

RELATIONSHIP AMONG CAPITAL STRUCTURE, OWNERSHIP STRUCTURE AND RESEARCH & DEVELOPMENT INVESTMENTS

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Abstract

We examine the relationship among capital structure, ownership structure and Research and Development (R&D) investments for the Indian emerging markets using a sample of 212 large, midcap and small manufacturing companies over 2011 to 2015. We find a positive relationship between R&D intensity and leverage of a firm implying that firms with high leverage invest in R&D. This result is contrary to the findings of majority of studies in this area and thus requires further investigation. We do not find a negative relationship between family ownership and R&D investments for Indian firms as documented by the existing literature. We find a negative relationship between institutional ownership and R&D investment suggesting that institutions have a myopic view and concentrate only on short-term performance of firms. Our results are also similar for domestic institutional ownership and R&D investments confirming the general belief that domestic financial institutions do not finance innovative firms. Finally, we find a positive relationship between foreign institutional ownership and R&D investments suggesting that such investors do promote R&D spending in Indian firms. This study further enriches our understanding of the relationship between ownership structure and R&D intensity.

Keywords: Capital structure, Ownership structure, Institutional ownership, R&D investments

Relationship among Capital Structure, Ownership Structure and Research & Development Investments

Introduction

Investment in Research and Development (R&D) has received a great deal of attention from governments, policy makers and academics throughout the world as it is now largely believed that they are the precursors to growth and economic development of countries (Chan, Lakonishok and Sougiannis 2001; Cho, 1998; Lev and Sougiannis, 1996).¹ In the same line at the micro level, for a firm to sustain and grow, it is imperative that it undertakes expenditure on research and development (Lau, 1998; Franko, 1989; Hill and Snell, 1988). Over the years, the dependence on technology and its quick obsolescence in business and more so in certain R&D intensive industries like information technology, automobiles, electronics, pharmaceuticals etc., has increased many folds. In some technology based industries the R&D investments are larger than their earnings (Chan, Lakonishok and Sougiannis, 2001). Substantial research documents the characteristics and performance of firms with respect to innovation (Lodh, Nandy and Chen, 2014) but little research has been done to examine the relationship between family ownership and innovation (Craig and Moores, 2006). Existing research substantiates the claim (you have already used the verb document) that technologically innovative companies may outperform their competitors (Geroski, Machin, and Van Reenen, 1993). Another stream of research in this area shows that agency problems have an adverse

effect of reducing investments in R&D. It is also possible that investors' preferences may be biased toward high R&D investments, forcing the firms to make huge investments in them (Aghion and Stein, 2008).

Our study extends the previous literature in several ways. First, to the best of our knowledge, this is the first study that examines the relationship among capital structure, ownership structure and R&D investment for an important emerging market like India. Examining the relationship between leverage and R&D for Indian listed firms is of considerable significance as in the last decade Indian firms have become highly leveraged. We, thus extend the sparse literature on emerging markets in this area.

Second, we examine the relationship between institutional ownership (both domestic and foreign) and investment in R&D. There is a dearth of literature which documents the role of ownership on investments in R&D in the Indian context. We could find only one study by Lodh et al., (2014) which provides evidence only for family ownership. However, they take the number of innovations or patents filed by a company as the variable of interest while we use the total amount of investments made in R&D by firms to measure R&D intensity. Over the years, the Indian capital markets and the Indian companies have witnessed the growing number and importance of big institutional investors, both domestic and foreign. They now have significant ownership in Indian companies and are thus able to exercise considerable influence on the decisions of companies. However, the legal system is very weak and the corporate governance mechanism is rather poor. Though there is a plethora of rules and regulations to protect minority shareholders, the execution of law is poor. Thus, in such a setting, findings from relationship between institutional ownership and investment in R&D from a large emerging market like India would be useful in view of the large body of predominantly US literature.

Third, we also look at whether family ownership affects the R&D intensity of firms which are by and large family owned. Thus, this study enriches our understanding of the relationship between ownership structure and R&D intensity for a country which has the highest number of listed companies in the world and requires extensive investments in R&D in order to become a developed economy.

The present paper is organized as follows. Section 2 reviews the relevant literature and develops the hypotheses for the study. Section 3 provides the sources for data; the variables used in the study and the descriptive statistics. Section 4 provides the methodology; the model specification and the details of the estimation methods. Section 5 discusses the key empirical results. Section 6 concludes.

Literature Review and Hypotheses Development

1. Capital Structure

R&D investments by their very nature require large amounts of capital and create intangible assets which do not serve as good collaterals for high levels of debt (Hsu, Venezia, and Schrader, 2015; Vicente-Lorente, 2001; Simerly and Li, 2000). These investments have been found to make significant contribution to the growth of information technology firms (Lee and O'Neill, 2003). Empirical research suggests capital structure to be an important criterion in making R&D investments. There is also strong empirical evidence to suggest that R&D intensive firms are less leveraged compared to those firms which are not, as firms which invest heavily in R&D activities cannot support a high leverage ratio (Hsu et al., 2015; Blass and Yosha, 2001; Hall 1994, 1993; Opler and Titman 1994, 1993). Thus, numerous studies have established that there is a negative relationship between R&D and leverage (O'Brien, 2003; Vicente-Lorente, 2001; Balakrishnan and Fox, 1993). Firms which are highly leveraged have higher risk of default and would find it difficult to fund their R&D activities through

external sources of finance (Whited, 1992) thus predicting a negative relationship between leverage and R&D intensity.

It is believed that agency problems in firms can be mitigated by the use of debt in the capital structure. Since payments of interest on debt are mandatory unlike payments of dividend which is the prerogative of the managements. So, the management of firms may not declare any dividend continuously for years, if they deem fit. However, they cannot abstain from making payments of interest on debt as this is their fixed obligation and any failure to do so on their part can lead their firms to bankruptcy. Thus, fixed payments of debt help in monitoring the risk-averse behaviour of managers in an environment of asymmetric information and financial discipline is imposed on these managers who cannot use the funds of their firms for their own benefit but only for profitable investments (Aghion et al., 1999; Zwiebel 1996; Hart and Moore 1995; Harris and Raviv 1990; Stulz 1990; Jensen, 1986).

It has also been observed that banks and other financial institutions are generally not keen on financing R&D investments which are treated as expenses and are not backed by any collateral in physical assets like other borrowings of the firms (Hall 2002). Since the benefits of these investments are known only to the managers of the firms, there a problem of information asymmetry between the lender and the borrowing firms (Bhattacharya and Ritter, 1983). This discourages the lenders to lend to these firms and forces them to impose additional monitoring of managers, other bonding mechanisms and charging higher rates of interest thereby increasing the cost of debt financing. However, financing through debt increases the leverage ratio and correspondingly decreases the free cash flow available to managers to invest discretionally in unproductive areas thereby reducing the total agency costs (Jensen, 1986).

Hsu, et al., (2015) uses a sample of 336 Korean information technology (IT) firms during 2006-2009 and finds capital structure to have a negative relationship with R&D investment suggesting that IT firms may use less debt when the outcome from these investments is uncertain. Yasuhiro, Takuya, and Miyajima (2011) find that large firms fund their R&D expenditure partly from debt. They also report that in case of firms with limited assets, higher leverage results in lower investment in R&D. Chen (2010) finds direct and indirect effects of different types of ownership on R&D investments. He shows that financial slack and leverage ratio that have been considered as determinants of R&D investments are only mediators through which ownership structure affects a company's strategic decision indirectly. Ogawa (2007) shows that in Japan the ratio of debt to total assets had a significant, negative effect on R&D investment in the late 1990s but this effect was insignificant in the late 1980s. Bhagat and Welch (1995) report a strong negative relationship between leverage and R&D expenditure. Thus, the arguments put forward in the existing literature predict a negative relationship between leverage and R&D intensity. Therefore, we lay down our first hypothesis as:

H1: The capital structure has a negative relationship with R&D investment

2. Family Ownership

Existing empirical literature documents the world-wide presence and dominance of family controlled firms. There is a little separation between ownership and control in these businesses and in small firms (Claessons et al., 2000), though, ownership and control can be separated to the benefit of large shareholders (La Porta 1999). In India, around 70 per cent of the businesses are family controlled and large family-controlled firms drive innovation because there is no other form of concentrated ownership (Piramal, 1996). Though this scenario has changed considerably after the economic reforms pursued by India since the 1990s, with ushering in of a large number of foreign investors, Indian firms are still predominantly family owned. There are reasons to believe that R&D investments in family

owned businesses are different from their non-family counterparts (De Massis, Frattini, and Lichtenthaler, 2012). This may be due to several reasons namely, different investment horizons, risk aversion, diversification plans, and return aspirations (Thomsen and Pedersen, 2000). It is also believed that a firm's ownership structure will also have an impact on its R&D activities (Hoskisson, Hitt, Johnson and Grossman, 2002; Kochhar and David, 1996).

By and large the findings of the studies examining the impact of family ownership on the level of a firm's R&D expenditure are consistent. They suggest a negative relationship between family ownership and R&D investments. This is so because it is generally believed that family owners tend to expropriate corporate wealth since they are the owner-managers with controlling stakes in their firms and are thus able to influence the decisions of the boards (La Porta et al., 1999).

Block (2012) finds that family ownership is negatively associated with the level of R&D intensity for large U.S. companies. Chrisman and Patel (2012) argue that family owned firms usually invest less in R&D than nonfamily firms. De Massis et al., (2012) show that family involvement has a direct effect on R&D expenditure. Minnetti, Murro, and Paiella (2012) examine the effect of ownership structure on innovation for a large sample of 20,000 Italian firms and find that ownership concentration has a negative effect on firm innovation and also reduce their R&D efforts. However, they do find some evidence that family ownership supports innovation more than financial institutions. Muñoz-Bullón and Sanchez-Bueno (2011) find that the Canadian listed companies have lower R&D intensities than non-family companies. Munari, Oriani, and Sobrero (2010) also find that family ownership is negatively associated with R&D investments for a sample of six European countries. Di Vito, Laurin and Bozec (2010) also report that concentration of ownership do have a negative impact on the intensity of R&D investment in Canada. Chen and Hsu (2009) find that family involvement in ownership is negatively correlated with the level of R&D investments for Taiwanese firms in the electronic industry. Czarnitzki and Kraft (2008) observe that widely-held German firms invest more in R&D activity than their closely held counterparts. Sirmon, Hitt, and Ireland, (2007) take a data set of French SMEs and report that family-influenced firms reduce their R&D investments significantly less than firms with no family influence. Yafeh and Yosha (2003) also find that ownership concentration has a significantly negative effect on R&D investment. Morck, David and Bernard (2002) observe that Canadian firms are by and large controlled by families and have very little incentive to invest in R&D activities and that ownership concentration may have a negative effect on R&D investment. In contrast to the findings of the above studies, Lodh et al., (2014) find a positive impact of family ownership on innovation productivity for an unbalanced panel of 395 Indian firms during 2001-2008. They also report that when these family firms are affiliated with the top 50 business groups, their innovation activities increase.

Thus, we lay down our second hypothesis as:

H2: Family ownership is negatively associated with R&D investment

3. Institutional Ownership (including both domestic and foreign)

There has been a tremendous increase in the ownership of institutional investors in the last few decades around the world. These investors are banks, insurance companies, mutual funds, pension funds, venture capital funds, sovereign funds and charitable endowments. In Europe they own around 50-60 per cent of the capital of the companies (Scott, 2014; Brossard, Lavigne, and Sakine 2013). They have reduced the ownership of families, companies and state or government agencies (Brossard et al., (2013). In the UK only 10 per cent of equity is held by physical persons (Çelik and Isaksson, 2014) while institutional investors own around 70 per cent of equity of U.S. corporations (Bogle, 2010). Thus, it is

quite obvious that they can exercise phenomenal influence on the management of companies and have the power to affect their decision making. There is substantial evidence documenting that they are better monitors compared to other investors (Almazan, Hartzell, and Starks, 2005; Parrino, Sias, and Starks, 2003; Maug, 1998). Some suggest that these institutions encourage R&D investments (Bange and De Bondt, 1998) while others find evidence to the contrary (Samuel, 2000).

The existing literature documents mixed results of the impact of institutional ownership on R&D investment. There is a vast majority of studies showing that institutional ownership and R&D investment are positively related (Scott 2014; Aghion et al., 2008; Eng and Shackell 2001; Wahal and McConnell 2000; Kochhar and David 1996; Francis and Smith 1995; Hansen and Hill 1991; Baysinger et al., 1991; Hill and Snell, 1988; Jarrell et al., 1985). This strand of literature supports the view that institutional investors by and large are long-term investors who are able to not only monitor but also influence the management of companies to create value by making huge investments in R&D. On the other hand, there are also many studies which find a negative relationship between institutional ownership and R&D investments (Dixon and Seddighi 1996; Graves and Waddock 1990; Graves 1988) or mixed (Bushee 2001, 1998; Graves 1990,) or even neutral (Chung et al., 2003; Majamda and Nagarajan 1997). Some of the earlier studies have stressed that institutional investors are short-term investors because they are appraised on a quarterly basis and thus their emphasis is only on maximizing quarterly earnings for their shareholders (Jacobs, 1991; Franko, 1989; Graves, 1988; Mitroff, 1987). Therefore, these investors do not provide any incentive to managers for making investments in R&D which by their very nature are long-term and can be highly risky.

There are some studies which show that institutional investors are unable to influence management of firms on R&D investments (Hsu et al., 2015; Chen 2010) while there are others who find that institutional investors do influence firms' decisions to invest in R&D (Kochhar and David 1996; Zahra, 1996; Baysinger, Kosnik and Turk, 1991; Hansen and Hill 1991). Taking a sample of 336 Korean IT firms during 2006 to 2009, Hsu et al., (2015) examine the relationship between institutional ownership and R&D investment. They find no significant relationship between them and conclude that institutional investors are not able to influence management decision making on R&D investments. Kim, Kim and Lee (2008) use agency theory to examine the influence of ownership structure on the relationship between financial slack and R&D investments. Their data set consists of Korean manufacturing firms in R&D-intensive industries during the period 1998 to 2003. They find financial slack to have an inverted U-shaped relationship with R&D investments and conclude that the relationship varies depending on the presence of different types of owners. Hansen and Hill (1991) find the institutional investors to be long-term oriented in the United States and do promote R&D investments. However, Chen (2010) finds that foreign and domestic institutional investors do not have any impact on Korean companies. He reasons that this is due to the fact that controlling owners in Korean companies do not succumb to pressures imposed by institutional investors in contrast to the US where professional managers are able to do so. Moreover, institutional investors have limited monitoring power due to the existing corporate governance set up.

Thus, we lay down our third hypothesis as:

H3: Institutional ownership has a negative relationship with R&D investment

4. Domestic Institutional Ownership

Domestic financial institutions have been the back bone for providing long-term, medium term and working capital finance to companies in India after its independence in 1947. These institutions were set up to provide scarce capital to the deficit business units at

soft interest rates for rapid industrialization and for ensuring balanced regional economic development of the country. Due to their large investments in companies both in the form of equity and debt, at times they are well represented on their boards to monitor the decisions of their managements. However, due to their close proximity to local companies in which they invest, domestic institutional investors may often have other business relationships. They may often be affiliated with banks that act as creditors, underwriters, advisors or hold board seats (Ferreira, Matos, and Pires 2015; Ferreira and Matos 2012). This could cause conflict of interest and these institutional investors may be less inclined to go along with the other external monitors and may have a softer attitude towards the management of companies. They may abstain from opposing strategic management decisions and may even support them, thus making them ineffective external monitors detrimental to the interests of the large number of small and diffused shareholders.

Thus, we lay down our fourth hypothesis as:

H4: Domestic Institutional ownership has a negative relationship with R&D investment

5. Foreign Ownership

There has been a sea change in India's approach to foreign investments from the early 1990s when it began structural economic reforms in almost all the sectors of the economy. Foreign institutional investors (FIIs) and overseas corporate bodies were allowed to invest in India by SEBI from September 14, 1992 and since then their numbers have grown rapidly to around 1,500 now. Majority of them are from the USA followed by Mauritius, Singapore and the UK. Their net investments stood at \$2.68 billion in March 2016 with their cumulative value of investments during April 2000-December 2015 being \$179.32 billion (wwwibef.org). This reflects their large investments in Indian companies and they are perceived as the drivers of the Indian stock markets since they have deep pockets.

One line of reasoning suggests that the presence of foreign investors as shareholders in companies may have the tendency to force their managers to reduce long-term investments in R&D expenditures as they are perceived to invest for short-term profits rather than remaining invested in companies for a longer period of time (Graves and Waddock, 1990). It is quite possible that such investors are able to influence the managers to take such strategic decisions which enhance profits in the short-term and forgo opportunities which provide return after a rather considerable period of time. It is also believed that the emphasis now is on maximizing quarterly earnings resulting in bonuses for managers rather than pushing for long term growth. Thus, such projects are undertaken which are easily understood by the stock markets at the cost of pursuing risky innovative opportunities (Ferreira, Manso, and Silva, 2014).

It is also quite possible that active monitoring by foreign investors may promote long-term investments in fixed capital, innovation, and human capital (Bena, Ferreira and Pires, 2016) since these investors are able to discipline the corporate insiders. However, Patnaik and Shah (2013) are of the view that these investors invest in companies having R&D expenses and reduced asset tangibility. David et al., (2006) find that they trade frequently since they are professional investors with short-term horizon to make profits and thus shuffle their portfolios frequently. It has also been argued that foreign investors may be in a better position to check the activities of the inside owners than domestic institutional investors. This is so because domestic institutional investors often have strong business association with the companies in which they invest and may, thus, be less effective as external monitors (Ferreira and Matos 2008; Gillan and Starks 2003).

Yasuhiro et al., (2011) find no evidence that large shareholdings by foreign investors enforce myopic behavior on firms in R&D intensive industries. Huang and Shiu (2009) find

that FII ownership in Taiwanese firms leads to higher R&D investment and better firm performance. Bena et al., (2016) find that a larger foreign institutional ownership leads to an increase in long-term investment (proxied by capital expenditure and R&D) and innovation output (proxied by patent counts).

Thus, we lay down our fifth hypothesis as:

H5: Foreign ownership has a positive relationship with R&D investment

Data, Variables and Descriptive Statistics

1. Sample

Our initial sample consisted of all companies constituting the three prominent Indian stock market indices-the S&P BSE 500 index, S&P BSE mid cap index and S&P BSE small cap index. These indices are maintained by the BSE (earlier known as the Bombay Stock Exchange). BSE is one of the two major stock exchanges in India with a market capitalization of Rs. 1.1 trillion (\$14.79 billion). A total of 1,340 companies are included in these indices out of which 410 companies were common to all indices. So, we were left with 930 companies. We excluded banks, financial companies and those companies for which the required financial and ownership data were not continuously available for five years. Our final sample comprises 212 manufacturing companies with 1,060 firm year observations during the five years period from 2011 to 2015. We have collected the data from Prowess database maintained by the Center for Monitoring Indian Economy (CMIE). This data base is widely used by academics in India for doing research due to their ready availability and reliability.

2. Variables

The dependent variable used in the study is R&D intensity. We examine the impact of capital structure and institutional ownership on R&D expenses. We regress R&D expenses on capital structure, family ownership, institutional ownership, foreign ownership, and other control variables. We measure R&D intensity by taking the ratio of R&D expenses to Total Sales (Hsu et al., 2015; Kim et al., 2008; Lee and O'Neill, 2003; O'Brien, 2003; Baysinger et al., 1991). Family Ownership is the percentage of shares held by individuals and Hindu Undivided Family (HUF). Institutional Ownership is measured by the percentage of shares held by institutions both foreign and domestic (Hsu et al., 2015). Domestic institutional ownership is the total percentage of equity ownership held by domestic institutional investors comprising mutual funds, financial institutions, insurance companies and banks, while foreign institutional ownership is the percentage of total equity ownership held by foreign investors. Capital structure or leverage is measured by the ratio of Total debt to Total assets (Hsu et al., 2015; Bah and Dumontier, 2001).

We select the control variables on the basis of their usage in the existing literature and also on the basis of availability of data. The control variables are helpful in addressing issues related to endogeneity. These control variables are: liquidity, capital intensity, prior-firm performance, and size. Liquidity is measured by the ratio of current assets to total assets. Capital Intensity is measured by the ratio of net fixed assets to total assets. Prior-firm Performance is measured by Prior ROA which is Profit after tax to Total assets of the earlier year. ROA is an important measure to determine the profitability of a firm. It is observed that a firm's profitability has an important bearing on a firm's leverage (Jensen et al., 1992). Size refers to the size of the firm and is measured by the log of fixed assets and is considered as a main factor in explaining firm-specific heterogeneity.

Table 1: Variable Proxies and Definitions

This table provides the definitions of the key variables used in the study

<i>Type of variable</i>	<i>Variable Definition and measurement</i>
R&D Intensity	Ratio of R&D expenses to Total Sales
Leverage	Total debt to Total assets
Institutional Ownership	Percentage shareholding of institutional investors (both foreign and domestic)
Family Ownership	Percentage of shares held by individuals and Hindu Undivided Family (HUF)
Domestic Institutional Ownership	Percentage of shares held by domestic financial institutions
Foreign Ownership	Percentage of shares held by foreign investors
Liquidity	Current assets to Total assets
Capital Intensity	Net fixed assets to Total assets
Prior-firm Performance	Measured by Prior ROA which is taken as Profit after tax to Total assets
Size	Natural logarithm of total assets

3. Descriptive Statistics

Table 2 provides the descriptive statistics of the dependent and explanatory variables used in the study. R&D intensity ranges from a minimum of zero to a maximum of 34 per cent, which indicates the large variance of R&D intensity of Indian listed companies. The standard deviation of R&D intensity is 1.4012. The present sample of 212 companies spent an average of 20 per cent of total sales as R&D expenses. The mean value of shares held by institutions is 0.4469 with a minimum holding of zero and a maximum holding of 0.9818. The mean value of domestic ownership is 0.2383 with a minimum of zero and a maximum of 0.8858. The mean value of foreign ownership is 0.1174 with a minimum of zero and a maximum of 0.8947. The mean value of family ownership is 0.1247 with a maximum of 0.7500. The model also includes certain control variables. Though the mean leverage ratio is 0.1787, there are many companies in the sample which are highly leveraged as the maximum leverage ratio is 1.0367. The average liquidity is 0.3941 with a standard deviation of 0.1796. Firm size, measured by log of fixed assets has a mean of 10.46 and a standard deviation of 1.56. The average capital intensity, measured by ratio of net fixed assets to total assets is 0.2713 with a minimum value of 0.1496 and a maximum value of 0.7101 and finally the average prior ROA is 0.0897.

Table 2: Descriptive Statistics

This table reports the descriptive statistics of our key variables. The sample is a balanced panel data comprising 1060 firm-year observations between 2011-2015.

Variables	Mean	Std Dev	Minimum	Maximum	No. of observations
R&D Intensity	0.2024	1.4012	0	34.1456	1060
Family Ownership	0.1247	0.1978	0	0.7500	1060
Institutional Ownership	0.4469	0.2775	0	0.9818	1060
Domestic Ownership	0.2383	0.2391	0	0.8858	1060
Foreign Ownership	0.1174	0.2332	0	0.8947	1060
Leverage	0.1787	0.1707	0	1.0367	1060

Liquidity	0.3941	0.1796	0.0141	0.8571	1060
Size	10.4639	1.5605	6.331	15.1969	1060
Capital Intensity	0.2713	0.1496	0.0000	0.7101	1060
Prior ROA	0.0897	0.1507	-3.7000	1.5100	1060

Table 3 provides the correlation matrix. It can be seen that the correlation among the independent variables is quite small and therefore, there is no problem of multicollinearity among the variables.

Table 3: Correlation Matrix

Pearson Correlation Coefficients, N = 1060										
Variables	R&D Intensity	Family Ownership	Foreign Ownership	Domestic Ownership	Institutional Ownership	Leverage	Liquidity	Size	Capital Intensity	Prior ROA
R&D Intensity	1.000									
Family Ownership	0.0306	1.000								
Foreign Ownership	-0.0129	-0.28098	1.00000							
Domestic Ownership	0.0394	-0.3070	-0.4209	1.000						
Institutional Ownership	0.0117	-0.3745	-0.4190	0.8850	1.000					
Leverage	0.0427	0.1073	-0.3187	0.1875	0.1051	1.000				
Liquidity	-0.1106	0.0667	0.1209	-0.1878	-0.2535	-0.2379	1.000			
Size	-0.0950	-0.4200	-0.0909	0.0251	0.2340	0.0965	-0.2345	1.000		
Capital Intensity	0.0405	0.0298	-0.1366	0.1558	0.0711	0.4097	-0.3813	-0.055	1.000	
Prior ROA	-0.0913	0.0473	0.0948	-0.0046	0.0401	-0.3046	0.0309	-0.0144	-0.1233	1.000

Source: SAS EGBS Package, Own contribution

Methodology

We use multiple regression analysis using panel data estimation methods in order to test the relationship between capital structure, ownership structure and R&D investment. The dataset is a panel data for 212 listed companies for the five year period 2011-2015. We use the following basic specification:

$$\text{R\&D Intensity}_{it} = \alpha + \beta \text{Ownership Variable}_{it} + \gamma \text{Control Variables}_{it} + \varepsilon_{it}$$

Where α represents the coefficient of the ownership variable, β represents the coefficients of the vector of control variables and ε_{it} is the error term.

To test the above hypotheses, the following models are estimated using OLS, fixed effects and random effects estimators:

$$\text{Model 1: R\&D Intensity}_{it} = \alpha + \beta \text{Leverage}_{it} + \gamma_1 \text{Liquidity}_{it} + \gamma_2 \text{Capital Intensity}_{it} + \gamma_3 \text{Prior ROA}_{it} + \gamma_4 \text{Size}_{it} + \varepsilon_{it} \quad (1)$$

$$\text{Model 2: R\&D Intensity}_{it} = \alpha + \beta \text{Family Ownership}_{it} + \gamma_1 \text{Liquidity}_{it} + \gamma_2 \text{Capital Intensity}_{it} + \gamma_3 \text{Prior ROA}_{it} + \gamma_4 \text{Size}_{it} + \varepsilon_{it} \quad (2)$$

$$\text{Model 3: R\&D Intensity}_{it} = \alpha + \beta \text{Institutional Ownership}_{it} + \gamma_1 \text{Liquidity}_{it} + \gamma_2 \text{Capital Intensity}_{it} + \gamma_3 \text{Prior ROA}_{it} + \gamma_4 \text{Size}_{it} + \varepsilon_{it} \quad (3)$$

$$\text{Model 4: R\&D Intensity}_{it} = \alpha + \beta \text{Domestic Institutional Ownership}_{it} + \gamma_1 \text{Liquidity}_{it} + \gamma_2 \text{Capital Intensity}_{it} + \gamma_3 \text{Prior ROA}_{it} + \gamma_4 \text{Size}_{it} + \varepsilon_{it} \quad (4)$$

$$\text{Model 5: R\&D Intensity}_{it} = \alpha + \beta \text{Foreign Ownership}_{it} + \gamma_1 \text{Liquidity}_{it} + \gamma_2 \text{Capital Intensity}_{it} + \gamma_3 \text{Prior ROA}_{it} + \gamma_4 \text{Size}_{it} + \varepsilon_{it} \quad (5)$$

Results

The results of panel regression estimation of the five models are shown in Table 4, taking R&D intensity as the dependent variable. We conduct the Hausman test to examine the correlation between α_i and the set of explanatory variables. This test examines as to whether the fixed effects model or the random effects model should be used. If there is no correlation between the unobserved variable and the explanatory variables, then the random effects model is appropriate. Our results show a significant statistic of 41.88 ($p=0.0001$) for Model 1, a statistic of 12.38 ($p=0.0299$) for Model 2, a statistic of 15.71 ($p=0.0077$) for Model 3, a statistic of 19.69 ($p=0.0014$) for Model 4 and a statistic of 22.06 ($p=0.0005$) for Model 5 respectively indicating that fixed effects model is more appropriate than the random effects model.

Table 4: Results of Panel Regression using R&D Intensity as Dependent Variable

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random
Constant	4.326 (0.0492) **	1.722 (0.0041) ***	3.220 (0.1515))	1.896 (0.0032) ***	3.222 (0.1496))	1.815 (0.0022) ***	4.320 (0.0574)*	1.834 (0.0021) ***	3.065 (0.1689))	1.736 (0.0037) ***
Independent Variables										
Leverage	3.320	1.448								

	(<.0001) ***	(0.0001) ***								
Family Owners hip			-0.140 (0.9113)	-0.145 (0.7138)						
Institutional Owners hip					-1.053 (0.0771) *	-0.106 (0.6818)				
Domestic Owners hip							-2.133 (0.0097) **	-0.131 (0.6618)		
Foreign Owners hip									2.541 (0.0021) ***	0.257 (0.4018)
Control variables										
Liquidity	-0.191 (0.7339)	-0.746 (0.0473) **	-0.541 (0.3443)	-0.891 (0.0169) **	-0.573 (0.3160)	-0.909 (0.0160) **	-0.613 (0.2830)	-0.904 (0.0163) **	- 0.54191 (0.3414)	-0.897 (0.0165) **
Capital Intensity	0.489 (0.4531)	-0.196 (0.6645)	1.025 (0.1219)	0.241 (0.5785)	1.006 (0.1280)	0.245 (0.5728)	0.962 (0.1446)	0.259 (0.5527)	1.0523 (0.1101)	0.280 (0.5223)
Prior ROA	0.351 (0.1437)	0.057 (0.8054)	0.057 (0.8148)	-0.134 (0.5616)	0.2051 (0.4216)	-0.126 (0.5902)	0.267 (0.2922)	-0.128 (0.5818)	0.0710 (0.7665)	-0.143 (0.5360)
Size	-0.471 (0.0391) **	-0.137 (0.0045) ***	-0.330 (0.1560)	-0.131 (0.0101) **	-0.263 (0.2617)	-0.120 (0.0127) **	-0.341 (0.1401)	-0.124 (0.0088) ***	-0.321 (0.1642)	-0.121 (0.0108) **
Number of observations	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
Adjusted R-squared	0.6454	0.0256	0.6293	0.0125	0.6307	0.0125	0.6322	0.0125	0.6334	0.0130
F-Statistic	6.70 (<.0001)		6.24 (<.0001)		6.27 (<.0001)		6.31 (<.0001)		6.35 (<.0001)	
Hausman test	41.88 (<.0001)		12.38 (0.0299)		15.71 (0.0077)		19.69 (0.0014)		22.06 (0.0005)	

Source: Own Contribution. ***, **, * indicate significance at 1%, 5% and 10% respectively. Figures in parentheses indicate p-values. The above models are corrected for heteroscedasticity using White's method.

The results of each of the models are now discussed below:

1. Leverage

We find a significantly positive relationship between R&D intensity and leverage of firms ($t=3.320$, $p=0.001$) implying that firms with high leverage do invest in R&D activities. Our results are in contrast to Hsu et al., 2015; Bhagat and Welch, 1995; and Baysinger and Hoskisson, 1989) who find a negative relationship between leverage ratio and the level of R&D expenditure. Thus, this result is contrary to the findings of the majority of the studies in this area and requires further investigation. The plausible reasons for this contrary result could be put forward in two ways. One, most of the research discussed above pertains to the developed nations. In case of emerging economies, research on the relationship between capital structure and R&D investments is very limited. Since these economies have a very different institutional set up and different corporate governance mechanisms, the findings of the studies conducted here may differ from those of the developed countries (Chen, 2010).

Second, India being a developing economy, firms have a continued need for expansion and product development which is only possible if they invest extensively in R&D activities thereby creating intangible assets. This helps them to remain competitive and operate in new markets and helps them to generate bigger revenues and increase in their profits. This would suggest a positive relationship between R&D investments and performance (Demsetz and Villalonga, 2001) thus necessitating the firms to invest extensively in R&D activities even at the risk of being highly leveraged. Our results warrant us to reject our first hypothesis (H1) that leverage has a negative relationship with R&D investment.

2. Family Ownership

By and large, the extant literature indicates a negative relationship between family ownership and R&D expenditure implying that with more involvement of families in businesses, there is less propensity to use funds towards R&D investments (Block, 2012; Muñoz-Bullón and Sanchez-Bueno, 2011; Munari, Oriani and Sobrero, 2010; Chen and Hsu, 2009). Firms with large family shareholdings are quite keen to transfer ownership and wealth to their next generation, which in turn makes them take decisions cautiously and discourage investments in innovation. Family-run businesses fund the risky R&D expenditure only under two circumstances, one, when they find growth opportunities in innovation exploration, and second, when the board structure separates the family owners from the CEOs of businesses. However, our results show a negative and insignificant relationship between family ownership and R&D expenditure ($t=-0.140$; $p=0.9113$). Our results are in contrast to the findings of Lodh et al., (2014) who find a positive impact of family ownership on product innovation for Indian firms. Our results warrant us to reject our second hypothesis (H2) that family ownership has a negative relationship with R&D investment.

3. Institutional Ownership

We find a negative and mildly significant relationship between institutional ownership and R&D investment ($t= -1.053$; $p= 0.0771$) at 10% significant level. This clearly indicates that institutions do not prefer to invest in firms with high R&D investments. This shows that institutions have a myopic view and concentrate only on short-term performance of firms. They do not encourage managers to invest in R&D activities. Our results are in line with Dixon and Seddighi, (1996); Samuel, (1996); Graves and Waddock, (1990); Graves, (1988) who find that institutional investors do not have much influence on firms' decisions to invest in R&D that is long-term and highly risky in nature. Whereas, Scott (2014) stresses that institutional investors will support R&D investments only if there is high information symmetry. In case of the Indian corporate sector, institutional owners are mainly foreign institutional investors, domestic financial institutions, commercial banks, mutual funds,

pension funds and insurance companies. Though institutional ownership has increased drastically over the years due to the opening of the Indian economy but corporate governance mechanism still remains quite weak due to the weak legal system prevalent in the country. Our results support our third hypothesis that institutional ownership has a negative relationship with R&D investment.

4.Domestic Institutional Ownership

We find a negative and highly significant relationship between domestic institutional ownership and R&D investment ($t = -2.133$; $p = 0.0097$) at 1% significant level. This suggests that in case of Indian firms, domestic institutional investors do not promote the risky and long-term R&D investments. Our results are similar to Patnaik and Shah (2013) who document that domestic institutional investors invest more in public sector companies which have more tangible assets and leave firms that invest in R&D. It is believed that domestic institutional investors are more concerned with high stock market returns, stable profits and high future growth rate. Therefore, they do not finance innovative firms. Gillan and Starks (2003) and Ferreira and Matos (2008) also report that domestic institutional investors are more considerate towards the managing and controlling shareholders and exert less influence as external monitors. Domestic institutional investors are outside owners and are more interested in immediate gains. This explains that domestic institutional investors support R&D investment in those firms that expound the benefits from investments in intangibles and provide rationality on long-term returns attached to such investments. Our results validate our fourth hypothesis that domestic institutional ownership has a negative relationship with R&D investment.

6.Foreign Ownership

We find a positive and significant relationship between foreign institutional ownership and R&D investment ($t = 2.541$; $p = 0.0021$) indicating that foreign institutional investors promote R&D spending in Indian firms. Our results are in line with Bena, et al., (2016); Huang and Shiu (2009); and Baysinger et al., (1991) who observe that a high positive outlook of foreign institutional investors enhances R&D spending in a firm. These investors act as dynamic monitors, support firms when they face innovation failures and promote exchange of innovative knowledge across countries. Foreign institutional investors play an important role in stimulating investment in firm innovation (Gillan and Starks, 2003). India is an emerging market and is an attractive destination for foreign investors for investment. This is evident from a very high share holding of 21 per cent foreign investor shareholding in 1,517 Indian companies listed on the leading stock exchange: The National Stock Exchange of India (NSE), as on June 2016.² Patnaik and Shah (2013) too observe a positive relationship between foreign institutional ownership and R&D intensity. These institutions are concerned more with long-term returns, future profits and growth. Since they invest across countries globally they are better diversified than domestic investors and are hence able to take larger risks. Their investment objectives are also not restricted by associations with company insiders and are thus able to reduce managerial entrenchment and promote investment in riskier growth opportunities through research and development. Our results support our fifth hypothesis that foreign institutional ownership has a positive relationship with R&D investment.

Conclusions

This study examined the relationship between ownership structure, capital structure and R&D expenditure for 212 Indian manufacturing companies during five years from 2011 to 2015. We find a positive relationship between R&D intensity and leverage of a firm

implying that an Indian firm with high leverage does invest in R&D activities. This result is contrary to findings of majority of studies in this area and requires further investigation. Our finding is quite significant, as it is generally believed that highly leveraged companies shy away from undertaking R&D activities. However, this is not so in case of Indian firms which have become increasingly leveraged in the last decade. One reason for this positive relationship could be that extensive investments in R&D activities help the firms to improve their performance (Demsetz and Villalonga, 2001) even at the risk of being highly leveraged.

Our findings do not suggest that family ownership has a negative relationship with R&D investment as is widely documented. We find a negative relationship between institutional ownership and R&D investment thus revalidating the belief that these investors have a very limited vision and only look for short-term performance of firms. Results are also similar for domestic institutional ownership and R&D investments confirming once again that these investors do not promote R&D activities. This is quite possible as domestic financial institutions are also lenders of medium to long-term finance to these companies and would thus like to protect their capital by not participating in the risky and long-term R&D activities.

Finally, we find a positive relationship between foreign institutional ownership and R&D investment suggesting that foreign institutional investors promote R&D spending in Indian firms. This is quite significant as investment by foreign investors is perceived to enhance the image of Indian companies and they are in a better position to raise funds from the capital markets. This also shows the long-term interests of foreign investors which is good for the Indian stock markets and for the growth and development of the Indian economy. The findings reconfirm that these investors act as dynamic monitors and support firms with innovative ideas and promote exchange of innovative knowledge.

The findings of this study could be useful to policy makers, management of firms, investors and researchers. In India, the corporate ownership structure has changed dramatically with the development and expansion of capital markets and with the advent of new category of investors in the form of Qualified Institutional Buyers (QIB) which essentially are foreign investors, domestic financial institutions and mutual funds. These investors subscribe heavily to new equity issues of capital from companies and in the stock markets. Therefore, the results should help the policy makers to better understand the relationship of institutional investors (both domestic and foreign) with R&D investments undertaken by firms. These expenditures are critical for the firms' survival and in obtaining a competitive advantage and are important for India's economic development.

The results should help the managers of firms operating in extensive R&D industries to effectively design the capital structure of their firms. Results also have direct implications for managers in getting an insight about the significance of R&D expenditures in obtaining a competitive advantage. The findings should be useful to stock market investors who can now better understand the relationship between R&D investment and capital structure and ownership structure and take informed investment decisions.

End Notes:

¹India had invested only 0.88% of its Gross Domestic Product (GDP) towards R&D, whereas USA and South Korea spent 2.79% and 3.36% respectively during 2011-12. Among BRICS nations, Brazil, Russia and China also spent more than 1% of their GDP on R&D (Press Information Bureau Government of India, Ministry of Science & Technology, 23/4/2015).

² For more information, see: <http://www.thehindubusinessline.com/markets/fii-shareholding-in-nse-listed-companies-up-20-in-june-quarter/article8994725.ece>.

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