Determinants of capital structure: an empirical study of manufacturing firms in India

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Abstract

Purpose – The purpose of this paper is to explore the most significant determinants of capital structure of manufacturing firms in India and to investigate whether the capital structure models derived from foreign research provide convincing explanations for capital structure decisions of Indian firms by using multiple regression model.

Design/methodology/approach – Different conditional theories of capital structure like trade off theory, pecking order theory and agency theory are reviewed to formulate testable propositions concerning determinants of capital structure of manufacturing firms. Multiple regression model and correlation matrix have been used as statistical tools to investigate the most significant determinants of capital structure of manufacturing firms in India with the help of SPSS Software for a sample of top 100 manufacturing firms listed in BSE.

Findings – The results suggest that variables like asset composition, business risk and return on assets are positively related to debt ratio whereas firm size and debt service capacity are negatively related to debt ratio. The asset composition, business risk and return on assets appear to be significant determinants of capital structure, while firm size and debt service capacity are insignificant determinants.

Research limitations/implications – The findings of this study are consistent with predictions of trade off, pecking order and agency theory of finance which helps in understanding financing behaviour of firms in India.

Practical implications – This study has laid some ground work to explore the determinants of capital structure of Indian firms upon which a more detailed evaluation could be based. Furthermore, empirical findings should help corporate managers to make optimal capital structure decisions.

Originality/value – To the authors' knowledge, this study is the first that explores the most significant determinants of capital structure of manufacturing firms in India by using the most recent data. Moreover, this study also confirms that same factors affect the capital structure decisions of firms in developing countries as identified for firms in developed economies.

Keywords Capital structure, Determinants, Leverage, Manufacturing

Paper type Research paper

1. Introduction

The determinants of capital structure have been one of the most contentious topic in finance literature (Thies and Klock, 1992) since Modigliani and Miller (M&M) introduced their capital structure propositions in 1958 and 1963 (Garg and Shekhar, 2002). Following the

seminal work of M&M on capital structure, the issue of capital structure has generated great interest among financial researchers (Harris and Raviv, 1991). Despite extensive research concerning the determinants influencing the capital structure of industries in developed countries such as Rajan and Zingales (1995) (G-7 Countries), Banerjee *et al.* (1999) (the UK and the USA) and Booth *et al.* (2001) (the USA), the research concerning the most significant determinants of capital structure remains one of the most controversial issues in modern corporate finance.

Despite the plethora of research undertaken in the field of capital structure to study the relationship between debt equity ratio and characteristics of firms, the issue of determinants of capital structure has continued to receive attention from researchers for over four decades now (Poornima and Manokaran, 2012). How a firm determines its capital structure continues to be a puzzle for researchers (Myers, 1984; Booth *et al.*, 2001), and no specific method has been developed by managers to determine the optimum capital structure by testing the significance of variables in determining the capital structure or debt equity ratio of selected companies (Myers and Majluf, 1984).

A review of literature shows that many studies have been conducted to study the relationship of determinants of capital structure with theories of finance of the developed economies (Myers, 1977; Frank and Goyal, 2002; Rajan and Zingales, 1995) and developing economies (Booth *et al.*, 2001; Huang, 2006). But the findings of these studies have not led to a consensus regarding the significant determinants of capital structure in developed as well as developing economies. It is important to determine that factors which affect the capital structure of developed economies can also affect the capital structure of Indian firms. So the main purpose of this research is to study the most significant determinants of capital structure of Indian manufacturing firms listed in BSE. The paper has been organized as follows: Section 2 explains the issue concerning the determinants of capital structure in context of Indian economic and financial markets. Section 3 discusses the theoretical background and empirical determinants of Indian manufacturing firms. Section 4 presents the research methodology. Section 5 presents the results of the empirical analysis. Section 6 discusses the findings of the study. Finally, Section 7 summarizes the findings of the research and concludes the discussion.

2. Economic and financial markets in India

The issue concerning the determinants of capital structure in manufacturing sector in India has gained a lot of attention in recent years in context of fast-changing institutional framework of India. India, has introduced many market-oriented reforms in financial sectors since the mid-1980s and -1990s. The widening and deepening of various financial markets, especially capital market, has provided the scope for corporate sectors to study the significant determinants of capital structure in manufacturing firms. Currently, manufacturing industry contributes 16 per cent to India's GDP and India's share in world manufacturing is only 1.8 per cent. India's manufacturing sector is gaining momentum and has been ranked fourth in terms of textiles, tenth in leather and leather products. According to McKinsey's report, rising demand in India along with multinationals desire to diversify their products will help India's manufacturing sector to grow sixfold by 2025 to $1tn by creating 90 million domestic jobs. India may become the fifth largest manufacturing nation from ninth position at present if country is able to increase the share of manufacturing in GDP to 25 per cent, a Boston Consultancy Group Report has said on March 17, 2013. The national manufacturing policy says that India's manufacturing sector should increase its share of GDP from 15 per cent at present to 25 per cent by 2022. So taking into consideration the significance of manufacturing sector in Indian Economy, a sample of top one hundred

manufacturing companies listed in BSE 500 have been selected from capital line data base on account of having the highest sales turnover as on 1.2.2011 out of a universe of 500 manufacturing companies for a period of 10 years from 2002-2003 to 2011-2012. These 100 companies thus selected have been classified into 11 industries.

3. Theoretical distribution and empirical determinants
The theories of corporate capital structure had long attracted the interest of researchers in developed countries. The studies on corporate capital structure had been concentrated upon in the developed countries like Germany and the USA and UK. From the existing literature, we found that studies done by Modigliani and Miller (1958, 1963), DeAngelo and Masulis (1980), Antoniou (2008), Myers (1984), Barton and Gordon (1988) and Barclay and Smith (1995) examined the theory of capital structure for corporations in France, Germany and the USA and the UK, and other developed countries.

3.1 Capital structure theories
In recent years, many theories have been proposed to explain the determinants of capital structure of firms. These theories suggest that firms select capital structure patterns on the basis of various costs and benefits attached with debt and equity financing. The modern theory of capital structure was initiated by M&M in 1958, highlighting issues like the value of a firm is independent of its capital structure and average cost of capital of a firm is completely independent of its capital structure. After M&M, many other theories as well as models of corporate capital structure like pecking-order theory (POT), trade-off theory (TOT), agency theory and bankruptcy theory were also evolved to study the determinants of corporate capital structure (Eldomiaty and Azim, 2008; Luigi and Sorin, 2009).

The first theory is the POT (Myers 1977, 1984; Myers and Majluf 1984), which builds upon asymmetric information between managers and investors (Ghosh and Cai, 1999). Firms prefer funding sources with the lowest degree of asymmetric information, as borrowing costs increase when we are obtaining funds from outside lenders. The POT implies that firms opt first for internally generated funds, then for debt and only as a last resort for outside equity.

The another theory is TOT, which states that a firm chooses the optimal capital structure by balancing tax benefits of debt and the costs of financial distress (DeAngelo and Masulis 1980; Bradley et al., 1984; Eriotis et al., 2007; Hennessy and Whited, 2005). Many researchers (Frank and Goyal, 2008; Graham and Harvey 2001; Hovakimian et al., 2001; Hovakimian and Tehranian, 2004) also support for pecking-order and trade-off capital structure hypothesis. They have identified a number of empirical facts on TOT and POT of finance. It has been identified that private firms use retained earnings and bank debt heavily. Small public firms make active use of equity financing and large public firms primarily use retained earnings and corporate bonds.

Many researchers as well as thinkers (Jensen and Meckling, 1976; Myers, 1977; Stulz 1990; Hart and Moore 1995) support and provide an evidence for agency costs of debt and equity financing. The agency theory implies that high leverage reduces agency costs and increases the value of firm by encouraging managers to act more in the interest of equity holders. (Grossman and Hart 1982; Williams 1987).

3.2 Determinants of capital structure
Most of the empirical evidence on capital structure comes from studies of determinants of corporate debt ratios (Titman and Wessel, 1988; Rajan and Zingales 1995;Graham 1996) and studies of issuing firm's debt versus equity financing choice (Marsh 1982; Jalilvand and

Harris 1984; Bayless and Chaplinsky 1990; Berens and Cuny 1995; Jung and Stulz,1996). These studies have found firm characteristics such as size, asset tangibility, profitability, business risk and return on capital used as most significant determinants of corporate financing choices. We discuss below the literature related to these determinants of leverage or debt equity ratio as well as their relation to capital structure theories in detail.

3.2.1 Profitability. Profitability plays an important role in leverage decisions. The TOT predicts a positive relation between profitability and debt equity ratio. Abor (2005) highlights that a profitable firm can afford to have more debt in its capital structure, as it has great potential to absorb a large sum of interest and gain a tax shield arising out of a high debt ratio. On the other hand, POT predicts a negative relation between profitability and debt equity ratio because more profits lead to more retained earnings and less reliance on external funds, suggesting that in the presence of asymmetric information, firms adopt a certain fixed pattern to rank different financial alternatives. They would select internal finances over external finances. Several empirical studies have found a negative relationship between leverage and profitability of firm (Myers and Majluf, 1984; Kester 1986; Titman and Wessel, 1988; Allen 1992; Jenson *et al.*, 1992; Rajan and Zingales 1995; Bhaduri, 2002; Booth *et al.*, 2001). The findings of these studies indicate the negative and significant relationship between profitability and debt equity ratio and support pecking order theory. Indian and Nepalese studies also show same evidence as foreign studies do (Baral, 1996). Hence, our first empirical proposition or hypotheses based on POT is as follows:

P1. Profitability is negatively related to leverage.

3.2.2 Firm size. This is a second determinant of capital structure. TOT suggests a positive relationship between firm size and leverage. Large companies have high level of indebtness. Large firms are more diversified with less risk of bankruptcy. Several empirical studies find a positive relationship between a firm size and leverage (Bhaduri, 2002; Titman and Wessel, 1988). POT suggests a negative relation between debt and firm size. Myers and Majluf (1984) suggested that information asymmetries are less in case of larger firms and can have the advantage to issue equity instead of debt. Our second empirical proposition or hypotheses based on TOT theory is:

P2. Firm size is positively related to leverage.

3.2.3 The firm's asset composition or asset structure. This is another factor determining the capital structure. Companies having more tangibles assets can afford large amount of debt as tangible assets can provide better collateral (Booth *et al.*, 2001; Rajan and Zingales 1995; Titman and Wessel, 1988). So TOT suggests a positive relationship between debt ratios and asset structure, but POT suggests no particular relationship. According to Jensen and Meckling (1976), a higher amount of tangible assets leads to higher leverage. Empirical studies like Rajan and Zingales (1995) and Booth *et al.* (2001) also confirm TOT. Hence, our third empirical proposition based on TOT is as follows:

P3. Asset structure is positively related to debt ratio.

3.2.4 The business risk or volatility. This is also another determinant of capital structure. The TOT theory suggests a positive relationship between business risk and leverage. But POT suggests a negative relationship between business risk and leverage. Bhaduri (2002) states that as debt involves a commitment of periodic funds, highly leveraged firms are prone to financial distress costs. Therefore, firms with volatile incomes are likely to be less leveraged. Thus, higher variability in earnings implies increasing probability of bankruptcy. So we can expect that firms with higher income variability have lower leverage.

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Firms that have high operating risk (volatility in earnings) can lower the volatility of net profit by reducing the level of debt. Hence, our fourth preposition as per TOT theory is as follows:

P4. Business risk or volatility is positively related to leverage.

3.2.5 Debt service capacity or interest coverage ratio. This is yet another determinant of capital structure. TOT suggests a positive relationship between debt service capacity and capital structure of enterprises. The debt service ratio measured by ratio of operating income to total interest charges indicates firm's ability to meet its interest payments out of its annual operating incomes. High debt service ratio shows higher debt capacity of firms. The several empirical studies also find a positive relationship between debt service capacity and capital structure of enterprises (Booth *et al.*, 2001). Our fifth empirical proposition or hypotheses based on TOT theory is the following:

P5. There is a positive relationship between debt service capacity and capital structure.

4. Description of the data and research methodology

4.1 Data set

Our data set has been provided by Capitaline Database, one of the most reliable and empowered Indian Corporate databases. This database provided a list of top one hundred manufacturing companies listed in BSE 500 on account of having the highest sales turnover as on 1.2.2011 out of a universe of 500 manufacturing companies. The main concern for taking the list of top companies is that our data is self-elected as it comes from Capitaline Database. We believe that our target sample size of 100 is highly representative of universe of whole manufacturing industries of India for several reasons. First, Capitaline is a financial and non-financial database with analytical tools. This should reduce the potential for selection issues to impact on our sample. It is also important to mention that when manufacturing companies have relationship with Capitaline Database; these selected companies are part of data set. This increases the relevance of dataset at hand. Second, the data has been taken from financial statements of these companies published in their annual reports for a continuous period of ten years from the websites of these companies.

These 100 companies thus selected have been classified into 11 industries such as metal, refinery and oil exploration, automobile and engineering, mining and mineral, fertilizer, construction, pharmaceutical, cement, transport, telecommunication and electric and miscellaneous industries. Out of these 100 companies, the analysis of only 91 companies could have been done due to the non-availability of data from 9 companies for a continuous period of 10 years. The present study has been based on a period of 10 years from 2002-2003 to 2011-2012.

4.2 Multiple regression model

In our study, the following model has been formulated to test the effect of following variables on debt equity mix or firm's capital structure:

$$D/E = \alpha + \beta_0 FS + \beta_1 AC + \beta_2 DS + \beta_3 BR + \beta_4 P + \varepsilon$$

where
α = Constant;
FS = Firm size;

AC = Asset composition;
DS = Debt service capacity;
BR = Business risk;
P = Profitability or return on assets; and
ε = Error term.

4.3 Measures
A model has been designed to test the effects of determinants or factors on debt equity mix or capital structure. The dependent variable is firm's debt equity ratio, which determines the level of debt financing and equity financing. The firm's debt equity mix is influenced by many factors like firm size, asset composition, profitability, growth, tax and business risk. In our study, we have selected five variables such as firm size, asset composition, debt service capacity, business risk and return on assets (ROA). These variables have been considered as independent variables. Table I shows the factors determining the debt equity choice along with their definitions. We summarize the predictions in Table I along with their measures, expected signs and relationships of previous empirical studies:

We use the different measures for capital structure as discussed below:

4.3.1 Firm size. The natural logarithm of total assets is used as the proxy for firm size (Bhaduri, 2002; Rajan and Zingales, 1995). To capture the effects of size on leverage of firm, the natural logarithm of sales is used. With this, the effects of size on leverage become non-linear (Titman and Wessel, 1988, Bhaduri, 2002).

4.3.2 Asset composition. The most widely used measure asset composition is measured as total assets upon fixed assets (Myers and Majluf, 1984; Titman and Wessel, 1988). We can relate firm leverage ratio positively to asset tangibility also (AS = Tangible assets/total assets).

4.3.3 Debt service capacity. The debt-service ratio measured by ratio of operating income to total interest charges indicates firm's ability to meet its interest payments out of its annual operating incomes

Variable	Measure	Expected signs	Relationship established by studies	Theory
Firm size	Log of sales	+	+	Trade-off theory
Asset composition/ tangibility	Fixed assets/total assets	+	+	Trade-off theory/Agency theory
Debt service capacity	Interest coverage ratio or EBIT/ interest on debentures	+	−	Trade-off theory
Business risk	Standard deviation of EBIT/average earnings before interest and taxes	+	−	Trade-off theory/agency theory/bankruptcy theory
Profitability/ return on assets	EBIT/total assets	+/−	−	Pecking order theory/ trade-off theory

Table I.
Determinants of capital structure with their measures, expected signs and relationships of previous empirical studies

Notes: In the above table, "+" indicates debt equity ratio increases with the variable specified. "−" denotes that debt equity ratio decreases with the variable mentioned. "+/−" means that it is possible to have both positive and negative relations between the debt equity ratio and the variable
Source: Compiled from various studies

4.3.4 Business risk. The current study uses the standard deviation of profits or earnings before interest and tax (EBIT) as an indicator for a firm's risk. It can also be used as the standard of deviation (SD) of percentage change in operating income.

4.3.5 Profitability. There are two measures of profitability such as ROA and profitability margin on sales (PMS). ROA represents contribution of fixed assets on profitability creation. ROA can also be called as profitability to asset ratio. ROA is ratio between net profit after taxes and average total assets. PMS is ratio of operating income over total sales. In this study, profitability is defined as earnings before interest, tax and depreciation divided by total assets.

4.4 Statistical tools

To study the impact of debt equity ratio on firm's capital structure, mean, median, standard deviation, minimum and maximum have been used for doing the statistical analysis. Apart from these tools, *multiple regression analysis* has been used to find out the influence of independent variables on dependent variable with the help of SPSS software. Further, *t*-test has also been applied to check the level of the significance of regression coefficients. The correlation matrix has also been used to find out if there is any multi co linearity among the independent variables, which would hamper the results of regression.

5. Findings and empirical results of study

5.1 Summary of variables of selected companies

Table II in appendix provides descriptive statistics on determinants of capital structure: firm size, asset composition, debt service capacity, business risk and profitability (ROA). The average of all the variables have been found by calculating the value of all the variables for selected companies from 2002-2003 to 2011-2012. Table II depicts the summary of average of variables of selected companies: Table II shows the average of values of variables like firm size, asset composition, debt service capacity, business risk, return on assets and debt equity ratio (all dependent and independent variables) for 10 years, i.e. 2002-2012.

5.2 Summary of variables of selected industries

To study the variation in industries, Table III shows the summary statistics of variables affecting the capital structure of selected industries. The average of all the variables have been found by calculating the value of all the variables for selected industries from 2002-2003 to 2012-2013. The following table depicts the summary of variables of selected industries:

The above table depicts that the average value of firm size for 10 years is significantly high in refinery/oil exploration industry (4.23). The firm size is lowest in fertilizer industry. The total value of asset composition is more in case of cement industry (0.63) as compared to other industries. The asset composition is lowest in case of mining and mineral industry. The value of debt service is the highest in telecom/electric industry (366.04) and the lowest in fertilizer industry. Business risk is more in cement industry (0.89) and very less in transport industry. ROA is the highest in case of mining and mineral industry (0.37) and the lowest in case of fertilizer industry. Debt equity ratio is very high in case of refinery/oil exploration industry (169.7) and very less in case of mining and mineral industry.

5.3 Correlation matrix

To study the relationship in variables, Table IV shows the summary statistics of correlation of variables affecting the capital structure pattern of selected industries. The following table depicts the findings of correlation of variable.

Firms	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets	Debt equity ratio
Jet Airways	3.85	0.73	10.49	1.74	0.17	5.88
Kingfisher Airlines	3.01	0.38	−1.66	−4.22	−0.004	3.47
Container Corp. Of India	3.44	0.57	716.07	0.3	0.33	0.003
Cipla	3.55	0.38	94.66	0.53	0.26	0.11
Lupin	3.34	0.43	17.13	0.65	0.23	0.8
Dr Reddy's	3.47	0.2	137.76	0.63	0.18	1.01
Shree Cement	3.17	0.52	5.62	1	0.33	1.2
Ultra Tech	3.37	0.74	9.25	0.9	0.31	0.74
India Cements	3.32	0.63	3.24	0.76	0.19	2.29
ABB	3.57	0.28	152.37	0.84	0.33	0.004
Bharti Airtel	3.85	0.67	29.81	1.11	0.24	0.36
BHEL	4.26	0.14	102.59	0.75	0.35	0.043
Reliance Communication	2.47	0.25	2.2	1.11	0.05	0.38
Idea Cellular	3.65	0.81	2.35	0.76	0.18	1.82
Reliance Infrastructure	3.8	0.27	4.4	0.68	0.1	0.49
Siemens	3.73	0.28	2980.21	0.58	0.44	0.003
Videocon Industries	2.97	0.5	2.3	0.84	0.11	0.86
Crompton Greaves	3.42	0.4	18.17	0.73	0.38	0.39
Mahindra & Mahindra	4.03	0.33	24.64	0.73	0.27	0.46
TVS Motor Company	3.57	0.68	9.25	0.49	0.26	0.65
Honda Siel Power Products	2.4	0.28	129.95	0.6	0.19	0.02
Exide Industries	3.36	0.49	45.86	0.77	0.29	0.39
Tata Motors	4.38	0.46	5.13	0.51	0.25	0.69
Larsen & Toubro	4.33	0.25	14.13	0.71	0.27	0.46
Maruti Suzuki	4.22	0.41	56.03	0.5	0.3	0.07
Bajaj Auto	2.83	0.21	753.07	0.97	0.34	0.28
Ashok Leyland	3.79	0.58	7.61	0.43	0.22	0.7
IOCL	5.33	0.48	8.57	0.26	0.2	0.85
Reliance	5.06	0.61	10.41	0.47	0.19	0.52
BPCL	4.96	0.52	7.25	0.35	0.19	1.12
HPCL	4.95	0.53	10.9	0.36	0.18	1.21
ONGC	4.72	0.17	877.74	0.34	0.41	0.17
Essar Oil	3.45	0.35	8.82	1.8	0.04	2.99
MRPL	4.4	0.62	7.83	0.45	0.26	1.48
Gail	4.28	0.65	36.96	0.27	0.31	0.17
Ruchi Soya	3.91	0.41	109.53	0.69	0.14	1.73
Oil India	3.79	0.38	198.94	0.45	0.35	0.007
KS Oils	2.78	0.29	2.81	1.41	0.16	1.75
Petronet LNG	3.08	0.45	5.15	0.85	0.17	3.06
Sail	4.51	0.55	20.64	0.43	0.35	0.98
Tata Steel	4.26	0.45	13.03	0.47	0.3	0.75
Hindalco	4.14	0.34	10.68	0.33	0.15	0.41
JSW Steel	3.97	0.79	3.7	0.5	0.2	2.13
Sterlite	3.91	0.2	5.58	0.69	0.1	0.61
Essar Steel	3.03	0.5	1.62	0.7	0.13	3.49
Hindustan Zinc	3.69	0.37	89.61	0.69	0.41	0.08
Jindal Steel	3.6	0.59	7.9	0.68	0.24	1.24
Jindal Saw	3.43	0.35	6.37	0.8	0.22	0.89
Welspun	2.97	0.59	2.56	0.8	0.12	2.11

(*continued*)

Table II.
The average of
variables of all the
companies

Firms	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets	Debt equity ratio
JSL Stainless	3.62	0.64	3.37	0.97	0.16	2.78
Bhushan Steel	3.56	0.39	6.79	0.95	0.13	2.58
Uttam Galva	3.41	0.7	1.8	0.56	0.18	2.18
South East Agro	−0.15	0.45	0	−1.53	0.012	0
NMDC	3.63	0.11	74.72	0.78	0.49	0
Sesa Goa	3.38	0.28	92.32	0.79	0.62	0.15
JP Associates	3.68	0.4	2.76	0.68	0.16	2.03
Punj Llyod	3.44	0.29	2.68	0.77	0.17	1.3
Simplex Infra	3.31	0.37	2.59	0.69	0.17	1.97
RCF	3.6	0.45	8.96	0.48	0.16	0.51
Coromondal Biotech	0.02	0.83	−503.37	−1.24	−0.0007	0.054
Tata Chemicals	3.61	0.36	10.81	0.43	0.16	0.61
Zuari	0.37	0.005	0.77	3.16	0.005	0.39
GSFC	3.53	0.6	20.2	0.8	0.24	0.83
MMTC	4.38	0.04	2.24	0.61	0.14	2.09
ITC	4.08	0.5	956.47	0.48	0.42	0.015
STC	4.09	0.02	2.34	0.83	0.07	2
Hind Unilever	4.14	0.6	1655.68	0.24	0.96	0.18
Rajesh Export	3.79	0.18	2.68	0.9	0.1	3.24
Adani Enterprises	3.87	0.03	2.38	0.45	0.14	1.39
JK Tyres	3.46	0.74	1.65	0.58	0.15	1.46
Rei Agro	3.18	0.16	2.28	0.87	0.11	3.93
United Spirit	3.63	0.19	2.65	0.78	0.13	1.05
Lanco Infratech	2.97	0.12	5.2	1.03	0.14	0.7
Power Fin Corp	3.69	0.002	1.71	0.6	0.1	3.81
PTC India	3.58	0.06	80.84	0.69	0.14	0
Surana Corp	3.1	0.2	2.67	0.83	0.21	1.95
Asian Paints	3.53	0.48	62.97	0.68	0.56	0.09
Apollo Tyres	3.53	0.61	4.55	0.56	0.21	0.78
Alok Industries	3.36	0.45	2.16	0.88	0.13	3.13
Voltas	3.41	0.26	30.01	0.78	0.35	0.25
Titan Ind	3.38	0.39	15.46	0.96	0.37	1.37
Century Textiles	3.51	0.71	4	0.51	0.24	1.32
Kesoram Industries	3.41	0.65	4.11	1.3	0.17	1.83
National Aluminium	4955.51	0.6	170.6	0.45	0.31	0.05
Gammon	2762.84	0.42	2.73	0.64	0.15	0.88
Grasim	7025.59	0.38	19.38	0.44	0.24	0.36
North east	327.48	0.21	2.15	0.65	0.11	0
Ivrcl	3211.38	0.05	1.37	0.68	0.03	0.32
Sterlite	9930.09	0.2	5.58	0.69	0.15	0.61
Coal India	273	0.006	12.49	0.63	0.21	0.075
Aditya Birla	3935.96	0.26	3.83	0.49	0.11	0.85

Source: Computed on the basis of figures of annual reports

Table II.

It has been observed that business risk, asset composition, debt service capacity and return on assets are negatively associated to the firm size, while the debt equity ratio also has a negative relationship with firm size. This is a clear indication that larger firm size tend to have less business risk, less asset composition and less debt service capacity. But the asset composition has positive relationship with ROA and debt equity ratio. The debt service

Industries	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets	Debt equity ratio
Transport	3.43	0.56	241.63	−0.72	0.16	3.12
Pharma	3.46	0.34	83.18	0.60	0.22	0.64
Cement	3.29	0.63	6.04	0.89	0.28	1.41
Telecom/electric	3.53	0.40	366.04	0.82	0.24	0.48
Automobile/engineering	3.66	0.41	116.18	0.64	0.27	0.41
Refinery/oil extraction industry	4.23	0.46	107.07	0.66	0.22	169.7
Metal industry	3.70	0.50	75.40	0.66	0.21	1.56
Mineral/mining industry	2.28	0.28	332.67	0.04	0.37	0.05
Construction industry	3.48	0.36	2.68	0.72	0.17	1.77
Fertiliser industry	2.23	0.45	−92.52	0.73	0.11	0.48
Miscellaneous	3.60	0.48	142.11	0.73	0.35	1.53

Table III.
Showing summary of variables of all the industries

Notes: This table presents the average value of variables of all the industries computed on the basis of figures of annual reports. Definitions of all the variables are presented in Table I

Variables	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets/ profitability	Debt equity ratio
Firm size	1					
Asset composition	−0.10635	1				
Debt service capacity	−0.04497	−0.06241	1			
Business risk	−0.01881	−0.15968	−0.00456	1		
Return on assets/ profitability	−0.07641	0.142387	0.52956	0.065659	1	
Debt equity ratio	−0.13414	0.114351	−0.22454	0.054912	−0.39801	1

Table IV.
Correlation matrix

Notes: This table provides the correlation matrix for the sample 91 companies as reported in Appendix. Definitions of all the variables are presented in Table I

capacity has positive relation with return on assets. The business risk also has positive correlation with return on assets and debt equity ratio. This highlights that asset composition and business risk have positive and significant correlation with debt–equity ratio. This shows that asset composition and business risk increases with the use of more debt and decreases with the use of less debt.

The existence of correlation of about 0.8 or larger indicates problem of multi-co-linearity (Lewis-Beck, 1993). The analysis of the correlation matrix shows that none of the variables has correlation of about 0.8 or more. So there is no multi-co-linearity in variables. Hence, all the independent variables are appropriate for testing the capital structure determinants of manufacturing companies. So, the correlation matrix has been used to find out any multi-co-linearity among the independent variables which would hamper the results of regression.

5.3.1 Summary statistics across industries. The mean, median, standard deviation, minimum and maximum of firm size, asset composition, debt service capacity, business risk, ROA and debt equity ratio for manufacturing firms operating in different industries have been calculated to show the summary statistics across industries. Table V shows the summary of these variables.

The above table shows that firm size value varies among industries on an average from 2.23 to 4.23. Asset composition varies from 0.28 to 0.63. Debt service capacity ranges from

Industry statistics/ variables	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets	Debt equity ratio
Transport (n = 3)						
Mean	3.43	0.56	241.63	−0.72	0.16	3.12
Median	3.50	0.55	0	0.30	0.16	2.07
SD	0.38	0.07	652.88	3.1	0.10	3.77
Maximum	4.18	1.14	291.65	1.74	0.42	20.83
Minimum	1.361	0.17	−9.49	−4.22	−0.62	0
Pharma (n = 3)						
Mean	3.46	0.34	83.18	0.60	0.22	0.64
Median	3.55	0.39	64.31	0.63	0.24	0.23
SD	0.01	0.03	79.79	0.06	0.01	0.66
Maximum	3.84	0.62	565.99	0.65	0.33	3.72
Minimum	3.01	0.14	2.66	0.53	0.06	0
Cement (n = 4)						
Mean	3.29	0.63	6.04	0.89	0.28	1.41
Median	3.41	0.64	2.805	0.90	0.29	1.09
SD	0.51	0.14	1.94	0.11	0.07	0.99
Maximum	4.26	1.03	357.52	1.00	5.95	5.95
Minimum	0	0	−0.19	0.76	0	0
Telecom/electric (n = 9)						
Mean	3.53	0.40	366.04	0.82	0.24	0.48
Median	3.90	0.36	12.62	0.76	0.28	0.37
SD	0.69	0.13	151.71	0.17	0.04	1.55
Maximum	4.67	1.34	143.33	1.11	0.58	4.96
Minimum	0	0	−0.75	0.58	−0.08	0
Automobile/eng. (n = 9)						
Mean	3.66	0.41	116.18	0.64	0.27	0.41
Median	3.94	0.39	12.32	0.60	0.29	0.43
SD	0.57	0.04	453.54	0.17	0.08	0.1
Maximum	4.73	1.00	428.00	0.97	0.84	1.16
Minimum	0	0	0	0.43	0	0
Refinery/oil exploration (n = 13)						
Mean	4.23	0.46	107.07	0.66	0.22	169.7
Median	4.35	0.48	4.56	0.45	0.19	1.01
SD	0.49	0.10	230.09	0.47	0.03	1847.77
Minimum	0	0	−26.47	0.27	−0.0076	0
Maximum	5.64	1.09	2483.76	1.80	0.53	20244.24
Metal (n = 14)						
Mean	3.70	0.50	75.40	0.66	0.21	1.56
Median	3.78	0.49	5.45	0.69	0.17	1.16
SD	0.37	0.08	380.17	0.19	0.05	1.13
Minimum	0	0	0	0.33	−0.02	0
Maximum	4.66	0.99	4694.85	0.97	0.86	12.28

(*continued*)

Table V.
Summary statistics
across industries

Industry statistics/ variables	Firm size	Asset composition	Debt service capacity	Business risk	Return on assets	Debt equity ratio
Mining/mineral (n = 5)						
Mean	2.28	0.28	332.67	0.04	0.37	0.05
Median	3.42	0.07	0	0.78	0.50	0
SD	0.10	0.26	145.92	1.30	0.15	0.11
Minimum	−0.60	0	0	−1.46	0	0
Maximum	4.05	1.23	841.20	0.79	1.20	0.61
Construction (n = 5)						
Mean	3.48	0.36	2.68	0.72	0.17	1.77
Median	3.48	0.37	2.75	0.69	0.15	1.82
SD	0.04	0.03	0.21	0.04	0.03	0.24
Minimum	2.73	0.16	1.16	0.68	0.09	0.39
Maximum	4.10	0.58	4.01	0.77	0.38	3.33
Fertilizer (n = 4)						
Mean	2.23	0.45	−92.52	0.73	0.11	0.48
Median	3.53	0.45	6.13	0.48	0.16	0.51
SD	0.46	0.22	715.13	1.57	0.04	0.51
Minimum	0	0	−4717.95	−1.24	−0.02	0
Maximum	3.92	1.32	82.12	3.16	0.40	3.93
Miscellaneous (n = 22)						
Mean	3.60	0.48	142.11	0.73	0.35	1.53
Median	3.53	0.29	3.06	0.73	0.15	1.29
SD	0.18	0.35	929.46	0.23	0.32	0.75
Minimum	1.39	0.0005	−6.76	0.24	−0.18	0
Maximum	4.83	4.13	11243.63	1.30	4.13	10.75

Notes: This table presents the mean, median, standard deviation, minimum and maximum of selected firms for manufacturing firms operating in different industries. Definitions of all the variables are presented in Table I

Table V.

−92.5 to 366.04. As far as business risk is concerned, it ranges from −72.47 to 89.12. Return on assets ranges from 0.11 to 0.37. As far as debt equity ratio is concerned, it ranges from 0.05 to 169.79. Mining and mineral industry has the lowest debt equity ratio and refinery industry has the highest debt equity ratio.

5.4 Multiple regression analysis
Multiple regression analysis has been used to examine the relationship between debt equity ratio and characteristics of firms. The regression results for the debt equity ratio are given in table given below (Tables VI and VII).

The R^2 for the equation has been found to be 23 per cent of variation in dependent variable. This shows that the results of the regression analysis on the various determinants of the coefficient of capital structure in majority have been found to be consistent with the various research studies. The F ratio value (5.28) shows that the multiple correlation coefficient is significant at 1 per cent level of significance in the first run model. As such, out of five independent variables, only three variables were included in final run model of regression analysis. The other two independent variables have been left out of the equation

Variables	Beta (coefficients)	Standard error	t-value	Significance
Constant	1.3730	6.43937	4.69**	Significant
Firm size	0.0000	0.0000	1.53	Insignificant
Asset composition	1.0230	1.96416	1.92	Insignificant
Debt service capacity	0.0001	0.000027	0.27	Insignificant
Business risk	0.3100	0.5766	1.86	Insignificant
Return on assets	−3.7620	−15.2361	4.05**	Significant
R-square	0.237			
F ratio	5.28**			

Notes: The regression model as per the first run will be as follows: $D/E = \alpha + \beta_0 FS + \beta_1 AC + \beta_2 DS + \beta_3 BR + \beta_4 P + \varepsilon$; $D/E = 1.3730 + (0.000)\ \beta_0 + (1.0230)\ \beta_1 + (0.0001)\ \beta_2 + (0.3100)\ \beta_3 + (−3.7620)\ \beta_4$; or $1.3730 + 0.000\ \beta_0 + 1.0230\ \beta_1 + 0.0001\ \beta_2 + 0.3100\ \beta_3 − 3.7620\ \beta_4$; **significant at 1% level
Source: Output of SPSS

Table VI.
Multiple regression
analysis of the first
run model

Variables	Beta (coefficients)	Standard error	t-value	Significance
Constant	1.2760	5.69096	4.46**	Significant
Firm size				
Asset composition	1.0750	2.20375	2.05*	Significant
Debt service capacity				
Business risk	0.3070	0.56488	1.84*	Significant
Return on assets	−3.5530	−16.27274	4.58**	Significant
R-square	0.215			
F ratio	7.95**			

Notes: The regression model as per final run will be as follows: $D/E = \alpha + \beta_0 FS + \beta_1 AC + \beta_2 DS + \beta_3 BR + \beta_4 P + \varepsilon$; $D/E = 1.2760 + (0.000)\ \ \beta_0 + (1.0750)\ \beta_1 + (0.000)\ \beta_2 + (0.3070)\ \beta_3 + (−3.5530)\ \beta_4$; or $1.2760 + 0.000\ \beta_0 + 1.0750\ \beta_1 + 0.000\ \ \beta_2 + 0.3070\ \beta_3 − 3.5530\ \beta_4$; ** Significant at 1% level * Significant at 5% level
Source: Output of SPSS

Table VII.
Final run model

as their contribution is negligible. So the major findings of the variables used in the regression model are that only the variable return on assets has significant effect on debt equity ratio at 1 per cent level of significance in the first run model. But in final run model, the variables like asset composition, business risk and return on assets have significant influence on debt equity ratio. The two independent variables namely asset composition and business risk are significant at 5 per cent level of significance. Only one variable, namely, ROA is significant at 1 per cent level of significance.

6. Discussion of findings
It has been found from the analysis that return on asset/profitability is significant at 1 per cent level of significance as per the first run model as well as final run model of regression analysis. The results indicate the negative and significant relationship between profitability and debt equity ratio and support POT. Strong support is found for *P1* as profitability is an important determinant of debt equity ratios of Indian firms when it is significant and has a moderate negative correlation with debt equity ratio.

The static trade off hypothesis pleads for low level of debt capital of risky firms (Myers, 1984). The higher profitability of firms implies higher debt capacity and less risky to debt holders. So as per static trade off theory, capital structure and profitability are positively associated. But POT suggests that this relation is negative. Firms prefer internal financing and follow strict dividend policy. If internal funds are not sufficient to finance financial requirements of firm, it prefers debt financing to equity financing (Myers, 1984). Most of the studies support POT. Studies of Rajan and Zingales (1995), Titman and Wessel (1988), Kester (1986) and Allen (1992) show negative relationship between level of debt in capital structure and profitability. Indian and Nepalese studies also show same evidence as foreign studies do (Baral, 1996). Only a few studies show evidence in favour of static trade off hypothesis.

The *P2* is rejected as firm size has insignificant relationship with debt–equity ratio. Myers and Majluf (1984) suggested that information asymmetries are less in case of larger firms and can have the advantage to issue equity instead of debt.

It is found from the analysis that asset composition is not significant as per the first run model of regression analysis. But in final run model, it has been found significant at 5 per cent level of significance. So asset composition has a positive relationship with debt equity ratio which is significant as strong support is found for *P3*. Thus, the results are matching with the TOT as far as the Indian scenario is concerned. This indicates that there exists a direct relationship between asset composition and debt equity ratio. On the basis of agency theory (Jensen and Meckling 1976), a large amount of tangible assets leads to higher leverage. Empirical studies by Rajan and Zingales (1995) also confirm the above contribution. Hence, the results of our study are also matching with the agency theory.

Strong support is found for *P4* as business risk is positively related with the leverage which is significant. It has been found from the analysis that business risk is not significant as per the first run model of regression analysis. But in final run model, it has been found significant at 5 per cent level of significance. The more the use of debt, the more is the business risk. Thus, the results are matching with the TOT.

But agency and bankruptcy cost theories suggest negative relationship between capital structure and business risk. As per bankruptcy theory, the less stable earnings of the enterprise, the greater is the chance of business failure and more will be the bankruptcy costs. So as the chances of bankruptcy increases, the agency problems related to debt aggravate. So, as per this theory, with the increase in business risk, the debt level in capital structure should decrease (Taggart, 1985). Studies carried out in Western countries during 1980s show contradictory evidence in this regard (Martin *et al.*, 1988). The studies carried out in India and Nepal also shows contradictory evidence on relation between risk and debt level. Sharma (1983) shows evidence against this and Garg (1988) do for relation consistent with bankruptcy and agency cost theories.

The positive but insignificant relationship of debt service capacity with debt equity ratio shows no strong support for *P5*. It is found from the analysis that debt service capacity is not significant as per the first run model of regression analysis as well as per final run model. The results of our study match with the findings of earlier studies done by Booth *et al.* (2001). However, our findings contradict with the findings of Bradley and Harris and Raviv (1991). It has been found that the high debt level in capital structure increases chances of bankruptcy and bank costs of the enterprise. It leads to chances of cash flows to be less than amount required for servicing the debt. The debt service ratio measured by ratio of operating income to total interest charges indicates the firm's ability to meet its interest payments out of its annual operating earnings (Keoun *et al.*, 1986). So high debt service ratio

indicates higher debt capacity of enterprises. Debt capacity theory suggests positive relation between debt service capacity and capital structure of enterprises.

7. Summary and conclusion

We used a multiple regression model to study the determinants influencing the capital structure of selected manufacturing industries. Our results of determinants of capital structure are mostly as per the predictions of POT. Manufacturing firms use profits to reduce their debt level, so they prefer internal funds to external funds. The results of our study also indicate that not only profits but also asset composition and business risk are important drivers of capital structure as per POT and TOT. A more detailed investigation of this is left for future research.

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