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Corporate Debt Overhang and Investment

Firm-Level Evidence

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Abstract

This paper investigates empirically the linkages between corporate debt overhang and investment activity at the firm level for a cross section of large-sized emerging market and developing economies. It analyzes the extent to which investment may be discouraged by high levels of debt that put at risk future profits, as well as firm dimensions that may sharpen the debt-investment link. Using balance sheet data from a broad set of emerging market and developing economy firms, the analysis suggests that corporate debt overhang imposes a sizable effect on investment at the firm level. This linkage is more pronounced for large firms and highly leveraged firms. The analysis also finds evidence of a nonlinear effect, in which debt overhang discourages investment more severely under high levels of indebtedness.

Corporate Debt Overhang and Investment: Firm-Level Evidence

Eduardo Borensztein and Lei Sandy Ye*

1. Introduction

Corporate debt in emerging market and developing economies (EMDEs) has risen substantially over the past decade, encouraged at least in part by the low interest rate, low risk aversion environment that has largely prevailed during this period. It has, on average, risen from about 60 percent of GDP in 2006 to 86 percent of GDP in 2017. This increase has been especially pronounced in China, where corporate debt exceeded 160 percent of GDP by 2017. In other EMDEs, corporate debt has risen by more than 10 percentage points of GDP over 2006-2017 (Figure 1).

At the same time, investment growth in EMDEs has slowed sharply after 2011, posing challenges for the longer-term growth prospects of these economies (World Bank 2017; Kose et al. 2017; Vashakmadze et al. 2018). In China and other EMDEs, private investment growth has been substantially below their longer-term (1995-2008) average rates. Moreover, firm-level data show that low-investment firms display higher levels of debt overhang (as defined later) than high-investment firms both in China and other EMDEs (Figure 2).

This paper examines the linkage between debt and corporate investment. We focus in particular on the "debt overhang" channel and the nonfinancial corporate sector. The corporate finance literature has studied conditions under which a debt overhang effect may discourage corporate investment since the seminal contribution by Myers (1977). Debt overhang arises when accumulated debts may be excessive relative to the earnings flowing from new investments, and hence may lead firms to underinvest in positive net present value projects. Indeed, corporate earnings have been generally declining over the past few years in the context of the economic slowdown in many EMDEs, as GDP growth in EMDEs has declined from 7.3 percent in 2010 to 4.3 percent in 2017 (World Bank 2018).

These developments suggest that risks associated with debt overhang conditions may be rising in emerging economies. Much of the attention to the rapid growth of corporate indebtedness has centered on the risks of a financial crisis (e.g., IMF 2015, Acharya et al. 2015, and Shin 2013). Instead, our focus here is on the possibility that the high debt burdens may slow down investment and thus impair medium-term economic growth. Debt overhang per se is not necessarily an early

warning indicator of a financial crisis. However, it describes conditions under which the burden of debt may cause weak levels of private investment. This situation may persist over time, as drawdowns of high debt levels tend to be slow processes. In fact, a recent study of credit booms found that about one-third of them are followed by an extended period of stagnation in economic growth (Dell'Ariccia et al. 2016).

This paper investigates the linkage between debt overhang and investment using balance sheet data from about half a million firms from the largest EMDEs. Firm-level data are much more useful than macroeconomic data to test the debt overhang hypothesis. Aggregate data would not show whether the most indebted firms (relative to their expected profitability) are the ones that are putting off investment opportunities. Further, financial statements provide information on variables like the levels of sales, leverage and profits, along with other controls that are useful to measure and test the debt overhang effect. In contrast to many studies that use only data from listed companies, we have access to a broad range of firms, most of which are much smaller than the typical listed firm. This can give a fuller insight into the situation of the corporate sector and its decisions.[1]

Our analysis suggests that the debt overhang effect is significant, robust, and fairly sizable. An increase in the debt overhang indicator (deterioration in the ratio of profits to debt, as explained below) from the 10th to 90th percentile is associated with a fall in the ratio of net investment to sales of 1 percentage point for Chinese firms and 2 percentage points for other EMDE firms.[2] We conduct the tests separately for China and the rest of the countries in view of special conditions in China. Corporate debt in China exceeded 160 percent of GDP in 2017, compared to a median of 47 percent in the rest of the countries in our sample. Debt tolerance may also be higher in China, where the large state-owned banks have been carrying a significant amount of loans for some time (Maliszewski et al. 2016). Over 40 percent of the observations available for the regressions correspond to Chinese firms.

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[1] We use the ORBIS data set commercially offered by Bureau van Dijk (see more details in section 3).
[2] Note that the mean value of the net investment to sales ratio is just 2.7 percent for Chinese firms and 5.3 percent for firms in other EMDEs.

In addition, we search for nonlinearities and interactions in the specification of the debt overhang effect. The nature of the debt overhang problems suggests that the impact may effectively be negligible at moderate levels of debt, but past a critical debt level, the effect would be significant. The critical debt level that triggers the overhang effect may depend on factors such as the interest rate charged on debt or the level of collateral that a firm has. Our results do suggest the presence of nonlinearities, as the debt overhang effect can be more than three times as large among highly indebted firms as compared to low debt firms.

The rest of the paper proceeds as follows. Section 2 briefly reviews the theory of corporate debt overhang and the empirical literature. Section 3 describes the firm-level data set used in our paper. Section 4 presents the empirical methodology and results. Section 5 concludes.

2. Conceptual framework and literature

The seminal paper by Myers (1977) introduces the concept of debt overhang rigorously.[3] In a simplified setup, consider a firm that has at its disposal an investment project with a payoff $V(s)$, where s denotes the "state of nature." The project has cost I. Assume that the state of nature is known before the investment decision is made; then, the firm will invest when $V(s) > I$. If the states of nature are arranged in increasing order of final value $V(s)$, there will be a critical state s_a such that $V(s_a) = I$. The firm will carry out the investment for all $s > s_a$ and will not engage in investment for $s < s_a$.

Suppose now that the firm is carrying an amount of debt D, which was acquired prior to the revelation of the state s and the investment decision and is due when the investment proceeds accrue. Assume that the interest rate is zero, such that after the return on the investment is realized the firm has to pay back just D. In this case, the firm will undertake the investment when $V(s) > I + D$. The "critical state" in this case—denote it as s_b—needs to satisfy $V(s_b) > I + D$. It follows that $s_b > s_a$ and thus there are fewer states in the world in which the firm would choose to invest when it has preexisting debt. This simple model describes, at its bare minimum, the debt overhang

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[3] Allen et al. (2008) show an alternative presentation of Myers' framework. Occhino and Pescatori (2015) study the macroeconomic implications of Myers' debt overhang channel. For models of debt overhang applied to sovereigns, see Krugman (1988).

problem. The causes of the debt overhang situation are a large preexisting debt, D, and/or a negative economic shock in the form of the realization of a low state of the world s.

To understand the result above, note that debt is senior to equity in corporate finance. When the firm realizes the return from its investment it must first pay back the creditors an amount D, and keeps only the residual amount. If this residual is not enough to cover the investment cost I, the firm will not undertake the investment project because it will produce a loss. Thus, the debt overhang situation arises due to a conflict between shareholders and debt holders. While this is a stripped-down case, it illustrates the basic forces at play. These are the preexisting, senior debt and the risks surrounding the return on investment. Our empirical test of debt overhang attempts to capture these two components.[4]

Although the theory of corporate debt overhang dates back several decades, the empirical literature on corporate debt in EMDEs has emerged only very recently. A number of studies have documented the rise in corporate debt in EMDEs, its determinants and potential financial stability risks (e.g., Acharya et al. 2015; World Bank 2016; IMF 2015; Feyen et al. 2017, 2015; Mooij and Hebous 2017; Alter and Elekdag 2016; Brown and Lane 2011; Beltran, Garud, and Rosenblum 2017; Corsetti et al. 2015; Alfaro et al. 2017). An even smaller set of papers has examined the implications of rising corporate debt on corporate investment in these economies. In their study of determinants of private investment, Magud and Sosa (2015) and IFC (2016) introduced a debt variable for a cross section of large, stock-market listed firms in various EMDEs, and found a negative relationship between leverage and investment. Das and Tulin (2017) find a similar relationship for a large sample of firms in India. Kalemli-Ozcan, Laeven, and Moreno (2015, KLM) test the effect on fixed investment of debt relative to current earnings for a broad sample of European firms in the aftermath of the financial crisis. They find a large effect: more than half of the decline in investment can be explained by the level of debt and rollover risk. They also focus on the effect of banks' financial soundness on investment by firms with established credit relationships with those banks.

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[4] A simple extension to Myers's framework would be the case in which the state of nature is not known to the firm at the time of the investment decision. In this case, the firm would compare the cost of investment I to the expected net revenue $E(V(s)) - D$, and would undertake the investment project only when the latter expression exceeds I. The implications are totally analogous.

This paper attempts to expand upon this small literature by studying the reaction of investment to debt overhang by both large and small private firms for a diverse sample of large emerging and developing economies, and subsequently exploring cross-sectional dimensions that may differentially affect the sensitivity of investment to debt overhang in different firms.

3. Data

The theoretical framework described in the previous section suggests that a variable that encapsulates well the concept of debt overhang empirically is the level of debt relative to the expected return on investment. The use of microeconomic data would be ideal to analyze this issue because debt overhang likely affects the "tail" of firms with higher debt levels and aggregate numbers would not provide much information about their situation. Moreover, the possible emergence of a debt overhang is a recent phenomenon, and macroeconomic data may not provide a suitable sample for the estimation of its impact.

The firm-level data come from the ORBIS database produced by Bureau van Dijk Electronic Publishing (BvD). Our sample contains firm-level balance sheet information in 13 EMDEs across Asia, Europe, Latin America, and Africa (Appendix Table A1). The balance sheet information comes from regulatory as well as other sources, such as local chambers of commerce. The sample is based on an unbalanced panel spanning 2007-2015. In contrast to most other major firm-level databases (such as Bloomberg and Worldscope), the vast majority of the firms in the sample are non-publicly-listed firms.[5] Less than 5 percent of the firms in the data set are listed in stock markets, and about 90 percent of them have an asset size below $50 million. Throughout the rest of the paper, we define large firms as those with average assets above $50 million over the sample period, and the rest as small firms.[6] Industry-level information is available based on the NACE Rev. 2 classification. The availability of industry information at a granular level allows us to employ a rich set of interactive fixed effects to control for factors that are intrinsic to industry

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[5] The Orbis data set does not comprise the full universe of firms in the EMDE sample considered. Nevertheless, compared to other standard cross-country data sets, it covers a much larger sample of private firms, which are important drivers of economic activity in the EMDE corporate sector.

[6] This criterion for large firms is similar to that of the European Union. Baseline results are not sensitive to alternative measures of large firms, such as those defined by the International Finance Corporation (IFC) (larger than $15 million). In robustness checks of the empirical analysis, the sample was broken into small, medium, and large firms based on the IFC criteria, but no significant differences were found between small and medium-sized firms.

demand and operating conditions. In contrast to most existing works, we are able to focus on cross-sectional differences among EMDE corporates, as opposed to simply studying aggregate trends over time.

Our data set comprises those firms in the ORBIS database that have available data on fixed assets, long-term corporate debt, earnings before interest and taxes (EBIT), and total assets (above 5 million USD) in at least one year over the sample period.[7] We conduct a cleaning procedure similar to Kalemli-Ozcan, Laeven, and Moreno (2015) to generate a usable data set, including the following:

1) drop company-years that simultaneously lack data on total assets, sales, and employment.
2) drop entire company for all years if total assets, employment, sales, tangible fixed assets, or fixed assets is negative in any given year.
3) drop companies denoted as non-profit organizations
4) change value to "missing" if long-term debt or current liabilities is negative.

All observations are winsorized at the 1 percent level to prevent the impact of extreme outliers.

Overall, the firm-level data depict a situation of sharply decelerating investment in the context of weakening sales and profits, and mostly rising debts, albeit with important differences across countries.[8] At the industry level, leverage appears to be high in a number of industrial sectors, such as utilities and mining (Figure 3). Domestically-owned firms exhibit higher leverage than multinationals, which can access funds via intra-company borrowing across affiliates within the conglomerate (e.g., Desai, Foley, and Forbes 2008). These trends are broadly consistent with the macroeconomic trends of these variables. Although the decline in fixed investment may respond to a number of factors; notably economic slowdown, negative terms of trade shocks, and decelerating capital flows; debt overhang, namely the increasing burden of debt relative to the flow of profits, may have also become a determinant of the decline in investment for many firms.

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[7] Only an extremely limited set of the sample data is available for the year 2016. Furthermore, data on capital expenditures are not available in Orbis. We calculate differences in fixed investment (scaled by sales or lagged capital stock) as our measures of investment.
[8] The filtering procedure yields an unbalanced sample of 434,256 firms. In the full baseline regression, constraints on data availability across all variables yields a firm sample of about 130,000 firms.

Given the special conditions that prevail in China, we divide the sample between Chinese companies and those of all the other countries for much of the empirical analysis that follows. The levels of corporate debt are much higher in China than in other EMDEs, despite some decline in the recent two years. The Chinese banking system is dominated by large state-owned institutions and has traditionally showed high tolerance for elevated debts even for companies that are not showing a strong profit performance or promising prospects. Also, China is undergoing a process of structural change as economic development expands, whereby growth is shifting from the industrial and construction sectors to the service sector, which is reinforced by policies; and this may affect bank credit allocation and creditor forbearance.

4. Empirical methodology and results

The basic insight that guides our empirical work is that when debt is high relative to expected profits, investment will suffer. This suggests that the variable of interest should reflect debt and (expected) profits. We postulate the ratio of earnings to total debt as the variable that best reflects debt overhang. The need to express the ratio with earnings in the numerator rather than the reciprocal arises from the possibility that earnings can be equal to or very close to zero and may create huge outliers. This ratio (profits to debt) is referred to as debt service capacity in the corporate finance literature. We introduce a couple of modifications and extensions. First, we take a three-year moving average of earnings to proxy expected profits and smooth cyclicality to some degree. Since we have less than ten years of data per firm, we cannot apply a more involved method to estimate cyclically-adjusted, expected profits. Second, we adjust negative value of earnings to zero. The debt overhang variable becomes distorted by negative profits, as its derivative with respect to debt becomes negative. Finally, we explore nonlinear specifications of the debt overhang variable, focusing on a piecewise linear function where debt overhang becomes relevant only after it crosses a certain threshold. These modifications are explained in more detail below.

Investment is measured from data on the stock of fixed assets. Thus, investment is measured on a net basis, calculated as the annual difference in fixed assets. We define total debt as the sum of long-term debt plus current liabilities. Our primary overhang variable is measured as the ratio of a rolling three-year average of EBIT to current total debt, which is an indicator of the size of

accumulated debts relative to expected profits.[9] We also include a variety of controls: sales growth, maturity, size, cash flows. We deflate our variables in terms of local currency CPI. In our specification, we also include firm fixed effects and country-industry-year fixed effects to control for firm-level time invariant heterogeneity and a rich set of unobserved and observed time-varying factors at the country-industry level, respectively. These factors may include, for example, industry demand effects or macroeconomic shocks. This effectively amounts to a framework in which we estimate differential sensitivity of debt overhang to investment across firms in the same country and industry in any given year. We estimate our specifications for China and non-China economies separately, given China's special characteristics.

To examine the impact of debt overhang on investment, our baseline estimating equation (similar to KLM 2015) is as follows:

$$y_{cijt} = a_0 + a_1 Overhang_{cij,t-1} + \boldsymbol{X_{cij,t-1}}'\boldsymbol{\delta} + u_i + v_{cjt} + \varepsilon_{cijt} \qquad \textbf{(1)}$$

where y_{cijt} denotes the net investment rate of firm i, industry j, country c, and year t. We consider the annual difference in fixed assets scaled by sales as the benchmark measure of investment. $Overhang_{cijt-1}$ denotes the benchmark measure of firm debt overhang as described earlier; as the variable is specified, $Overhang_{cijt-1}$ will be a measure of the debt service capacity of a firm and thus the coefficient a_1 is expected to have a positive sign. A higher value of a_1 implies a higher sensitivity of investment to debt service capacity. $\boldsymbol{X_{cij,t-1}}$ denotes a vector of control variables, which include size (log of total sales), real sales growth, leverage (debt to sales), maturity (ratio of long-term debt to total debt), cash flows (EBIT to sales). These variables are considered standard control variables in the corporate finance literature. ε_{cijt} is the error term. Standard errors are clustered at the firm level. u_i and v_{cjt} denote firm and country-industry-year fixed effects, respectively.[10]

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[9] Other works that have used similar measures to proxy for debt overhang include Blattner, Farinha, and Rebelo (2017), Chen and Lu (2016), IMF (2018), and Kalemli-Ozcan, Laeven, and Moreno (2015).

[10] In supplementary exercises, we also estimate equation (1) by scaling net investment by lagged capital stock (Appendix Table A2). The benchmark results are broadly similar.

As more than 90 percent of the firms in the sample are not listed in stock markets, we cannot use Tobin's Q as a determinant for investment. However, the cash flow variable, which incorporates a smoothed EBIT, may proxy for the present value of future profits, namely the value of the firm. In addition, the three-year rolling average of EBIT is similar in spirit to performing a cyclical adjustment of earnings, which the short time span of the data for each firm precludes. Cyclical adjustment of corporate earnings is a standard practice when computing Price/Earnings ratios, for example.[11] We also need to make an adjustment to the overhang variable. Note that, in instances where EBIT is negative, the profits to debt ratio will increase (become less negative) artificially if the debt stock increases, that is, the debt overhang position will improve as debt increases. Thus, to avoid this inconsistency, we replace the negative values of this observation to be 0. All variables on the right-hand side are lagged by one period.

Prior studies on corporate investment tend to include the leverage ratio as a determinant to account for debt constraints that a firm may face. Unlike these works (but like KLM), we use the EBIT to debt ratio as our preferred measure of the influence of debt on investment, but also include a leverage variable among the controls. We are somewhat agnostic in interpreting the leverage variable. While a larger value may signal a drag to creditworthiness, and thus access to credit under less favorable conditions, for a successful firm high leverage may just be a sign of ease of access to credit. Our approach is thus to assess the impact of debt overhang conditional upon the enhanced or diminished access to finance that the value of leverage may indicate.

Table 1 shows the baseline results of equation (1). Given that our debt overhang measure includes EBIT as well as total debt, it may be correlated to some extent with cash flows and leverage. Thus, we include these two variables sequentially to check the robustness of the debt overhang term. The results show that the debt overhang term is positive and significant across all columns, which implies that higher debt service capacity is associated with higher investment rate. The coefficient is significant for both non-Chinese economies and China, but the magnitude is smaller for China.[12]

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[11] For example, Shiller's CAPE (cyclically-adjusted Price/Earnings ratio) uses a ten-year average of earnings (Campbell and Shiller 1988).

[12] The firm-level data for China contain only a limited number of state-owned enterprises. Thus, the data are likely more reflective of the debt service capacity to investment sensitivity among firms in the non-state-owned private sector.

Furthermore, the coefficients are not sensitive to the inclusion of cash flows or leverage, although their magnitudes decrease slightly once controlling for the latter two variables.

In the entire sample, the magnitude of the coefficient implies that an increase in debt service capacity from the 10th to 90th percentile, conditional upon leverage and profitability, is associated with a 1.4-percentage-point increase in the investment to sales ratio. This amounts to about one-third of the average net investment to sales ratio of these economies. This coefficient remains significant but smaller for China, for which a 10th to 90th percentile increase in debt service capacity is associated with 1 percentage-point higher investment to sales ratio, also amounting to about one-third of the average investment rate of China in the sample. In aggregate, debt overhang is associated with about 16 percent of the decline in the net investment-to-sales ratio in the sample from 2011-2015. This effect was concentrated in the China sample, however, where deterioration in debt service capacity is higher than the non-China sample and is associated with about one-fifth of the decline in investment from 2011-15. Furthermore, in Table 2, we show that the results are also robust to a specification in which the debt service capacity coefficient is not adjusted for negative earnings, which suggests that the adjustment of this variable does not drive the results. In Table 3, we also show that the results are not driven by the smoothing of EBIT over three years.

Another interesting dimension to explore is the size of firms. Size is an important heterogeneity to consider, as a large literature in macroeconomics and finance has established the importance of size as a signal of a firm's credit constraints as well asymmetric information (e.g. Chodorow-Reich 2014; Gertler and Gilchrist 1994). Large firms tend to enjoy wider access to both bank credit and bond markets, and thus may be more likely to overextend their liabilities and run into a debt overhang situation when a bad shock hits. A growing literature has also shown large firms may be more exposed to international financial and goods markets, and thus be more sensitive to debt service costs associated with fluctuations in global financing conditions. Large firms' performance can have a systemic impact and is more correlated with aggregate growth of an economy (Gabaix 2011), can be more sensitive to macroeconomic shocks (Alfaro et al. 2017), and serve as a key channel for foreign shocks transmission (di Giovanni, Levchenko, and Mejean 2014, 2018). However, smaller firms may be more sensitive to debt overhang risk as they may lack the resources or reputation to benefit from creditors' forbearance in such situation.

To assess the relative importance of these effects, we estimate our baseline equations for small and large firms separately. Table 4 shows the results, which suggest the debt overhang effect is present among both groups, although the coefficient is not significant for China's large firms. The coefficients for large firms in the overall and non-China sample are larger than those of smaller firms. The estimates suggest that a 10th to 90th percentile decrease in debt overhang is associated with 2 and 1 percentage-point higher investment ratio for large and small firms, respectively. This result is perhaps somewhat surprising and is likely linked to an increasing debt overhang effect as debt is higher, that is to say, a nonlinearity in the effect. In this vein, larger firms may be more sensitive to debt overhang because they disproportionately use more leverage as they enjoy better access to finance. We explore nonlinearities below.

Debt overhang is a concept that is difficult to specify in a simple, linear form. For example, it is possible that, at low levels of risk of debt overhang, the level of debt is irrelevant for investment decisions. However, when the debt overhang risk crosses certain threshold values, investment will start to react to debt levels. But other factors may also affect that reaction. The volatility of future profits, and the growth prospects of the company, for example, are likely to interact with debt levels in impacting the firm's investment. Also, investment often consists of large, lumpy projects, which is an additional source of nonlinearity in the relationship.

This suggests that to obtain a more accurate measure of the effect of debt on investment, it is necessary to explore non-linear relationships and interactions. A first step in this direction would be to employ the large cross-sectional nature of our data set to examine the differential sensitivity of debt service capacity to investment across firms' varying levels of financial leverage. Our modified estimating equation will thus be as follows:

$$y_{cijt} = a_0 + a_1 Overhang_{cij,t-1} + a_2 Overhang_{cij,t-1} \times HighDebt_{cij,t-1} +$$
$$a_3 HighDebt_{cij,t-1} + \boldsymbol{X_{cij,t-1}}'\boldsymbol{\delta} + u_i + v_{cjt} + \varepsilon_{cijt} \ (2)$$

where all the variables are as defined in equation (1), with the addition of one interaction term, $Overhang_{cij,t-1} \times HighDebt_{cij,t-1}$. $HighDebt_{cij,t-1}$ denotes the measure of firm vulnerability considered. This vulnerability measure should capture the firm's risk profile in servicing debt. The

most natural candidate is a dummy variable for high and low levels of debt. We define the threshold for high and low levels of debt as the median of this variable within a country-industry pair, given that leverage levels may be to some extent driven by the business structure and operational needs of an industry of a country.

Table 5 shows these results. The interaction term suggests that the debt overhang effect is more acute for firms with high debt levels, and moreover, the effect of debt overhang is more than three times higher in high debt firms compared to low debt firms. This effect appears to be less strong for China, however. These results suggest that the sensitivity of investment to debt overhang can vary significantly, conditional upon pre-existing leverage levels. Consistent with Myers' theory, at high levels of debt, the debtor-equity holder conflict becomes more prominent, as a greater proportion of positive-net present value project payoff needs to be paid back to creditors. This situation induces debt service capacity to become more binding, potentially causing higher cutbacks in investment.

An alternative to exogenously-specified interaction models is to allow for endogenous thresholds in the relationship between debt overhang and investment. To assess this, we estimate threshold regressions following the methodology of Hansen (1999). This approach allows the coefficient between debt overhang and investment to differ across different threshold levels of debt. In our setup, we allow for one threshold. Given that this method can only accommodate strongly balanced panels, we convert our data set to a strongly balanced sample from 2010-2015.[13]

We first estimate this specification in which the threshold variable is the debt to sales ratio. Consistent with the findings earlier, these results suggest a nonlinear effect (Table 6). The coefficient on debt overhang is significantly higher and more sizable under high levels of leverage. The estimated threshold appears to fall under the 65th-85th percentiles of the sample debt-to-sales ratio distribution. Relatedly, we estimate the same specification where the threshold variable is the debt service capacity level (Table 7). Similar to the previous specification, the coefficient under

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[13] We maintain about one-third of the full sample size when moving to a strongly balanced panel. We also exclude country-industry-year fixed effects in this setup, as the Hansen methodology is designed with one-dimensional fixed effects. We have also conducted our baseline estimation based on this balanced sample and found that the results are consistent with the main specification.

high debt overhang is again substantially higher compared to that under low debt overhang. The threshold regressions suggest that the threshold of debt overhang falls in the 15th-30th percentile of the sample debt service capacity distribution. In other words, less than one-third of the sample firms are considered to be under high debt overhang. These results are consistent with the notion that debt overhang becomes a deterrent to investment once a certain level of overhang is exceeded.

5. Conclusions

Corporate debt in EMDEs has risen to unprecedented levels. Although this may be partly a reflection of improved access to domestic and international capital markets, it also implies that firms in these economies are more susceptible to vulnerabilities associated with elevated debt.[14] Grounded in the fundamental insights of Myers (1977), the results of this paper suggest that one such vulnerability is weak investment. Our results suggest that while debt overhang is significantly associated with weaker investment rate, this effect is uneven across big and small firms. Furthermore, the marginal effect on investment is higher for firms with higher pre-existing leverage levels.

Given the potential implications of slowing investment for an extended period of time, these results should be a wake-up call for policymakers in countries with high corporate debt levels. There are several reforms that could help reduce the risk of falling into a debt overhang trap. Many tax systems favor the use of debt over equity by providing tax deductibility for interest payments. Many EMDEs have not developed their equity markets to full potential in part because of excessive regulations and red tape conspiring against new listings and failing to ensure the integrity and liquidity of stock markets. An excessive accumulation of corporate debt can occur when explicit or implicit state guarantees are widely granted, and when bankruptcy regimes do not allow quick and fair debt workouts for companies. These dimensions are important areas for future research, given that the debt overhang–investment channel may become more prominent in EMDEs over the coming years.

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[14] For examples of works on financial access and capital market developments in EMDEs, see Love, Martínez Pería, and Singh (2013); Hale, Jones, and Spiegel (2016); Cortina, Didier, and Schmukler (forthcoming); and Ayyagari, Demirguc-Kunt, and Maksimovic (2017).

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Figure 1. Corporate debt in EMDEs: General trends

A. Corporate debt

Percent of GDP
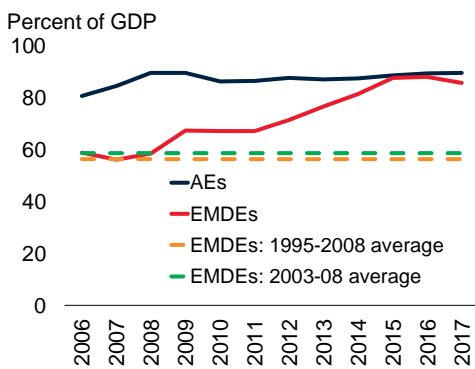
B. Corporate debt: EMDEs ex China

Percent of GDP
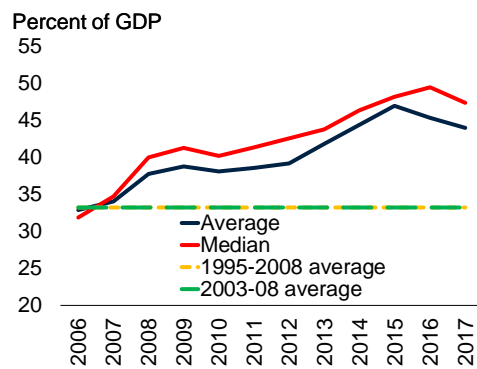
Source: Bank for International Settlements, Institute of International Finance.
Notes: GDP-weighted averages for 16 EMDEs and 27 advanced economies (AEs). Figure B excludes China.

Figure 2. Corporate debt and private investment growth in EMDEs

A. Private investment growth: EMDEs
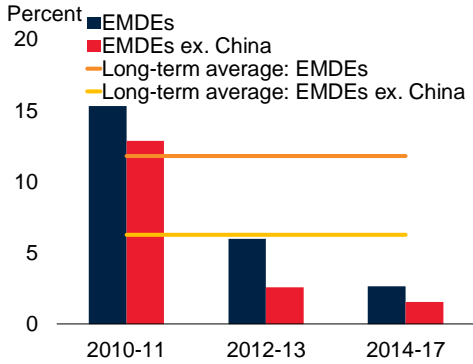
B. Debt to earnings in low and high investment firms
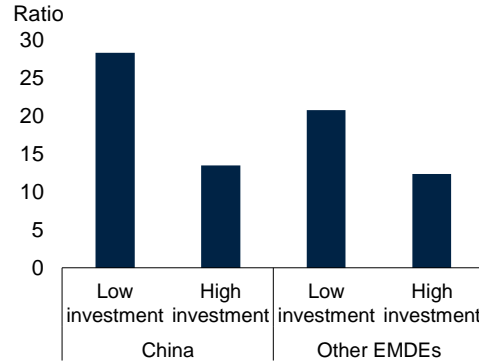
Source: Bank for International Settlements, Haver Analytics, International Monetary Fund, Institute of International Finance, Orbis, Oxford Economics, World Bank.
A. GDP-weighted average of 12 EMDEs (available data among BIS corporate debt sample countries). Data are estimates for some EMDEs. Long-term average refers to 1995-2008. Period average of annual growth rates. B. Low and high investment rates denote the bottom and top one-thirds, respectively, of the investment rate distribution. Inverse of median EBIT (3-year smoothed average) to debt ratio in 2015. Investment denotes net investment. Based on all available data in Orbis for 13 EMDEs.

Figure 3. Stylized facts of firm-level data

A. Industry leverage: China

Percent of sales

B. Industry leverage (ex China)

Percent of sales

C. Debt to sales ratio

Percent of sales

D. Leverage: Domestic vs foreign ownership

Percent of sales
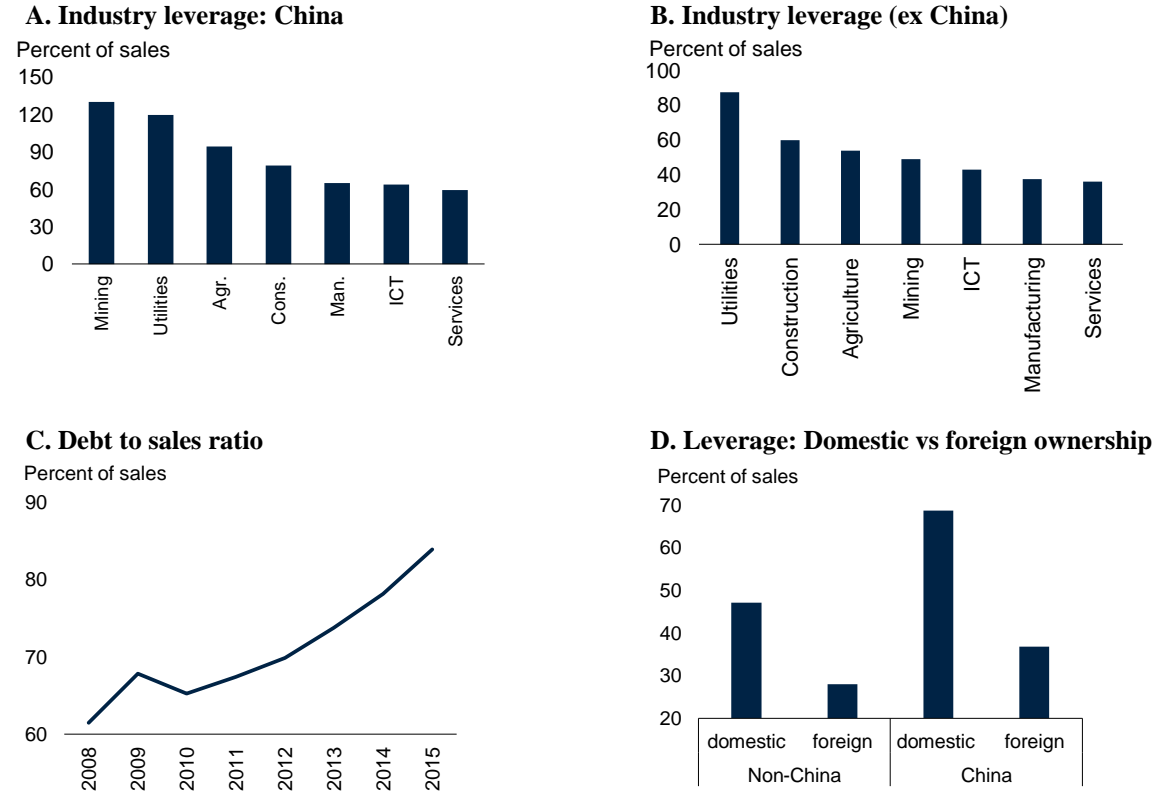
Source: Orbis

A.B.D. Firm total debt scaled by sales. Medians across firms in 2015. Agr. denotes Agriculture. Cons. denotes construction. Man. denotes manufacturing.

C. Sales-weighted averages of debt to sales ratio based on a fully balanced sample of firms over 2008-2015.

Table 1. Debt overhang and investment: baseline specification

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) all	(3) all	(4) all	(5) ex China	(6) ex China	(7) ex China	(8) ex China	(9) China	(10) China	(11) China	(12) China
Debt overhang (inverse)	0.020***	0.018***	0.017***	0.017***	0.033***	0.028***	0.030***	0.027***	0.009***	0.009***	0.007***	0.007***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)	(0.005)	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)
Cash flows			0.068***	0.034			0.045	0.013			0.126***	0.105**
			(0.026)	(0.027)			(0.031)	(0.032)			(0.043)	(0.042)
Leverage		-0.013***		-0.013***		-0.013***		-0.013***		-0.017***		-0.016***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.005)		(0.005)
Maturity	-0.081***	-0.068***	-0.083***	-0.068***	-0.106***	-0.088***	-0.108***	-0.089***	-0.045***	-0.039***	-0.047***	-0.040***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.020)	(0.020)	(0.020)	(0.020)	(0.012)	(0.012)	(0.012)	(0.012)
Sales growth	0.013***	0.013***	0.014***	0.013***	-0.001	-0.002	-0.001	-0.002	0.024***	0.024***	0.024***	0.024***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Size	-0.057***	-0.083***	-0.059***	-0.083***	-0.050***	-0.082***	-0.052***	-0.083***	-0.057***	-0.076***	-0.054***	-0.073***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)	(0.007)	(0.008)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	453,793	453,793	453,793	453,793	241,173	241,173	241,173	241,173	212,620	212,620	212,620	212,620
R-squared	0.361	0.362	0.361	0.362	0.353	0.354	0.353	0.354	0.388	0.389	0.388	0.389

All right-hand-side variables are lagged by one year. Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment to sales ratio. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Regressions include firm and country-sector-year fixed effects. Columns (5) to (8) exclude China. Full regression sample includes 129,687 firms.

Table 2. Debt overhang and investment: non-adjusted overhang term

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) all	(3) all	(4) all	(5) ex China	(6) ex China	(7) ex China	(8) ex China	(9) China	(10) China	(11) China	(12) China
Debt overhang (inverse)	0.020***	0.018***	0.017***	0.017***	0.032***	0.028***	0.030***	0.028***	0.009***	0.009***	0.007***	0.007***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.005)	(0.005)	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)
Cash flows			0.064**	0.028			0.038	0.004			0.125***	0.104**
			(0.027)	(0.027)			(0.032)	(0.033)			(0.043)	(0.042)
Leverage		-0.013***		-0.013***		-0.013***		-0.013***		-0.017***		-0.016***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.005)		(0.005)
Maturity	-0.082***	-0.068***	-0.083***	-0.069***	-0.108***	-0.089***	-0.110***	-0.089***	-0.045***	-0.039***	-0.047***	-0.040***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.020)	(0.020)	(0.020)	(0.020)	(0.012)	(0.012)	(0.012)	(0.012)
Sales growth	0.013***	0.013***	0.014***	0.013***	-0.001	-0.002	-0.001	-0.002	0.024***	0.024***	0.024***	0.024***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Size	-0.057***	-0.084***	-0.059***	-0.084***	-0.051***	-0.084***	-0.053***	-0.084***	-0.057***	-0.076***	-0.054***	-0.073***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)	(0.007)	(0.008)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	453,793	453,793	453,793	453,793	241,173	241,173	241,173	241,173	212,620	212,620	212,620	212,620
R-squared	0.361	0.362	0.361	0.362	0.353	0.354	0.353	0.354	0.388	0.389	0.388	0.389

All right-hand-side variables are lagged by one year. Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment to sales ratio. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt (where negative earnings are not adjusted to be zero). Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Regressions include firm and country-sector-year fixed effects. Columns (5) to (8) exclude China.

Table 3. Debt overhang and investment: non-smoothed EBIT

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) all	(3) all	(4) all	(5) ex China	(6) ex China	(7) ex China	(8) ex China	(9) China	(10) China	(11) China	(12) China
Debt overhang (inverse)	0.007***	0.008***	0.004***	0.006***	0.016***	0.016***	0.007*	0.011**	0.003***	0.004***	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)
Cash flows			0.093***	0.048***			0.092***	0.051**			0.123***	0.051**
			(0.017)	(0.018)			(0.021)	(0.022)			(0.024)	(0.024)
Leverage		-0.014***		-0.013***		-0.014***		-0.013***		-0.022***		-0.020***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.003)
Maturity	-0.084***	-0.071***	-0.085***	-0.072***	-0.128***	-0.107***	-0.132***	-0.111***	-0.048***	-0.040***	-0.049***	-0.041***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.018)	(0.018)	(0.018)	(0.018)	(0.009)	(0.009)	(0.009)	(0.009)
Sales growth	0.007***	0.007***	0.007***	0.007***	-0.005**	-0.006***	-0.006***	-0.006***	0.015***	0.015***	0.015***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Size	-0.058***	-0.083***	-0.066***	-0.086***	-0.062***	-0.095***	-0.072***	-0.098***	-0.050***	-0.072***	-0.056***	-0.073***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)	(0.004)	(0.003)	(0.003)
Observations	660,675	660,675	660,675	660,675	302,290	302,290	302,290	302,290	358,385	358,385	358,385	358,385
R-squared	0.331	0.333	0.332	0.333	0.334	0.336	0.335	0.336	0.326	0.328	0.326	0.328

All right-hand-side variables are lagged by one year. Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment to sales ratio. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. Regressions include firm and country-sector-year fixed effects. Columns (5) to (8) exclude China.

Table 4. Small and large firms

Dependent variable: Net investment to sales

VARIABLES	(1) all large firms	(2) exclude China large firms	(3) China large firms	(4) all small firms	(5) exclude China small firms	(6) China small firms
Debt overhang (inverse)	0.030***	0.032**	0.014	0.014***	0.024***	0.006***
	(0.011)	(0.016)	(0.012)	(0.003)	(0.006)	(0.002)
Cash flows	0.006	-0.052	0.158	0.031	0.014	0.091**
	(0.062)	(0.079)	(0.099)	(0.030)	(0.036)	(0.037)
Leverage	-0.019***	-0.025***	-0.008	-0.011***	-0.010***	-0.030***
	(0.004)	(0.006)	(0.007)	(0.002)	(0.002)	(0.005)
Maturity	-0.058*	-0.083*	-0.035	-0.072***	-0.092***	-0.041***
	(0.032)	(0.048)	(0.041)	(0.013)	(0.022)	(0.012)
Sales growth	0.017***	0.003	0.027***	0.013***	-0.003	0.024***
	(0.004)	(0.007)	(0.004)	(0.002)	(0.003)	(0.001)
Size	-0.164***	-0.195***	-0.110***	-0.063***	-0.056***	-0.069***
	(0.014)	(0.021)	(0.018)	(0.006)	(0.008)	(0.005)
Observations	85,705	43,647	42,058	367,093	196,633	170,460
R-squared	0.403	0.414	0.385	0.359	0.352	0.392

All right-hand-side variables are lagged by one year. Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment to sales ratio. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Large firms denote those with sample average asset size greater than 50 mil USD. Regressions include firm and country-sector-year fixed effects.

Table 5. High and low debt firms

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) ex China	(3) China
Debt overhang (inverse) * High debt dummy	0.045***	0.037*	0.040
	(0.017)	(0.019)	(0.029)
Debt overhang (inverse)	0.012***	0.020***	0.006***
	(0.002)	(0.006)	(0.002)
High debt dummy	-0.052***	-0.053***	-0.042***
	(0.004)	(0.005)	(0.006)
Cash flows	0.023	0.008	0.090*
	(0.028)	(0.033)	(0.047)
Leverage	-0.012***	-0.013***	-0.016***
	(0.002)	(0.002)	(0.005)
Maturity	-0.054***	-0.069***	-0.034***
	(0.013)	(0.021)	(0.012)
Sales growth	0.013***	-0.002	0.024***
	(0.002)	(0.003)	(0.001)
Size	-0.087***	-0.085***	-0.078***
	(0.005)	(0.008)	(0.006)
Observations	453,793	241,173	212,620
R-squared	0.362	0.355	0.390

All right-hand-side variables are lagged by one year.
Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1
Notes: Dependent variable is net investment to sales ratio. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Regressions include firm and country-sector-year fixed effects. Column (2) excludes China. High debt dummy denotes an indicator variable that equals 1 if debt to sales ratio in any given firm-year is higher than the country-industry median (exclude country-industries with less than 10 observations of debt to sales ratio).

Table 6. Threshold regressions: threshold variable denotes debt/sales ratio.

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) China	(3) exclude China
Cash flows	0.085***	0.341***	0.066***
	(0.015)	(0.049)	(0.016)
Leverage	-0.008***	0.001	-0.008***
	(0.001)	(0.003)	(0.001)
Maturity	-0.114***	-0.111**	-0.116***
	(0.014)	(0.045)	(0.015)
Sales growth	-0.001	0.010*	-0.001
	(0.002)	(0.005)	(0.002)
Size	-0.072***	-0.075***	-0.073***
	(0.005)	(0.012)	(0.005)
Debt service capacity (high leverage)	0.133***	0.770***	0.120***
	(0.008)	(0.039)	(0.008)
Debt service capacity (low leverage)	0.013***	-0.018	0.016***
	(0.004)	(0.015)	(0.004)
Constant	0.765***	0.994***	0.749***
	(0.048)	(0.149)	(0.050)
Threshold	0.94	0.93	0.97
Percentile	82	67.5	84.4
Observations	134,610	12,960	121,650
R-squared	0.007	0.048	0.007

All right-hand-side variables are lagged by one year. Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment to sales ratio. Debt service capacity denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Threshold regressions following Hansen (1999), where the threshold variable for high/low leverage is debt to sales ratio. Regression includes firm fixed effects. Column (3) excludes China.

Table 7. Threshold regressions: threshold variable denotes debt service capacity.

Dependent variable: Net investment to sales

VARIABLES	(1) all	(2) China	(3) exclude China
Cash flows	0.080***	0.339***	0.062***
	(0.016)	(0.049)	(0.016)
Leverage	-0.008***	0.001	-0.008***
	(0.001)	(0.003)	(0.001)
Maturity	-0.112***	-0.107**	-0.114***
	(0.014)	(0.045)	(0.015)
Sales growth	-0.000	0.009*	-0.001
	(0.002)	(0.005)	(0.002)
Size	-0.069***	-0.071***	-0.070***
	(0.005)	(0.012)	(0.005)
Debt service capacity (high overhang)	0.096***	0.599***	0.086***
	(0.006)	(0.036)	(0.006)
Debt service capacity (low overhang)	0.013***	-0.006	0.016***
	(0.004)	(0.015)	(0.004)
Constant	0.730***	0.936***	0.719***
	(0.048)	(0.150)	(0.050)
Threshold	0.44	0.18	0.45
Percentile	16.6	31.2	16.9
Observations	134,610	12,960	121,650
R-squared	0.007	0.039	0.006

All right-hand-side variables are lagged by one year. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Notes: Dependent variable is net investment to sales ratio. Debt service capacity denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Cash flows is EBIT-to-sales ratio. Leverage is total debt-to-sales ratio. Maturity is the ratio of long-term debt to total debt. Size is log of sales. EBIT is three-year smoothed average. Threshold regressions following Hansen (1999), where the threshold variable for high/low overhang is EBIT to debt ratio (e.g., the value of EBIT/D above which the sensitivity of debt service capacity to investment changes). Regression includes firm fixed effects. Column (3) excludes China.

Appendix Table A1. Countries in firm-level sample

Brazil
China
Colombia
Hungary
India
Malaysia
Mexico
Philippines
Poland
Russian Federation
South Africa
Thailand
Turkey

Appendix Table A2. Debt overhang and investment: baseline specification scaled by lagged capital stock.

Dependent variable: Net investment to fixed assets

VARIABLES	(1) all	(2) exclude China	(3) China	(4) all large firms	(5) all small firms	(6) all
Debt overhang (inverse)	0.045***	0.054***	0.031***	0.073**	0.042***	0.040***
	(0.009)	(0.015)	(0.010)	(0.032)	(0.009)	(0.008)
Debt overhang (inverse) * High debt dummy						0.086*
						(0.047)
High debt dummy						-0.020
						(0.014)
Size	-1.350***	-1.315***	-1.336***	-1.285***	-1.364***	-1.348***
	(0.017)	(0.025)	(0.024)	(0.044)	(0.019)	(0.018)
Controls	Y	Y	Y	Y	Y	Y
Observations	456,019	243,037	212,982	86,088	368,951	456,019
R-squared	0.486	0.454	0.518	0.489	0.490	0.486

All right-hand-side variables are lagged by one year. Clustered standard errors by firm in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variable is net investment scaled by lagged fixed assets. Debt overhang (inverse) denotes the ratio of earnings before interest and taxes (EBIT) to total debt. Size is log of fixed assets. EBIT is three-year smoothed average. Control variables include cash flows (EBIT to fixed assets ratio), leverage (total debt to fixed assets ratio), maturity (ratio of long-term debt to total debt), and sales growth. Regressions include firm and country-sector-year fixed effects. Column (2) excludes China. Large firms denote those with sample average asset size greater than 50 mil USD. High debt dummy denotes an indicator variable that equals 1 if debt to fixed assets ratio in any given firm-year is higher than the country-industry median (exclude country-industries with less than 10 observations of debt to fixed assets ratio).