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Alternative measure of financial development and investment-cash flow sensitivity: evidence from an emerging economy

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Abstract

This study examines the impact of financial development on corporate investment in terms of their influence on financing constraints. This study also tries to find the effect of financial development on the investment-cash flow sensitivity across the size, degree of financial constraints and group affiliation of the firm. This study employs dynamic panel data model or more specifically system generalized method of moments (GMM) estimation technique. The estimation results reveal that cash flow affects the investment decision of the company positively, which implies that Indian firms are financially constrained. Also, we observe that financial development reduces the investment-cash flow sensitivity and the effect of financial development is more prominent for small size and standalone firms. The results are robust across the period and, for both financially constrained and unconstrained firms. This study contributes to the existing literature by analyzing the impact of financial development on the role of cash flow in determining investments undertaken by the Indian firms, which is an unexplored issue from an emerging market perspective.

Keywords: Business groups, Cash flow, Corporate investment, Financial constraints, Financial development, Firm size, Generalized method of moments

Introduction

Pertinent to the pervasive importance of corporate investment in the growth process of the firm, over the years, the research on the identification of the factors affecting the corporate investment has grown by many folds. The Q-model of investment assumes that, in the perfect capital market, the internal and external funds are perfect substitutes and therefore, the investment decision of a firm is solely a function of investment opportunities and invariant to the firms' cash flow. In the imperfect market condition, external funding is more costly than internal financing because of frictions arising from asymmetric information, agency problem and transaction costs. Under such conditions, firms' investments are mostly affected by the availability of internal funds. Fazzari et al. (1988, 2000) document that under an imperfect capital market investments carried out by more financially constrained firms are more sensitive to the availability of internal funds even after controlling growth opportunity proxy (Q). The investment-cash flow sensitivity changes with the

financing constraints. Most of the studies find the same evidence for developed as well as emerging economies (see for example, Kadapakkam et al. 1998; Goergen and Renneboog 2001; Laeven 2003; Bhaduri 2005; Shen and Wang 2005; Ghosh and Ghosh 2006; Degryse and De Jong 2006; Aggarwal and Zong 2006; Cleary et al. 2007). A controversy arises when Kaplan and Zingales (1997, 2000) and Cleary (1999) show that least financially constrained U.S. firms also exhibit greater investment–cash flow sensitivity. Later empirical studies argue that the criteria used to classify firms into financially constrained and unconstrained firms like dividend pay-out ratio, debt financing, debt rating etc. are endogenous and these classifying factors are time-variant also. The potential to resolve the controversy lies in the analysis of data whereby researcher can use exogenous criteria.

Over the years, the literature has focussed on the impact of various other exogenous factors such as financial condition, financial market liberalization, corporate governance etc. on the effect of internal cash flow in investment decision of the firms (Koo and Maeng 2005; Francis et al. 2013; Tran and Le 2017). Financial condition is defined as the current state of financial variables that characterize the supply or demand of financial instruments relevant for economic activity (Hatzius et al. 2010). Movements in financial variables, such as interest rates, exchange rates, asset prices, credit demand, and development of financial institutions may indirectly affect firms' investment via their impacts on financing constraints, that is, the sensitivity of investment to internal funds. The sensitivity of investment to cash flow decreases with the financial development because development of the financial system reduces the corporate borrowing constraints and thus, reduces the dependence of investment on internal funds. The previous empirical studies on the impact of financial development in determination of corporate investment use alternative proxies to measure the financial development. All these proxies include domestic bank credit to private sector divided by gross domestic product (Gochoco-Bautista et al. 2014)), ratio of the sum of total market value for bank lending, stock market capitalization and corporate bond market scaled by gross domestic product (Ro et al. 2017), financial condition index constructed from a group of variables such as spread of lending rates over policy rates, real effective exchange rate, growth of stock market and growth of bank credit to private sector (Tran and Le 2017). All these proxies for financial development measure the financial depth only. But financial development is a multidimensional concept as there are many financial institutions (banks, mutual funds, pension funds, insurance companies etc.) and financial markets (stock market, bond market, money market, foreign exchange market etc.) operate in financial system. The diversity of financial system demands to measure the financial development from multiple indicator perspective. Considering the importance of this issue, the International Monetary Fund (IMF) has advocated the construction of financial institution and financial market development indices in terms of the size of financial institutions and markets (financial depth), degree to which individuals can and do use financial services (access), and efficiency of financial intermediaries and markets in intermediating resources and facilitating financial transactions (efficiency). Further, the World Bank has added another dimension into this i.e. stability of financial institutions and markets (stability). The existing empirical studies fail to consider this multidimensional approach to construct the financial development index. This study extends the existing literature considering all the dimensions of financial development (depth, access, efficiency and stability) suggested by World Bank to construct the financial development index for India.

Additionally, King and Levine (1993) and Loayza and Ranciere (2006) document that debt financing has contributed significantly to the development and growth of an economy. Singh and Faircloth (2005) have observed that financial leverage plays a multidimensional role in determining corporate financial performance, business growth and long term investment. This is perhaps the reason why the trend in resource allocation for the majority of developed and developing countries shows a consistent increase in debt ratios[1] over time. However, India remains an exception where debt ratios of firms are consistently declining since the economic liberalization in the early 1990s. Further, debt ratios in many other emerging markets are showing an increasing trend (Mitton, 2007). However, institutional deficiencies in form of underdeveloped bond markets were found to be significant in explaining the decline in the debt ratios (Chauhan, 2017). Indian corporate sector is highly dependent on bank financing (average total bank borrowings to total borrowings is around 17%) as the corporate debt market is not developed in India. The findings of Chauhan (2017) suggest that firms could be credit rationed and hence, losing value on account of such deficiencies in the institution such as bond markets. The changes in the Indian economy and more specifically, various changes in the financial system such as changes in interest rate, availability of more alternative sources of finance and more reliance on bank capital demand a study on the relationship role of financial development on the determination of corporate investment in the context of India during the period of liberalization.

This study focuses on an emerging Indian economy where the regulatory and institutional constraints are different from the other developed countries. Apart from this, there are many changes that have taken place during the recent years both at the macroeconomic level as well as specific sector level. We observe that (i) foreign investment inflows (FII) have increased from Rs. 224.5 billion in the year 2000 to Rs. 2546.53 billion in 2014, (ii) Growth rate of gross domestic product (GDP) has been varying between 3.8% to 9.6% during the same period, and (iii) Private capital formation has changed from Rs. 1065. 24 billion in the year 2000 to 9978.16 billion in the year 2014 (Source: RBI, various annual reports and Handbooks of Statistics on Indian Economy). We also observe that short term interest rate (repo rate) has changed frequently, that reached an all-time high of 14.50% in August of 2000 and a record low of 4.25% in April of 2009. All these above-mentioned changes may affect the alternative sources of finance for investments and also the average lending rates of the commercial banks and financial institutions. "India is fifteen years ahead of China in economic and financial market reforms. Interest rates in India are market determined with the RBI doing away with ad hoc government funding in the late 1990s. Government borrowing costs are market determined with the government bond yield curve being the benchmark that determines the borrowing costs for state governments, municipal corporations, banks and corporates. Indian government bond market, one of the most liquid in Asia, is well regulated by the RBI and is also fully electronic. The banking system in India is well regulated and banks' reporting standards, reserve ratios and capital adequacy hold the system strong even in the face of adversities such as the global financial market collapse in 2007-08. SEBI as a regulator has come a long way since it was formed in the early 1990s. As a market regulator, it may have had its ups and downs but the laws that govern capital markets are well formed. The regulator has largely been responsible for the transparency in Indian markets. India has largely allowed FIIs to invest in equities and has increased debt investment limits from $2.5 billion in 2003 to $81 billion as of 2013.

FIIs own atleast 48 percent of free float market cap in India as per a Citigroup report. FIIs like India due to its vibrant financial markets".[2]

"India has clocked an average growth rate over 6.75% since it ushered into the liberalization regime 25 years back. Favourable demographics, rising middle class, growing urbanization, high knowledge-based industries – umpteen arguments have been articulated about why India is the happening place. But these are only the parameters that indicate the attractiveness of the Indian economy; the right lever which is working to make India an attractive and happening place from the perspective of an investor is the gradual reforms process underway. Almost all the sectors of the economy-industrial, financial, agricultural, have been exposed to competitive forces, and in the process have emerged stronger. Though the pace of reforms has been uneven, the process has taken deep enough roots in the political economy to be reversed".[3]

Overall this study examines the role of financial development on corporate investment in terms of their influence on financing constraints and isolated effect of financial development on corporate investment. This study also tries to test whether the effect of financial development on the investment-cash flow sensitivity depends on the period of study, size of the firm, financial constraints and group affiliation of the firm. The data set consists of 617 firms during 1999–2014. We estimate the impact of financial sector development on the investment-cash flow sensitivity by using the system-generalized method of moments (GMM). The major findings of the paper are: (i) Financial development reduces the financial constraints faced by the firm, thereby, declines the investment-cash flow sensitivity and have positive impact on corporate investment. (ii) The effect of the financial development on financial constraints is more (less) during (before) the crisis period and for the firms which pay low (high) dividends and also, the individual effect of financial development is more for low dividend paying firms and during the crisis period. (iii) The effect of the financial development on financial constraints is stronger for smaller and standalone firms than the larger and group affiliated firms and also, financial development have its positive impact on corporate investment across the firm size and ownership style such as group afflation.

The rest of the paper is organized as follows. Section 2 highlights the brief review of literature. Section 3 presents the data and variables. Section 4 presents the models and estimation method. Section 5 discusses the results. The final section provides the conclusions of the study.

Literature review

The empirical studies on the determination of corporate investment have largely been focused on the firm specific factors. Lamont (1997) has identified that internal funds are accounted for more than three quarters of capital expenditure outlays for the period 1981–1991 for US non-financial corporations. A perfect capital market has free access to external market which leads to the fact that investment decisions will be based on the future profitability and growth opportunities and it does not depend on the internal fund. In an imperfect capital market, the internal and external finances are not perfect substitutes as the presence of information asymmetry cost (Myers and Majluf 1984) and agency cost (Jensen and Meckling 1976) create a wedge between the internal and external funds, making the latter more costly.

Fazzari et al. (1988) demonstrate that in an imperfect capital market the sensitivity of corporate investment to internal cash flow would be the strongest for firms that faced the greatest wedge between the costs of internal and external funds, i.e. firms that have high financial constraints (firms paying less dividends). This study finds a positive sensitivity of investment to cash flow, even after controlling the growth opportunity proxy Q. A study of Kaplan and Zingales (1997) questioned the interpretation of investment-cash flow sensitivity as a measure of financial constraints. Also, other studies question the interpretation of investment-cash flow sensitivity as an indicator of financial constraints. For example, Kadapakkam et al. (1998) document that investment-cash flow sensitivity was generally highest (smallest) among the larger (smaller) firms. Cleary (1999) also finds that more constrained and less creditworthy firms have smaller investment-cash flow sensitivity. A study conducted by Gomes (2001) document that investment-cash flow sensitivity is theoretically not sufficient for measuring financial constraints. Also, study of Alti (2003) found that new investment is sensitive to cash flow without financing frictions.

The study of Moyen (2004) considers a model with and without financial constraints. Their simulation results showed that investment-cash flow sensitivity is observed in both models. Cleary (2006) documents that firms with a stronger financial position and higher dividend payout have higher investment-cash flow sensitivity than firms with a weaker financial position and lower payout. Cleary et al. (2007) also find that the relationship between investment and cash flow is U-shaped: investment increases monotonically with large internal funds but decreases with low funds. Gatchev et al. (2010) document that investment-cash flow sensitivity does not acknowledge the multifaceted interdependence between financial and investment decisions and provides an incomplete and misleading view of true financial constraints.

Studies conducted by Erickson and Whited (Erickson and Whited 2000; Whited and Erickson 2002) found that mismeasured q leads to an overstated relationship between investment and cash flow, even for financially constrained firms, and that q theory has good explanatory power once purged of measurement error. Alti (2003) also document that q is a noisy proxy of near-term investment opportunities. Adding to the debate on the interpretation of investment-cash flow sensitivity, its sharp decline in the U.S and other countries, Allayannis and Mozumdar (2004) recorded a decline in investment-cash flow sensitivity over the period from 1977 to 1996, particularly for the most constrained firms. Ağca and Mozumdar (2008) suggested that investment-cash flow sensitivity decreases with factors that reduce capital market imperfections. Islam and Mozumdar (2007) found a negative relationship between cross-country financial development and the importance of internal capital for investment decisions. Brown and Petersen (2009) examined the changes in investment-cash flow sensitivity over the period from 1970 to 2006. Their study argues that the decline can be attributed to the changing composition of investment from physical investment to R&D and the rising importance of public equity.

More recently, a study conducted by Chen and Chen (2012) made the observation that investment-cash flow sesntivity has declined and disappeared during the 2007–2009 credit crunch. Moshirian et al. (2017) find that changes in asset composition (from tangible to intangible productive capital) play an important role in explaining the fading of investment-cash flow sensitivity over time. Specifically, lower intensity of physical

investment in developed countries over time explains the cross-country variation in the sensitivity as well as the time trend.

Several empirical studies of the investment-cash flow sensitivity show their strong support towards the findings of Fazzari et al. (1988). These studies have classified the sample in different sub-samples with different degrees of financial constraints based on certain parameters such as group affiliation (Hoshi et al. 1991), bond rating (Gilchrist and Himmelberg 1995), size of the firm (Audretsch and Elston 2002), leverage (Calomiris et al. 1994; Aivazian et al. 2005; Ahn et al. 2006), investor horizon (Attig et al. 2012), information asymmetry (Ascioglu et al. 2008) and find the evidence that internal cash flow has a positive impact on investments undertaken by the firm and the impact is more for the more financially constrained firms than the less financially constrained firms. Love (2003) uses an Euler equation approach and confirms that firms in less developed countries show a greater sensitivity of investment to cash stock.

The studies of Kadapakkam et al. (1998) and Cleary (2006) also, find that in several developed countries investment is more sensitive to cash flow for firms that are a priori expected to be less financially constrained. Shin and Park (1999) also find that more constrained firms have higher sensitivity of firm investment to internal funds for the Korean companies and Caggese (2007) finds the similar results in the context of UK companies. These studies conclude that internal liquidity of the firm is a significant determinant of corporate investment for the financially constrained firms and investment-cash flow sensitivity can also be used as a useful measure of financial constraints. On the other side, Kaplan and Zingales (1997) and Cleary (1999) have shown that sensitivity of firms is more for the least financial constrained firms.

George et al. (2011) find strong investment-cash flow sensitivity for both group affiliated and independent firms in India. This study also suggests that investment-cash flow sensitivity of group affiliated firms is not significantly lower than the unaffiliated firms. Considering the data from the Euro zone Pindado et al. (2011) suggest that the investment cash flow sensitivity is lower for the family owned firms. Gochoco-Bautista et al. (2014) find that financial conditions affect firms' growth opportunities and investment demand, financial development primarily affects firms' external financing constraints and large firms benefit more from improved financial conditions, while small firms benefit more from financial development. Ro et al. (2017) also find that financial development affects a firm's investment by reducing the firm's financial restrictions in Korea and the effects of financial development on a firm's financial restrictions are varied by industry, firm size and financial crisis.

Further, the empirical studies investigate the investment-cash flow sensitivity hypothesis considering various other factors like size and age of the company, nature of affiliation of the company, financial markets liberalization, financial market development, financial condition of the market, corporate governance, labour unions etc. Devereux and Schiantarelli (1990) and Schaller (1993) find that cash flow effects are important for smaller and young firms. Houston and James (1996) find that investment-cash flow sensitivity is higher for firms that are closely tied to a single bank than the firms that have relationship with several banks. Firms that hedge their financial risk with derivatives and foreign currency debt are able to reduce their financial constraints, which further decline the investment-cash flow sensitivity (Froot et al. 1993; Geczy et al. 1997; Allayannis and Mozumdar 2000; Kedia and Mozumdar 2001). Koo and Maeng (2005) find that financial

market liberalization decreases the effect of internal cash flow on investment for the Korean firms and this effect is more pronounced for the large and Chaebol affiliated firms.

Francis et al. (2013) find that better corporate governance lowers the dependence of emerging market firm's investment on internally generated cash flows. This study also suggests the substitutability between firm-specific and country level governance in determining the firms' investment sensitivity to internal cash flow. Using a Q-model of investment Chen and Chen (2013) find that the capital expenditure of firms are 1.71 times more sensitive to internal cash flow when unionization rates increase one standard deviation from the mean. This study suggests that higher investment-cash flow sensitivity in unionized firms is primarily driven by the incentive of these firms to reduce liquidity and enhance bargaining power against the union. Financial development and financial condition of the market also reduce the investment-cash flow sensitivity in Asian emerging markets and the degree of sensitivity varies across the size of the firm (Gochoco-Bautista et al. 2014). Andrén and Jankensgård (2015) find that when excess liquidity or availability of capital becomes abundant, the investment-cash flow sensitivity decreases for financially constrained firms and increases for unconstrained firms suggesting the fact that the relationship is driven by the agency problems related to free cash flow. Chowdhury et al. (2016) show that information asymmetry decreases following Sarbanes-Oxley Act and there is a decrease in the investment cash-flow sensitivity pre to post Sarbanes-Oxley Act. Analysing the data of the Vietnamese listed firms, Tran and Le (2017) find that financial conditions of the market affect investment behaviour only for the firms with negative cash flows, which implies that better financial conditions alleviate the financing constraints and also the sensitivity of investment to negative cash flow. This study also suggests that this effect is greater for larger firms and firms without state ownership.

In a nutshell, it is observed that the investment-cash flow sensitivity hypothesis has been investigated all over the world from time to time. Most of the studies have shown their support to findings of Fazzari et al. (1988) and this hypothesis has been reinvestigated again and again considering the impact of various exogenous factors like corporate governance, financial market condition, and financial liberalization etc. on the role of internal cash flow in determining the corporate investment. However, the studies on impact of financial development on investment-cash flow sensitivity are few and the measures of financial development capture only one dimension of development i.e. depth. This study tries to overcome this research gap by analysing the effect of financial development, which captures all four dimensions of development i.e. depth, access, efficiency and stability on investment-cash flow sensitivity of the Indian listed companies. This study provides out-of-sample evidence from an emerging market perspective.

Data and variables

Our data targets all the manufacturing firm data available in the prowess database maintained by Center for Monitoring Indian Economy (CMIE). We find 1922 companies which have continues fixed investment data during the study period i.e. 1999–2000 to 2013–14. Out of 1922 firms 1246 firms don't have the adequate data for other major explanatory variables. Further following Jangili and Kumar (2010), we have not considered 18 Private firms as private firms do not disclose their financial statement. Finally, we

selected 617 firms which have continuous data throughout the period. The variables used to construct financial development index are collected from World Bank Development Indicators (World Bank) data base. Table 1 shows the variables used in this paper. All continuous variables are winsorized at their 1st and 99th percentile.

We divide the sample according to crises period, dividend payout ratio, size and group affiliation to test the difference in the effect of financial development on the investment cash flow sensitivity. We divide our data into two sub-periods, i.e., data period without any major crisis (1999–2000 to 2006–2007) and the remaining period (2007–2008 to 2013–2014) which has witnessed the series of crises such as global financial crisis (2007–08), the European sovereign debt crisis (2010) and the Russian financial crisis (2014), and carryout our analysis.

Measuring financial development index

As suggested by World Bank we construct a multidimensional financial development index for India. According to IMF [Source: Svirydzenka 2016] and World Bank, financial development is defined as a combination of depth (size and liquidity of markets), access (ability of individuals and companies to access financial services), efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues, and the level of activity of capital markets) and stability (stability of financial institutions and markets). Following the procedure provided in OECD Handbook on Constructing Composite Indicators [Source: (OECD, 2008)] the financial development index for India has been constructed. This broad multi-dimensional approach to defining financial development follows the following matrix (Fig. 1) of financial system characteristics:

Following the approach followed by Svirydzenka (2016) first, starting from the bottom of the pyramid in Fig. 1, eight lower level sub-indices are constructed using a list of indicators to measure how deep, accessible, efficient and stable financial institutions and

Table 1 Variables descriptions

Abbreviation	Description
(1)	(2)
K_{it}	Capital at the beginning of period t (fixed assets at the end of the period t-1)
I_{it}	Investment during period t (K_{t+1}+ $DEPR_t - K_t$)
$DEPR_{it}$	Depreciation during period t
Q_{it}	Average Q at the beginning of period t
B_{it}	Book value of debt at the beginning period t
E_{it}	Market value of equity at the beginning period t
TA_{it}	Total assets at the beginning of period of t
CF_{it}	Cash flow during the period t (Net profit after tax + depreciation during t-1)
S_{it}	Sales during the period t
FDI_t	Financial development index during the period t
BIG_i	1 for larger firms, = 0 for small firms
$SMALL_i$	1 for small firms, = 0 for large firms
$STAND_i$	1 for standalone firms, 0 for group affiliated firms
$GROUP_i$	1 for group affiliated firms, 0 for standalone firms

Source: Author's own classification

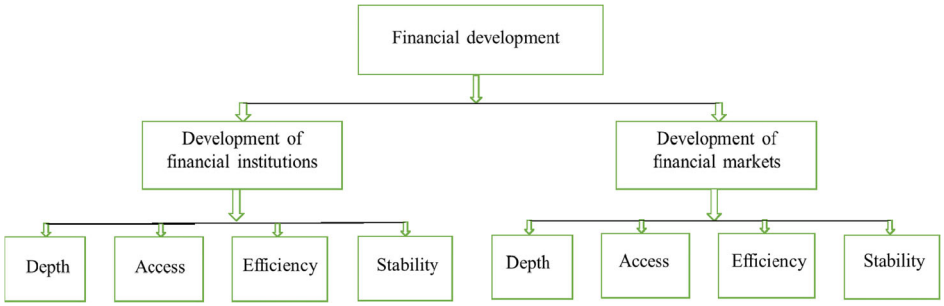

Fig. 1 Financial development index pyramid. Following the approach followed by Svirydzenka (2016) first, starting from the bottom of the pyramid in Fig. 1, eight lower level sub-indices are constructed using a list of indicators to measure how deep, accessible, efficient and stable financial institutions and financial markets are. These sub-indices are aggregated into two higher level sub-indices, which measure how developed financial institutions and financial markets are overall. Finally, these two sub-indices are aggregated into the overall measure of financial development index

financial markets are. These sub-indices are aggregated into two higher level sub-indices, which measure how developed financial institutions and financial markets are overall. Finally, these two sub-indices are aggregated into the overall measure of financial development index. Table 2 presents the set of key indicators chosen to capture the different aspects of the financial system characteristics. Those variables are selected, which are available across the study period.

Following steps are followed to construct the index:

(i) Each series is winsorized to prevent extreme values from distorting the 0–1 indicators.
(ii) Winsorized indicators are then normalized between 0 and 1, using the min-max procedures[4] to facilitate aggregation over variables expressed in different measurement units.

Table 2 Variables used for construction of financial development index

Category	Indicator	
	Financial Institutions	Financial Markets
Depth	Private sector credit to GDP Mutual fund assets to GDP Pension fund assets to GDP Nonbank financial assets to GDP	Stock market capitalization to GDP Stock market total value traded to GDP International debt issues to GDP Outstanding domestic private debt securities to GDP Outstanding domestic public debt securities to GDP
Access	Bank branches per 100,000 adults ATMs per 100,000 adults Working capital financed by banks	Market capitalization excluding 10 top largest companies to total market capitalization Non-financial corporate bonds to total bonds Investments financed by equity or stock sales
Efficiency	Bank net interest margin Bank lending-deposit spread Non-investment income to total income Return on assets Return on equity Bank cost to income ratio Bank overhead cost to total assets	Stock market turnover ratio (stocks traded to capitalization)
Stability	Bank Z-score Non-performing loans to total loans (%) Bank credit to bank deposits Capital to risk weighted assets	Stock price volatility

Source: Authors' own compilation

(iii) Indicators are then aggregated into eight sub-indices at the bottom of the pyramid in Fig. 1. The aggregation is a weighted linear average of the underlying series, where the weights are obtained from principal component analysis,[5] reflecting the contribution of each underlying series to the variation in the specific sub-index. The factor loadings on the first principal component are chosen as weights as it explains more than 60% of the variance. Table 3 shows the principal component analysis results.

(iv) All of the sub-indices are then re-normalized using the min-max procedure, to keep the range between 0 and 1.

(v) Sub-indices are aggregated into higher-level indices using the same procedure as above (points I to III) to construct the aggregate financial development index (FDI). The FDI is again renormalized to keep the range between 0 and 1.

Also, we separated our whole sample into two sub-samples such as low dividend pay-out ratio firms and high dividend pay-out ratio firms. Further, Following Lin et al. (2012) and Kadapakkam et al. (1998), we divided all total assets value (market capitalization) in three sub-sample such as top, middle and bottom sample based on the tercile approach. A large size dummy variable *BIG* takes the value 1 if the value of total assets comes in the top sample (upper tercile) and zero otherwise. Similarly we use a dummy variable 1 for construct a small size dummy variable *SMALL* which indicates that total assets value comes in the bottom sample (lower tercile) and zero otherwise. The total assets value come under the middle sample (middle tercile) considered as medium size firms. The firm's affiliation to any group is represented as a dummy variable *GROUP* and take value 1 and the remaining firms as *STAND* and take value zero. The firm's which are not affiliated to any group represented as a dummy variable *STAND* and takes value 1 and the remaining firms as *GROUP* and take value zero.

Table 4 presents the summary statistics (mean and standard deviation) of investment to capital ratio, sales to capital ratio, cash flow and Q ratio. This table showing the behavior of these ratio across the nature of firms and period such as business group affiliation, frim size and crisis period. Large, group affiliated and high dividend paying firms have higher investment to capital ratio than small, standalone or independent and low dividend paying firms. Large, group affiliated and high dividend paying firms appear to hold more internal cash flow relative to capital than the small, standalone and low dividend paying firms. Also, sales to capital ratio for small, standalone and low

Table 3 Share of variance explained by PCA components

	Financial Institutions (FI)				Financial Markets (FM)				Sub-Indices		
	Depth	Access	Efficiency	Stability	Depth	Access	Efficiency	Stability	FI	FM	FD
PC_1	0.67	0.78	0.51	0.63	0.57	0.65	–	–	0.63	0.71	0.81
PC_2	0.17	0.20	0.21	0.19	0.21	0.19	–	–	0.17	0.14	0.19
PC_3	0.11	0.12	0.11	0.12	0.11	0.09	–	–	0.12	0.09	–
PC_4	0.05	–	0.08	0.06	0.08	0.07	–	–	0.08	0.06	–
PC_5	–	–	0.05	–	0.03	–	–	–	–	–	–
PC_6	–	–	0.03	–	–	–	–	–	–	–	–
PC_7	–	–	0.01	–	–	–	–	–	–	–	

Source: Authors' own estimation

Table 4 Summary statistics of the key variables

Firms/Periods	I/K Mean (Std.)	CF/K Mean (Std.)	Q Mean (Std.)	S/K Mean (Std.)	No. of firms
	(1)	(2)	(3)	(4)	(5)
All firms	0.19 (0.23)	0.16 (0.47)	1.12 (0.74)	0.20 (0.49)	617
Large firms	0.22 (0.37)	0.19 (0.43)	1.36 (0.81)	0.22 (0.45)	146
Small firms	0.14 (0.42)	0.13 (0.47)	1.02 (0.65)	0.18 (0.58)	335
Standalone firms	0.18 (0.26)	0.14 (0.45)	1.45 (0.68)	0.16 (0.38)	220
Group affiliated firms	0.23 (0.21)	0.17 (0.52)	1.10 (0.76)	0.24 (0.46)	397
High dividend paying firms	0.23 (0.41)	0.21 (0.32)	1.34 (0.55)	0.22 (0.36)	233
Low dividend paying firms	0.17 (0.33)	0.15 (0.38)	1.15 (0.63)	0.14 (0.42)	384
Before crisis period	0.23 (0.31)	0.17 (0.35)	1.41 (0.68)	0.21 (0.29)	617
During crisis period	0.21 (0.49)	0.11 (0.41)	0.98 (0.83)	0.19 (0.42)	617

Source: Prowess database. Source: Author's own Calculation

dividend paying firms are higher than the large, group affiliated and high dividend paying firms. The Q-ratio is more for large, group affiliated and high dividend paying firms. Our summary statistics also reveal that investment to capital ratio, sales to capital ratio, cash flow and Q are high before the crisis period than during the crisis period.

Table 5 presents the correlation matrix of the key variables used in this study. The correlation coefficient of 0.671 among I/K and CF/K confirm that there has been a positive relationship between investment and internal cash flow. We also find that positive association among investment to capital ratio and other independent variables used in this study such as Tobin's Q and sales to capital ratio. Insignificant and lesser correlation among the explanatory variables rules out the problem of multicollinearity in the estimation process. The VIF test results also confirm the lesser multicollinearity problem in this case.

Models and estimation methods

Investment models

Following Love (2003), Laeven (2003) and Ratti et al. (2008) this paper adopts both Q-model and Euler model of investment.

Table 5 Correlation matrix of the key variables

Variables	I/K	CF/K	Q	S/K
	(1)	(2)	(3)	(4)
I/K	1			
CF/K	0.671	1		
Q	0.557	0.1590*	1	
S/K	0.573	0.0022	0.008*	1
VIF	1.11	1.21	1.01	1.00

Note: (i) * show the 10% level of significance respectively

Q-model

In the Q-model each firm is assumed to maximise its present value subject to the capital accumulation constraint. The final equation of the Q-model is specified as:

The final equation of the Q-model is specified as:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \vartheta_i + \lambda_t + \mu_{it} \tag{1}$$

Where, I= net investment, K = capital stock at the beginning of the period, Q= Q-ratio. ϑ_i is the firm specific effects, λ_t is the time specific effect, μ_{it} is white noise. The subscripts i, and t, represent the firms' and time respectively. According to the Q-model financial factors do not affect investment, only Q is the sole determinant of investment.

Further, we include another term measuring financial condition of the firm to eq. (1) in order to test the impact of financial constraints on investment. The equation becomes:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \vartheta_i + \lambda_t + \mu_{it} \tag{2}$$

Here, CF is the internal cash flow of the firm.

Our paper examines the role of financial development on corporate investment in terms of their influence on financing constraints. We assume that as financial development has direct impact on the cost of external finance the state of the financial development may change the role of internal liquidity condition of the firm in determining the corporate investment. Considering the neoclassical model of investment and the effect of financial development on investment-cash flow sensitivity, the model is specified as follows:

$$\begin{aligned}\left(I/K\right)_{it} = {} & \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times FDI_t \\ & + \vartheta_i + \lambda_t + \mu_{it}\end{aligned} \tag{3}$$

Here, FDI is the financial development index.

The interaction term in eq. (3) captures the effect of financial development on the sensitivity of investment to internal funds. We expect that $\beta_3 > 0$ as an increase in cash flow leads to an increase in the level of investment expenditure or cash flow does not affects firm's investment (i.e. $\beta_3 = 0$). The primary hypothesis of this paper is that the sensitivity of investment to cash flow decreases with the financial development because developments in the financial system reduce the corporate borrowing constraints and thus, reduce the dependence of investment on internal funds. Therefore, we expect that $\beta_4 < 0$.

Further, we modify eq. (3) by incorporating a direct impact of financial development on corporate investment and the model is specified as follows:

$$\begin{aligned}\left(I/K\right)_{it} = {} & \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times FDI_t \\ & + \beta_5 FDI_t + \vartheta_i + \lambda_t + \mu_{it}\end{aligned} \tag{4}$$

Further, we try to test whether the effect of financial development on the investment - cash flow sensitivity depends on the size of the firm by estimating the following equation:

$$\begin{aligned}\left(I/K\right)_{it} = {} & \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times BIG_i \\ & \times FDI_t + \beta_5\left(CF/K\right)_{it} \times SMALL_i \times FDI_t + \vartheta_i + \lambda_t + \mu_{it}\end{aligned} \tag{5}$$

Where, *BIG* is a dummy variable whose value is 1 for big firms and zero otherwise. Similarly, the value of *SMALL* is one for small firms and 0 otherwise. We expect that $\beta_3 > 0$, $\beta_4 < 0$ and $\beta_5 < 0$. Comparing the abslute value of β_4 and β_5 we examine whether the effect of financial development is stronger for big firms or small firms.

Next, as business group affiliation is a very important issue in the context of Indian corporate sector we estimate another equation specified below to investigate whether affiliation to a business group affects the impact of financial development on the investment-cash flow sensitivity.

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times STAND_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times GROUP_i \times FDI_t + \vartheta_i + \lambda_t + \mu_{it} \quad (6)$$

Where, *STAND* is a dummy variable whose value is 1 for standalone companies and zero otherwise. Similarly *GROUP* is a dummy whose value is 1 for group affiliated firms and zero otherwise. We can examine the relative influence of financial development on the investment-cash flow sensitivity of the standalone and group affiliated firms.

Further, we modify eqs. (5) and (6) by incorporating a direct impact of financial development on corporate investment. These models are specified as follows:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times BIG_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times SMALL_i \times FDI_t + \beta_6 FDI_t + \vartheta_i + \lambda_t + \mu_{it} \quad (7)$$

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2 Q_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times STAND_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times GROUP_i \times FDI_t + \beta_6 FDI_t + \vartheta_i + \lambda_t + \mu_{it} \quad (8)$$

Euler's equation

Further, considering the certain limitation of Q-model of investment a number of studies estimate the Euler equation, which is obtained by rearranging first order conditions to the problem of firm value optimization under an imperfect capital market.

The Euler equation in the linear form is specified as:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \vartheta_i + \lambda_t + \mu_{it} \quad (9)$$

Where S = net sales.

Considering the effect of financial development on investment-cash flow sensitivity, the model is specified as follows:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{10}$$

We expect that $\beta_3 > 0$, and $\beta_4 < 0$.

Considering the direct effect of financial development on corporate investment, the model is specified as follows:

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times FDI_t + \beta_5 FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{11}$$

Further considering the effect of firm size and group affiliation on investment-cash flow sensitivity and also, the individual effect of financial development on corporate investment in the Euler's equation we specify following four eqs. (12), (13), (14) and (15).

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times BIG_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times SMALL_i \times FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{12}$$

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times STAND_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times GROUP_i \times FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{13}$$

Comparing the absolute values of the coefficients β_4 and β_5 in the eqs. (12) and (13) we can test which firm are more strongly affected by the financial development.

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times BIG_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times SMALL_i \times FDI_t + \beta_6 FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{14}$$

$$\left(I/K\right)_{it} = \alpha + \beta_1\left(I/K\right)_{it-1} + \beta_2\left(S/K\right)_{it} + \beta_3\left(CF/K\right)_{it} + \beta_4\left(CF/K\right)_{it} \times STAND_i \times FDI_t + \beta_5\left(CF/K\right)_{it} \times GROUP_i \times FDI_t + \beta_6 FDI_t + \vartheta_i + \lambda_t + \mu_{it} \tag{15}$$

Estimation method

The dynamic investment models specified in eqs. (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15) are likely to suffer from both endogeneity and heterogeneity problems. The explanatory variables in the investment function may be correlated with the error term. Further, the potential correlation of $\left(I/K\right)_{it-1}$ with the fixed effects (ϑ_i and λ_t) also leads to dynamic panel bias (Nickell 1981). The presence of lagged investment to

capital ratio as an explanatory variable may provide bias estimate from the ordinary least square estimation. Substantial difference across firms in their investment behaviour may also result in a heterogeneity problem. Assuming the presence of unobserved fixed effects we transform over data by applying the forward orthogonal deviation (FOD) transformation proposed by Arellano and Bover (1995), which uses forward mean differencing to transform time series in the dataset. We use a system generalised method of moments (GMM) estimator proposed by Arellano and Bover (1995) and augmented by Blundell and Bond (1998). The system GMM estimator uses lagged level variables as instrument for the differenced equation and lagged differenced variable as instruments for the level equation. We estimate all these equations via two step system GMM with instruments including lagged values of all the variables on the right hand side of the equation. For the post estimation tests we apply the Arellano-Bond test for autocorrelation of the disturbance term μ_{it} and Sargan and Hansen tests of over identifying restrictions (i.e. test for joint validity of the instruments). We report test statistics for both the Sargan and Hansen tests because there is a trade-off between their robustness and consistency because of the effects of instrument proliferation. Wald test is used to test the joint significance of the estimated coefficients for all the variables.

Discussion of results

Baseline results

Columns (1 and 3) and (2 and 4) in the Table 6 provide the GMM estimation results of both investment function (Q-model and Euler equation) for the whole sample period. Following the Lensink et al. (2003) we use the p-values of m_1 and m_2 test statistics which indicates that very little unobserved firm specific effects exist in the estimation results. The consistency of the estimates also depends on the absence of serial correlation (M1 and M2 in the table) in the error terms. We display tests for first-order and second-order serial correlation related to the estimated residuals in the first differences. The null hypothesis here relates to "insignificance" so that a low P-value for the test on first-order serial correlation and a high P-value for the test on second-order serial correlation suggests that the disturbances are not serially correlated. The test statistics are asymptotically distributed as standard normal variables. The Sargan and Hansen tests for over-identifying restrictions results show that validity of instruments used for regressions is not rejected and conclude that the instruments used in the estimation are valid. The Wald test results confirm the significance of explanatory variables in explaining the dependent variable. The significant positive coefficient of lagged investment to capital ratio implies that current investment depends on past investment (i.e. there has been a persistence effect in firms' investment undertaken). This positive effect is consistent with the findings in Laeven (2003), Love (2003), Ratti et al. (2008), Firth et al. (2012) and Tran and Le (2017), but inconsistent with the evidence shown by Guariglia (2008) and Gochoco-Bautista et al. (2014). Tobin's Q plays the significant role of increasing the investment-capital ratio as predicted by the theory. The significant positive coefficient of cash flow found from our estimation results in both the investments models implies the presence of financing constraints for Indian firms. With a significant regression coefficient of 0.128, sales also have a strong explanatory power for firm investment behaviour.

Table 6 Estimation results of base line investment models

Variables	Q-Model (Eq. 2)	Euler Equation (Eq. 6)	Q-Model (Eq. 3)	Euler Equation (Eq. 7)	Q-Model (Eq. 4)	Euler Equation (Eq. 11)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.1427*** (9.2)	0.1965*** (5.96)	0.2929*** (11.92)	0.1074*** (4.12)	0.2316** (2.33)	0.1814** (2.14)
$(I/K)_{it-1}$	0.1102***(5.36)	0.1989*** (2.68)	0.0550*** (5.81)	0.0869*** (6.48)	0.0619***(3.15)	0.0711*** (3.28)
Q_{it}	0.0165*** (4.19)	–	0.0253*** (2.82)	–	0.0758*** (2.86)	–
$(S/K)_{it}$	–	0.1280*** (7.52)	–	0.1035*** (4.07)	–	0.1151*** (3.05)
$(CF/K)_{it}$	0.2734*** (6.76)	0.2417*** (2.58)	0.2136*** (5.14)	0.1575** (2.36)	0.2314*** (4.99)	0.1844** (2.17)
$(CF/K)_{it} \times FDI_t$	–	–	−0.1140** (− 2.27)	− 0.0670** (− 2.38)	−0.1319** (− 2.15)	−0.0913** (− 2.49)
FDI_t	–	–	–	–	0.0912** (2.42)	0.0814** (2.51)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.19)	(0.74)	(0.11)	(0.78)	(0.22)	(0.29)
Sargan Test	(0.19)	(0.22)	(0.17)	(0.28)	(0.29)	(0.38)
Hansen-J Test	(0.27)	(0.29)	(0.23)	(0.15)	(0.51)	(0.56)
Wald Test	χ^2 (04) = 481.41 (0.0000)	χ^2 (04) = 986.79 (0.0000)	χ^2 (05) = 273.59 (0.0000)	χ2(05) = 827.36 (0.0001)	χ^2 (06) = 374.53 (0.0000)	χ2(06) = 628.3 (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are *p* values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present *p* value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

Columns (3) and (4) of the Table 6 present the results of the effect of financial development on cash flow-investment sensitivity (i.e. financial constraints). In both the investment models the interaction term of *FDI* and CF/K is included. Sargan test and Hansen *J* test results indicate the validity of instrumental variables used in this model. The m_2 statistics rules out the existence of firm specific effects. Wald test results imply that the model is correctly specified. The regression coefficients of lagged investment to capital ratio, Tobin's Q, sales to capital ratio and cash flow have their expected sign and statistically significant. As an explanatory variable, the interaction term of cash flow and *FDI* is statistically significant having the negative coefficient for both the investment models suggest that financial development reduce financing constraints. This implies that the sensitivity of investment to cash flow decreases with the developments in the financial system. It could be due to the fact that financial development reduces the external borrowing constraints and thus, reduces the dependence of investment on internal funds. Columns (5) and (6) of the Table 6 present the results of the individual effect of financial development on corporate investment. Empirical results show that financial development is positively associated with corporate investment. All other variables have their sign as expected and are statistically significant. We also find similar results across industries within the manufacturing sector.[6]

The robustness of the results are tested across the different time periods and nature of the companies. Tables 7 and 8 present the results for before crisis period and during crisis period respectively. The first sub period is from 1999 to 2000 to 2006–07 (before crisis period), and the second sub period 2007–08 to 2013–14 (during crisis period), which has witnessed many financial crisis such as global financial crisis (2007), European sovereign debt crisis (2010) and Russian financial crisis (2014). It is assumed that due to the limited availability of funds in the crisis period the cost of external capital increases, which make the firms more financially constrained. In this context, we hypothesize that the impact of financial development on investment-cash flow sensitivity is more during the crisis period than the before crisis period. The *p*-value of m_2 test statistics, Sargan test and Hansen *J* test results and Wald test results in Tables 7 and 8 suggest the little existence of firm specific effects, validity of the instruments and correct specification of model respectively. Results of Tables 7 and 8 reveal that investment-cash flow sensitivity is higher during the crisis period than before the crisis period. The results of interaction between cash flow and financial development dummy $CF/K \times FDI$ explain that the financial development reduces the role of cash flow more in the crisis period than the before crisis. Also, the individual effect of financial development on corporate investment is more (less) during (before) the crisis period. All other variables have their sign as expected and are statistically significant.

Robustness tests (time period and dividend tests)

Tables 9 and 10 present the results for high dividend paying firms and low dividend paying firms respectively. The first sub sample is for firms which pay high dividend (greater than the mean dividend pay-out ratio), and the second sub sample for firms which pay low dividend (lesser than the mean dividend pay-out ratio period). Considering the study of Kaplan and Zingales (1997), it has been argued that high dividend paying

Table 7 Estimation results of base line investment models (Before crises period)

Variables	Q-Model (Eq. 2)	Euler Equation (Eq. 6)	Q-Model (Eq. 3)	Euler Equation (Eq. 7)	Q-Model (Eq. 4)	Euler Equation (Eq. 11)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0945** (2.38)	0.0812* (1.92)	0.1261** (2.37)	0.0911 (1.17)	0.0517* (1.67)	0.0716 (1.19)
$(I/K)_{it-1}$	0.0796** (2.41)	0.0842** (2.36)	0.0611** (2.12)	0.0419** (2.05)	0.0651** (2.38)	0.0518** (2.49)
Q_{it}	0.0615** (2.09)	–	0.0618** (2.19)	–	0.0518* (1.91)	–
$(S/K)_{it}$	–	0.1147** (2.13)	–	0.1218** (2.15)	–	0.0714* (1.69)
$(CF/K)_{it}$	0.1614*** (3.88)	0.1671** (2.55)	0.1738*** (3.88)	01719** (2.44)	0.1842** (2.42)	0.1519** (2.09)
$(CF/K)_{it} \times FDI_t$	–	–	−0.0718** (−2.14)	− 0.0903** (− 2.05)	− 0.0611* (−1.78)	−0.0513** (− 1.96)
FDI_t	–	–	–	–	0.1206** (2.13)	0.1315** (2.47)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.35)	(0.55)	(0.28)	(0.58)	(0.31)	(0.52)
Sargan Test	(0.27)	(0.34)	(0.31)	(0.42)	(0.32)	(0.19)
Hansen-J Test	(0.41)	(0.43)	(0.50)	(0.26)	(0.51)	(0.45)
Wald Test	χ^2 (04) = 632.15 (0.0000)	χ^2 (04) = 528.14 (0.0000)	χ^2 (05) = 438.19 (0.0000)	$\chi 2(05) = 721.36$ (0.0001)	χ^2 (05) = 458.99 (0.0000)	$\chi 2(05) = 651.49$ (0.0001)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are *p* values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present *p* value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

Table 8 Estimation results of base line investment models (During crises period)

Variables	Q-Model (Eq. 2)	Euler Equation (Eq. 6)	Q-Model (Eq. 3)	Euler Equation (Eq. 7)	Q-Model (Eq. 4)	Euler Equation (Eq. 11)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0811 (1.19)	0.0651* (1.83)	0.1014** (2.46)	0.1107** (2.12)	0.1127** (2.47)	0.1334** (2.39)
$(I/K)_{it-1}$	0.0759** (2.36)	0.0716** (2.16)	0.0813** (2.44)	0.1167** (2.48)	0.1052** (2.45)	0.1216** (1.99)
Q_{it}	0.0408** (2.38)	–	0.0419*** (2.89)	–	0.0612*** (3.59)	–
$(S/K)_{it}$	–	0.0913** (2.53)	–	0.1404*** (3.17)	–	0.1123*** (5.54)
$(CF/K)_{it}$	0.1914*** (4.16)	0.2219** (2.15)	0.2215*** (3.88)	0.1901** (2.11)	0.2012*** (3.14)	0.1704** (2.16)
$(CF/K)_{it} \times FDI_t$	–	–	−0.1302** (−2.09)	− 0.1116** (− 2.18)	−0.0891** (− 2.01)	−0.0652** (− 2.11)
FDI_t	–	–	–	–	0.1419** (2.51)	0.1708** (2.14)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.17)	(0.62)	(0.18)	(0.53)	(0.14)	(0.37)
Sargan Test	(0.21)	(0.26)	(0.23)	(0.27)	(0.33)	(0.35)
Hansen-J Test	(0.27)	(0.31)	(0.18)	(0.34)	(0.26)	(0.38)
Wald Test	χ^2 (04) = 382.11 (0.0000)	χ^2 (04) = 523.41 (0.0000)	χ^2 (05) = 388.26 (0.0000)	$\chi 2(05) = 611.29$ (0.0000)	χ^2 (06) = 426.35 (0.0000)	$\chi 2(06) = 655.35$ (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are *p* values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present *p* value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

Table 9 Estimation results of base line investment models (High dividend paying firms)

Variables	Q-Model (Eq. 2)	Euler Equation (Eq. 6)	Q-Model (Eq. 3)	Euler Equation (Eq. 7)	Q-Model (Eq. 4)	Euler Equation (Eq. 11)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0314 (1.21)	0.0415* (1.91)	0.0517* (1.91)	0.0782*(1.94)	0.0616** (2.15)	0.0811** (2.42)
$(I/K)_{it-1}$	0.0619** (2.16)	0.0811** (2.12)	0.0583** (2.18)	0.0911* (1.89)	0.0558** (2.11)	0.0716** (2.35)
Q_{it}	0.0368*** (5.68)	–	0.0511*** (4.88)	–	0.0617** (2.12)	–
$(S/K)_{it}$	–	0.0981** (2.51)	–	0.1158** (2.10)	–	0.1192** (2.33)
$(CF/K)_{it}$	0.1154** (2.34)	0.1018** (2.15)	0.1054** (2.47)	0.1067** (2.06)	0.0918** (2.13)	0.0811** (2.39)
$(CF/K)_{it} \times FDI_t$	–	–	−0.0615** (−2.35)	− 0.0618** (− 2.38)	−0.0498** (− 2.16)	−0.0419** (− 2.15)
FDI_t	–	–	–	–	0.1153** (2.01)	0.1315** (2.15)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.71)	(0.56)	(0.64)	(0.29)	(0.39)	(0.21)
Sargan Test	(0.26)	(0.29)	(0.34)	(0.36)	(0.31)	(0.38)
Hansen-J Test	(0.42)	(0.47)	(0.21)	(0.28)	(0.44)	(0.51)
Wald Test	χ^2 (04) = 521.66 (0.0000)	χ^2 (04) = 885.35 (0.0000)	χ^2 (05) = 489.11 (0.0000)	χ2(05) = 636.19 (0.0000)	χ^2 (06) = 694.36 (0.0000)	χ2(06) = 721.35 (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are *p* values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present *p* value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

Table 10 Estimation results of base line investment models (Low dividend paying firms)

Variables	Q-Model (Eq. 2)	Euler Equation (Eq. 6)	Q-Model (Eq. 3)	Euler Equation (Eq. 7)	Q-Model (Eq. 4)	Euler Equation (Eq. 11)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0612* (1.68)	0.0812* (1.88)	0.0312* (1.84)	0.0718* (1.91)	0.0511** (2.11)	0.0748** (2.19)
$(I/K)_{it-1}$	0.0821** (2.44)	0.0919** (2.48)	0.0912** (2.11)	0.1051** (2.36)	0.0746** (2.03)	0.0915** (2.15)
Q_{it}	0.0612** (2.33)	–	0.0811*** (3.69)	–	0.0938*** (3.51)	–
$(S/K)_{it}$	–	0.1218** (2.54)	–	0.1014** (2.19)	–	0.1052** (2.03)
$(CF/K)_{it}$	0.2219*** (4.56)	0.2611*** (3.98)	0.2315*** (3.21)	0.2282*** (2.88)	0.2118*** (3.31)	0.1914*** (3.91)
$(CF/K)_{it} \times FDI_t$	–	–	−0.1018* (−1.83)	− 0.1241* (−1.88)	−0.1183* (− 1.81)	−0.1217** (− 2.12)
FDI_t	–	–	–	–	0.1803** (2.19)	0.2115** (2.46)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.56)	(0.29)	(0.48)	(0.35)	(0.45)	(0.33)
Sargan Test	(0.33)	(0.49)	(0.51)	(0.29)	(0.38)	(0.31)
Hansen-J Test	(0.47)	(0.32)	(0.23)	(0.49)	(0.44)	(0.41)
Wald Test	χ^2 (04) = 489.11 (0.0000)	χ^2 (04) = 515.06 (0.0000)	χ^2 (05) = 421.15 (0.0000)	$\chi 2(05) = 626.10$ (0.0000)	χ^2 (06) = 515.21 (0.0000)	$\chi 2(06) = 818.99$ (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are p values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present p value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

firms treated as non-financially constraints than those firms which pay less dividend and treated as financially constraints firms. Also, this study assumed that financially constraints (unconstraint) firms have high (low) investment cash flow sensitivity. Considering the effects of financial constraints, we hypothesize that financial development decreases more (less) the investment-cash flow sensitivity for the low (high) dividend paying firms. The *p*-value of m_2 test statistics, Sargan test and Hansen *J* test results and Wald test results suggest the little existence of firm specific effects, validity of the instruments and correct specification of model respectively. We find that investment-cash flow sensitivity is high for the firms which pay low dividend than the firms which pay high dividend. The result of interactions between cash flow and financial development dummy $CF/K \times FDI$ reveal that financial development reduces the impact of cash flow on corporate investment more for low dividend paying firms that the high dividend paying firms, which can be infer form the coefficients of interaction of cash flow and financial development dummy presented in the Tables 9 and 10. Additionally, the independent role of financial development on corporate investment is more (less) for low (high) dividend paying firms. Also, all other variables have their sign as expected and are statistically significant.

Effect heterogeneity (size and group tests)

Further, we make an attempt to test whether financial development has any different impact on the investment-cash flow sensitivity across various firm characteristics. The columns (1) and (2) in Table 11 present the GMM estimation results of the investment models with the interaction terms between size of the company and financial development index. It is evident from the results that the sign of the coefficients of $CF/K \times FDI \times BIG$ and $CF/K \times FDI \times SMALL$ are negative implying that the investment-cash flow sensitivity decreases with financial sector development. However, it is statistically significant in the case of *SMALL* and not for the BIG. This result suggests that small firms are more influenced by the financial development in India. Columns (3) and (4) of the Table 11 display the independent role of financial development on corporate investment. Empirical results reveal that financial development is positively associated with corporate investment across the size of the firms. All other estimates have their expected sign and the statistical significance. These results are consistent with the findings of Laeven (2003). The p-value of m_2 test statistics, Sargan test and Hansen *J* test results and Wald test results suggest the little existence of firm specific effects, validity of the instruments and correct specification of model respectively.

Another subsample analysis is based on the affiliation of business group. *STAND* captures the independent, unaffiliated or standalone firms and *GROUP* represents the group affiliated firms. The results are presented in the columns (1) and (2) of the Table 12. All the test statistics supports the use of GMM estimation. Most of the previous studies claim that in India, independent or standalone firms are more financially constrained than the group affiliated firms (Khanna and Palepu 2000; Khanna and Palepu 1999a, 1999b; Khanna and Yafeh 2005). Group affiliated firms are generally not financially constraints due to the existence of internal capital market and it is easier for the affiliated firm to borrow from the external capital market because of their reputation and political connection (Lensink et al. 2003).

Table 11 Estimation results of investment models by categories (Firm size)

Variables	Q-Model (Eq. 5)	Euler Equation (Eq. 12)	Q-Model (Eq. 7)	Euler Equation (Eq. 14)
	(1)	(2)	(3)	(4)
$(I/K)_{it-1}$	0.1468*** (3.11)	0.1316** (2.19)	0.0811** (2.19)	0.1119** (2.16)
Q_{it}	0.0219*** (2.83)	–	0.0288** (2.15)	–
$(S/K)_{it}$	–	0.1518*** (3.08)	–	0.1219*** (3.29)
$(CF/K)_{it}$	0.2451*** (6.62)	0.1812*** (5.49)	0.2216*** (4.89)	0.1563*** (3.29)
$(CF/K)_{it} \times FDI_t \times BIG_i$	−0.1317 (−1.09)	− 0.1218 (− 1.13)	−0.1217 (− 1.26)	−0.1182 (− 1.41)
$(CF/K)_{it} \times FDI_t \times SMALL_i$	− 0.1705** (− 2.41)	−0.1614** (− 2.36)	−0.1834** (− 2.53)	−0.1746** (− 2.49)
FDI_t	–	–	0.0828** (2.11)	0.1028** (2.03)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.15)	(0.27)	(0.17)	(0.31)
Sargan Test	(0.19)	(0.18)	(0.26)	(0.38)
Hansen-J Test	(0.31)	(0.37)	(0.46)	(0.51)
Wald Test	χ2(06) = 941.28 (0.0000)	χ2(06) = 851.33 (0.0000)	χ2(06) = 998.11 (0.0000)	χ2(06) = 891.18 (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are p values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present p value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

Table 12 Estimation results of investment models by categories (Business group affiliation)

Variables	Q-Model (Eq. 6)	Euler Equation (Eq. 13)	Q-Model (Eq. 8)	Euler Equation (Eq. 15)
	(1)	(2)	(3)	(4)
$(I/K)_{it-1}$	0.1105*** (3.4)	0.0750*** (3.61)	0.1218*** (4.26)	0.0913*** (3.21)
Q_{it}	0.0245** (2.45)	–	0.0416** (2.41)	–
$(S/K)_{it}$	–	0.0499*** (2.52)	–	0.0512** (2.13)
$(CF/K)_{it}$	0.1859*** (2.87)	0.1154*** (4.44)	0.1611** (2.18)	0.1014** (2.19)
$(CF/K)_{it} \times FDI_t \times STAND_i$	−0.0471** (−2.46)	− 0.0553*** (− 2.85)	−0.0511** (− 2.32)	−0.0718** (− 2.15)
$(CF/K)_{it} \times FDI_t \times GROUP_i$	− 0.0731 (−1.45)	−0.0621 (− 1.22)	−0.0914 (− 1.03)	−0.0684 (− 1.19)
FDI_t	–	–	0.1018** (2.11)	0.0918** (2.33)
m_1 (p)	(0.00)	(0.00)	(0.00)	(0.00)
m_2 (p)	(0.42)	(0.56)	(0.48)	(0.59)
Sargan Test	(0.38)	(0.41)	(0.41)	(0.46)
Hansen-J Test	(0.55)	(0.68)	(0.53)	(0.58)
Wald Test	χ2(06) = 855.60 (0.0000)	χ2(06) = 950.72 (0.0000)	χ2(07) = 912.29 (0.0000)	χ2(07) = 998.18 (0.0000)

Notes: (1) The z values are in parentheses. (2) Time dummies are included, but are not reported. (3) The m_1 and m_2 are p values of the test for first- and second-order serial correlation of residuals, respectively. (4) Sargan test and Hansen *J*-test results present p value of the test for over identification, (5) Wald test results present p value of test for joint significance of coefficients. (6)*, **, and *** present the 10%, 5% and 1% level of significance respectively

It is interesting to see the impact of financial development on the investment-cash flow sensitivity of group affiliated firms and standalone firms as it is expected that financial development, may reduce the financial constraint faced by the independent firms. The estimation results of the Q-model and Euler equation show that the regression coefficient in the interaction between financial development index and cash flow is more for group affiliated firms than the stand alone firms. However, the effect of development in financial sector on the investment-cash flow sensitivity of the group affiliated firms is not statistically significant, but for standalone firms, it is statistically significant at 5% level. This implies that standalone firms may have the better access to the external borrowings from the financial market due to the improvements in the financial market condition. Columns (3) and (4) of the Table 12 shows the independent role of financial development on corporate investment in both models. Empirical results postulate that financial development is positively associated with corporate investment across the ownership style of the firms. All other variables have their sign as expected and are statistically significant. These results are consistent with findings of Fazzari et al. (1988), La Cava (2005), Carpenter and Guariglia (2008), Guariglia (2008) and Chen and Chen (2012). In this study, we find strong evidence that financial development affects the financial constraints faced by the firms. We also find that the investment-cash flow sensitivity of the small and independent firms are seem to be significantly influenced more by financial development than the larger and group affiliated firms.

Conclusions

The empirical studies have mostly considered the impact of various exogenous factors like financial condition, liberalisation and corporate governance etc. on the investment-cash flow sensitivity. This study revisits the role of financial development on the role of internal liquidity in the determination of the investments undertaken by the firm in India. The empirical findings of this paper suggest that financial sector development decreases the role of internal cash flow in determining the investment undertaken by the firm. In other words, financial constraints measured by the cash flow sensitivity of investment, decreases with the financial development. This implies that development in the financial system increases the firms' availability to external borrowings and therefore, the reliance on internal cash flow for undertaking the investment declines. This study also reveals that the impact of financial development on the investment-cash flow sensitivity is more during the crisis period and low dividend paying firms than the before crisis period and high dividend paying firms. Further, this study also finds that small and non-affiliated firms, which are financially more constraints, seem to gain more from the financial sector development than the large and group affiliated firm. This study overall highlights the significance of financial development on determination of corporate investment in an emerging economy India.

Endnotes

[1]Debt ratios estimated as the ratio of total debt to capitalisation (sum of total debt and total shareholders' funds) and total debt to assets.

[2]Source: https://www.firstpost.com/blogs/when-it-comes-to-financial-sector-india-is-way-ahead-of-china-1236293.html

[3]Source: http://www.marketexpress.in/2017/01/india-other-emerging-markets-and-how-india-is-different.html

[4] $V_x = \frac{x - x_{min}}{x_{max} - x_{min}}$, $V_x = 1 - \frac{x - x_{min}}{x_{max} - x_{min}}$ Here, x is the underlying actual data and V is the transformed continues 0–1 indicator.

[5]The data frequency is yearly, so that the number of observations is not adequate to employ the principal component analysis considering Indian data only. Therefore, we consider all the emerging economies data to construct the financial development index. We consider all the emerging countries, which have been commonly identified as emerging economy by International Monetary Fund (IMF), Morgan Stanley Capital International (MSCI), Standard and Poor's (S&P), Russell and Dow Jones. This includes Brazil, Chile, China, Colombia, Hungary, Indonesia, India, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand and Turkey.

[6]The sample comprises the data for 9 different industries. We have estimated both Q-model and Euler equation for each industry using the equation (1), (2), (3) and (4). As number of tables are many we have not presented all the results table here due to the lack of space. For brevity we have represented only whole sample results.

Abbreviations

CMIE: Centre for monitoring Indian economy; FDI: Financial development index; FII: Foreign investment inflow; FOD: Forward orthogonal deviation; GDP: Gross domestic product; GMM: Generalized method of moments; IMF: International monetary fund; OECD: Organisation for economic co-operation and development; RBI: Reserve bank of India; VIF: Variance inflation factor

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Competing interests

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