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Financial Frictions, Underinvestment, and Investment Composition: Evidence from Indian Corporates

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Financial Frictions, Underinvestment, and Investment Composition: Evidence from Indian Corporates[1]

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Abstract

This paper studies private investment in India against the backdrop of a significant investment decline over the past decade. We analyze the potential causes of weaker investment at the firm level, using both firm-level financial statements and a novel dataset on firms' investment project decisions, and find that financial frictions have played a role in the slowdown. Firms with higher financial leverage invest less, as do firms with lower earnings relative to their interest expenses. Consistent with the notion of credit constraints leading to pro-cyclical investment, we also find that firms with higher leverage are (i) less likely to undertake new investment projects, (ii) less likely to complete investment projects once begun, and (iii) undertake shorter-term investment projects.

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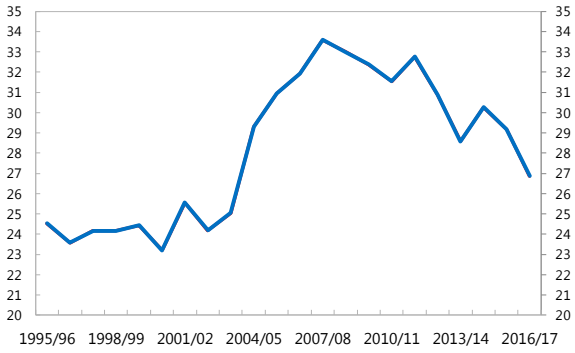
I. INTRODUCTION

Investment growth in India has slowed sharply in recent years. Aggregate gross fixed capital formation growth averaged 12 percent per year over the decade ending in 2011/12 but only 3½ percent in the five years since. Consequently, the investment-to-GDP ratio is estimated to have plummeted from a peak of 33½ percent of GDP recorded in 2007/08[2] to 27 percent in 2016/17 (Figure 1). The decline took place across most industries, but was more severe in capital intensive sectors. The investment-to-GDP ratio of infrastructure-related industries has fallen by one third, and in utilities and manufacturing it has declined by one fourth (Table 1).

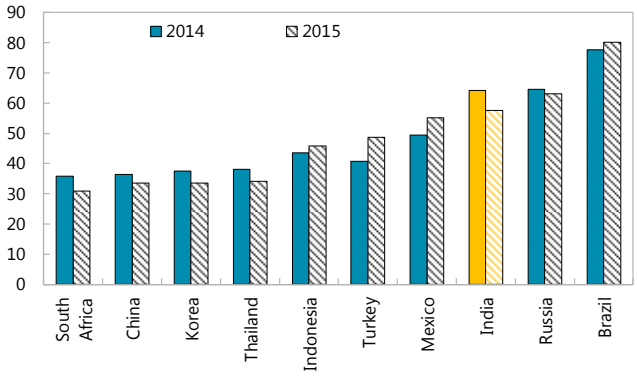
Figure 1. Gross Fixed Capital Formation
(As percent of GDP)



Source: Haver Analytics.

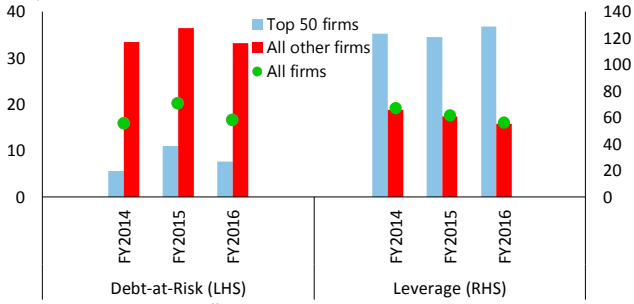
At the same time, the financial leverage of Indian firms has been rising and is high relative to other emerging market economies (Figure 2), raising the question of the extent to which financial frictions have been constraining private investment. Even though the vulnerabilities of corporates have begun to subside, reflecting policy measures to easing supply-side bottlenecks, leverage levels generally remain high (IMF, 2017). Moreover, high leverage is concentrated in certain industries, such as metals and mining, construction and

Figure 2. Corporates: Median Debt to Equity
(In percent)



Sources: IMF, Corporate Vulnerability Utility.

Figure 3. Corporate Sector Vulnerabilities
(In percent)



Sources: CapitalIQ; and IMF staff estimates.
Note: Based on a sample of 2,057 firms. Top 50 firms based on total assets. Leverage is the median debt-to-equity ratio within each group, excluding 227 firms with negative equity. Debt-at-risk is the share of debt of firms with interest coverage ratio (ICR) less than 1 in each group's overall debt.

[2] Indian fiscal years run from April 1 to March 31. That is, 2007/08 is from April 1, 2007 to March 31, 2008.

engineering, and transportation and infrastructure. These industries are also the ones that have recorded the largest slowdown in investment rates over the past several years.

This paper studies the drivers of private fixed investment in India over the past twenty years. Understanding the causes of the investment slowdown and the relative importance of driving factors is key to deriving potential policy responses.

From a theoretical standpoint, explanations of the determinants of firm investment rates can broadly be grouped into two: theories that relate current investment to expectations of future demand, i.e. firm growth opportunities, and theories that are relevant when assumptions that underpin the first group—that of no financial constraints, shareholder value maximization, and constant returns to scale and perfect competition—do not hold. The most popular model in the first group is the Q model, in which all relevant expectations of future profitability are summarized by the firm's stock market valuation and thus investment can be explained as a function of the Q ratio.[3]

The empirical literature has focused on estimating the relationship between firm investment and Q, which is plagued by difficulties in measuring Q in practice, and on testing the hypothesis that financial frictions lead to underinvestment. In this paper, we contribute to the latter literature on firm investment and financial frictions, which has been conducted primarily using data on U.S. firms, and extend it along several dimensions.

First, using firm-level data, we confirm that the negative relationship between investment rates, measured as the ratio of investment expenditure to the existing capital stock, and financial leverage which has been found in the literature holds for Indian firms. Given that the weak performance of empirical measures of Q in explaining firm-level investment even in advanced economies (see Eberly et al. (2012), and Gala and Gomes (2013) for example) and the added difficulty of using the empirical proxy for Q in an economy such as India with low equity market participation, we study directly whether a decrease in expectations of future growth due to the global financial crisis (GFC) – an explanation that would work through lower Q in theory and is proxied in this manner in

[3] Tobin (1969) introduced "Q", the ratio of the market value of a firm to the replacement cost of its capital stock, as a measure of its incentive to invest in capital.

studies of U.S. firms – has affected firm investment in India. In particular, we study whether investment has slowed more at firms in industries where demand for Indian exports fell, and among exporting firms in particular. We find that, while investment at exporting firms is affected by external demand, investment among exporting firms did not fall significantly after the GFC.

Next, we estimate a series of empirical specifications to further test the hypothesis that financial frictions are a factor in decreasing firm investment. In particular, we estimate how financial leverage affects investment at: (i) firms that have differential access to external finance; (ii) firms that have different dependence on banks as their primary source of finance; and (iii) by using a firm's interest coverage ratio (ICR)—that is, the ratio of its earnings to interest expenses—as a proxy for financial distress. We find that the relationship between investment and leverage is less negative for firms with lower financial constraints and, overall, the results suggest that investment is weakened by high financing burdens.

Finally, we study a new measure of investment—the probability a firm undertakes a new investment project—as well as provide evidence on how financial leverage affects the composition of investment, which is proxied by the length of the investment project. We find that leverage negatively affects the likelihood that a firm decides to undertake new investment projects as well as the length of investment projects that are undertaken. This is consistent with the model of Aghion et al. (2010), who show that the share of long-term investment to total investment is countercyclical when financial markets are perfect; but that this share may turn pro-cyclical when firms face tight credit constraints due to the higher liquidity risk of long-term investment. Our analysis benefits from a novel data set on Indian corporates' investment project decisions, which we merge to the firm-level data.

II. Related Literature

A. Theoretical Building Blocks

Macroeconomic theory traditionally modeled investment according to the notion that there are convex adjustment costs to investment, leading to a flexible accelerator model of investment where investments follow a path that results in the actual capital stock adjusting

to some desired capital stock over time.[4] Tobin (1969) introduced "Q", the ratio of the market value of a firm to the replacement cost of its capital stock, as a measure of its incentive to invest in capital. The link between convex costs of adjustment and the Q-theory of investment was made explicit by Mussa (1977) and Abel (1983), both focusing on marginal q —the ratio of the value of an additional unit of capital to its acquisition cost—and showing that q is a sufficient statistic for investment.

In the corporate finance literature, a large class of theories arose on how asymmetric information or agency problems lead external finance to be costly, and thus affect firm investment. See Stein (2003) for a detailed survey. A prominent model that can roughly be placed in this group is Myers's (1977) theory of debt overhang, which shows how outstanding debt can distort a firm's investment incentives and thus lead to underinvestment. With high debt, decision makers that seek to maximize the value of their firm's equity (shareholders or managers compensated with equity) may be reluctant to invest in positive net present value projects because part of the return will accrue to the debt holders, compared to a situation where the face value of the firm's debt is lower. Steigum (1983) tied these two literatures together by modeling a specific financial friction—where a firm's cost of borrowing depends on its debt to equity ratio—and showing that the optimal investment plan was approximated by the flexible accelerator model.

More recent theories of investment focus on: (i) the structure of firm financing; and (ii) the composition of investment. An implication of Myers (1977) is that debt of shorter maturity would lessen the underinvestment problem, as debt that matures before an investment decision cannot cause overhang. Diamond and He (2014) study the effect of debt maturity on investment in a dynamic model, and find that shorter maturities can both increase or decrease overhang effects. For immediate investment, shorter-term debt typically imposes lower overhang. Shorter-term debt leads to more volatile future debt overhang, however, making future investment incentives volatile. Regarding the composition of investment,

[4] That is, $\dot{K(t)} = b[K^* - K(t)]$ where K^* and $\dot{K(t)}$ are the desired and actual stocks of capital at time t, and b is the speed of adjustment coefficient.

Hennessy (2004) shows that debt overhang distorts both the level and composition of investment, with underinvestment being more severe for long-lived assets.

B. Empirical Literature

A large empirical literature on the determinants of firm investment exists, much of it focused on estimating the relationship between investment and Tobin's Q, alongside many studies that establish that establish that firms with more cash and less debt invest more,[5] countering the implication of Modigliani-Miller (1958) that a firm's investment should depend only on the profitability of its investment opportunities as measured, for example, by Q.

More recent papers revisit the Tobin's Q hypothesis, focusing on the measurement error of Q in previous work. Since marginal *q* is unobservable, Tobin's average *Q*, the ratio of equity plus debt value to replacement cost of the capital stock, is commonly used as an empirical proxy.[6] However, the focus on Tobin's Q to explain firm-level investment is receding. Eberly et al. (2012), for example, show that the best predictor of current investment at the firm level is lagged investment, working better than Tobin's Q and cash flow combined on the usual sample of U.S. firms. Gala and Gomes (2013) question the use of Q-ratios in empirical studies of investment, showing that Q bears only a weak relation to optimal investment under all but very stringent assumptions about the nature of markets and technologies, and find that it is better to use the underlying state variables, such as firm size and sales, directly. Using measures of firm fundamentals directly also avoids the measurement error concerns induced by potential stock market misvaluations (Blanchard, Rhee and Summers, 1993), which is even more relevant when studying investment in countries with a lower share of publicly-listed firms and lower stock-market participation.

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[5] For example, early papers using data on U.S. firms showed that investment is excessively correlated with cash flow (Lang, Ofek, and Stulz 1996) and ensured that this holds beyond any role that cash flow may have as an indicator of investment opportunities (Gilchrist and Himmelberg 1995). Subsequent papers have taken a variety of approaches to deal with the potential endogeneity stemming from cash or other financing variables containing information about investment opportunities.

[6] Hayashi (1982) and Abel and Eberly (1994) provided formal justification for this practice, deriving conditions under which average Q and marginal *q* are equal. Both models, however, preclude any role for financial structure by assuming that the firm is financed exclusively with equity.

Empirically, investment expenditures are often lumpy, irregular and infrequent (Doms and Dunne 1998) as opposed to the rather smooth increments to the capital stock implied by theory, and big investment projects typically are irreversible, or at least nearly so. Cooper, Haltiwanger, and Power (1995) find that the probability of an investment spike for a plant increases with the time that has elapsed since the previous spike, lending additional support to the view of a microeconomic environment characterized by nonconvexities in the adjustment technology.

The only paper, to our knowledge, that has focused on the composition of investment is Aghion et al (2010), who model firms that engage in two types of investment: short-term and long-term, where long-term investment contributes more to productivity growth. They show that the share of long-term investment in total investment is countercyclical when financial markets are perfect; but that this share may turn pro-cyclical when firms face tight credit constraints due to the higher liquidity risk of long-term investment. Thus, through its effect on the cyclical composition of investment, tighter credit can lead to both higher volatility and lower mean growth.

C. Investment in India

Tokuoka (2012) took a first look at the investment slowdown in India and found that macroeconomic factors could partially explain corporate investment, but could not fully account for the recent weak investment, and that corporate investment was weaker in cities and states with more difficult business environments. Anand and Tulin (2014) also found that standard macro-financial variables could not fully explain the slowdown in investment at the aggregate level, and that heightened policy uncertainty played a key role. Bahal, Raissi, and Tulin (2016) study the relationship between public-capital accumulation and private investment at the aggregate level India. Their results suggest that while public-capital accumulation crowds out private investment in India over 1950–2012 the opposite is true after 1980, which they attribute to the policy reforms which started during early 1980s and gained momentum after the 1991 Indian balance of payments crisis.

III. Data and Descriptive Statistics

Two main datasets are used in the analysis. The first is the Prowess panel database on Indian firms from the Centre for Monitoring Indian Economy (CMIE). It covers approximately 30,000 Indian companies, both publicly-listed companies and other large companies, and contains the standard balance-sheet variables and information from cash-flow statements. The second database, Capex, is also from CMIE and provides information on investment projects planned or undertaken by India companies. For example, the date that projects are announced, the date they are completed or, if they fail, the date on which they are abandoned. In addition to this information on project events, it also contains the location and industry of projects.

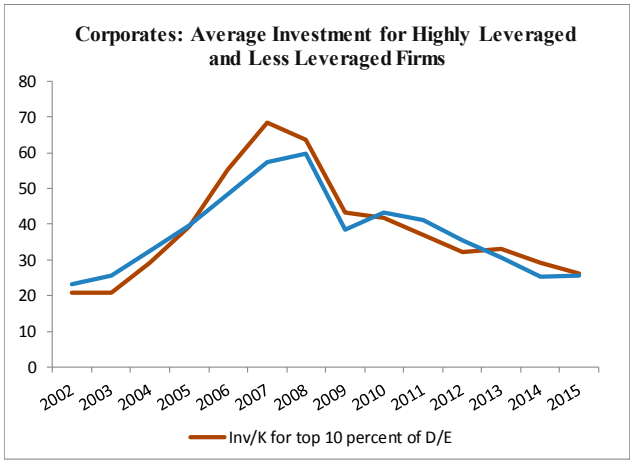
Our main firm-year sample consists of 10,974 firms from 1995 to 2015. We exclude all financial firms (NIC codes: 641–663) and only firms with at least five years of data are included in the sample. Sample averages shows that India's most leveraged companies have had lower investment rates compared to their less-leveraged peers in recent years (Figure 4). Table 2 presents the summary statistics for the annual variables from the Prowess database that are used in the analysis.

The Capex database contains 44,584 investment projects from 1995–2015. Firms can undertake more than one project, of course, so this corresponds to 13,887 firms. After matching this to the Prowess data at the firm-year level, we see that firms began new investment projects in about 9 percent of the Prowess firm-year sample (Table 3). This is consistent with previous evidence on discrete and lumpy investment which suggests that a lack of 'zeros' in annual investment expenditure at the firm level is due to aggregation over different types of capital and production units, as well as a reflection of the lengthy nature of investment implementation.

The average length of time taken to complete investment projects is 3.7 years. Figure 5 shows the distribution of project length for completed projects in the sample.[7]

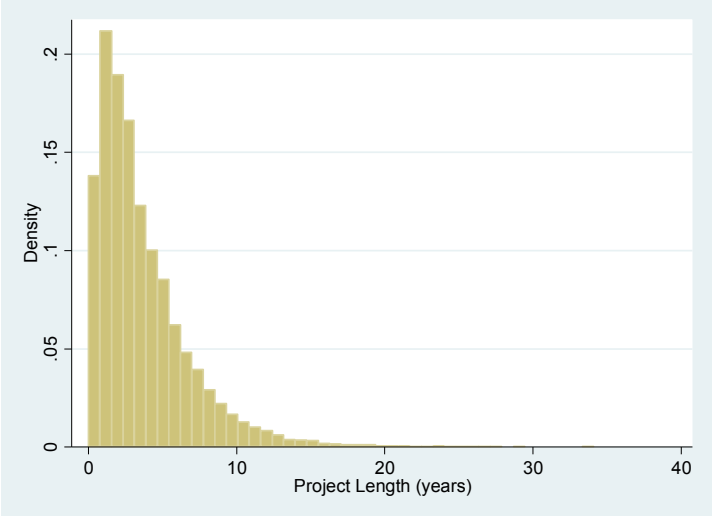
[7] The average time between project announcement and completion is about 2 years in manufacturing, 3.5 years in the services sector, which covers investments related to transportation and communications infrastructure, and about 4 years in the electricity sector.

Figure 4.



Source: CMIE Prowess database.
Note: Firms are ranked by their debt to equity ratios in each year and the average investment rate is shown by year for: (i) firms with the highest 10 percent of debt to equity ratios, and (ii) firms with the lower 90 percent of debt to equity ratios.

Figure 5. Investment Project Length



Source: CMIE Capex database.
Note: Histogram of the length of completed investment projects. Average length is 3.7 years.

IV. Empirical Method

A. Benchmark Specification, Firm-Level Investment Rates

The benchmark econometric specification is as follows:

$$(1) \quad Inv_{it} = \alpha + \mu_i + \beta Lev_{it-1} + \delta X_{it-1} + \nu_t + \varepsilon_{it}$$

where Inv_{it} is investment rate of firm *i* in year *t*. This is measured as the expenditure on fixed assets in period *t*, scaled by the estimate of capital stock at the beginning of the period. That is, by net fixed assets at the end of period *t-1*. The main explanatory variable of interest is the leverage ratio, Lev, calculated as the debt to equity ratio (book values) of the firm, and X is a vector of control variables including:

- the cash flow to (beginning of period) capital stock ratio,
- the sales to (beginning of period) capital stock ratio,
- the size of the firm (log of beginning of period capital stock).

We include a firm-specific effect, μ_i, year dummies, ν_t, to capture aggregate shocks and ε_{it} is an error term uncorrelated with current or lagged values of *X*. We first employ a panel fixed effects estimator, as our benchmark for the subsequent regressions. The hypothesis is the investment rate is lower for firms that are more highly levered, i.e. that $\beta < 0$.

B. Growth Opportunities and External Demand

In the next specification we explore further the relationship between expectations of future profitability and investment. First, with exporting firms being more vulnerable to the global trade slowdown following the global financial crisis, we study how investment was affected at firms in industries where export demand fell, and in particular at exporting firms. The corresponding specification is as follows:

$$(2) \quad Inv_{it} = \alpha + \mu_i + \beta_1 Lev_{it-1} + \beta_2 Exp_{it-1} + \beta_3 WorldImportGrowth_{jt-1} + \delta X_{it-1} + \nu_t + \varepsilon_{it}$$

where:

- Exp is indicator variable for exporting firms (in specifications without fixed effects) or export intensity, measured as the export to sales ratio;

- $WorldImportGrowth_{jt-1}$ is the growth in the volume of imports in industry *j* at time *t-1* of India's trading partners;[8]
- the specification includes an interaction term between the exporting firm indicator variable, or export intensity, and the growth in the volume of world imports by industry;
- and certain estimations also include an interaction terms between the exporting firm indicator variable, or export intensity, and a post-global financial crisis dummy variable, which is equal to one from 2009 onwards.

C. Financial Frictions

To further test the hypothesis that financial frictions are a factor in decreasing firm investment, we next estimate an interaction terms between leverage and several measures of financial constraints. The three proxies for financial constraints are:

1) Firm age, as older firms have developed long-term lending relationships and are less subject to asymmetric information problems (Hadlock and Pierce 2010).
2) Whether a firm is a member of a business group. Firms that belong to business groups have access to intra-group loans from the affiliated group firms (Gopalan et al. 2014) and should thus be less financially constrained compared to other firms.
3) The Rajan and Zingales (1998) measure of dependence on external finance, which captures an industry's technological need for external financing.

If leverage affects firm investment by making borrowing more difficult or costly, the negative relationship between investment and leverage should be stronger for firms that are more financially constrained.

Additionally, as financial constraints may differ between bank-dependent firms, firms that rely more on capital markets, and, in the case of India, firms that rely more on informal

[8] The variable is constructed for 36 product groups (2-digit SITC Rev.3 classification) and matched to the firm according to the firm's main product group, that is product group from which the company gets more than half of its revenue. It covers 49 countries which account for over 90 percent of India's exports. The volume indices are based on product-specific international market prices for commodities and primary products and the U.S. import price indices for other products. For further details, see Raissi and Tulin (2015).

sources of finance, we test whether leverage with a greater bank-debt component affects investment. Unlike in samples of U.S. firms, where the distinction is between bank borrowing and capital market borrowing, and bank-dependent firms are more financially constrained (see Chen et al. 2017), in India many firms, particularly smaller ones, rely on alternative sources of finance.[9] This includes financing from all nonbank, nonmarket sources, and is generally backed by non-legal mechanisms. Bank loans, in turn, are the second most important external financing source for firms, while financial markets have played a limited role in financing the investment and operations of Indian firms (Allen et al. 2012). We find that Indian firms with a greater share of bank debt in fact have higher investment. However, the greater the share of bank debt that is secured debt, the lower investment, and the higher the share of short-term bank debt, the lower investment.

Next, as an alternative measure to financial leverage, we proxy firm financial distress by its interest coverage ratio (ICR). An ICR of less than one is an often used indicator of corporate vulnerability, however, some firms have a low ICR due to shocks to revenues or costs, or because they are new firms that have not yet realized their revenue potential. To account for this, Chung and Ratnovski (2016) use a more persistent measure of ICR: firms that have had and ICR less that one for several consecutive years. We find, as expected, that firms with higher ICRs have higher investment rates, and that firms with ICR < 1 in the previous year, or for several consecutive years, have lower investment rates.

D. New Investment Variable and Investment Project Length

In the next specification, we study a new investment variable built up from the project-level data: the probability that a firm announces a new investment project in a particular year. The predictions of theory apply more directly to this variable than cash expenditure on investment, which is the variable primarily studied in the previous empirical literature, and which has been shown to depend strongly on past investment (Eberly et al. 2012).

[9] Equity and debt raised from private sources including group companies, promoters and founders, trade credits, and other liabilities.

$$(3) \quad \Pr\{NewProject_{sit}\} = \alpha + \mu_i + \beta Lev_{it-1} + \delta X_{it-1} + \nu_t + \varepsilon_{sit}$$

where $NewProject_{sit} = 1$ if firm *i* announces it is beginning new project *s* in year *t*. Since firms with high leverage may also have to abandon investment projects due to financing difficulties, we also estimate the relationship between financial leverage and probability of completing an investment project. Finally, we get at the composition of investment by analyzing the factors that affect project length:

$$(4) \quad \log(ProjectLength_{sit}) = \alpha + \mu_i + \beta Lev_{it-1} + \delta X_{it-1} + \nu_t + \varepsilon_{sit}$$

E. Robustness

Several additional specifications were estimated as robustness exercises. To allow for the possibility that high leverage is less of an issue for firms with:

- higher cash flow or sales, who may have better growth opportunities, or
- for larger firms who may have more established relationship with lenders,

an interaction term of leverage with each of cash flow, sales, and size variables was included one by one in equation (1). In each case, the estimated coefficient on the interaction term was not statistically significant. This suggests that that issue of leverage negatively affecting investment is widespread across Indian firms, and not mitigated for firms with higher sales or for larger firms.

For specifications with the firm investment rate as the dependent variable, the investment rate in the previous period was included as an explanatory variable and two-stage least squares estimation, with the second and third lags of the investment rate as instruments, as well as Arellano and Bond's (1991) consistent GMM estimator, were used given the potential endogeneity of the lagged dependent variable. The results presented in Tables 4–8 are not sensitive to the inclusion of the lagged investment rate.

V. Results and Discussion

A. Benchmark Specification, Firm-Level Investment Rates

The regression results confirm the expected negative impact of leverage on investment. Specifically, a 1 percentage point increase in company's debt to equity ratio leads to about a 1 percentage point decline in investment as a share of its capital stock (Table 4). The sales to capital ratio is found to have a statistically significant, positive effect on investment, while the cash flow to capital stock ratio is found to have a positive effect on investment only in some specifications. Larger firms have lower investment rates, which is expected as large firms would be finished with their main expansion or growth phases.

B. Growth Opportunities and External Demand

Table 5 shows the effect of changes in export demand on Indian firms' investment rates. In column (1a), we see that exporting firms' investment rates were 1.9 percent higher than other firms on average through the sample period. Column (1b) includes an interaction term between the indicator variable that identifies exporting firms and a post-GFC dummy, which is equal to one from 2009 onwards. The coefficient on the interaction term is negative, at -0.228, but not statistically significant, suggest no significant change in investment at exporting firms after the crisis. Columns (2a) includes a measure of firms' export intensity, the export to sales ratio, and confirms that exporting firms invest more on average, and column (2b) interacts the export intensity with the post-GFC dummy and we again find a negative but statistically insignificant coefficient on the interaction term.

In columns (3) to (4b), we include a measure of external demand – the growth in the volume of world imports at the industry level. The coefficient on *WorldImportGrowth* in column (3) indicates that that investment is not significantly different at firms in industries with higher external demand. In column (4a), we include an interaction term between *WorldImportGrowth* and firm's export intensity and find, as expected, that exporting firms, however, do have higher investment when external demand is higher. Next, in column (4b), the interaction between *WorldImportGrowth* and a firm's export intensity is further interacted with the post-GFC dummy variable—to test whether the relationship between the investment rate of exporting firms and external demand changed after the crisis. The negative

but statistically insignificant coefficient of -0.032 on this interaction terms indicated that it did not. Overall, the results indicate that, while investment at exporting firms is affected by external demand, the responsiveness of investment to external demand neither increased, as might be expected, or decreased as trade collapsed after the crisis.

C. Financial Frictions

Table 6 shows the results from interacting leverage with three measures of financial constraints: firm age (column 1), whether a firm is a member of a business group (column 2), and the Rajan and Zingales industry-level measure of dependence on external finance (columns 3 and 4). In each case, the relationship between investment and leverage is less negative for firms with lower financial constraints. For example, in column (1), the negative effect of a one percentage point higher leverage ratio on investment for older firms is 0.012 percentage points lower than for the whole sample of firms. The effect of being in a business group is found to be important, with the relationship between investment and leverage being less negative by almost one percentage point for firms belonging to business groups.

In Table 7, we see that firms that are more dependent on bank finance in fact have higher investment than other firms in India. Specifically, firms with a 1 percentage point higher share of bank debt to total debt have marginally higher investment rates, by about 0.034 percentage points (column 2). Interestingly, this positive effect is offset for firms where the bank debt is in the form of secured debt (column 3). That is, when firms are subject to the loss of collateral, firms that have borrowed from banks do not have higher investment rates. Column (4) separates bank debt into its short-term and long-term components,[10] and the estimated coefficients indicate that the negative effect on investment comes from the short-term component. Unlike the underinvestment channel in Diamond and He (2014), where shorter-term debt typically imposes lower overhang, these results suggest that a large repayment burden over the coming year is what prevents near-term investment.

[10] For a subset of the firm sample, where this breakdown of bank debt into short and long term is available.

The relationship between firm interest coverage ratios and investment provides further support for the notion of investment being dampened by high financing burdens (Table 8). Firms with one percentage point higher ICRs (greater earnings relative to interest expenses) have higher investment rates, by about 0.13 percent points on average (column 1). Columns (2) and (3) show that firms with ICR<1 in the previous year, or firms that have ICR<1 for five consecutive years, have lower investment rates, by about 5 percentage points.

D. New Investment Variable and Investment Project Length

Turning to the new investment variable (Table 9), we see that leverage has a negative effect on the likelihood that a firm decides to undertake new investment projects (column 1a). Column (1b) shows the corresponding marginal effect: a 1 percentage point increase in the leverage ratio (from the sample mean) leads to a 3.3 percent decline in the probability of undertaking a new investment project. This is a sizeable effect given that, overall, new investment projects are initiated in 9 percent of the firm-year sample. Cash flow and sales do not have economically or statistically significant effects on the probably of undertaking new investment projects. The coefficient on size is positive, unlike in specifications with investment rates as the dependent variable. While large firms would be expected to have lower expenditure on investment relative to their existing capital stock, since they are done with their main expansion or growth phases, this result suggests that large firms are still likely continue to undertake new investments.

Similarly, the probability of completing an investment project, once started, is lower for firms with higher leverage (Table 10). The estimated marginal effect in column (1b) shows that a 1 percentage point increase in the leverage ratio (from the sample mean) leads to an almost 1 percent decline in the probability of completing an investment project.

Finally, Table 11 shows the results of estimating the relationship between leverage and the length of an investment project. The coefficient on leverage of -0.02 indicates that firms with 1 percentage point higher leverage are associated with projects that are one year shorter on average in duration.

VI. CONCLUSIONS

This paper studies the causes of the decline in private investment in India that has taken place over the past decade. We analyze the potential causes of weaker investment at both the firm and investment project levels and find that financial frictions have played a role in the slowdown. Taken together, our results indicate that the debt burdens of Indian corporates are affecting private investment.

We find that firms with higher financial leverage invest less, and find a larger negative relationship between leverage and investment rates at firms that are more subject to financial constraints or more dependent on external finance. Firms who are less able to cover their interest expenses are also found to invest less. We also find that firms with higher leverage are (i) less likely to undertake new investment projects, (ii) less likely to complete investment projects once begun, and (iii) undertake shorter-term investment projects. This is consistent with notion that credit constraints lead the share of long-term investment in total investment to turn pro-cyclical.

Corporate deleveraging in India has been slow and uneven across sectors, particularly among larger firms. Corporate leverage ratios and associated vulnerability indicators continue to be high in comparison to other emerging market economies (IMF, 2017). To address these problems, a multi-pronged approach has been put in place to make it easier for borrowers and lenders to deal with corporate financial distress. First, several asset restructuring mechanisms, aimed at refinancing, strategic debt restructuring, and debt-to-equity swaps, have been introduced. Second, measures to rehabilitate distressed sectors, such as in road construction, textiles, and coal mining, have been implemented. Finally, a new bankruptcy law promises to simplify the winding-up of failing enterprises and recovery of their debts. So far, these measures have had varying success and some are yet to gain full force. Thus, continued efforts to speed up corporate deleveraging and reduce debt burdens remain key to improving operating performance and encouraging an investment revival.

Given the bank-centered nature of India's financial system, and in particular the dominant role of its public sector banks, a prompt rebuilding of a healthy banking system is also key. The Asset Quality Review initiated by the Reserve Bank of India in December 2015, and completed in March 2017, has been instrumental in bringing about a

comprehensive recognition of distressed bank assets and thereby instigated appropriate loss provisioning. That said, India's distressed debt markets are underdeveloped, so even though market-based mechanisms should eventually become central to a turnaround of troubled corporates, a pragmatic approach is needed to preserve the health of the Indian banking system. This entails continued stringent supervision, following up on corporate governance reforms in public sector banks, and ensuring adequate capital at banks, including through capital injections by the Government of India.

Table 1. Gross Capital Formation by Industry

	2011/12	2015/16	Change in the ratio	
	(in percent of GDP)		(in percentage points)	(in percent)
Agriculture	3.1	2.4	-0.7	-22.3
Mining	0.8	0.5	-0.3	-34.7
Manufacturing	7.1	5.2	-1.9	-26.2
Utilities	3.5	2.6	-0.9	-25.7
Construction	2.6	1.7	-0.9	-34.2
Trade	2.2	3.1	0.9	40.7
Transportation, Communication	3.0	2.0	-1.0	-33.4
Real estate, Professional services	9.3	8.4	-0.9	-9.8
Other services	1.7	1.7	0.0	-0.1
Total	33.4	27.7	-5.6	-16.9

Source: Haver Analytics and authors' calculations.

Note: Excludes Financial sector, Public administration and defense.

Table 2. Summary Statistics

	Obs	Mean	Median	Std Dev
Investment/K (percent)	74,205	33.9	13.8	66.9
Debt/Equity	74,205	1.37	0.75	2.20
ICR	65,104	4.79	0.74	17.4
ICR < 1	65,104	0.55		
ICR < 1 for past five years	65,104	0.11		
Bank debt / Total Debt (percent)	61,684	63.8	69.9	30.5
Secured bank debt / Bank Debt (percent)	60,796	96.7	100	12.9
Long-term bank debt / Equity	40,928	0.51	0.19	1.0
Short-term bank debt / Equity	56,865	0.58	0.33	1.0
Exporter	74,205	0.57		
Exports/Sales (percent)	73,252	14.1	0.7	24.9
Cashflow/K (percent)	74,205	34.5	3.8	653.8
Sales/K (percent)	74,205	380.8	307.4	273.8
Assets (million USD)	74,205	168.4	16.3	1174.2

Notes: Investment/K is the investment rate (the expenditure on fixed assets, scaled by the beginning of period capital stock); Debt/Equity is the debt to equity (book values) ratio; ICR is the interest coverage ratio (earnings to interest expenses); ICR < 1 is a dummy variable equal to one if the ICR is less than one; ICR < 1 for past five years is a dummy variable equal to one if a firm's ICR has been last than 1 in each of the past five years; Exporter is a dummy variable equal to one if a firm is an exporter; Exports/Sales is the ratio of export receipts to total sales; Cashflow/K is the cash flow to beginning of period capital stock ratio; Sales/K is the sales to beginning of period capital stock ratio; Assets denotes the firm's total assets.

Table 3. New Project Announcements

	Firm-Year Obs	Percent
New project	6,664	8.98
No announcement	67,541	91.0
Total	74,205	

Table 4. Firm Investment—Benchmark Specification

Dependent variable: Investment/K

	(1)	(2)	(3)
	OLS	FE	FE
	Industry Effects		
Debt/Equity (t-1)	-0.944***	-1.056***	-1.025***
	(0.099)	(0.157)	(0.159)
Cashflow/K (t-1)	0.001	0.001	0.002*
	(0.001)	(0.001)	(0.001)
Sales/K (t-1)	0.011***	0.014***	
	(0.000)	(0.001)	
Sales growth (t-1)			0.000
			(0.000)
Size (t-1)	-2.977***	-26.010***	-29.530***
	(0.172)	(0.875)	(0.828)
Constant	57.217***	77.054***	87.712***
	(2.210)	(2.117)	(1.800)
Observations	74,205	74,205	74,205
No. Firms	10974	10974	10974
Rsquared	0.078	0.149	0.137

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: Size is the log of the beginning of period capital stock and other variables are as in Table 2.

Table 5. Firm Investment—Exporters and External Demand

Dependent variable: Investment/K

	(1a)	(1b)	(2a)	(2b)	(3)	(4a)	(4b)
	OLS	OLS	FE	FE	FE	FE	FE
	Industry Effect	Industry Effects					
Debt/Equity (t-1)	-0.924***	-0.925***	-1.052***	-1.050***	-1.350***	-1.350***	-1.348***
	(0.100)	(0.100)	(0.157)	(0.157)	(0.168)	(0.168)	(0.168)
Exporter	1.892***	1.981***					
	(0.566)	(0.705)					
Exporter * post-GFC dummy		-0.228					
		(1.007)					
Export Intensity (t-1)			0.047*	0.060**			
			(0.028)	(0.030)			
Export Intensity (t-1) * post-GFC dummy				-0.035			
				(0.025)			
World Import Growth (Industry) (t-1)					-0.006	-0.017	-0.017
					(0.011)	(0.013)	(0.013)
World Import Growth (t-1) * Export Intensity (t-1)						0.001**	0.001**
						(0.000)	(0.000)
World Import Growth (t-1) * Export Intensity (t-1) * post-GFC dummy							-0.032
							(0.030)
Observations	74,205	74,205	73,252	73,252	45,202	45,202	45,202
No. Firms	10974	10974	10827	10827	5954	5954	5954
Rsquared	0.078	0.078	0.148	0.148	0.161	0.161	0.161

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Explanatory variables not shown are the cashflow to capital ratio, the sales to capital ratio, and the size of the firm.

Notes: Exporter is a dummy variable equal to one if a firm is an exporter, Export Intensity is the exports to sales ratio, post-GFC dummy is equal to one from 2009 onwards, World Import Growth (Industry) is the growth in the volume of imports in industry j of India's trading partners.

Table 6. Firm Investment—Interaction with Financial Constraints

Dependent variable: Investment/K

	(1) Age	(2) BusGroup	(3) R&Z	(4) R&Z
Debt/Equity	-1.417***	-1.473***	-1.241***	
	(0.289)	(0.211)	(0.227)	
Debt/Equity * Age	0.012**			
	(0.006)			
Debt/Equity * BusinessGroup		0.999***		
		(0.315)		
Debt/Equity * ExternalDependence			-0.515	
			(0.639)	
Debt/Equity * Low ExternalDependence				-1.230***
				(0.258)
Debt/Equity * Middle ExternalDependence				-1.285***
				(0.356)
Debt/Equity * High ExternalDependence				-1.642***
				(0.290)
Observations	73,963	74,205	44,096	44,096
No. Firms	10895	10974	5736	5736
Rsquared	0.148	0.149	0.166	0.166

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Explanatory variables not shown are the cashflow to capital ratio, the sales to capital ratio, and the size of the firm.

Notes: Age denotes the age of the firm; BusinessGroup is a dummy variable equal to one if the firm is a member of a business group; ExternalDependence is the Rajan and Zingales (1998) industry-level measure of dependence on external finance; Low, Middle, and High External Dependence denote the bottom, middle, and top tertile of industries in terms of their dependence on external finance.

Table 7. Firm Investment—Bank Dependence

Dependent variable: Investment/K

	(1) FE	(2) FE	(3) FE	(4) FE
Debt/Equity (t-1)	-1.056***	-1.244***	-1.277***	
	(0.157)	(0.158)	(0.159)	
Bank Debt / Total debt (t-1)		0.034**	0.032**	0.073***
		(0.014)	(0.014)	(0.022)
Secured Bank Debt / Bank debt (t-1)			-0.043*	
			(0.024)	
Long-term Bank Debt/Equity (t-1)				0.281
				(0.685)
Short-term Bank Debt/Equity (t-1)				-4.900***
				(0.635)
Observations	74,205	61,684	60,796	35,735
No. Firms	10,974	9,627	9,520	6,931
Rsquared	0.147	0.159	0.161	0.199

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Explanatory variables not shown are the cashflow to capital ratio, the sales to capital ratio, and the size of the firm.

Table 8. Firm Investment—Interest Coverage Ratio

Dependent variable: Investment/K

	(1) FE	(2) FE	(3) FE
Debt/Equity (t-1)	-1.005***	-0.775***	-0.984***
	(0.147)	(0.148)	(0.148)
ICR (t-1)	0.131***		
	(0.022)		
ICR < 1 in previous year		-7.898***	
		(0.588)	
ICR < 1 for past five years			-4.884***
			(0.754)
Observations	65,104	65,104	65,104
No. Firms	10,069	10,069	10,069
Rsquared	0.154	0.157	0.154

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Explanatory variables not shown are the cashflow to capital ratio, the sales to capital ratio, and the size of the firm.

Notes: ICR is the interest coverage ratio (earnings to interest expenses); ICR < 1 is a dummy variable equal to one if the ICR is less than one; ICR < 1 for past five years is a dummy variable equal to one if a firm's ICR has been last than 1 in each of the past five years.

Table 9. New Investment Projects

Dependent variable: Prob{New Project}

	(1a)	(1b)
	FE Logit	Marginal Effects
Debt/Equity	-0.165***	-0.033***
	(0.011)	(0.002)
Cashflow/K (t-1)	-0.000	-0.000
	(0.000)	(0.000)
Sales/K (t-1)	0.001***	0.000***
	(0.000)	(0.000)
Size (t-1)	0.264***	0.053***
	(0.021)	(0.005)
Observations	46,884	
No. Firms	4269	
Pseudo Rsquared	0.0815	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Notes: $NewProject = 1$ if a firm announces it is beginning new project in year *t*.

Table 10. Investment Project Completion

Dependent variable: Prob{Project Completion}		
	(1a)	(1b)
	FE Logit	Marginal Effects
Debt/Equity	-0.046*	-0.008*
	(0.026)	(0.004)
Cashflow/K (t-1)	-0.000	-0.000
	(0.000)	(0.000)
Sales/K (t-1)	-0.000	-0.000
	(0.000)	(0.000)
Size (t-1)	-0.118**	-0.020***
	(0.052)	(0.008)
Observations	11,378	
No. Firms	3648	
Pseudo Rsquared	0.108	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Notes: $ProjectCompletion_t = 1$ if the firm completes its investment project in year *t*.

Table 11. Investment Project Length

Dependent variable: Project Length		
	(1)	(2)
	OLS	OLS
	Industry Effects	Fixed Effects
Debt/Equity	-0.012*	-0.020**
	(0.006)	(0.010)
Cashflow/K (t-1)	-0.000	-0.000
	(0.000)	(0.000)
Sales/K (t-1)	0.000***	0.015
	(0.000)	(0.027)
Size (t-1)	0.045***	0.000
	(0.005)	(0.000)
Observations	11,170	11,170
No. Firms	3815	
Pseudo Rsquared	0.208	0.020

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Notes: Project Length is the length of an investment project in years, from beginning to completion.

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