed based upon the rankings of the size of **Beta, DFL, and DOL**. The 58 portfolios are ranked in ascending order by the size of **Beta, DFL, and DOL**. These 58 portfolios equally divide into two sub-groups, one (first 29 portfolios) with *low* Beta, DFL and DOL and another (rest 29 portfolios) with *high* Beta, DFL and DOL, to determine the values of means, standard deviations and correlation coefficients of the portfolios. In a case of the whole portfolio for each basis of rankings, the findings from Table 9 show no statistically significant correlation between DOL and DFL which is inconsistent with the trade-off hypothesis, statistically significant negative correlation between DOL and DFL, hypothesized and accepted by Mandelker and Rhee (1984). However, there is consistent statistically significant correlation between DFL and Beta which signals an association between them and an insignificant positive correlation between DOL and Beta is found which indicates no relationship between them. But interestingly the portfolios of firms with *high* DOL and Beta show a significant correlation between DOL and Beta; this indicates a positive association between

them. However, the portfolios of firms with *high* DFL have no statistically significant relationship between DOL and Beta. This means the variations in stock prices are more (standard deviation of Beta: 0.13) for the firms operating with *high* DOL than the firms with *low* DOL (standard deviation of Beta: 0.09).

**TABLE 13: MEANS, STANDARD DEVIATIONS AND CORRELATION COEFFICIENTS FOR PORTFOLIOS FORMED BASED UPON THE RANKINGS OF THE SIZE OF BETA, DFL, DOL.**

Basis of ranking	Type of Portfolio	Number of Portfolios	DOL Mean (Standard deviation)	DFL Mean (Standard deviation)	Beta Mean (Standard deviation)	$\ell$ (DOL <sub>p</sub> , DFL <sub>p</sub> )	$\ell$ (DFL <sub>p</sub> , Beta <sub>p</sub> )	$\ell$ (DOL <sub>p</sub> , Beta <sub>p</sub> )
<b>Beta</b>	Low	29	1.22 (.28)	1.24 (.18)	0.57 (.13)	-.106	.448*	-.078
	High	29	1.18 (.23)	1.40 (.33)	0.93 (.15)	-.119	-.147	.403**
	Whole	58	1.20 (.25)	1.32 (.27)	0.75 (.23)	-.124	.262**	.031
<b>DFL</b>	Low	29	1.14 (.19)	0.99 (.16)	0.71 (.13)	.443*	-.240	-.020
	High	29	1.26 (.38)	1.65 (.63)	0.80 (.07)	-.036	.284***	-.085
	Whole	58	1.20 (.30)	1.32 (.56)	0.75 (.11)	.129	.298**	.043
<b>DOL</b>	Low	29	0.82 (.23)	1.29 (.25)	0.77 (.09)	-.107	-.078	-.004
	High	29	1.58 (.49)	1.35 (.32)	0.74 (.13)	.197	.363**	.286***
	Whole	58	1.20 (.54)	1.32 (.28)	0.75 (.11)	.155	.181***	.043

\* significance level at the 01 per cent; \*\* significance level at the 05 per cent; and \*\*\* significance level at the 10 per cent. Figures in parentheses are t-values.

**Table 14** depicts the summary of the empirical results. Finally, the next sections of this study will take the conclusions and the limitations, implications and direction for further research in the area of value relevance of accounting numbers disclosed and published in the financial statements which are considered the most useful communication device for the firms to attract investors around the world.

**Table 14: SUMMARY OF EMPIRICAL RESULTS**

<b>S. No.</b>	<b>Details of Empirical Results</b>
1.	<b>Descriptive Statistics</b>
1.1	The sample manufacturing firms operate at high level of operating risk and financial risk. However, their average return looks reasonably high.
1.2	These manufacturing firms vary in terms of size (total assets) and firm value (PE ratio). However, the variance is not significant in case of Beta, NFATA and TDTA.
2.	<b>Correlations among Variables Studied</b>
2.1	No significant correlation between DOL and DFL at firm level is found. However, a consistent significant positive correlation between DOL and DFL at the level of portfolio of firms is found.
2.2	DOL and DFL are significantly positively correlated with the stock returns. This indicates a positive association of DOL and DFL with the stock returns. However, DOL has higher positive correlation with the stock returns than DFL.
2.3	DFL is found significantly positively correlated with Beta (systematic risk). However, insignificant correlation between DOL and Beta (systematic risk) is found. Moreover, NFATA, an instrumental variable for DOL, and TDTA, an instrumental variable for DFL, are found significantly positively correlated with Beta (systematic risk). Therefore, creating the portfolio of firms based upon the size of NFATA and TDTA is appropriate and a positive association between DFL and systematic risk is expected.
2.4	Insignificant negative correlation between DFL and PE Ratio is found. However, a significant positive correlation between DOL and PE Ratio leads to a positive association between DOL and PE Ratio, proxy of firm value.
3.	<b>Difference in Dependent Variables at various Levels of Risk</b>
3.1	Returns and beta are significantly different for the firms operating at various levels of risk represented by four treatments based upon the values of DOL and DFL. However, the levels of risk of the firms do not matter for PE Ratio as it is not found significantly different.
3.2	High level of DFL combined with high level of DOL of the firms (Treatment 4) historically earns high returns and vice-versa (Treatment 1: Low level of DOL and DFL).

4.	<b>Difference in Variables of the firms distributed across nine Industries</b>
4.1	Returns and PE Ratio are not significantly different across nine industries. This means that returns earned and value of firm are independent of the nature of industry in which the firms operate.
4.2	Beta and the instrumental variables, NFATA and TDTA, are significantly different across industries. This suggests that the firms operate at different level of market risk, operating and financial risks depending upon the nature of their industry.
5.	<b>Results of Regression Models</b>
5.1	<p>There is a significant positive impact of DOL and DFL on the stock returns at firm level over long-window. This means high DOL and DFL leads to high stock returns. Since the regression coefficients of DOL and DFL in the regression model are significantly different from zero; hence they are considered value-relevant.</p> <p>Moreover, the control variables, ROA and firm size, do not show any impact on the stock returns when they are included in the regression equation along with main interest variables, DOL and DFL.</p>
5.2	<p>There is a significant positive impact of DFL on the systematic risk (Beta) of the common stocks of the firms at portfolio level formed on the basis of the size of NFATA and TDTA of the firms. DOL has statistically no significant impact on beta, the systematic risk.</p> <p>Further, DOL and Beta are highly correlated when the firms have high values of DOL and Beta. Moreover, portfolio grouping approach is found more appropriate in this case as it shows higher explanatory power of the model.</p>
5.3	<p>A significant positive impact of DOL on the firm value (PE ratio) of the firms at firm level. DFL has statistically no significant impact on PE ratio, proxy of firm value.</p> <p>This means that the market compensates for sound investment decisions made by the firms. Moreover, firm size, a control variable, has significant impact on firm value. However, ROA, another control variable, has no significant impact on firm value.</p>

## CHAPTER 6

### CONCLUSIONS AND IMPLICATIONS

The data in all regression models seem fitted well for the empirical results since the F-statistic in each model is found significant. Any accounting number of interest in explaining value or returns (over long windows) given other specified variables is typically deemed to be value relevant if its estimated regression coefficient is significantly different from zero (Holthausen and Watts, 2001). The results indicate that the regression coefficients of DOL and DFL in explaining stock returns, results of *Model 1*, are significantly different from zero; therefore both DOL and DFL are value-relevant<sup>3</sup>. In other words, both types of the degrees of leverage have significant relevance for listed manufacturing firms in India, one of the fastest growing emerging markets, since the firms show the pattern of high returns over a long window for the firms operating with high DOL and DFL. However, this study depicts mix results for the impact of DOL and DFL on the systematic risk and the firm value.

Both DOL and DFL are found value-relevant in Indian context since there is a positive and significant impact of DOL and DFL on the stock returns of the sample firms over a period from 2001-2002 to 2010-2011. This finding supports the results of several previous studies conducted in a different context, data set and period. For instance, Garcia and Jorgensen (2010) found a positive relation between DOL and average stock returns in the cross-section, but they found a positive, but weak, relationship between DFL and stock returns. Obreja (2006) found that financially leveraged firms tend to have higher equity returns. Novy-Marx (2011) reported a positive relationship between operating leverage and stock returns. The returns in cross-section

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<sup>3</sup>Gupta, P. K., Kumar, S. & Verma, P. (2016). Value Relevance of the Degree of Leverages. *International Journal of Business and Emerging Markets*, Vol. 8, No.2, pp. 166-182. (Appendix 1)

can be predicted by operating leverage and average returns are significantly higher for the firms with “levered” assets (Novy-Marx, 2011). AL-Qudah and Laham (2013) showed a significant association between financial leverage and stock returns. De Medeiros et al. (2006) and Lee and Park (2014) empirically found a positive association between operating leverage and stock returns. This positive relationship of DOL and DFL with the stock returns leads to higher stock returns to the common stock of the firms. Also, the possibility of earning the returns is high as the investors perceive DFL more important than DOL as far as the riskiness of the firms is concerned. Further, a significant positive impact of DFL on the systematic risk of the common stock<sup>4</sup> of the firms is found. This indicates that higher DFL leads to higher systematic risk or beta (Mandelkar and Rhee, 1984; Huffman, 1989; Alaghi, 2011 & 2013; Ramadan, Zeyad S., 2012; Tan, Chua and Salamanca, 2015).

Further, investors consider DOL a critical accounting number in valuing the firms at the marketplace since there is a significant positive effect of DOL on the firm value (PE ratio) over long-window. For instance, Lee and Park (2014) found a strong positive relationship between operating leverage and book-to-market equity ratio. In this study, DFL has no significant impact on the firm value; therefore this shows that the firm value is independent of its financial risk. However, Rayan (2008) found that a relationship between financial leverage and firm value is a key issue and Sharma (2006) found the significant effect of firms' financial leverage on the firm value. Furthermore, the mean values of Beta, NFATA and TDTA are statistically found significant across industries. Thus, firms across various industries under study vary about the systematic risk and the degrees of leverage.

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<sup>4</sup>Gupta, P. K., Kumar, S. & Verma, P. (2016). Impact of Degrees of Operating and Financial Leverage on Systematic Risk: Evidence from India. *Academy of Taiwan Business Management Review*, Vol. 12, No. 1, pp. 140-148. (Appendix 1)

Since the estimation of year-wise DOL and DFL is not attempted in this study; therefore the use of panel data or pooled regression is not relevant to test the proposed hypotheses. This study employed the time-series regression approach for calculating DOL and DFL which was pioneered by Mandelker and Rhee (1984) and Ang and Peterson (1984). This time-series regression approach has been used extensively in the literature [e.g., Huffman (1989); DeYoung and Roland (2001); Griffin and Dugan (2003); Ho, Xu, and Yap (2004); Garcia and Jorgensen (2010)]. The time-series regression estimates seem to be more appropriate theoretically (Dugan and Shriver, 1989). Further, the point-to-point approach of estimating the degrees of operating and financial leverage i.e. NFATA and TDTA is not relevant for creating panel data and using pooled regression to test the proposed hypotheses because of the following reasons:

- i. No significant correlation between the stock returns and NFATA & TDTA is found. This means that the application of pooled regression is not relevant to anticipate the impact of DOL and DFL on the stock returns (Hypothesis 1).
- ii. A significant correlation is found between beta and NFATA and TDTA. This indicates the use of pooled regression for testing proposed Hypothesis 2. In this study, Hypothesis 2 is tested based on well-established portfolio-grouping approach employed by Mandelker and Rhee (1984) and Huffman (1989) which have not recommended to employing pooled regression. Further, these studies used NFATA and TDTA as the instrumental variables for DOL and DFL, respectively.
- iii. No significant correlation between the price-earnings (PE) ratio and NFATA & TDTA is found. This means that the application of pooled regression is not relevant to anticipate the impact of degrees of leverage on the firm value, represented by PE ratio (Hypothesis 3).

The empirical findings of this study are not only considerably worthy of scholarly attention but also relevant for various interested participants using accounting numbers for decision-making in the marketplace. Following are the several indications pointing towards the need for this study. **First**, the value relevance of the degrees of leverage found in this study is enrichment to the value relevance literature in the Indian context. **Second**, the previous studies in the Indian context examined the value relevance of several independent variables (e.g. earnings, accrual earnings, book value per share, earnings per share, cash flows from an operation, changes in earnings and book value). However, there is a lack of research in the context of India that takes two important accounting numbers, DOL and DFL, as independent variables to examine their value relevance. Therefore, these two accounting numbers, DOL and DFL, of this study are new to the list of variables explored empirically in the previous research studies. **Third**, this study produces evidence that the firms operating with high degrees of leverage historically earn higher returns than the firms with the low degrees of leverage. This means high risks are compensated. **Fourth**, the applicability of various well-published theories established in the developed markets has been reexamined in the context of an emerging market, called India. **Fifth**, stock returns and firm value across industries are statistically not significant; however, systematic risk is statistically found significant across industries. This indicates the different industries are exposed to different market risk depending upon their business models, investment and financing decisions. **Sixth**, the present study provides the valuable insights to the managers of the manufacturing firms while reporting its financial reports or statements and various market participants for the usefulness of DOL and DFL at marketplace.

Furthermore, this study has taken firm-level and portfolio-level approaches to find the empirical results and check the robustness of methods and results. This study also finds that the

use of instrumental variables is appropriate for the portfolio grouping approach when there is a significant correlation of these instrumental variables with the dependent variable(s). If there is no correlation, then using firm-level approach is more appropriate.

The value relevance study of Mousa and Desoky (2014) discussed the practical implications of their research for the professionals, the investment community, the educators and the associations or regulators involved in improving the financial reporting. This study also provides an important insight to the practitioners, the researchers, the finance managers and the investors for the significance of accounting numbers in the context of India, one of fastest growing emerging markets in the world. The present study could be useful for corporate or security valuation in case of mergers and acquisitions. However, it is to ensure the key sources of valuable accounting information to the investors who can influence the process of security valuation (Fiador, 2013). The present study is the enrichment to the literature of CMBAR which explores the association between the stock price-based dependent variable and independent accounting variables in the Indian context. In other words, this study achieves its usefulness by contributing to the existing literature of CMBAR and Value Relevance Research in an emerging market, the empirical findings, and its relevance to the various market participants and scholars.

For the purpose of reporting, the listed firms can calculate DOL and DFL by using time-series regression approach from the last ten years data for revenue and profit figures. These values of DOL and DFL can be submitted in that section of annual reports where ten years financial information is presented by most of the Indian listed firms in its annual report. It indicates the firms' riskiness level, operating and financial, over a period of ten years. In that section, the firms should present the cumulative returns of the firms in the same period for its investors. However, the firms may also display the values of DOL and DFL in its quarterly

reports by taking the revenue and the profit figures of last ten quarters and cumulative returns for the same period. If the listed Indian firms start reporting these numbers on a regular basis in its quarterly/annual, then the investors at marketplace will recognize the usefulness of DOL and DFL. Since this study has found the value relevance of DOL and DFL, therefore it is suggested that the listed Indian firms should disseminate the values of DOL and DFL in its quarterly/annual reports.

## CHAPTER 7

### LIMITATIONS AND FUTURE RESEARCH

This study is limited to the NSE-listed manufacturing firms in India for a period of ten years from 2001-2002 to 2010-2011 including the recessionary period that could affect the empirical results. Moreover, the sample manufacturing firms under this study are 230 only. The present study is limited to an emerging market, the India. The changes in DOL and DFL over time are not discussed as the estimation of year-wise DOL and DFL is not attempted in this study. A panel data or pooled regression method could be applied to test the stated hypotheses if year-wise DOL and DFL are available. However, the usefulness of this study cannot be undermined due to the above limitations since the present study extends the efficacy of well-established theories (e.g. valuation theory; theory of risk decomposition; capital asset model theory; capital structure theory) developed earlier in the literature. Since this study is based on these well-accepted theories and reliable methodologies; hence its findings are considered relevant in the Indian context. Further, these limitations are not so critical that could significantly jeopardize the results of the present study.

The further research is directed to explore the relationship of degrees of leverage with other micro and macro-economic factors for larger sample size and period in the context of emerging markets. The changes over time in dependent and independent variables are noted, and then the relationships among them could be examined. Also, the value relevance of accounting numbers could be investigated across stock markets with same period and sample size. The impact of the application of International Financial Reporting Standards on value relevance of accounting numbers may be explored. Besides, the same study could be revisited in the context of under-developed markets to test the consistency of the empirical results of this study.

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- [8] Note that Mandelkar and Rhee use a logarithmic transformation to avoid a nonlinear multiplicative effect of financial structure on operating risk as well as on the beta of risky corporate debt.
- [9] Mandelkar and Rhee, pp.52 reports the work of Theil, H. (1971), pp.445 from his book.
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## Appendix 1: List of Publications

S. NO.	DETAILS OF PUBLICATIONS
1.	<b>Conference Proceedings</b>
	Gupta, P.K., & Kumar, S. (2012). Value Relevance Research: A review. <i>Proceedings of National Conference on Changing perspectives and paradigms in Business and Behavioural Sciences</i> , pp. 270-275. Patiala, India: Thapar University.
2.	<b>Journal Publications</b>
2.1	Gupta, P. K., Kumar, S. & Verma, P. (2016). Association between Degree of Leverages and Firm Value. <i>Asian Journal of Finance &amp; Accounting</i> , Vol. 8, No.1, pp. 212-229. <a href="http://dx.doi.org/10.5296/ajfa.v8i1.9455">http://dx.doi.org/10.5296/ajfa.v8i1.9455</a>
2.2	Gupta, P. K., Kumar, S. & Verma, P. (2016). Value Relevance of the Degree of Leverages. <i>International Journal of Business and Emerging Markets</i> , Vol. 8, No.2, pp. 166-182. <a href="http://dx.doi.org/10.1504/IJBEM.2016.076603">http://dx.doi.org/10.1504/IJBEM.2016.076603</a>
2.3	Gupta, P. K., Kumar, S., & Verma, P. (2016). Impact of Degrees of Operating and Financial Leverage on Systematic Risk: Evidence from India. <i>Academy of Taiwan Business Management Review</i> , Vol. 12, No. 1, pp. 140-148.