DOI : 10.18843/ijms/v5i2(1)/06
DOI URL :http://dx.doi.org/10.18843/ijms/v5i2(1)/06

Sector and Firm Specific Variance Composition of Capital Structure: A Panel Data Analysis on Indian Chemical Industry

Shilpa N.C.,
Research Scholar (UGC-SRF),
B. N. Bahadur Institute of Management Sciences, University of Mysore, Manasagangothri, Mysore, India.

Dr. Amulya M.,
Assistant Professor,
B.N. Bahadur Institute of Management Sciences, University of Mysore, Manasagangothri, Mysore, India.

ABSTRACT

All corporate strategies are cast in background of external environment in consideration that firms cannot operate in isolation. Industry characteristics along with peer firms substantially influence and subsequently set boundaries for all strategic decisions related to financing, investing and growth decisions. Also the changes in macroeconomic situations of country and its dealings with other countries impact the monetary and fiscal policies will impact the firm decisions. The paper presents empirical examination of impact from firm, sector and year specific factors that influence the leverage decisions of firm. Multilevel regression model is expended to explain concurrently cross-sectional and time-series dependency. Hierarchical data is used to estimate the variance composition of the leverage variable. The result indicate that variance in leverage is largely contributed by firm-specific factors, advocating financial decisions linked to strategic management.

Keywords: Leverage decision, Variance, Multilevel regression.

INTRODUCTION AND LITERATURE REVIEW:

Achieving optimal capital structure by deciding the blend of debt and equity for firm to finance its operations and investments is crucial. The discourse on determining the optimal capital structure and its relevance to firm value was embarked by Modigliani and Miller (1958). Initially they argued, under ideal market assumptions, market value of firm is constant despite the amount of leverage employed. Followed by subsequent research Modigliani and Miller (1963) found violations of tax assumptions to conclude that value of levered firm is greater than value of unlevered firm because of tax benefits.

Kraus and Robert H. Lichtenberger (1973) provides insight to traditional trade off theory explaining the advantage of tax benefits of debt and its detrimental effect of financial distress. Later Miller (1977) included personal taxes and corporate taxes in view of financing decisions and concluded that capital structure matters at macro level and not for individuals. Bradley et al. (1984) presented static trade-off theory to empirically prove optimal firm leverage is inversely related to expected costs of financial distress and to the amount of non-debt tax shields. They reported that leverage ratios of firm are substantially influenced by the industry to which they belong to.

Kane et al. (1984) opined that dynamic trade off between tax benefits and financial distress cost furnishes negligible intuition in determining optimal capital structure. Brander and Lewis (1988) proposed that financial structure influences the output market equilibrium. Foresighted stakeholders of the firms will have incentives to use financial structure precisely so as to influence the output market in their favour. Fischer et al. (1989) in their model predicted the debt ratio range around which the firm allow to vary by introducing recapitalization costs. The empirical observation revealed that capital structure choice has intense fluctuations due to firm specific attributes over time.

Identical firms in the operating in same industry exhibit diverse financial structures. Nevertheless, the volatility of cash flows from new project is regulated and conditioned on the investment decisions of all firms in industry equilibrium (Maksimovic and Zechner, 1991). Opler and Titman (1994) collected data related to distressed industries rather than distressed firms to curtail the reverse causality problem. Empirical analysis revealed that during economic distress situations, highly levered firms with significant Research and Development expenditure suffer the most.

Previous studies manifests and empirically validate that numerous factors impact the decision of Capital structure. According to Frank and Goyal (2009), factors include observable variables such as profitability, size, growth and tangibility which specific to firm along with macroeconomic factors. Balakrishnan and Fox (1993) affirm that firm specific effects are more important in explaining observed cross-sectional (52%) variations in leverage compared to inter-industry variation (11%).

Harris and Raviv(1991) asserts that leverage increases with increase in fixed assets, non-debt tax shield, investment opportunity and firm size. On the other hand, leverage decreases with advertising expenditure, cost of financial distress, profitability and product distinctiveness. However, impact of firm size on capital structure has mixed opinion. Titman and Wessels (1988) compared firms based on size and found small firms use more short term debt. Also profitable firms use less debt based on pecking order theory.

Pratheepan and Yatiwella (2016) unveil inverse relationship between profitability and leverage. Conversely, Growth and size specify direct relationship with leverage. Arsov and Naumoski (2016) reveal that large firms exhibit higher leverage compared to profitable firms. Öztekin (2017) has shown that firms with profits tend to have less leverage and firm size does not have a significant influence on leverage in weak institutional settings.

According to traditional trade-off theory, increase in firm size, fixed assets, profitability increase leverage and growth opportunity has inverse relationship. The reason is due to agency conflict between shareholder and debt holder, Manager acting in shareholders' interest opts to forego value generating project. According pecking order theory, leverage elevates with increase in size, tangibility and growth opportunities but diminishes with increase in profitability. This is because internal sources of fund i.e., retained earnings is given top priority by the management. Thus debt will be reduced for profitable firm.

Chen (2003) reflects that, due to China's institutional setting and banking sector constraints, firms neither follow traditional trade-off nor pecking order hypothesis as considered in western countries. Houthoofd and Hendrickx (2012) manoeuvre multilevel analysis to explain the sources of variance of firm performance. The illustration indicated 30 to 40 % variation described by firm effects and only 10% by inter-industry effects.

Lewellen (2012) emphasizes on firms to be classified into firm specific Industry (FSI) to explain variations in capital structure. In capital intensive industries, firms encounter multi-staged financing challenges under vigilant industry rivals (Leach et al., 2013). Consequently firm decide upon the strategic debt levels leading to varying capital structures across industries.

Rajan and Zingales (1995) investigated capital structures across countries and found that institutional differences such as bank or market based orientation influence firms financing decisions. According to Showalter (1999) the unobservable characteristics specific to a particular industry influence the levels of debt within that industry. He illustrates that optimal debt equity mix perhaps used effectively will lead firm to gain a strategic position in the output market. Almazan and Molina (2002) examined the intra-industry dispersion among the six largest firms in each industry and then relate this dispersion to industry characteristics. MacKay and Phillips (2005) findings support the idea that industry factors affect individual firm decisions and financial characteristics within industries.

Degryse et al. (2009) notices that capital structure varies across industries but firm characteristics are more important than industry characteristics. Kayo and Kimura (2011) manifested that the substantial variance in leverage is explained at firm level, suggesting that management should emphasize on intrinsic firm characteristics when making financing decisions. In contradiction, Bereznicka (2013) estimates the relative importance of the industry over firm specific factors on the corporate capital structures. The conclusion drawn is that leverage ratios depend more on the industry, in which a firm operates, rather than on the firm size. Smith et al. (2014) proposed that Industry characteristics provide reason for variance in capital structures. Li and Islam (2015) demonstrate that firms tend to be more leveraged if they operate in industries with a better market performance. They conclude that industry-specific factors are important in terms of corporate capital structure formation.

Based on panel data analysis Rani et al.(2016) contemplated that profitability, size, growth opportunities and uniqueness are important determinants of capital structure for the Indian firms. Sheikh and Wang (2011) firm size is positively correlated with the debt ratio based on pecking order hypothesis. Degryse et al. (2009) report that Dutch firms are consistent with pecking order hypothesis by proving firms use profits to reduce debt and

growth firms take advantage of strategic debt.
Firm management engages in various strategies to align firm with the external environment. In manufacturing industry, firms are capital intensive and assets serve as collateral to reduce risk. However, the firm's ability to finance these assets with debt is limited since customised assets which cannot be reallocated to other firms without being altered. In such situations, leverage increases which perplex management. Thus the proficiency of management to deal with lenders will lead the firm to attain competitive advantage.
The paper is organised as follows section II presents the conceptual framework used to analyse data. Section III provides in methodology which includes sampling procedure and data sources. Section IV provides empirical results and interpretation followed by summary and conclusion presented in Section V.

CONCEPTUAL FRAMEWORK:

Strategic management has partially expressed techniques for firms to achieve competitive advantage ushering them towards superior performance. Despite there are diverse outlook towards explaining variance of capital structure, some suggesting firm specific and others referring to industry specific. The following firm variables are preferred based on past empirical studies of capital structure: firm size, tangible assets, profitability and growth
The general model is as follows:

$$y_{ijk}=\mu+\alpha_k+\beta_j+\cdots+\varepsilon_{ijk} \quad (1)$$

Where
y_{ijk} is the performance measure of unit i, at time t, for industry k, and other effects (as specified by Rumelt, 1991)
Data is structured in three level hierarchies: Firms for observing period (years) within sectors. Estimating within- and between-cluster effects discretely enables detailed and essential interpretations of individual effects. The clustered model permits to fit a regression model to the individual measurements while accounting for systematic unexplained variation among different sectors. The below clustered data representation of mixed model is used to estimate the variance composition of the leverage variable.

$$y_{itk} = x_i\beta + u_{00i} + u_{00k} + u_{00t} + \varepsilon_{ijk} \quad (2)$$

Where,
y_{ijk} is the leverage of firm i, at time t, for sector k
$x_i\beta$ is the fixed effects of dependent variables
u_{00i} is the random effect of firm i
u_{00k} is the random effect of sector k
u_{00t} is the random effect of time t
ε_{ijk} is the error term.
The variance of leverage $var(y_{itk})$ is

$$var(y_{itk}) = var(u_{00k}) + var(u_{00i}) + (u_{00t}) + var(\varepsilon_{ikt}) \quad (3)$$

METHODOLOGY:

The objective of paper is to determine the impact of firm, sector and year specific factors on leverage decisions of firm and hence empirical in nature. Indian Firms which are registered under Chemical and chemical products Industry are considered. They are classified into six different sectors namely dyes & pigments, fertilizers, inorganic chemicals, organic chemicals, pesticides and polymers. A framework of multilevel regression model is considered which accounts for cross-sectional and time-series dependency simultaneously.

Sample and data:

Our sample is composed of Indian firms listed under chemical and chemical products Industry collected from Centre for Monitoring Indian Economy (CMIE) corporate database PROWESS. It contains 56 firms listed in National Stock Exchange clustered under six sectors for the years 2010 to 2016. The procedure of constructing unbalanced static panel data set is as follows. Initially all the firms listed in manufacturing industry were collected. We choose firms which belong to chemical and chemical products Industry which had 71 firms classified under eight categories. We eliminated those sectors which had less than five firms. Annual data for seven years was gathered for the select variables.

RESULTS AND INTERPRETATION:

Table 1a contains the descriptive statistics of firm specific variables of overall observations after filtering outliers. The negative leverage of firm indicates high cost of debt compared to cost of equity financing. On the

other hand high leverage ratio indicates firm financing with high debt. The mean leverage of chemical and chemical products Industry is 0.83 which is high. Negative growth which is proxy of price to book ratio suggest assets are amplified. Table 1b presents data of individual sector mean and median. Graph 1 shows mean leverage connected by line and dispersion of leverage over mean of individual sectors. Organic chemical sector depicts huge variations in leverage ratio compared to firms of other sectors.

Table 1a: Summary statistics

Variable	Mean	Std. Dev	Min	Max
Leverage	0.83	1.42	-4.83	10.68
Profitability	0.35	0.22	0.02	2.16
Tangibility	0.36	0.16	0.04	1.02
Size	7.33	1.26	3.96	11.03
Growth	1.62	2.16	-11.86	17.89

Table 1b: Mean values of variables across sectors

sector	Leverage	Profitability	Tangibility	Size	Growth
Dyes & pigments	0.695	0.341	0.282	6.735	1.567
	(0.370)	(0.347)	(0.272)	(6.951)	(1.170)
Fertilizers	0.920	0.417	0.359	8.542	1.369
	(0.840)	(0.328)	(0.323)	(8.613)	(0.985)
Inorganic chemicals	1.441	0.285	0.425	6.791	6.438
	(0.690)	(0.238)	(0.413)	(6.758)	(0.760)
Organic chemicals	0.698	0.337	0.376	7.080	1.343
	(0.460)	(0.313)	(0.376)	(7.095)	(0.920)
Pesticides	1.748	0.250	0.312	7.469	3.160
	(0.525)	(0.255)	(0.272)	(7.358)	(2.775)
Polymers	0.305	0.535	0.393	7.531	2.011
	(0.300)	(0.481)	(0.385)	(7.385)	(1.930)

* median results are presented in parentheses

Graph 1: Leverage variations across sectors

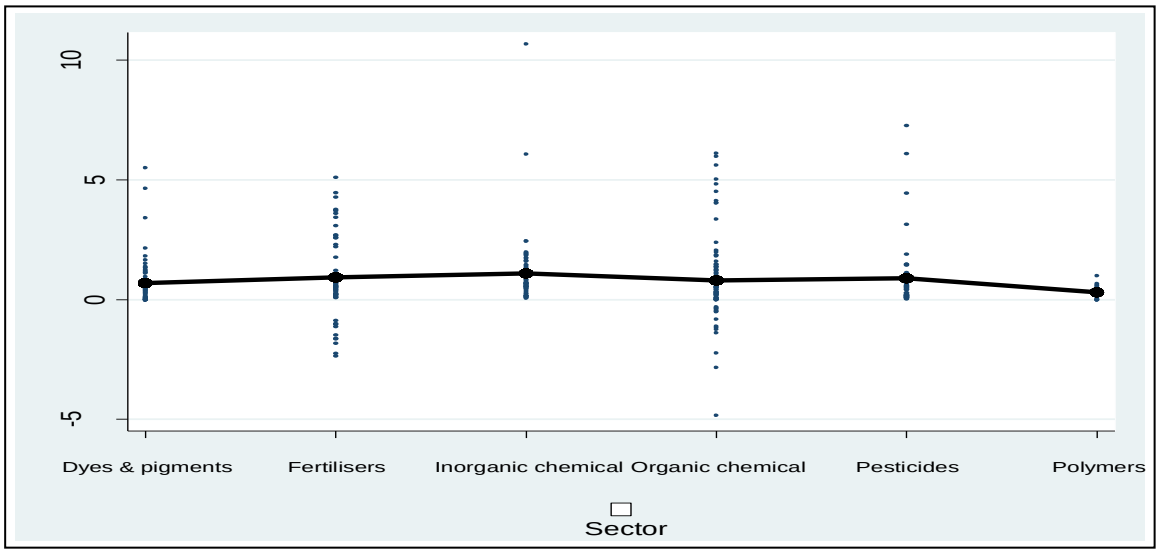

Table 3 represents the fixed effects specification considering Leverage as dependent variable regressed on firm-specific variables using maximum likelihood estimates. We use Expectation- maximization algorithm which treats random effects as missing values. The outcome indicates that profitability and growth are the variables significantly affecting leverage of firm. Profitability has inverse relation with leverage which is in line with pecking order theory that firms choose to invest new projects with retained earnings. There is no significant

relation between leverage and tangibility even though firms with tangible assets are expected to have high leverage. Regarding the firm size, smaller firms confront information asymmetry problems choose debt unlike large firms. Consequently firm size has negative relation with leverage. Finally, growth firms require large funds opt for debt as investment strategy implying positive relation between leverage.

Table 3: Fixed effects results

Variables	Coef.	Std. Error	z values	P>|z|
Intercept	0.7441	0.7273	1.0200	0.3060
Profitability	-0.8635	0.3798	-2.2700	0.0230**
Tangibility	0.4548	0.5206	0.8700	0.3820
Size	-0.0235	0.0939	-0.2500	0.8020
Growth	0.2824	0.0257	10.9900	0.0000*

*, **, *** indicates significance at 1%, 5% and 10% respectively
Source: Authors own computation

Table 4 presents the result of random effect parameters using leverage as dependent variable. Inter sector variance accounts for only 1.75% compared to firm variance which is around 82.24%. From the outcome it is empirically evident that firm effect is important while explaining capital structures.

Table 4: Variance component

Random-effects Parameters	Estimate	Std. Err.	[95% Conf. Interval]		Percentage contribution
Sector					
var(_cons)	0.0302	0.0394	0.0023	0.3897	1.75%
Firm					
var(_cons)	1.4176	0.1279	1.1878	1.6918	82.24%
Year					
var(_cons)	2.48E-11	1.71E-10	3.44E-17	1.79E-05	0.00%
Error term					
var(Residual)	0.2760				16.01%

Source: Authors own computation

SUMMARY AND CONCLUSION:

Indian chemical industry accounts for around 2.1% of country's GDP as reported by The Federation of Indian Chambers of Commerce and Industry. It currently contributes for around 3% of world chemical market positioning India as sixth largest chemical producer. In recent past, due to enthralling economic growth in India and diversification within chemical industry, there is prominent increase in demand for chemicals (extensively used as raw material) in all three major sectors viz agriculture, service and manufacturing. It provides key building blocks to a host of downstream industries such as automobiles, textiles, papers, paints, soaps, detergents, pharmaceuticals among many others. Nevertheless, domestic firms are still sluggish confronting challenges since growing demands is driving exports. To overcome stagnation and decline, firms have to establish strategic decisions related to financing, investing and growth aspects.

The optimal mix of debt and equity is one such means for firm to be going concern and path to prosperity. The objective of this paper is to empirically determine impact from firm, sector and year specific factors that influence the leverage decisions of firm. Our sample consists of 56 firms which belong to chemical and chemical products industry as indicated by CMIE prowess database. These firms are listed in National Stock Exchange clustered under six sectors for the years 2010 to 2016. Multilevel regression model framework is considered which attributes for unobserved sector, firm specific effects and time-series dependency concurrently.

In fixed effects parameter results, we find significant negative relationship between profitability and leverage which is reconcilable with pecking order indicating retention of earnings to fund the future investments rather than distributing with shareholders. Also external financing is costlier because firm tends to surrender large portion of project NPV to new investors according to information asymmetry theory. Also the firms looking out for growth opportunities require fund. They desire external financing especially debt as investment strategy

implying significant positive relation with leverage. From the random effect parameter results, it is evident that firm characteristics have major impact on capital structure decisions compared to sector and year effects. The result is in line with Balakrishnan and Fox (1993) indicating that capital structure decisions are inextricably linked to strategic management of firm.

The limitation of the study is that only 56 standalone firms from one Industry were considered in the sample. Extension of the study to realize individual firm heterogeneity by considering firm level regression can be conceived. Further, diversified chemical firms can be added to sample to investigate if there are significant differences in capital structure.

APPENDIX:

Variables	Details
Leverage	Debt to equity ratio
Profitability	Operating income to fixed assets ratio
Tangibility	Fixed assets to total assets ratio
Size	Natural log of net sales
Growth	Price to book ratio

REFERENCES:

Ahmed Sheikh, N., & Wang, Z. (2011). Determinants of capital structure: An empirical study of firms in manufacturing industry of Pakistan. *Managerial Finance*, *37*(2), 117–133.

Almazan, A., & Molina, C. A. (2005). Intra-Industry Capital Structure Dispersion. *Journal of Economics & Management Strategy*, *14*(2), 263–297.

Arsov, S., & Naumoski, A. (2016). Determinants of capital structure: An empirical study of companies from selected post-transition economies. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2803133

Balakrishnan, S., & Fox, I. (1993). Asset specificity, firm heterogeneity and capital structure. *Strategic Management Journal*, *14*(1), 3–16.

Bradley, M., Jarrell, G. A., & Kim, E. (1984). On the existence of an optimal capital structure: Theory and evidence. *The Journal of Finance*, *39*(3), 857–878.

Brander, J. A., & Lewis, T. R. (1986). Oligopoly and financial structure: The limited liability effect. *The American Economic Review*, 956–970.

Chen, J. J. (2004). Determinants of capital structure of Chinese-listed companies. *Journal of Business Research*, *57*(12), 1341–1351.

Degryse, H., de Goeij, P., & Kappert, P. (2012). The impact of firm and industry characteristics on small firms' capital structure. *Small Business Economics*, *38*(4), 431–447.

Fischer, E. O., Heinkel, R., & Zechner, J. (1989). Dynamic capital structure choice: Theory and tests. *The Journal of Finance*, *44*(1), 19–40.

Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important? *Financial Management*, *38*(1), 1–37.

Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance*, *46*(1), 297–355.

Houthoofd, N., & Hendrickx, J. (2012). Industry segment effects and firm effects on firm performance in single industry firms. In *A Focused Issue on Competence Perspectives on New Industry Dynamics* (pp. 237–264). Emerald Group Publishing Limited. Retrieved from http://www.emeraldinsight.com/doi/pdf/10.1108/S1744-2117(2012)0000006010

Kane, A., Marcus, A. J., & McDonald, R. L. (1984). How big is the tax advantage to debt? *The Journal of Finance*, *39*(3), 841–853.

Kayo, E. K., & Kimura, H. (2011). Hierarchical determinants of capital structure. *Journal of Banking & Finance*, *35*(2), 358–371.

Koralun-Bereznicka, J. (2013). The Relative Importance of Industry and Size Effect in Corporate Capital Structure Empirical Evidence from the EU Countries. *Eurasian Journal of Economics and Finance*, *1*(2), 1–27.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *The Journal of Finance*, *28*(4), 911–922.

Lewellen, S. (2012). *Firm-specific industries*. Working Paper. Retrieved from

https://sites.google.com/site/stefanlewellen/firm_specific_industries.pdf

Li, L., & Islam, S. Z. (2015). Firm and Industry Specific Determinants of Capital Structure: Evidence from Australian Market Paper.

MacKay, P., & Phillips, G. M. (2005). How does industry affect firm financial structure? *The Review of Financial Studies*, *18*(4), 1433–1466.

Maksimovic, V., & Zechner, J. (1991). Debt, agency costs, and industry equilibrium. *The Journal of Finance*, *46*(5), 1619–1643.

Miller, M. H. (1977). Debt and taxes. *The Journal of Finance*, *32*(2), 261–275.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, *48*(3), 261–297.

Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. *The American Economic Review*, 433–443.

Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. *The Journal of Finance*, *49*(3), 1015–1040.

Öztekin, Ö. (2015). Capital structure decisions around the world: which factors are reliably important? *Journal of Financial and Quantitative Analysis*, *50*(3), 301–323.

Pratheepan, T., & Yatiwella, W. B. (2016). The Determinants of Capital Structure: Evidence from Selected Listed Companies in Sri Lanka. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2725792

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The Journal of Finance*, *50*(5), 1421–1460.

Rani, A., Narain & Dhawan, S. (2016). Determinants of Leverage decisions of Indian Firms: An empirical study. Business analyst SRCC, 37(1), 19-30.

Ross, S. A. (1977). The determination of financial structure: the incentive-signalling approach. *The Bell Journal of Economics*, 23–40.

Showalter, D. (1999). Strategic debt: evidence in manufacturing. *International Journal of Industrial Organization*, *17*(3), 319–333.

Smith, D. J., Chen, J., & Anderson, H. D. (2015). The influence of firm financial position and industry characteristics on capital structure adjustment. *Accounting & Finance*, *55*(4), 1135–1169.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The Journal of Finance*, *43*(1), 1–19.
