

Firm leverage relationship with rd expenditure and performance



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2. 1. Introduction

This part of the study investigates how firms' leverage plays its role in relationship of R&D expenditures with firm performance and stock returns. Using the panel data fixed effect estimates study analyse annual data for firm performance and monthly data for stock returns of firms listed at NYSE, AMEX and NASDAQ over the period of 1975 till 2016. Studies have drawn some link between R&D investments and capital structure and have established that R&D firms tend to be low leverage firms but none of the studies have investigated how interaction of underlying characteristics of R&D and leverage makes R&D a less or more profitable investment under varying degrees of leverage.

Studies found a link between R&D intensity and capital structure but there's been a gap in how leverage effects the returns related to R&D. Most of the studies have found negative relationship between leverage and R&D intensity. The negative relationship arises either due to constraints from supply side of financing or due to R&D firms' own preference of financing through debt rather than equity. The financing frictions could arise due to

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various factors. First reason would be intangibility; higher level of intellectual capital limits the firm's debt capacity because of its low liquidation value in case of bankruptcy (Brown et al., 2009; Liu and Wong, 2011). Tangibility increases the value that can be captured by creditors in default states (Almeida and Campello, 2007) and investors tend towards financing of tangible physical assets as compared to intangible assets (Chiao, 2002). Secondly uncertainty related to success of R&D investments; ambiguity about future success, inflexibility and time lapse between input and output make R&D investment uncertain in terms of profitability (Kothari et al. 2002; Hall 2002; Bloom 2007; Li 2011) (Kothari et al. 2002; Hall 2002; Bloom 2007; Li 2011). Third factor that may affect the financing of R&D investments is income volatility; as studies have established that R&D increases earnings volatility (Ciftci and Creedy, 2011) and variability of future earnings due to R&D expenditures is greater than that due to capital expenditures (Kothari et al., 2002). Fourth factor is the distress risk that may be rooted into previous factors but studies have found strong relationship of R&D and financial distress (Zhang, 2015).

On the other side it's been argued that highly innovative firms' themselves prefer equity financing over debt financing. Chang and Song (2014) argued that even firms with good patent characteristics have lower leverage, so these firms should not have supply constraint as patents reduce the information asymmetry and can also be used as collaterals, so highly innovative firms themselves opt for equity to finance investments. The choice of equity over debt by highly innovative firms could be argued on the basis of information flow; firms that rely on private, firm specific information

may tend to secure equity instead of debt financing as release of information may reduce the value of innovative projects as a source of competitive advantage (Myers and Majluf, 1984; Turk and Hoskisson, 1991). Magri (2014) argued that equity is a better source of external finance than debt for innovation, as equity financing does not require collateral and doesn't increase the risk of bankruptcy.

All these studies have looked into why highly innovative firms tend to be low leverage, but none of the studies has looked into how leverage affects returns related to R&D activity of the firms. Based on the leverage and R&D specific characteristics this study propose that leverage can affect in either positive or negative way. Negative channel is rooted into the bankruptcy cost effect of leverage where both R&D and debt induce risk into the firm and increase bankruptcy cost thus leverage leading to magnify the bankruptcy affect associated with R&D and negatively affect the R&D related firm's profits. While on the other side positive effect is embedded in the governance effect of the debt financing where it is argued that debt financing incorporates element of vigilance in governance and firm investments, thus making investment choices more scrutinized which leads to increase the success of R&D projects and so the R&D related firms' profitability. The governance effect of leverage has never been talked about in terms of R&D investments. Thus the study is aimed towards exploring whether governance impact is more vigorous than bankruptcy cost impact of debt financing or vice versa.

2. 2. Literature Review

2. 2. 1. Leverage, Firm Performance and Stock Returns

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Does leverage affects the firm value? This debate has been started since 1958 with eminent paper of Modigliani and Miller (1958) that claimed that value of the firm to be independent of the capital structure. By taking assumptions of the perfect market, absence of taxes, no transaction cost and same borrowing rate for individuals and corporations MM claimed that capital structure thus firm's leverage doesn't affect value of the firm but revised their stance taking into consideration the tax effect (Modigliani and Miller 1963) and claimed that firms value is positively associated with debt level due to benefit of tax shield. However this claim showed debt as an ultimate choice for the firms without considering the risk effects associated with debt financing. Moving beyond irrelevance to relevance of capital structure studies acknowledged that there may exists a link with firm value which shifted the literature focus on the ways capital structure exerts influence over the firm's value.

Considering a balance between benefits associated with debt financing in form of tax shield and risk in form of bankruptcy cost, Kraus and Litzenberger (1973) proposed existence of an optimal capital structure and put forth a belief that firms maximize their value at optimal capital structure and departure from it will lead to decline it's value. Agency cost and free-cash-flow theories suggest that the capital structure influences firm performance (Jensen and Meckling, 1976; Jensen, 1986). Thus trade-off theory avows that firm's financing decisions are aimed towards an optimal level which is determined by a trade-off between marginal costs (agency costs and bankruptcy costs) and benefits (tax shield and reduction of free cash flow) of debt. Further literature adds to how capital structure affects the

investments, governance and the performance of the firm. Stiglitz (1988) put a glance on the contradictory issues from the capital structure irrelevance theory to show why capital structure matters targeting the governance impact of capital structure. Study claimed that debt holders exercise more effective control over capital than equity holders and managerial incentives are markedly different with debt and equity contracts as debt imposes a threat of bankruptcy on managers. Hamada (1972) studying the impact of leverage in systematic risk argued that systematic risk of the stock of a firm with higher debt to equity should be greater than for the stock with lower debt to equity ratio. Bhandari (1988) showed that leverage has a predictive relationship with expected returns and illustrate that expected return on high leverage stocks is high while expected return on low leverage stocks is low.

Empirical evidence of relationship of leverage with performance and stock returns provides quite contradictory results. Leverage has been found detrimental to firms performance and stock market returns by various studies (Rajan and Zingales, 1995; Majumdar and Chhibber, 1997; Booth et al, 2001; Fama and French, 2002; Margaritis and Psillaki, 2007; Dimitrov and Jain, 2008; Muradoglu and Sivaprasad, 2012; Kimathi et al, 2013). Rajan and Zingales (1995) used data from G7 countries that includes US, France, Italy, UK, Japan, Germany and Canada and found a negative relationship between leverage and firm performance. Investigating the relationship for varying firm size they reported that this negative association is considerably more important for large firms in US, Japan, Italy and Canada, however more positive in case of UK, while for insignificant for Germany and France. Booth et al (2001) studied the capital structure in developing countries including

Korea, Turkey, Pakistan, India, Thailand, Malaysia, Zimbabwe, Mexico, Brazil and Jordan, and found that high profitable firms are low lower leverage firms, results being consistent for both country and pooled data, demonstrating a negative association between firm profitability and leverage. Authors argued that their finding is consistent with the Pecking-Order hypothesis and also supports the existence of significant information asymmetries, suggesting that external financing is costly and consequently is avoided by firms. However some studies suggest that the way leverage affects performance also depends on the nature of debt capital where relational debt and performance has been found to be positively associated (Degryse and Ongena, 2001; James, 1987; Lummer & McConnell, 3 1989; Slovin, Johnson and Glascock, 1992; David et al., 2008).

2. 2. 2. R&D, Firm Performance and Stock Returns

Chapter 1 section 1. 2. 1 and 1. 2. 2 provides a detailed highlight on relationship of R&D with firm performance and stock returns. In summary most of the earlier work on the said relationship found a positive association (Eberhart et al., 2004; Anagnostopoulou et al., 2008; Aw et al., 2011; Ciftci and Creedy, 2011; Hirshleifer et al. 2013; Boler et al., 2015; Kung and Schmid, 2015). But there are few exceptions to these mainstream findings where the relationship is found to be positive for only high R&D industries and doesn't stand true for all companies Anagnostopoulou et al. (2008). As far as relationship of R&D intensity and stock returns is concerned studies have reported the positive link between two (Chan et al., 2001; Ho et al., 2004; Hsu, 2009; Bena and Garlappi, 2010; Cohen et al., 2013; Hirshleifer et al., 2013; Lin and Wang, 2016). However some studies found deviation or <https://assignbuster.com/firm-leverage-relationship-with-rd-expenditure-and-performance/>

conditioned these results to other company specific or industry specific factors. Garlappi (2004) reported that risk premium decreases as a result of technical progress, while Li (2011) argued that positive R&D and stock return relation exists only among financially constrained firms. Bena and Garlappi (2010) suggests that modelling industry rivalry is important for understanding the cost of capital of firms in different competitive environments.

2. 2. 3. Leverage and R&D

Studies suggest that financing behaviour of firms and thus the level of leverage varies with nature of their assets (Aghion et al., 2004; Almeida and Campello, 2007; Casson et al. 2008; Chang and Song, 2014). Aghion et al. (2004) advocated that “ financial behaviour of more innovative firms, as indicated by the presence and extent of R&D expenditure, differs from the financial behaviour of less innovative firms”. Analysing the publically traded UK firms they found that there exists a nonlinear relationship between the debt/assets ratio and the firm’s R&D profile. Positive R&D firms use more debt financing than firms with no-R&D but within firms that report positive R&D debt financing decreases with increase in R&D intensity. They found that probability to raise new equity increases with increase in R&D intensity. They argued that more innovative firms have more attractive investment opportunities and thus become more reliant on external sources of finance; first relying on debt to avoid dilution of control and then go for external equity as R&D intensity increases.

Studying the relationship between financing frictions and investments

Almeida and Campello (2007) argued that assets that are more tangible sustain more external financing because these assets mitigate contractibility problems. Tangibility increases the value that can be captured by creditors in default states. Analysing the US market firms, study found that asset tangibility itself affects the credit status of the firm, as firms with very tangible assets may become unconstrained. Casson et al. (2008) also argued that more innovative firms have more attractive investment opportunities, they will become more dependent on external financing, with at first a preference for debt financing because they can keep more control of business. Chiao (2002) carried out a study on the relationship between debt and R&D using US firm sample and found that current R&D is negatively affected by current debt but this holds true only for firms in science-based industries which usually have high R&D intensity compared to other industries. Chiao argued that investors tend towards financing of tangible physical assets as compared to intangible assets and high R&D capital stock will increase the marginal cost of debt for those firms.

David et al. (2008) found that there are two types of debt with different implications for R&D investment. Taking this into consideration, the choice of debt by managers is no longer irrelevant but will have a huge impact on R&D activity. David et al. (2008) make a distinction between relational debt (loan between firm and financial institution) and transactional debt (public securities, for example bonds). They found that R&D intensive firms that rely more on relational debt outperform those that rely more heavily on transactional debt. Other studies have also found that relational debt and

performance are positively related (Degryse and Ongena, 2001; James, 1987; Lummer & McConnell, 3 1989; Slovin, Johnson and Glascock, 1992)

Czarnitzki and Kraft (2009) analysing the German manufacturing companies found that the higher the leverage the more disciplined the managers behave. Moreover, companies with widely held capital stock are more actively involved in innovation activity as measured by patent applications implying weakly controlled managers show a higher innovation propensity. Czarnitzki and Hottenrott (2011) analysing the German business sector showed that internal sources of finance are preferred by firms but great reliance on internal sources of financing for R&D projects may constrain financing of those R&D projects for firms who have limited internal financial resources. Study employed credit rating index to determine the external capital constraints. Moreover, internal funds are more important for investments in R&D than it is for the level of capital investment. They argued that physical capital investment offers more collateral and thus costs less for external financing compared to intangible investment with low or no collaterals. Therefore companies who invest in capital investments are less dependent on internal funds than companies investing in R&D. Besides, for smaller firms the investment in R&D increases when it is easier for them to get access to external funding. For larger firms however, this does not matter. For those firms, the gap between internal and external costs of capital is lower.

Liu and Wong (2011) investigated two distinct roles of intellectual capital in corporate financing decisions; first role in limiting the firm's debt capacity to raise debt because of low liquidation value of intellectual capital and second <https://assignbuster.com/firm-leverage-relationship-with-rd-expenditure-and-performance/>

role in improving firm's debt capacity through its positive impact on the earning potential. The study took four patent based metrics i. e. number of patents, the number of citations received by each patent, the technological class of the patent, and the year that the patent application was filed and granted and one R&D based variable i. e. residual R&D as a proxy for the intellectual capital. Study found that the impact of intellectual capital on firm leverage is both statistically and economically significant. Moreover on one side higher level of intellectual capital limits the firm's debt capacity because of its low liquidation value in case of bankruptcy, while on the other side a higher level of IC enhance the firm's debt capacity because of its positive impact on earnings but the former effect remains dominant. Furthermore study also revealed that the intellectual capital effect on firm leverage is more pronounced for intellectual capital intensive firms

Chang and Song (2014) agreed to the finding that highly innovative firms issue more equity than debt and eventually move towards zero leverage. But they argued that high leverage is not due to the financial constraints they face from debt suppliers but these firms choose to prefer equity over debt. They based their argument on the findings that even firms with good patent characteristics have lower leverage, so these firms should not have supply constraint as patents reduce the information asymmetry and can also be used as collaterals. Based on the outcomes they argued that highly innovative firms chose to finance their capital through equity because they may find equity to be more favourable.

Magri (2014) argued that equity is a better source of external finance than debt for innovation, even though equity can be affected by issuing costs and <https://assignbuster.com/firm-leverage-relationship-with-rd-expenditure-and-performance/>

adverse selection problems that arise from information asymmetry. The main arguments for this are that equity financing does not require collateral and doesn't increase the risk of bankruptcy and it allows investors to earn the entire benefits of the returns of innovative projects. Hall et al. (2015) argued lack of internal funds eventually lead to lower levels of innovations and reduce the impact of innovation on the performance of firms. Moreover they argued that financing constraints can be mitigated by patenting and by underlying firm quality signalled like high TFP or exporting.

Leverage can play two distinct roles in firm performance thus can affect returns to R&D investment in two ways. First as a tool for corporate control (Sriglitz, 1988; Casson et al., 2008; Czarnitzki and Kraft, 2009), debt holders exercise more effective control over capital than equity holders (Sriglitz, 1988) and debt imposes a threat of bankruptcy on managers, so makes them more vigilant in allocation of resources (Czarnitzki and Kraft, 2009) based on this school of thought it is assumed that firms with higher debt in their capital structure are more vigilant in allocation of resources which in our case is investment on research and development expenditures, so If corporate control component is stronger, high leverage in the firm will lead to better returns related to R&D investments. While on the other side use of leverage more than optimal level would lead to deteriorate the financial performance of the firm as per cost benefit trade-off (Kraus and Litzenberger, 1973), or underinvestment issue related to default risk (Myers, 1977) while empirical studies have also found negative relationship of leverage with firm performance. Leverage has been found detrimental to firms performance and stock market returns by various studies

(Margaritis and Psillaki, 2007; Muradoglu and Sivaprasad, 2012; Kimathi et al, 2013). Moreover both R&D and leverage are associated with high risk and bankruptcy costs (Eisdorfer and Hsu, 2011; Zhang, 2015). So presence of leverage magnifies the bankruptcy cost impact which is linked to R&D as well, thus performance related to R&D will decline in presence of high leverage.

Chiao (2002) it is shown that, in (non-)science-based industries, current R&D (raises) lowers current debt and current physical investment raises current debt; and that current debt raises current physical investment and (raises) reduces R&D. In other words, the evidence supports that debt is a resource to enhance both physical investment and R&D in nonscience-based industries, but debt is only a resource to enhance physical investment but not R&D in science-based industries.

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