Leverage and firm investment: the role of information asymmetry and growth

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Abstract

Purpose: This paper demonstrates how financial leverage impacts firm investment and the extent to which this relationship is conditional on the level of information asymmetry as well as growth.

Design/methodology/approach: The paper relies on data from 2403 Indian firms during the period 1995–2014, generating a total of 19,544 firm-year observations. Analysis is conducted by using various panel econometric techniques.

Findings: Drawing insights from agency theories, the paper uncovers that financial leverage is negatively and significantly related to firm investment. It is also observed that the impact of financial leverage on firm investment is significant for high information asymmetric firms. Finally, the paper shows that the relationship between leverage and firm investment is significant for low-growth firms. However, no significant relationship is found between leverage and investment for high-growth firms.

Originality/value: This paper provides fresh evidence on the leverage-investment nexus and, to the authors' knowledge, it the first paper to examine the extent to which this leverage-investment relationship is driven by the level of information asymmetry.

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1. Introduction

This paper provides a new contribution to the existing literature by examining the effect of firm leverage on investment with a specific focus on Indian firms. It also distinctively examines the extent to which the leverage-investment relationship is driven by the level of information asymmetry as well as firm growth. The analyses are conducted and the results interpreted within a classic agency theoretical framework.

The central proposition of Modigliani and Miller's (hereafter MM) (1958) seminal work is that, under the assumption of perfect capital markets, capital structure is irrelevant to firm value and hence a firm's financing and investment decisions are independent. This means that firm managers could not maximise the value of their firms by altering the debt-equity mix. Thus, in the view of MM (1958), a firm with profitable investment opportunities could still obtain the external funds required regardless of the state of its financial position. Subsequent developments, however, suggest that a firm's capital structure is essentially relevant as finance affects real investment decisions. For instance, Myers (1977) shows that firms with more debt service are likely to have their positive net present value (NPV) projects go unfunded because of the issue of debt overhang created by prior debt financing. Consequently, this suggests that the leverage level of a firm matters in its investment decision. In respect of this, a significant number of studies (e.g. Bradley et al., 1984; Friend and Lang, 1988; Denis and Denis, 1993; McConnell and Servaes, 1995; Lang et al., 1996; Cleary, 1999; Aivazian et al., 2005a; Cleary, 2006) have been devoted to examining the leverage-investment relationship. However, these empirical studies are heavily biased to data originating in developed nation settings, ignoring potential variations in the investment outcome of financial leverage in firms located in less developed markets. Given this gap, it is therefore important to probe the leverage-investment relationship in the context of an emerging market such as India. Thus, by relying on large-scale data from over 2400 firms,

this study offers a fresh insight into the leverage-investment relationship from the context of an emerging economy – India. Our work is closely related in spirit, though distinct from prior studies (e.g. Aivazian et al., 2005 and Ahn et al., 2006) in one major respect: we argue on the basis of prior scholarly works (e.g. Lang et al., 1996) that management chooses leverage based on its private information about the firm's future growth opportunities. Thus, as a way of extension, the paper assesses the extent to which the leverage-investment relationship is conditional on the level of information asymmetry. Consistent with other empirical works (e.g. Lang et al., 1996; Aivazian et al., 2005;d Ahn et al., 2006), the results indicate that leverage is negatively related to firm investment and significantly stronger for high information asymmetric firms. Moreover, it is observed that this negative effect is also significantly stronger for low-growth firms than for high-growth firms.

The paper contributes to the finance literature in the following ways. First, by relying on data from India, it is among the first to examine the leverage-investment nexus outside the context of a developed market. By so doing, it demonstrates that the leverage-investment relationship evident in the developed context is also applicable in the context of an emerging market. Second, despite the burgeoning managerial and academic interest in capital structure issues, scholarly research is yet to examine if information asymmetry drives the leverage-investment relationship. Given this, the paper extends extant knowledge on the financial leverage-investment relationship by showing how the relationship is shaped by degrees of information asymmetry. By relying on analysts' forecast properties, the paper demonstrates that leverage is negatively related to investment and that this negative effect is significantly stronger for high information asymmetric firms. To the best of the authors' knowledge, this is the first study to examine this.

The rest of the paper is organised as follows: section 2 provides a brief background of the study; section 3 examines relevant literature and its theoretical underpinnings; section 4 discusses the sample, empirical design and measurement of variables; section 5 presents the regression results and discussion; finally, section 6 provides a summary of the findings and concludes the study.

2. Background of study

An overview of the unique features of India's economic, financial and investment structure puts this paper into perspective. In India, there has been continuously rapid economic growth over the last three decades, for instance, the institutionalisation of the 1991 financial liberalisation reforms which over time gradually opened up the sector through interest deregulation and easing of restrictions on capital flows (Bhattacharyya et al., 1997a, b; Kumbhakar et al., 2003; Ataullah et al., 2004; Shanmugam and Das, 2004). As early as 1992/93, the Central Bank of India (the Reserve Bank of India (RBI)) instituted guidelines for the establishment of Joint Ventures (JVs) and Wholly-Owned Subsidiaries (WOS) by Indian corporations abroad. In 1997/98, policies regarding Indian investment overseas were liberalised, allowing mutual funds and fund managers registered with the Securities and Exchange Board of India (i.e. the stock market regulator) to undertake investment opportunities in foreign markets within an overall capital restriction of USD 500m. Subsequently, restrictions regarding the specific use of external funds raised under external commercial borrowing regulations by firms were lessened. By the early 2000s, Indian firms were granted authority to acquire foreign firms and/or make direct investment in other countries/economies through Joint Ventures (JVs) and Wholly-Owned Subsidiaries (WOS). Indian firms were also permitted to invest up to 100% (rather than the prior ceiling of 50%) of their American Depository Receipts/Global Depository Receipts (ADR/GDR) proceeds for acquisitions of foreign corporations and direct investments in Joint Ventures (JVs) and Wholly-Owned Subsidiaries (WOS). These reforms also facilitated an upsurge in financial innovations in the financial sector, ensuring that Indian firms have better availability, access and freedom to choose debt instruments suitable to their investment and funding needs (Jadiyappa et al., 2016). Hence, blue-chip firms borrowed significantly in foreign markets in order to support their investment projects. Firms preferred borrowing from foreign markets due to the relatively low cost associated (i.e. low interest rates prevalent in foreign markets) (Sanyal and Shankar, 2011). Although the liberalisation was aimed at increasing firm performance and competition, the high preference created certain concerns which the Reserve Bank of India (RBI) has over time continued to stress, particularly regarding unhedged foreign currency exposures of Indian firms (Reserve Bank of India, 2002a, b; 2004). In spite of this significant economic progress, India's financial sector is still dominated by an inefficient banking sector which results in significant misallocation of financial resources. In view of this, firm financing from non-bank and non-market sources (backed by non-legal

mechanisms) constitutes the main form of external finance for investment projects (Allen et al., 2012). Given this background, India presents a significant case example to investigate how leverage affects investment and the extent to which the leverage-investment relationship is driven by information asymmetry and growth.

3. Related literature

Myers (1977) introduced the principal-agent model which highlights the potential interactions between growth opportunities, information asymmetry and leverage. He indicated that, given the presence of agency conflicts, especially for high-growth firms with risky debts, firm managers may pass up positive NPV projects. The motivation for this decision is to avoid payoffs from the positive NPV projects accruing to debtholders rather than to shareholders and managers (Biddle et al., 2009). The consequence of this decision is the underinvestment bias or debt-overhang problem. The more growth opportunities available to a firm, the greater the extent of underinvestment biases the firm encounters. To mitigate these problems, a firm anticipating an increase in valuable growth opportunities must lessen its leverage capacity (Myers, 1977). Lessening a firm's leverage capacity could be achieved either through debt covenants[4] or shortening the maturity structure of debt[5] to lower the cost of risky underinvestment problems. Thus, the underinvestment hypothesis postulates that firms that exhibit high growth potential should avoid debt financing ex-ante purposely to mitigate any conflict of interests between debtholders and shareholders. This will consequently control for the 'debt overhang' problems and any ensuing underinvestment incentives (Myers, 1977). On the other hand, Jensen (1986) and Stulz (1990) contend that, given the availability of large free cash flows, particularly for low-growth firms, the use of leverage may serve as a vehicle of discipline for managers, hence inducing managers to invest free cash flows solely in projects that earn returns above the company's cost of capital rather than overinvesting in risky projects. Overinvestment results in the lock-up of a firm's funds in idle fields of production capacity, consequently resulting in wastage of scarce resources and reduction in

[4] Debt covenants serve as an alternative means of controlling for underinvestment problems. See Smith and Warner (1979) and Demiroglu and James (2010) for an assessment of debt covenants; Nash et al. (2003), Billett et al. (2007) and Chava and Roberts (2008) for an empirical study of the role of debt covenants on investment.

[5] The use of short-term debt with expiration/maturity date due before the implementation of an investment project entitles a firm's shareholders and managers to the full benefit to be accrued from the new project. This can be achieved through renegotiation of debt contracts between shareholders/managers and debtholders, hence mitigating the adverse underinvestment biases (Dang, 2011).

firm value. Hence, Stulz (1990) contends that managers will be induced to invest too much when cash flow is high and too little when cash flow is low.

According to Aivazian et al. (2005a), the structure of anticipations regarding future growth opportunities and any associated costs of re-contracting are both vital in examining the effect of leverage and debt maturity on firm investment. This is because unanticipated growth opportunities reduce the scope for mitigating underinvestment problems. Renegotiations with debtholders tend to become very time consuming and thus costlier compared to when growth opportunities are anticipated. Moreover, when growth is unanticipated, negotiations may require rapid completion before the growth opportunities disappear via competition. Consequently, the anticipation of growth opportunities and the renegotiation costs are adversely related, thus implying that long-term debt has a highly significant adverse effect on firm investment when growth opportunities are unanticipated compared to when they are anticipated. This is because, in the case of the former, adjustment costs of debt are higher. Hence, a low-leverage and/or short-term debt maturity strategy create room for more growth options to be taken, resulting in a higher level of investment (Dang, 2011). Put simply, reducing a firm's leverage and/or shortening its debt maturity are expected to increase the positive impact of growth opportunities on investment.

Following the above discussion, several pieces of recent empirical evidence advocate that the attempt to rebalance a firm's capital structure to its optimal level is generally subjected to significant adjustment costs (see Betker, 1997; Fama and French, 2002; Leary and Roberts, 2005). Therefore, Dang (2011) suggests that a firm is better off without adjustments to leverage and debt maturity when related costs exceed lost underinvestment benefits. Likewise, when the cost of the liquidity risk associated with short-term debt outweighs the mitigated cost of underinvestment problems, firms will have fewer incentives to shorten their debt maturity. Hence, transaction costs and liquidity risk may restrict and prevent firms from fully adjusting their leverage and debt maturity structure, consequently leading to underinvestment ex-post.

However, the financial flexibility hypothesis contends that, due to the existence of imperfect markets or market frictions such as adverse selection (Myers and Majluf, 1984) or transaction costs (Leary and Roberts, 2005), high-growth firms will strategically opt for low debt levels with large cash reserves in order to preserve their borrowing capacity for future investment opportunities (Modigliani and Miller, 1963; Almeida et al., 2004; Gamba and Triantis, 2008;

Harford et al., 2009; de Jong et al., 2012; Arslan-Ayaydin et al., 2014). In addition, Eisfeldt and Rampini (2009) contend that, in an attempt to sustain flexibility, firms would be more likely to utilise lease financing instead of relying on external financing for procurement of assets. Arslan-Ayaydin et al. (2014) suggest that highly flexible firms in particular have greater ability to undertake investment opportunities and also exhibit better performance levels compared to less flexible firms during crisis periods. Thus, both the underinvestment hypothesis (Myers, 1977) and financial flexibility hypotheses (Marchica and Mura, 2010; Denis, 2011; Denis and McKeon, 2012) suggest that firms strategically have zero leverage structures in order to preserve financial flexibility and alleviate investment distortions (Dang, 2013). Nevertheless, the financial flexibility hypothesis additionally highlights the vital role of cash reserves as a mechanism for enhancing a firm's investment ability.

Extant literature demonstrates how leverage relates to firm investment. To begin with, Fazzari et al. (1988), Hoshi et al. (1991), Gertler and Gilchrist (1994) and Lamont (1997) provide evidence to show that there is a positive relationship between internal cash flow and investment and that the relationship is significant particularly for firms experiencing significant barriers to external funds. Scandizzo (2005) confirms this finding and further indicates that the significant relationship between internal cash flow and investment is particularly applicable to innovative firms. Similarly, Denis and Denis (1993) also demonstrate that an increase in a firm's financial leverage is accompanied by a significant decrease in its capital expenditure (investment). Lang et al. (1996) also analyse the nexus between leverage and firm investment, relying on a sample period between 1970 and 1989. By controlling for sales, growth (Tobin's Q) and cash flow, the evidence indicates that leverage has a significant but negative impact on a firm's investment. Aivazian et al. (2005a) also demonstrate that leverage has a negative and significant impact on investment decisions of public Canadian firms. Similarly, Firth et al. (2008) observe a negative relationship between investment and leverage for Chinese listed firms. In a similar vein, Ahn et al. (2006) also investigate the impact of leverage on investment in diversified firms in the United States and observe a negative impact of firm leverage on investment.

Other empirical extensions in the literature (e.g. Oliner and Rudebusch, 1992; Gilchrist and Himmelberg, 1995; Kadapakkam et al., 1998) also focus on examining the nexus between information asymmetry and investment-cash flow sensitivity. Degryse and De Jong (2006) posit that the magnitude of information asymmetry biases and any resulting underinvestment biases depend on certain firm-level features (e.g. information sensitivity of an industry and

bank-firm relationships). Hoshi et al. (1991) introduce information asymmetry and overinvestment problems explicitly by distinguishing between firms with low and high investment opportunities. They conclude that overinvestment problems are typically less relevant for firms with high growth opportunities. Along similar lines, a more recent extension of the literature by Nahar et al. (2016) and Song (2014) observe that superior accounting policy leads to a reduction of information asymmetry. Thus, the reduction of information asymmetry should have significant effect on cost of capital and investment decision.

However, on the whole, research on the leverage-investment relationship and the extent to which this relationship is driven by the level of information asymmetry and firm growth in this context of emerging economies is scant to date. In response, this paper provides new evidence on this, specifically highlighting the extent to which this relationship is shaped by the level of information asymmetry as well as firm growth.

4. Methodology

4.1. Data and variables

Annual financial data was obtained for 2403 Indian firms from the DataStream database for the period 1995-2013. In all, a total number of 19,544 of unbalanced firm-year observations were used in the regression analyses. Variables used in this study were chosen in line with the extant literature. The dependent variable is investment (*INV*). The independent variables are Overall Leverage (*LEV*) and Long-term Leverage (*LTLev*). Also, the paper controls for a number of firm-specific variables. These control variables are firm size (*SZ*), asset tangibility (*TAN*), return on assets (ROA), firm growth (*GR*), liquidity (*LIQ*) and non-debt tax shield (*NDTS*). Also, analysts' forecast data for measuring information asymmetry was obtained from the Institutional Brokers Estimate System (*IBES*) International database. All variables are winsorised at a 5% level on either tail to mitigate the effect of outliers. A summary of the variables used and their descriptions are presented in Table 1.

[Table 1 about here]

4.2. Descriptive statistics and correlations

The summary statistics of the variables used in this study are presented in Table 2. The

average value of firm investment (*INV*) is 0.30 and has a standard deviation of 0.33. This variable has a minimum value of 0.00 and a maximum value of 1.27, signifying a high degree of heterogeneity. Also, the average value of overall leverage (*LEV*) is 0.31. This low figure may reflect the fact that Indian firms are mainly equity financed. The average value of long-term leverage is 0.19 and has a standard deviation of 0.17. Firm size (*SZ*) has a mean value of 14.77 and a standard deviation of 1.60. This variable has a minimum and maximum value of 11.89 and 17.81 respectively, signifying a fair degree of heterogeneity. It is further observed that the average performance of firms investigated (as measured by ROA) is 0.06, with a standard deviation of 0.08. This variable has a minimum value of -0.11 and a maximum value of 0.22. This suggests that some of the firms investigated experienced a negative performance. It is also observed that firm growth (*GR*) has a mean value of 0.20 and a standard deviation of 0.333. This variable has a minimum value of -0.36 and a maximum value of 1.04. This suggests that some of the firms investigated experienced a negative growth during the period under observation.

[Table 2 about here]

In relation to Table 3, the paper investigates whether the independent variables employed are likely to suffer from collinearity problems. First, it can be observed that the correlation between the two independent variables (*Lev* and *LTLev*) is very high (0.82). This suggests that both variables are capturing a similar aspect. However, this poses no concerns about multicollinearity as both variables enter the regression model alternatively. It can also be seen that the correlation (but not necessarily the causal relationship) between the dependent (*INV*) and independent variables (*LEV*, *LTLev*) is negative. In relation to the control variables, the correlation among them reveals there is no multicollinearity issue. In general, the findings from both tables 2 and 3 indicate that none of the variables suffer from any serious bias that is likely to plague the regression results.

[Table 3 about here]

4.3. Estimation method

In this section, the empirical models are formulated to test the relationships described in section 1 above. The baseline regression model is formulated as:

$$INV_{i,t} = \alpha + \beta X_{i,t-1} + \lambda_t + \varepsilon_{i,t-1} \quad (1)$$

Where *INV* (Investment) is the measure of firm investment (as defined in Table 1 above), *X* is the matrix of the independent and control variables also previously referenced and defined in Table 1, ε is the composite error term which includes the time-invariant firm-fixed effects and an independently and identically distributed component with mean zero:

$$\varepsilon_{i,t-1} = \mu_i + \upsilon_{t-1} \quad (2)$$

To test the relationship between the dependent (*INV*) and independent variables (*Lev* and *LTLev)*, each of the independent variables enters the regression equation alternatively.

The models, Eq. (1) and Eq. (2), can be estimated using OLS. However, this estimation approach fails to control for unobserved firm-level heterogeneity, leading to biased and inconsistent estimates (Wooldridge, 2009, p. 246). Thus, a practical approach in dealing with this is to adopt a panel fixed-effects or random-effects estimation method. Using the Hausman test, it can be confirmed that the fixed-effects (FE) models are most appropriate to account for the firm-level heterogeneity. Hence, the analysis is based on the panel fixed-effects models and the pooled OLS is used for robustness checks. In order to control for possible heteroscedasticity and autocorrelation within firms, the paper adjusts the standard errors of the regression coefficients by using the Huber-White approach and clustering at the firm level. Finally, in order to isolate the analysis from the potential reverse causality between dependent and independent variables, the paper follows the existing literature (e.g. Danso and Adomako, 2014; Zou and Xiao, 2006) and lags the explanatory variables by one period.

5. Results and Discussion

This section presents the paper's estimation results: first, the results for the baseline models, where firm investment (*INV*) is explained by the two independent variables (*Lev and LTLev*). This result is presented in Table 4. This is followed up by checking the robustness of the results (Tables 5 and 6). Next, the section examines the extent to which information

asymmetry matters in the leverage-investment relationship (Table 7). Finally, it looks at how firm growth impacts on the leverage-firm investment relationship (Table 8).

5.1. Leverage and firm investment

The baseline results are presented in Table 4. Two main estimation methods are used, OLS and fixed-effects models. Models 1-2 and 5-6 are based on OLS whilst the remaining models (i.e. 3-4 and 7-8) are based on fixed effects. A Hausman specification test is performed, and it provides support for the fixed-effects estimation. Thus, the results are discussed using the fully specified fixed-effects model estimations. The discussion starts with model 4, where overall leverage (*LEV*) is negatively and significantly related to firm investment (*INV*). The coefficient of this variable is -0.049 and has a standard deviation of 0.21. This suggests that a one standard deviation increase in LEV is associated with a 1.03% decrease in firm investment (*INV*). This finding is generally consistent with the view that capital structure plays an important role in the investment decisions of firms. Higher leverage levels lead to higher cost of future financing for firms, thus supporting Jensen's (1986) agency cost of free cash flow hypothesis and Myers' (1977) argument that leverage creates potential underinvestment incentives particularly for highly levered firms. This confirms other empirical findings (e.g. Lang et al., 1996; Aivazian et al., 2005b; Ahn et al., 2006). With regard to the long-term leverage (*LTLev*), the paper finds that the coefficient of the variable, as indicated by model 8 (i.e. the fully specified FE model), is negative and significant at the 1% level. Based on this result, a one standard deviation increase in LTLev is associated with a 0.66% decrease in firm investment, thus indicating that LTLev (which is the most stable part of overall debt) also decreases firm investment.

[Table 4 about here]

Turning to the control variables, the paper finds that firm size (*SZ*), asset tangibility (*TAN*) and non-debt tax shield (*NDTS*) have negative and significant effects across all models. However, Return on assets (*ROA*) and Liquidity (*LIQ*) have positive significant effects on investment. Growth (*GR*) positively affects investment, although this effect is insignificant.

5.2. Robustness check

5.2.1. Using an alternative measure of firm investment

The results obtained so far are based on firm investment defined as ratio of net capital expenditure (capital expenditure minus depreciation) of firm *i* to total assets for the current year (Firth et al., 2008). This section assesses the sensitivity of the results to an alternative measure of firm investment defined as the ratio of capital expenditures to the start-of-period net property, plant and equipment (Chava, and Roberts, 2008). The results of this are presented in Table 5. It can be observed from the results that the signs on the coefficients of the two independent variables (*Lev* and *LTLev*) do not change. In general, the magnitude of the estimated coefficients of the independent variables in the fully specified fixed-effects models remains negative and significant for both LEV and LTLev. This is a confirmation of the findings reported in Tables 4.

[Table 5 about here]

5.2.2. Leverage and firm investment – GMM estimation

Until now, the paper has documented that LEV and LTLev have a negative and significant impact on firm investment. At this stage, the robustness of the results is probed by addressing the potential endogeneity problems that are likely to plague the findings. Such problems may arise from possible reverse causality between leverage and firm investment. Although lagged values were used for the independent variables in the models to mitigate such simultaneity bias, the paper follows existing literature (e.g. Ozkan, 2001; Fosu, 2013) to fully address the simultaneity issues and omitted variable bias in respect of leverage, and re-estimates all the models using the 2-step Generalised Method of Moments (*GMM*) technique. The result of this is presented in Table 6[6].

[Table 6 about here]

[6] The results in Table 6 confirm that that the instruments are valid and relevant: the Hansen J-statistics p-values are all in excess of 0.1, suggesting that the over-identifying restrictions are valid (see Baum, Schaffer, & Stillman, 2003).

It can be observed from the GMM results that the signs and magnitude of the estimated coefficients remain similar to what is already reported in tables 4 and 5 above. For instance, both LEV and LTlev (as reported in tables 4 and 5) are negative and significant at the 1% level. This is similar to what is reported in the GMM estimation in Table 6. This shows that the main results reported in Table 4 above are robust with respect to an alternative econometric model.

5.3. Leverage and firm investment: the role of information asymmetry

One way to extend extant knowledge on the financial leverage-investment relationship is to examine how the relationship is shaped by degrees of information asymmetry. The authors' position is that, given that firms have private information regarding the quality of their investment projects, this creates incentives for adverse selection and capital rationing. Basically, the presence of private information has implications for the cost of capital and thus subsequent investment decisions (Myers, 1984; Myers and Majluf, 1984). Therefore, to examine the role of information asymmetry in the leverage-investment relationship, the paper follows the analyst forecast properties literature (e.g. Krishnaswami et al., 1999; Drobetz et al., 2010; Fosu et al., 2016) and measures the information asymmetry using dispersion of analyst forecast. Specifically, the information asymmetry is computed as the standard deviation of analysts' forecast earnings per share for the fiscal year. The sample firms are then split into quantiles where the firms in the top one-third quantile of the standard deviation of analysts' forecast earnings per share for the fiscal year are marked as high information asymmetric firms, whilst those in the bottom one-third quantile are marked as low information asymmetric firms. The results of this are presented in Table 7 and variation can be observed in the leverage-investment relationship for low and high information asymmetric firms. Indeed, evidence obtained indicates that both LEV and LTLev are not significantly related to investment for firms with low information asymmetry. In contrast, both LEV and LTLev are negatively and significantly related to firms with high information asymmetry. This indicates that leverage constrains investment more in firms that have higher information asymmetry. Therefore, firms with a higher level of information asymmetry would choose a lower level of leverage to avoid underinvestment problems.

[Table 7 about here]

5.4. Leverage and firm investment: the role of firm growth

This sub-section extends the baseline model presented in section 3.3 by examining the extent to which firm growth matters in the leverage-investment relationship. To do this, the authors follow Fosu et al. (2016) and use one-year growth rate of sales as a proxy for firm growth and split the sample firms into quantiles where the firms in the top one-third quantile of the one-year growth rate of sales are marked as high-growth firms, whilst those in the bottom one-third quantile are marked as low-growth firms. The results of this are presented in Table 8.

[Table 8 about here]

First, the results are consistent with and complementary to the main findings that leverage and firm investment are negatively related. However, it is worth noting that the impact of both LEV and LTLev on INV is insignificant for high-growth firms. In the case of low-growth firms, the coefficients for both LEV and LTLev are statistically significant at the 1% level. With regard to LEV, a standard deviation increase leads to a 1.02% reduction in firm investment, whilst, for LTLev, a standard deviation increase is associated with up to a 1.22% reduction in investment. The result indicates that, whilst high-growth firms vigorously attempt to lessen leverage to moderate biases, the decrease in agency cost of risky debt overhang may be trivial in magnitude, hence restricting their ability to pursue more valuable growth opportunities ex post (Tsuruta, 2015). Thus, for low-growth firms, leverage may limit the effective actualisation of investment opportunities. The results are broadly consistent with Aivazian et al. (2005b).

6. Conclusion

Using a large dataset from 2403 Indian firms, this paper documents the leverage-investment relationship and the extent to which this relationship is driven by the level of information asymmetry as well as growth. The investigation provides important insights into the extent to which firm investment is driven by leverage. The evidence obtained suggests that both overall leverage (LEV) and long-term leverage (LTLev) exert a negative effect on firm investment. The robustness of this result is verified by an alternative definition of firm investment as well as using a different econometric technique (GMM). The study provides support for a study of Canadian firms by Aivazian et al. (2005b). Going beyond this, it also shows that both information asymmetry and growth matter in this leverage-investment relationship. Specifically, the paper observes that, for high information asymmetric firms, the leverage-investment relationship is negative and significant. However, no significant relationship is found for low information asymmetric firms. In the case of growth, the paper documents that the leverage-investment relationship is positive and significant for low-growth firms.

To conclude, this study provides new insights into the leverage-investment relationship and the role of information asymmetry and firm growth. It will be interesting and useful to extend this research to test how this relationship matters across industrial lines. This is something that could be looked at in future research.

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Table 1: Description of variables

Dependent Variable	***Description***	***Literature***
Firm Investment (INV)	Ratio of net capital expenditure (capital expenditure minus depreciation) of firm *i* to total assets for the current year	Firth et al. (2008)
Independent Variables		
Overall Leverage (LEV)	Ratio of total debt to total assets	Chen (2004), Chava and Roberts (2008), Chen et al. (2010)
Long-Term Leverage (*LTLev*)	Ratio of long-term debt to total assets	Chen (2004)
Control Variables		
Firm size (*SZ*)	Log of total assets	Fosu et al. (2016), Qian and Yeung (2015)
Asset tangibility (*TAN*)	Ratio of fixed assets to total assets	Qian and Yeung (2015), Danso and Adomako (2014)
Return on Assets (ROA)	Ratio of total operating profit plus depreciation and amortisation (EBITDA) to total assets	Fosu (2013)
Firm growth (*GR*)	The one-year growth rate of sales	Fosu et al. (2016), Fosu (2013)
Liquidity (LIQ)	Ratio of current assets to current liabilities	De Jong et al. (2008)
None Debt Tax Shield (NDTS)	Ratio of depreciation expense to total assets	Danso and Adomako (2014), Zhang and Kanazaki (2007)

This table presents the description of all the variables used.

Table 2: Descriptive statistics

	Mean	Std. Dev.	Min	Max	25th%	50th%	75th%	Obs.
INV	0.30	0.33	0.00	1.27	0.06	0.18	0.40	18377
LEV	0.31	0.21	0.00	0.71	0.12	0.31	0.46	19544
LTLev	0.19	0.17	0.00	0.57	0.03	0.14	0.30	19541
SZ	14.77	1.60	11.89	17.81	13.57	14.74	15.89	19559
TAN	0.37	0.21	0.04	0.74	0.20	0.36	0.53	19514
ROA	0.06	0.08	-0.11	0.22	0.01	0.07	0.11	19459
GR	0.20	0.33	-0.36	1.04	0.01	0.16	0.34	16893
LIQ	1.86	1.26	0.56	5.75	1.11	1.44	2.09	19425
NDTS	0.03	0.02	0.00	0.08	0.02	0.03	0.04	19446

This table presents the descriptive statistics for the data. The sample comprises 2403 Indian firms over the period 1995 to 2013. The variable descriptions are provided in Table 1 above.

Table 3: Correlations matrix

	INV	LEV	LTLev	SZ	TAN	ROA	GR	LIQ	NDTS
INV	1.00								
LEV	-0.15***	1.00							
LTLev	-0.11***	0.82***	1.00						
SZ	-0.03***	0.14***	0.16***	1.00					
TAN	-0.24***	0.43***	0.49***	0.13***	1.00				
ROA	0.28***	-0.28***	-0.23***	0.15***	-0.08***	1.00			
GR	0.26***	-0.01	0.02***	0.05***	-0.06***	0.29***	1.00		
LIQ	0.16***	-0.35***	-0.12***	-0.22***	-0.28***	0.08***	0.04***	1.00	
NDTS	-0.12***	0.17***	0.20***	-0.01	0.46***	-0.05***	-0.10***	-0.16***	1.00

This table presents the correlation matrix for the data. The sample and variable definitions are as described in Table 1.
*** indicates significance at 1% or better

Table 4: Regression results for the full sample period – Dependent variable = INV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	FE	FE	OLS	OLS	FE	FE
LEV	-0.001	0.004	-0.099***	-0.049***				
	(0.004)	(0.004)	(0.006)	(0.006)				
LTLev					0.017***	0.006	-0.075***	-0.039***
					(0.005)	(0.005)	(0.006)	(0.007)
SZ		0.003***		-0.013***		0.003***		-0.013***
		(0.000)		(0.002)		(0.000)		(0.002)
TAN		0.080***		-0.027***		0.079***		-0.026***
		(0.004)		(0.009)		(0.005)		(0.009)
ROA		0.195***		0.133***		0.195***		0.144***
		(0.009)		(0.012)		(0.009)		(0.012)
GR		0.022***		0.002		0.022***		0.002
		(0.002)		(0.002)		(0.002)		(0.002)
LIQ		0.005***		0.005***		0.005***		0.007***
		(0.001)		(0.001)		(0.001)		(0.001)
NDTS		-0.519***		-0.788***		-0.520***		-0.807***
		(0.045)		(0.076)		(0.045)		(0.075)
_cons	0.082***	-0.068***	0.056***	0.258***	0.078***	-0.063***	0.036***	0.254***
	(0.005)	(0.009)	(0.002)	(0.028)	(0.005)	(0.009)	(0.002)	(0.028)
N	18199	15492	18199	15492	18197	15491	18197	15491
r2	0.045	0.175	0.106	0.144	0.047	0.175	0.087	0.141
N_clust	2367	2296	2367	2296	2367.000	2296	2367	2296

Standard errors in parentheses. All variable definitions are as described in Table 1. ⋆ Indicates significance at 10%; ⋆⋆ Indicates significance at 5%; ⋆⋆⋆ Indicates significance at 1%.

Table 5: Regression results using an alternative measure of firm investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	FE	FE	OLS	OLS	FE	FE
LEV	-0.234***	0.052***	-0.530***	-0.169***				
	(0.017)	(0.018)	(0.026)	(0.029)				
LTLev					-0.242***	0.089***	-0.437***	-0.101***
					(0.021)	(0.023)	(0.029)	(0.031)
SZ		0.004*		-0.096***		0.003		-0.098***
		(0.002)		(0.009)		(0.002)		(0.009)
TAN		-0.348***		-0.663***		-0.364***		-0.669***
		(0.020)		(0.044)		(0.021)		(0.044)
ROA		0.783***		0.531***		0.794***		0.578***
		(0.043)		(0.055)		(0.042)		(0.054)
GR		0.165***		0.042***		0.163***		0.041***
		(0.010)		(0.010)		(0.011)		(0.010)
LIQ		0.023***		0.023***		0.020***		0.028***
		(0.003)		(0.004)		(0.003)		(0.004)
NDTS		0.334*		-1.861***		0.321		-1.927***
		(0.199)		(0.323)		(0.199)		(0.322)
_cons	0.499***	0.202***	0.373***	1.964***	0.348***	0.226***	0.272***	1.965***
	(0.022)	(0.038)	(0.009)	(0.151)	(0.017)	(0.037)	(0.007)	(0.150)
N	18364	15694	18364	15694	18362	15693	18362	15693
r2	0.070	0.200	0.112	0.191	0.064	0.201	0.093	0.189
N_clust	2357	2291	2357	2291	2357	2291	2357	2291

This table presents the OLS and FE estimation results for the full sample period. Standard errors robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

⋆ Indicates significance at 10%; ⋆⋆ Indicates significance at 5%; ⋆⋆⋆ Indicates significance at 1%.

Table 6: Investment determinants: 2-STEP GMM

	(1)	(2)
LEV	-0.072***	
	(0.024)	
LTLev		-0.101***
		(0.029)
SZ	-0.014***	-0.013**
	(0.005)	(0.005)
TAN	-0.133***	-0.114***
	(0.030)	(0.030)
ROA	0.202***	0.201***
	(0.059)	(0.055)
GR	0.024*	0.024*
	(0.013)	(0.013)
LIQ	0.017***	0.022***
	(0.006)	(0.005)
NDTS	-0.078	-0.151
	(0.298)	(0.303)
N	8548	8547
No. of firms	1840	1840
K-P WF Stats	4.872	4.783
K-P LM stats	91.857	89.835
Hansen J statistic	33.025	34.987
Hansen J p-value	0.003	0.001

Standard errors in parentheses. All variable definitions are as described in Table 1. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%.

Table 7 Regression results for the firm-level determinants of investment: the role of information asymmetry

	Low information asymmetric firms		High information asymmetric firms	
	(1)	(2)	(3)	(4)
	FE	FE	FE	FE
LEV	-0.043		-0.048***	
	(0.033)		(0.007)	
LTLev		-0.055		-0.037***
		(0.044)		(0.007)
SZ	-0.003	-0.003	-0.013***	-0.013***
	(0.007)	(0.008)	(0.002)	(0.002)
TAN	-0.029	-0.024	-0.030***	-0.030***
	(0.040)	(0.040)	(0.009)	(0.009)
ROA	0.157**	0.156**	0.129***	0.139***
	(0.068)	(0.068)	(0.012)	(0.012)
GR	0.008	0.009	0.002	0.002
	(0.010)	(0.010)	(0.002)	(0.002)
LIQ	0.002	0.003	0.005***	0.007***
	(0.003)	(0.003)	(0.001)	(0.001)
NDTS	-1.063***	-1.071***	-0.795***	-0.814***
	(0.305)	(0.302)	(0.077)	(0.077)
_cons	0.111	0.101	0.246***	0.242***
	(0.123)	(0.125)	(0.027)	(0.026)
N	795	795	14697	14697
r2	0.213	0.214	0.144	0.140
N_clust	374	374	2295	2295

Standard errors in parentheses. All variable definitions are as described in Table 1. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%.

Table 8: Regression results for impact of leverage on investment: low vs. high-growth firms

	Low-growth firms		High-growth firms	
	(1)	(2)	(3)	(4)
	FE	FE	FE	FE
LEV	-0.035***		-0.022	
	(0.012)		(0.013)	
LTLev		-0.042***		-0.018
		(0.014)		(0.015)
SZ	-0.005	-0.005	-0.015***	-0.015***
	(0.003)	(0.003)	(0.003)	(0.003)
TAN	-0.015	-0.013	-0.068***	-0.067***
	(0.017)	(0.017)	(0.017)	(0.017)
ROA	0.109***	0.112***	0.147***	0.150***
	(0.025)	(0.024)	(0.030)	(0.030)
GR	0.002	0.002	0.009	0.010
	(0.010)	(0.010)	(0.006)	(0.006)
LIQ	0.008***	0.009***	0.006***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
NDTS	-0.600***	-0.609***	-0.799***	-0.806***
	(0.131)	(0.131)	(0.165)	(0.165)
_cons	0.101**	0.093*	0.302***	0.299***
	(0.051)	(0.051)	(0.050)	(0.050)
N	3695	3695	3885	3884
r2	0.121	0.122	0.167	0.167
N_clust	1670	1670	1720	1720

Standard errors in parentheses. All variable definitions are as described in Table 1. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%.