Is Corporate Indebtedness a Drag on Investment After Financial Shocks?

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June 2022
Working Paper No: 22/03

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Abstract

Using a novel firm-level dataset, this paper examines whether elevated corporate indebtedness holds back investment in the aftermath of a large financial shock such as the one experienced in Turkey in 2018. The results of the difference in differences model reveal that high-indebted firms reduce their investments significantly compared to low-indebted firms. This suggests that high debt remained on corporate balance sheets seems to become a substantial impediment to investment growth. Accordingly, loans are found to be decreasing with leverage. Results also reveal that the detrimental impact of high financial leverage seems to be valid only for SMEs but not for large firms. Moreover, the impact is more pronounced for non-exporters and young firms, and firms with high cash holdings could attenuate the adverse impact of high indebtedness. Findings of this paper highlight the importance of policies that deepen the capital markets and make equity financing more attractive.

Keywords: *Corporate debt; financial shocks; firm investment; debt overhang; cash policy, SMEs*

JEL classifications: *C23, D22, E22, G31, G32*

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Non-technical Summary

The elevated corporate indebtedness in emerging countries over the last decade render corporates vulnerable to the shifts in risk sentiment and financial shocks, posing challenges for investments and substantial growth. Accordingly, the issue has received vast attention on both policy-making and academic fronts. This paper examines whether elevated corporate indebtedness holds back investment in the aftermath of a large financial shock such as the one experienced in Turkey in 2018.

Using the firm-level data of all incorporated manufacturing firms in Turkey, the results of the difference in differences model reveal that high-indebted firms reduce their investments significantly compared to low-indebted firms in the aftermath of the financial shock. This suggests that high debt remained on corporate balance sheets seems to become a substantial impediment to investment growth. Accordingly, corporate loans are found to be decreasing with leverage. The results also reveal that the detrimental impact of high financial leverage is valid only for SMEs but not for large firms, which lends support to the arguments that debt overhang is more likely to affect small firms. Besides, the impact is more pronounced for non-exporters and young firms indicating their lower tolerance to elevated indebtedness.

Another important result is that firms with high cash holdings could alleviate the adverse impact of high financial leverage. This is consistent with the precautionary motive of corporate cash holdings in the literature while points out the importance of the insurance systems for receivables to improve corporate cash management, especially for SMEs.

During the Covid-19 pandemic, policy makers have provided liquidity injections to corporates in the form of new lines of credit and loan guarantees, which have been essential to deal with liquidity shortages. On the flip side, this has further elevated the corporate indebtedness, and thus the concerns regarding the investment prospects (Ebeke et al., 2021; OECD, 2021). Given the challenging backdrop, the findings of the paper emphasize the importance of regulations that decrease vulnerabilities of corporates to financial and economic conditions, especially for emerging countries, and prevent firms from excessive debt that is potentially a drag on investment activities. However, in many emerging economies, the bank lending, which is highly vulnerable to financial conditions, is the dominant source of external finance whereas alternative sources such as equity issue is quite limited, especially for SMEs. In Turkey, for instance there are only around 400 listed firms

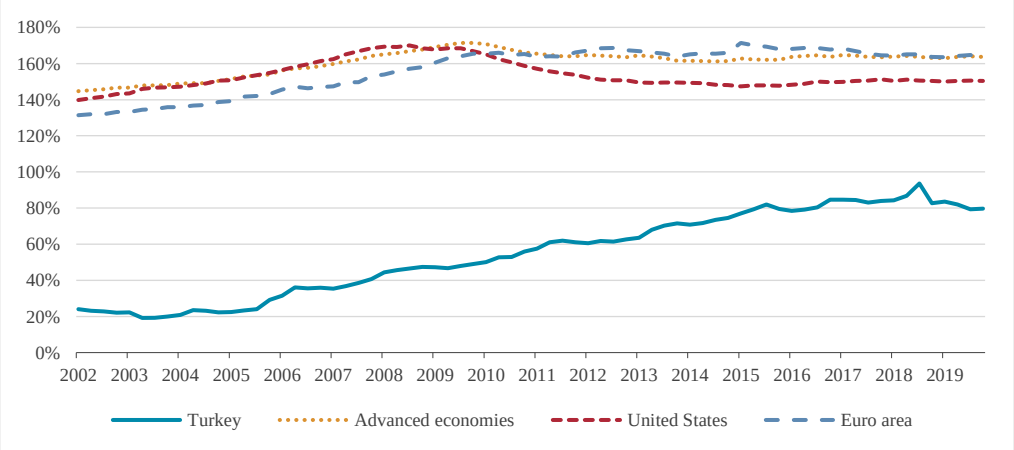
(71% of which are large firms) despite the significant evidence of positive impact of listing on firm growth and investment (e.g., Yarba and Yassa, 2021). In that sense, the findings of this paper highlight the importance of policies that deepen the capital markets and make equity financing more attractive.

1. Introduction

Corporate indebtedness has increased rapidly in emerging countries over the last decade largely due to the low risk aversion environment, easy access to credit and low interest rates. The elevated indebtedness render corporates vulnerable to the shifts in risk sentiment and financial shocks, posing challenges for investments and substantial growth in emerging countries. Accordingly, the issue has received vast attention on both policy-making and academic fronts (Borensztein and Ye 2021, World Bank 2017; and Kose et al., 2017).

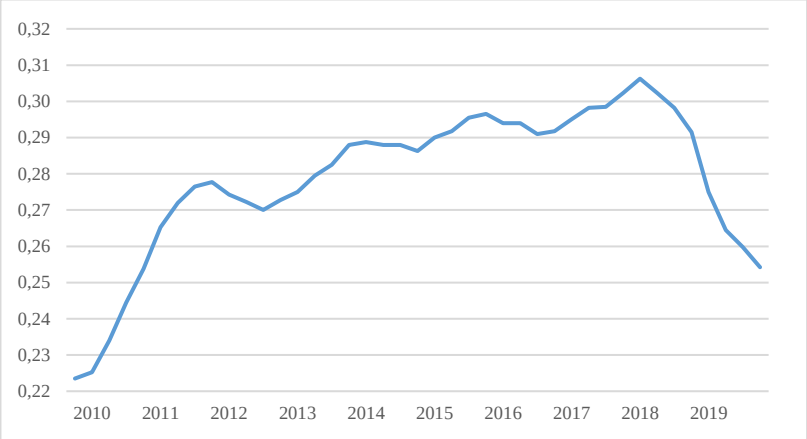
This paper aims to analyze the case of Turkey, one of the largest emerging economies. In particular, I examine whether the elevated corporate indebtedness becomes an impediment on investment growth in the aftermath of a financial shock. Turkey is a good laboratory for analyzing the issue. Contrary to Euro Area and US, corporate debt scaled by Gross Domestic Product (GDP) in Turkey continued to increase in the years following the 2007-2009 global financial crisis (Figure 1). At the same time, capital formation in percent of GDP had an increasing trend (Figure 2). However, as shown in Figure 2, it declined dramatically in 2018 when Turkey experienced a large financial shock triggered by the escalation of political tension between the US and Turkey. The Turkish lira experienced a sharp depreciation against the US dollar in mid-2018, which was 81% at its peak compared to end-2017 (Figure 3). This was also the case for EUR/TL (73%) (Figure 3). The increases in Credit Default Spread (CDS), implied volatilities of foreign exchange (FX) market and spreads in bond market were even more dramatic: 225% for CDS (Figure 4), 428% for implied volatility of USD/TL (Figure 3), 443% for implied volatility of EUR/TL (Figure 3) and 104% for bond market spread (Figure 4).

Figure 1. Non-financial corporate debt, in percent of Gross Domestic Product (GDP)



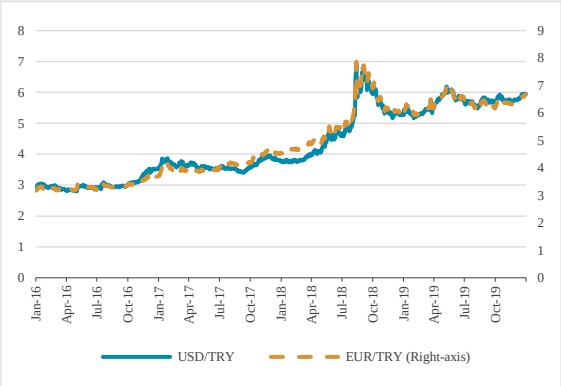
Notes: Quarterly data over the 2002-2019 period. Source: Bank for International Settlements (BIS) database

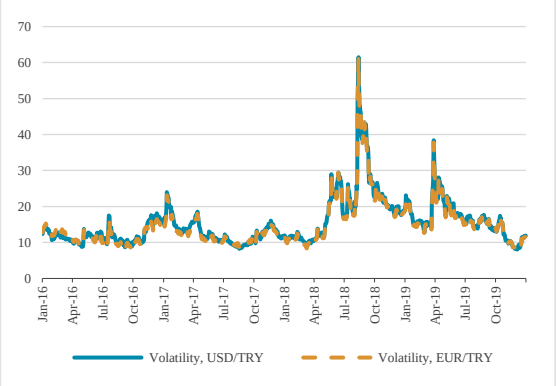
Figure 2. Gross fixed capital formation trend in Turkey, in percent of GDP



Notes: Moving average (4-quarter) of gross fixed capital formation in percent of GDP over the 2010-2019 period. Source Turkish Statistical Institute

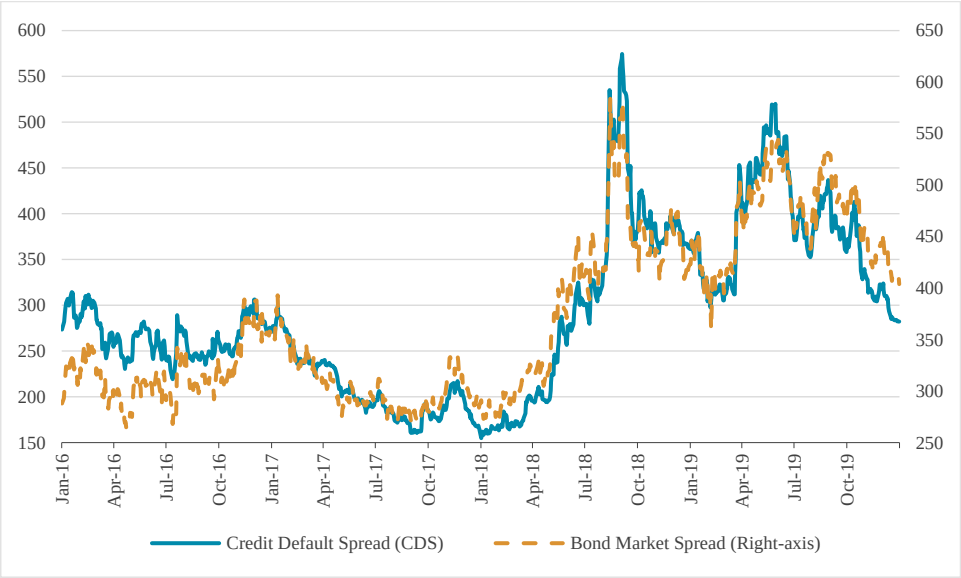
Figure 3. Evolution of Turkish lira and implied volatilities





Notes: The unit value of Turkish lira against US dollars (USD/TRY) and Euro (EUR/TRY) (left-hand side, panel A). The solid and dashed lines represent 1 month implied volatilities of USD/TL and EUR/TL, respectively (right-hand side, panel B). Daily data over the 2016-2019 period. Source: Bloomberg.

Figure 4. Credit default spread (CDS) and spreads in the bond market



Notes: The solid line represents 5 Year Credit Default Spread in USD for Turkey which has the highest trading volume, while the dashed line represents bond market spread, the commonly used Emerging Market Bond Index spread (EMBI) for Turkey. Daily data over the 2016-2019 period. Source: Bloomberg.

In order to compare investment behavior among firms with different indebtedness before and after a large financial shock such as the one experienced in 2018, a difference in differences (DID) estimation approach is employed. The granularity of the micro-rich data used in the study enables to saturate the model with multi-dimensional fixed effects. These allow me to account for variations in investment behaviors across firms, which might be driven by demand or technology shocks rather than the corporate debt, i.e. region- and sector-year fixed effects. The results of the DID model show that investment growth is decreasing with financial leverage in the aftermath of the shock. On average, high-indebted firms reduce their investments by 1.5 percentage point compared to low-indebted firms. Accordingly, corporate loans are found to be decreasing with leverage. This suggests that high corporate indebtedness seems to be an impediment to investment growth during the post-financial shock period.

I next examine the heterogeneities across firms. First, in order to investigate whether firm size matters, I re-estimate the DID model for firms with different sizes. The results show that the impact of high financial leverage is found to be negative and statistically significant for SMEs including micro, small and medium sized firms. The impact is negative and not significant for large firms with employment above 250 while it turns out to be positive for

larger firms with employment above 500. These suggest that the adverse impact of high financial leverage on investment growth is valid for SMEs but not for large firms.

I further analyze the possible differential effects of corporate cash holdings, export orientation and firm age. Results reveal that the impact is negative and statistically significant for the firms with low cash holdings while it is very small and insignificant for the firms with high cash holdings. The results indicate that firms with high cash flow could lessen the adverse impact of high financial leverage. Moreover, results show that high-indebted firms' reduction in investment growth in the aftermath of the financial shock compared to low indebted firms exists for both exporters and non-exporters. This is also the case for both young and old firms. However, results reveal that the adverse impact is more pronounced for non-exporters and young firms indicating their lower tolerance to elevated indebtedness.

As additional robustness checks, I first conduct a placebo test to ensure internal validity of the DID model. I falsely assume that the shock started in 2017 and repeat the analysis. I find no statistically significant effect of financial leverage on investment, which supports the parallel trends assumption of the model. Second, I perform additional analyses to address the potential endogeneity problem between investment and leverage. Moreover, I use alternative measures for leverage and investment growth. The re-estimated results are in line with the baseline estimates.

The results of the study contribute to a large literature on the impact of capital structure on investment activity. Evidence provided in the existing literature is mixed and there is no consensus on the corporate leverage and investment linkage. One the one hand, agency costs reduction between shareholders and managers (Ross, 1977; Grossman and Hart, 1982), disciplining managers to avoid wasting resources on perks (Grossman and Hart, 1982) and tax advantages (Modigliani and Miller, 1963) provided by external debt are shown to have positive impacts on investment. On the other hand, Myers (1977) argues that debt overhang induces underinvestment as existing debt holders benefit from proceeds of additional investments rather than shareholders. High debt inhibits investment activities by increasing payment and interest expenses and thereby lowering available funds for investment. The findings of this paper are in line with previous empirical work that lends support to debt overhang which induces underinvestment (e.g., Borensztein and Ye, 2021; Cevik and

Miryugin, 2020; Gebauer et al 2018; Lang et al., 1996). In particular, this paper documents the differential impact of high leverage that becomes a strenuous burden on investment after financial shocks, which is in line with the recent work, Kalemli-Özcan et al. (2019). Using a broad sample of European firms, they report the role of high leverage in declining investment in the aftermath of the 2007-2009 global financial crisis.

Moreover, this study expands upon the small empirical literature on the corporate debt-investment linkage in emerging economies. Borensztein and Ye (2021), for instance show the detrimental impact of high leverage on investment for a set of firms in emerging and developing economies. Similarly, Das and Tulin (2017) and Magud and Sosa (2015) report the negative association between corporate indebtedness and investment. However, the lack of representativeness of their samples is the main drawback of these studies, which can be attributed to the lack data availability of privately held firms. The former study utilizes a dataset of 10,974 Indian firms while the latter uses 16,000 publicly traded firms in emerging countries. Unlike these studies, this paper investigates the issue in detail by utilizing a comprehensive firm-level dataset, which contains the universe of all incorporated manufacturing firms in Turkey.

Finally, this paper contributes to the literature on the role of corporate cash holdings. Previous literature (e.g., Jensen, 1986; Pinkowitz et al., 2006; Dittmar and Mahrt-Smith, 2007) provide ample evidence of downside of excessive cash holdings such as agency costs associated with excessive liquidity. Contrary to these findings, findings of this study reveal the significant role of cash holdings in attenuating the adverse effect of high indebtedness on investment, which is in support of the precautionary motive for cash holdings. This line of research argues that precautionary cash holdings alleviate the underinvestment problem by providing a buffer against financial frictions (e.g., Harford et al., 2014; Stiglitz and Weiss, 1981; Opler et al., 1999).

The remainder of the paper is organized as follows: The data and empirical framework used in the paper are introduced in Section 2. The results of the empirical analysis are reported in Section 3. A series of additional robustness checks is discussed in Section 4 and concluding remarks are presented in Section 5.

2. Data and Empirical Methodology

The unique panel dataset used in this study is constructed using various sources. The main source is the Revenue Administration dataset (RA) which is made available by the Central Bank of the Republic of Turkey (CBRT). This confidential firm-level database includes the universe of incorporated manufacturing firms in Turkey. It contains the financial statement data including annual income statements and balance sheets. In addition, the Credit Register database of the Banks Association of Turkey is used, which provides firm-level credit information in detail. The dataset is further linked to firm-level employment database of the Social Security Institution of Turkey to obtain information about firm size.

As is common in the literature, firm-year observations with inconsistent data such as observations with negative total assets, total liabilities, employment, debt or fixed assets are dropped. Besides, non-profit organizations and governmental firms are excluded. In order to minimize the possible influence of outliers, all firm-level variables used in the study are winsorized at the first percentile in each tail. Descriptive statistics on all relevant variables used in the empirical analysis are presented in Table 1.

Table 1. Summary statistics

	Full sample			SMEs			Large firms		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Investment	0.11	0.00	0.26	0.11	0.00	0.26	0.14	0.07	0.20
Leverage	0.12	0.02	0.16	0.11	0.02	0.16	0.27	0.28	0.19
Firm Size	14.86	14.83	2.11	14.76	14.79	2.01	19.25	19.22	1.33
Firm growth	0.15	0.01	0.74	0.15	0.01	0.75	0.10	0.07	0.37
Maturity	0.13	0.00	0.23	0.13	0.00	0.23	0.26	0.22	0.23
Cash flow	0.00	0.00	0.11	0.00	0.00	0.11	-0.01	-0.02	0.12
Firm age	2.33	2.48	0.80	2.32	2.48	0.80	2.85	3.04	0.69
Number of observations	313,655			306,428			7,227		

This table reports descriptive statistics of relevant variables used in the analysis over the period between 2016 and 2019. Leverage is the total financial debt ratio scaled by total assets; investment growth is the logarithmic change in plant, machinery and equipment; firm size is log of total assets; growth is the percentage change of annual net sales; maturity is the share of long-term debt in total debt; cash flow is earnings before interest, tax and depreciation scaled by total assets, and firm age is log of the number of years since founding. A firm is classified as a large firm if its number of employees is higher than 250, and SME, otherwise.

In order to compare investment behavior before and after the financial shock among firms with different indebtedness, I employ a difference-in-differences (DID) estimation approach, where I define the pre-period as 2016-2017 and the post-period as 2018-2019. In the model, I control for the relevant determinants of investment commonly used in the literature (e.g., Badertscher et al., 2013; Zubair et al., 2020 and Lang et al., 1996). Specifically, I control for firm size, age and cash flow. Firm size is measured by the logarithm of total assets, age is the logarithm of the number of years since founding of the firm, and cash flow is proxied by earnings before interest, tax and depreciation scaled by total assets. I also control for maturity structure of debt. It is measured as the share of long-term debt in total debt, where long-term debt is the outstanding debt with a maturity of one year or longer than a year. I further control for growth opportunities. Tobin's q and other market-based proxies are not available for privately held firms, which are approximately 99.79% of the sample. Thus, following the literature, growth opportunity is proxied by sales growth measured as the annual percentage change of net sales (e.g., Asker et al., 2015; Mortal and Reisel, 2013; Shin and Stulz, 1998).

Variations in investment behaviors across firms may be driven by demand or technology shocks rather than the corporate debt. Thus, province x year ($\vartheta_{r,t}$) and sector x year ($\delta_{s,t}$) fixed effects are included to the model to control for any possible omitted and time variant region and industry factors. The specification further controls for firm fixed effects (μ_i) to absorb any firm specific and time invariant (unobserved) heterogeneity. The econometric specification employed in this paper is given below:

$$Y_{i,t} = \lambda_0 + \lambda_1 Lev_i + \lambda_2 POST_i + \lambda_3 POST_t \, x \, Lev_i + \sum_k \beta_k \theta_{k,i,t-1} + \mu_i + \vartheta_s x \, \delta_t + \varphi_r x \, \delta_t + \varepsilon_{i,t} \quad (1)$$

The outcome of interest is the investment growth (Y_{it}) for the firm *i* in year *t*. Following the literature, it is measured as the logarithmic change in plant, machinery and equipment. The main variable of interest, corporate financial leverage (Lev_i) is the 2017 year-end financial debt to total assets ratio.[1] Alternatively, instead of a continuous variable, I also use a dummy variable, which is equal to one if the leverage of firm *i* is in the highest quartile of the sample distribution at the end of 2017, and zero otherwise. This allows me to examine how firms

[1] Robustness tests using alternative measurements for investment and leverage are discussed in Section 4

with low and high indebtedness respond to the shock differentially in terms of investment behavior. Lev_i is absorbed by firm fixed effects in the model since it is defined as time invariant at firm level. $POST_t$ takes a value of one for the post-crisis period from 2018 to 2019, and zero otherwise. μ_i, $\vartheta_s x \delta_t$ and $\varphi_r x \delta_t$ are the firm, sector x year and region x year fixed effects, respectively. θ stands for the control variables including firm size, cash flow, age, maturity and growth opportunities. λ_3 is the coefficient of interest showing the effect of financial leverage on differentiation in investment behavior in response to the shock.

3. Empirical Results

3.1. Baseline specification

Table 2 presents the estimations of the DID model in equation 1 for the full sample. All regressions include firm, sector x year and province x year fixed effects, which control for any time-invariant unobserved heterogeneity and any time variant unobservable region and industry factors. In column 1, the coefficient of *Post x Leverage* is negative and significant at 1% level. The result remains robust when I further control for firm specific variables including firm size, cash flow, age, maturity and growth opportunities (Column 2). This suggests that investment growth is decreasing with financial leverage during the post-financial shock period.

I also estimate the model using a binary variable instead of a continuous variable, which allows me to examine how firms with low and high indebtedness respond to the shock differentially. The binary variable is equal to one for the firms whose leverage ratios (measured as financial debt to total assets) are in the top quartile of the sample distribution at the end of 2017, and zero otherwise.[2] The coefficients of *Post x Leverage* reported in columns 3 and 4 are also negative and statistically significant, which are in line with those reported in columns 1 and 2. The results show that high-indebted firms reduce their investments by 1.5 percentage point during the post-financial shock period compared to low-indebted firms. Considering the average investment rate of 10.7 percent, this impact is economically significant and relevant as well. This suggests that high corporate

[2] The results using median value as the threshold are similar, thus for the sake of brevity, they are not reported but available upon request

indebtedness seems to be a significant impediment on investment growth during the post-financial shock period.

Table 2. Baseline results: Corporate indebtedness and investment growth, full sample

	Investment			
	Panel A: Continuous		Panel B: Binary	
	(1)	(2)	(3)	(4)
POST x Leverage	-0.05458***	-0.04383***	-0.01857***	-0.01495***
	(0.00588)	(0.00589)	(0.00219)	(0.00219)
Firm size		-0.03922***		-0.03926***
		(0.00185)		(0.00185)
Firm growth		0.00079		0.00079
		(0.00074)		(0.00074)
Maturity		-0.01955***		-0.02022***
		(0.00465)		(0.00465)
Cash flow		0.11102***		0.11153***
		(0.00702)		(0.00702)
Firm age		-0.02503***		-0.02486***
		(0.00379)		(0.00379)
Firm FE	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes
Observations	313,655	313,655	313,655	313,655
R-squared	0.41081	0.41446	0.41078	0.41444

This table reports the baseline estimations for the full sample. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

In all specifications, the coefficients of firm size and firm age are significantly negative while the coefficient of cash flow is significantly positive. These suggest that all else equal, smaller firms tend to invest more than larger firms confirming decreasing return to scale. This is also the case for younger firms. Besides, firms with higher cash flows tend to undertake more investment indicating the positive impact of cash flow on investment in line with the previous empirical work. On the other hand, maturity structure (the share of long-term debt in total debt) has significantly negative coefficients in all specifications. The impact of maturity structure is theoretically ambiguous in the literature. Downside of short-term debt such as higher rollover risk and less-risk sharing are argued to have detrimental impact on investment behavior (see Diamond and He, 2014 and Acharya et al., 2011, among others). Contrary to these arguments, our results reported in Table 2 suggest that all else

equal, investment growth is increasing with short term debt. This is consistent with the arguments in the literature that shorter maturity of debt enables better monitoring (e.g., Diamond, 1991, 1993) and can mitigate debt overhang (Myers, 1977).

In order to ensure internal validity of the DID model and that the results are not biased, I now check whether firms with different leverage ratios had similar investment activity trends before the shock. These parallel trends suggest that leverage would not lead to a differential effect on investment growth, which is the crucial assumption of DID methodology. To do so, I falsely assume the shock started in 2017 and I define the pre-period as 2015-2016 and the post-period as 2017-2018. The estimation results presented in Table 3 show that there is no significant differential impact among firms with different leverages. This is the case in all specifications reported in Table 3, which implies that the parallel trends assumption of the DID model holds.

Table 3. Placebo test

	Investment			
	Panel A: Continuous		Panel B: Binary	
	(1)	(2)	(3)	(4)
POST x Leverage	0.00723	0.04759	-0.00827	0.00719
	(0.03516)	(0.03491)	(0.01230)	(0.01229)
Firm size		-0.43977***		-0.43967***
		(0.01947)		(0.01948)
Firm growth		-0.00120		-0.00125
		(0.00570)		(0.00570)
Maturity		-0.05951*		-0.05807*
		(0.03046)		(0.03044)
Cash flow		0.61281***		0.61172***
		(0.05261)		(0.05258)
Firm age		-0.06877**		-0.06952**
		(0.02815)		(0.02814)
Year FE	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes
Observations	298,100	298,100	298,100	298,100
R-squared	0.35716	0.36649	0.35716	0.36649

This table reports the estimations of the placebo test that falsely assumes the shock started in 2017 where the pre-period is 2015-2016 and the post-period is 2017-2018. Definitions of variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

I now assess the possible impact of excessive leverage on corporate loans. Debt overhang, which was first discussed by Myers (1977), engages underinvestment by reducing the incentive to invest as existing debt holders benefit from proceeds of additional profitable investments rather than shareholders. Similarly, excessive leverage reduces lenders' incentive to extend new credit, which lowers available funds for investment (Myers, 1977; Lamont, 1995). To test these arguments, I exploit credit register database that contains firm-level loan data. Estimation of the DID model in equation 1 by using loans as dependent variable are presented in Table 4. The results show that loans are decreasing significantly with the increase in financial leverage (columns 1 and 2). In line with the expectation, loans are decreased for high indebted firms by 28 % on average compared to low indebted firms in the aftermath of the financial shock (column 4).

Table 4. Corporate indebtedness and loans

	Loans			
	Panel A: Continuous		Panel B: Binary	
	(1)	(2)	(3)	(4)
POST x Leverage	-0.92649***	-0.99588***	-0.26669***	-0.28974***
	(0.06109)	(0.06131)	(0.02211)	(0.02210)
Firm size		0.57212***		0.57022***
		(0.01978)		(0.01978)
Firm growth		0.08131***		0.08133***
		(0.00874)		(0.00875)
Maturity		0.03181		0.00612
		(0.05083)		(0.05069)
Cash flow		0.04729		0.06548
		(0.08544)		(0.08541)
Firm age		0.08067*		0.08759**
		(0.04374)		(0.04375)
Firm FE	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes
Observations	313,655	313,655	313,655	313,655
R-squared	0.84874	0.84998	0.84868	0.84991

This table reports the baseline estimations for the full sample where the dependent variable is the logarithm of firm loans. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

3.2. Does firm size matter?

The detrimental impact of high leverage on investment growth is expected to be less to larger firms since the continuance of the lending relationship is less valuable with smaller

firms compared to larger firms (see Iyer et al., 2014 and Khwaja and Mian, 2008, among others). Besides, it is well documented in the literature that borrowing capacity and access to credit problem is less severe when firm size is larger (see Yarba, 2021a; Yarba and Güner, 2020a,b; Mutluer Kurul and Tiryaki, 2016, Berger and Udell, 1992, among others).

In order to investigate whether firm size matters, I re-estimate the DID model for micro-sized, small, medium-sized and large firms, separately using the number of employees of 10, 50, and 250 as thresholds. Table 5 presents the re-estimated results. The estimated coefficient of *POSTxLeverage* is found to be negative and statistically significant for only SMEs including micro, small and medium sized firms (columns 1 to 6 of Table 5). The coefficient is negative and not significant for large firms with employment above 250 (columns 7 and 8 of Table 5) while it turns out to be positive for larger firms with employment above 500 (columns 5 to 8 of Table 6). In line with the literature, the results suggest that the adverse impact of high leverage on investment in the aftermath of the financial shock is valid for SMEs, which is not the case for large firms.

Table 5. Corporate indebtedness and investment by firm size

	Investment							
	Micro		Small		Medium		Large	
	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST x Leverage	-0.04105***	-0.01408***	-0.03879***	-0.01323***	-0.03235**	-0.01124**	-0.03428	-0.00685
	(0.00986)	(0.00364)	(0.01044)	(0.00376)	(0.01474)	(0.00546)	(0.02620)	(0.01012)
Firm size	-0.03443***	-0.03445***	-0.04469***	-0.04471***	-0.06860***	-0.06846***	-0.04882**	-0.04825**
	(0.00221)	(0.00221)	(0.00387)	(0.00387)	(0.00750)	(0.00750)	(0.02056)	(0.02057)
Firm growth	0.00011	0.00011	0.00277	0.00277	0.00666*	0.00662*	0.00442	0.00447
	(0.00082)	(0.00082)	(0.00181)	(0.00181)	(0.00380)	(0.00380)	(0.00724)	(0.00724)
Maturity	-0.00849	-0.00887	-0.03265***	-0.03340***	-0.02518*	-0.02582*	-0.00542	-0.00697
	(0.00633)	(0.00632)	(0.00830)	(0.00828)	(0.01325)	(0.01324)	(0.02437)	(0.02439)
Cash flow	0.06590***	0.06608***	0.16967***	0.17037***	0.19814***	0.19896***	0.24844***	0.25152***
	(0.00854)	(0.00854)	(0.01461)	(0.01461)	(0.02398)	(0.02396)	(0.04581)	(0.04578)
Firm age	-0.01324***	-0.01324***	-0.04119***	-0.04108***	-0.04803***	-0.04811***	-0.06285**	-0.06364**
	(0.00471)	(0.00471)	(0.00769)	(0.00769)	(0.01340)	(0.01340)	(0.02670)	(0.02676)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	168,903	168,903	104,193	104,193	33,332	33,332	7,227	7,227
R-squared	0.43214	0.43213	0.38182	0.38181	0.38888	0.38887	0.44578	0.44564

This table reports estimations of the model in equation 1 for micro, small, medium, and large firms, where the number of employees of 10, 50, and 250 are used as thresholds. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 6. SMEs versus large firms

	Investment							
	SMEs: employment<250		Large firms: employment ≥ 250		Large firms: employment ≥ 500		Large firms: employment ≥ 1000	
	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST x Leverage	-0.04508***	-0.01548***	-0.03428	-0.00685	0.01926	0.01321	0.17277**	0.05965**
	(0.00611)	(0.00226)	(0.02620)	(0.01012)	(0.04113)	(0.01522)	(0.08769)	(0.02971)
Firm size	-0.03918***	-0.03923***	-0.04882**	-0.04825**	0.01695	0.01785	0.00026	-0.00491
	(0.00186)	(0.00186)	(0.02056)	(0.02057)	(0.04857)	(0.04869)	(0.21539)	(0.21293)
Firm growth	0.00083	0.00083	0.00442	0.00447	0.00909	0.00911	-0.00610	-0.00636
	(0.00074)	(0.00074)	(0.00724)	(0.00724)	(0.01147)	(0.01142)	(0.01695)	(0.01687)
Maturity	-0.01967***	-0.02034***	-0.00542	-0.00697	0.04221	0.04184	0.06359	0.07020
	(0.00473)	(0.00472)	(0.02437)	(0.02439)	(0.04179)	(0.04185)	(0.06377)	(0.06351)
Cash flow	0.10805***	0.10853***	0.24844***	0.25152***	0.22782***	0.22978***	0.20573	0.19912
	(0.00711)	(0.00711)	(0.04581)	(0.04578)	(0.07571)	(0.07565)	(0.12532)	(0.12359)
Firm age	-0.02433***	-0.02419***	-0.06285**	-0.06364**	-0.12845**	-0.12952**	-0.00291	-0.00064
	(0.00383)	(0.00383)	(0.02670)	(0.02676)	(0.06177)	(0.06201)	(0.11545)	(0.11363)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	306,428	306,428	7,227	7,227	2,775	2,775	1,061	1,061
R-squared	0.41424	0.41422	0.44578	0.44564	0.46727	0.46743	0.54880	0.54845

This table reports estimations of the model in equation 1 for firms with different sizes with thresholds of 250, 500 and 1000 employees.. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

3.3. Additional heterogeneous effects by cash holdings, export orientation and firm age

In this section, I analyze additional heterogeneities with respect to cash holdings, export orientation and firm age. These analyses can also be viewed as additional robustness checks on the main results presented in Section 3.1.

I first examine the role of corporate cash holdings. The impact of cash holdings is theoretically ambiguous and the evidence provided by prior empirical work is mixed. On the one hand, precautionary cash holdings of corporates are argued to be a buffer against financial frictions, which lessen the underinvestment problem (e.g., Opler et al., 1999; Stiglitz and Weiss, 1981). Harford et al. (2014) also show that cash holdings can prevent

the corporates from forgoing growth opportunities by alleviating the refinancing risk. On the other hand, some other studies (e.g., Jensen, 1986; Pinkowitz et al., 2006; Dittmar and Mahrt-Smith, 2007) provide significant evidence of downside of excessive cash holdings such as agency costs associated with excessive liquidity.

In order to investigate the possible differential effect of corporate cash holdings, I split the full sample into firms with low and high cash holdings. Firms with high cash holdings are the firms whose cash ratios (defined as cash and equivalents scaled by total assets) are in the top quartile of the sample distribution at the end of 2017, and low-cash holders, otherwise.[3] The re-estimated results presented in Table 7 for these subgroups reveal strong heterogeneity.

Table 7. Low cash holdings versus high cash holdings

	Investment			
	Firms with low cash holdings		Firms with high cash holdings	
	Continuous	Binary	Continuous	Binary
	(1)	(2)	(3)	(4)
POST x Leverage	-0.04396***	-0.01557***	-0.02263*	-0.00603
	(0.00662)	(0.00245)	(0.01326)	(0.00494)
Firm size	-0.04389***	-0.04396***	-0.03041***	-0.03040***
	(0.00221)	(0.00221)	(0.00330)	(0.00330)
Firm growth	0.00051	0.00051	0.00174	0.00174
	(0.00085)	(0.00085)	(0.00153)	(0.00153)
Maturity	-0.01741***	-0.01799***	-0.02909***	-0.02981***
	(0.00532)	(0.00531)	(0.00960)	(0.00960)
Cash flow	0.12814***	0.12859***	0.07752***	0.07784***
	(0.00885)	(0.00885)	(0.01155)	(0.01155)
Firm age	-0.03032***	-0.03011***	-0.00881	-0.00883
	(0.00445)	(0.00445)	(0.00723)	(0.00723)
Firm FE	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes
Observations	233,547	233,547	80,108	80,108
R-squared	0.40751	0.40750	0.43932	0.43930

This table reports estimations of the model in equation 1. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In Panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

[3] The results using median value as the threshold are similar with those reported in Table 7. Thus, for the sake of brevity they are not reported but available upon request.

The coefficient of *Post x Leverage* is negative and statistically significant for the firms with low cash holdings (columns 1 and 2) while it is small and insignificant for the firms with high cash holdings (column 3 and 4). The results suggest that the adverse impact of high indebtedness on investment growth during post financial shock is valid only for the firms with low cash holdings. In other words, firms with high cash flow appear to be able to lessen the adverse impact of high leverage on investment growth, which is in line with the precautionary motive of cash holdings.

I next proceed to examine whether the export orientation matters. To this aim, I repeat the analysis for exporters and non-exporters, separately. The re-estimated results for these subgroups are reported in columns 1 to 4 of Table 8.

Table 8. Additional heterogeneous effects by export orientation and capital intensity

	Investment							
	Exporters		Non-exporters		Young firms		Old firms	
	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST x Leverage	-0.03954***	-0.01265***	-0.05554***	-0.01916***	-0.04918***	-0.01705***	-0.03132***	-0.00954***
	(0.00955)	(0.00352)	(0.00794)	(0.00294)	(0.00734)	(0.00270)	(0.00932)	(0.00349)
Firm size	-0.04267***	-0.04268***	-0.03875***	-0.03878***	-0.04142***	-0.04146***	-0.02841***	-0.02847***
	(0.00400)	(0.00400)	(0.00208)	(0.00208)	(0.00208)	(0.00208)	(0.00395)	(0.00395)
Firm growth	0.00257	0.00256	0.00034	0.00034	0.00086	0.00086	0.00059	0.00057
	(0.00169)	(0.00169)	(0.00082)	(0.00082)	(0.00084)	(0.00084)	(0.00140)	(0.00140)
Maturity	-0.01871**	-0.01978**	-0.01878***	-0.01939***	-0.02096***	-0.02157***	-0.01576**	-0.01668**
	(0.00819)	(0.00818)	(0.00566)	(0.00565)	(0.00555)	(0.00555)	(0.00793)	(0.00791)
Cash flow	0.17008***	0.17120***	0.08409***	0.08448***	0.11859***	0.11909***	0.08213***	0.08279***
	(0.01347)	(0.01347)	(0.00822)	(0.00822)	(0.00832)	(0.00832)	(0.01219)	(0.01220)
Firm age	-0.02713***	-0.02682***	-0.02282***	-0.02274***	-0.02278***	-0.02264***	-0.07707	-0.07204
	(0.00727)	(0.00727)	(0.00446)	(0.00446)	(0.00421)	(0.00421)	(0.05630)	(0.05622)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	100,346	100,346	213,309	213,309	241,192	241,192	72,463	72,463
R-squared	0.39582	0.39579	0.41930	0.41927	0.42324	0.42322	0.35452	0.35446

This table reports estimations of the model in equation 1. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. In Panel A, $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. In Panel B, it is the binary variable that is equal to one for the firms whose leverage ratios are in the top quartile of the sample distribution at the end of 2017, and zero otherwise. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Results show that high-indebted firms' reduction in investment growth during the post financial shock compared to low indebted firms exists for both exporters and non-exporters.

However, the adverse impact is smaller for the former. As reported in column 2 of Table 8, high-indebted exporters reduce their investments by 1.27 percentage point during the post-financial shock period compared to low-indebted exporters while the reduction is 1.92 percentage points for non-exporters on average (column 4 of Table 8). This suggests that exporters can mitigate the adverse effect of high indebtedness in line with the literature pointing out the role of the export orientation in contributing the credit access. Moreover, in order to assess whether the impact depends on firm age, I re-estimate the empirical model for young and old firms, separately where the top quartile of the sample distribution is used as the threshold.[4] The re-estimated results reported in columns 5 to 8 of Table 8 reveal that the negative impact exits for both old and young firms, whereas it is higher for the latter group (columns 6 and 8 of Table 8) on average. In line with the literature, these suggest that the tolerance of elevated indebtedness is lower for younger firms.

4. Additional robustness checks

In this section, additional analyses are conducted to further confirm the robustness of the results.[5]. In the previous section, leverage is measured as total financial debt over total assets where trade credit is excluded due to the arguments in the literature that it serves for transaction purposes rather than financing activities (see Gebauer et al., 2018, among others). In order to account for the possible usage of trade credit as a complement to financial debt (see McGuinness et al., 2018, among others), an alternative measure of leverage including trade credit is constructed Besides, in his recent study, Yarba (2021b) argues that other liabilities which are neither financial nor trade debt are also used as an alternative of channel of firm finance. Thus, a measure of leverage including all other liabilities is constructed as well. The re-estimated results with these alternative measures of leverage are presented in columns 1 and 2 of Table 9. Estimated coefficients further confirm the baseline results reported in Table 2.

As another check, I repeat the analysis with the subset of firms with positive financial debt excluding firms in the sample that have no financial debt. I next repeat the analysis using investment (measured as the annual change in plant, machinery and equipment) over net

4 The results using median value as the threshold are similar with those reported in Table 8. Thus, for the sake of brevity they are not reported but available upon request.

5 In all specifications, estimation results using leverage as a binary variable are similar to those using leverage as a continuous variable. Thus, for brevity estimations using leverage as a dummy variable are not reported, but available upon request.

sales as the dependent variable instead of investment growth (the logarithmic change in plant, machinery and equipment). Re-estimated results reported in columns 3 and 4 of Table 9 are in line with those reported in Table 2.

Firms that hold foreign currency denominated debt account for 12.99 percent of firms in the analysis. In order to assess whether this induces any bias, I re-estimate the model by excluding the firms with foreign currency debt. No bias is evident in these results reported in columns 5 of Table 9.

I next perform additional analysis to address the potential endogeneity problem between investment and leverage. In the baseline model, corporate leverage is measured as the 2017 year-end total debt to total assets ratio. Alternatively, I repeat the analysis where leverage is measured as the mean value of 2016 and 2017. The re-estimated coefficients are similar with the baseline estimations (column 6 of Table 9).

To address the issue further, a structural two-step approach is performed. Following the literature, in the first stage, leverage is estimated using the standard estimation approach over the 2009-2017 period. In the estimation model, firm size (log of assets), profitability (operating income/net sales), liquidity (cash and cash equivalents/total assets), tangibility (tangible fixed assets/total assets), and sales growth (percentage change of annual net sales) are used as explanatory variables (Frank and Goyal, 2009; Rajan and Zingales, 1995; and Yarba and Güner, 2020a). Firm fixed effects are included to the model to absorb any firm specific and time invariant (unobserved) heterogeneity. Province-year and sector-year fixed effects are also incorporated into the estimation model to control for any possible omitted and time variant region and industry factors.

Alternatively, in order to account for persistence in the leverage, the lagged leverage is included into the model as an additional explanatory variable. The leverage is predicted by the Arellano and Bond (1991) two-step generalized method of moments (GMM) approach. In the estimation, two-step robust errors are used and the variables are transformed using forward deviations to reduce the number of observations dropped from the estimation (Arellano and Bover, 1995).

Table 9. Additional robustness checks

	Investment							
	Leverage including trade credits	Leverage including all liabilities	Excluding firms with zero financial debt	Dependent variable: investment to net sales ratio	Excluding FX debt holders	Leverage: Average of the 2016-2017 period	Leverage: fitted value	Leverage: fitted value (GMM)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST x Leverage	-0.02764***	-0.02737***	-0.03164***	-0.00994***	-0.06352***	-0.04313***	-0.04618***	-0.01407***
	(0.00299)	(0.00299)	(0.00670)	(0.00151)	(0.00726)	(0.00608)	(0.00707)	(0.00483)
Firm size	-0.03904***	-0.03914***	-0.04266***	-0.00965***	-0.03916***	-0.03938***	-0.03939***	-0.03843***
	(0.00185)	(0.00185)	(0.00259)	(0.00054)	(0.00194)	(0.00185)	(0.00185)	(0.00191)
Firm growth	0.00078	0.00078	0.00199*	-0.00029	0.00022	0.00078	0.00073	0.00164**
	(0.00074)	(0.00074)	(0.00116)	(0.00020)	(0.00076)	(0.00074)	(0.00074)	(0.00077)
Maturity	-0.02425***	-0.02223***	-0.02790***	-0.00283**	-0.00890*	-0.02140***	-0.02268***	-0.02362***
	(0.00464)	(0.00464)	(0.00561)	(0.00128)	(0.00511)	(0.00464)	(0.00464)	(0.00468)
Cash flow	0.11413***	0.11458***	0.13758***	0.02879***	0.09683***	0.11213***	0.11334***	0.11299***
	(0.00702)	(0.00702)	(0.01001)	(0.00197)	(0.00737)	(0.00702)	(0.00702)	(0.00717)
Firm age	-0.02051***	-0.02060***	-0.02836***	0.00048	-0.02332***	-0.02516***	-0.02521***	-0.02627***
	(0.00380)	(0.00380)	(0.00525)	(0.00086)	(0.00400)	(0.00379)	(0.00379)	(0.00401)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province x year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	313,655	313,655	194,607	313,655	272,891	313,655	305,094	287,380
R-squared	0.41450	0.41448	0.38575	0.41253	0.43329	0.41444	0.38886	0.36779

This table reports estimations of the model in equation 1. $POST_t$ is one for the post-crisis period from 2018 to 2019, and zero otherwise. $Leverage_i$ is the 2017 year-end financial debt to total assets ratio. Definitions of other variables are in the note for Table 1. Robust standard errors are clustered at firm level, and reported in parentheses. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

The fitted values of leverage from the standard approach and GMM estimation display nearly zero correlation with the residuals of the baseline model where the correlation is -0.0009 for the former and 0.0097 for the latter. On the other hand, they are significantly correlated the leverage. The correlations are 0.8479 and 0.5514 for the fitted values from standard approach and GMM estimation, respectively. Thus, they both seem to be suitable instrument candidates. The re-estimated results of the model by replacing the leverage in the baseline model with the fitted values (columns 7 and 8 of Table 9) are in line with the baseline estimations reported in Table 2.[6]

[6] Leverage estimations are not reported to conserve space, but available upon request.

5. Conclusion

The elevated corporate indebtedness in emerging countries over the last decade render corporates vulnerable to the shifts in risk sentiment and financial shocks, posing challenges for investments and substantial growth. Despite the importance of the issue, the evidence provided is scarce which can be attributable to a lack of data availability. To expand upon the literature on emerging economies, this paper examines whether elevated corporate indebtedness holds back investment in the aftermath of a large financial shock such as the one experienced in Turkey in 2018.

Using the firm-level data of all incorporated manufacturing firms in Turkey, the results of the difference in differences model reveal that high-indebted firms reduce their investments significantly compared to low-indebted firms in the aftermath of the financial shock. This suggests that high debt remained on corporate balance sheets seems to become a substantial impediment to investment growth. Accordingly, corporate loans are found to be decreasing with leverage. The results also reveal that the detrimental impact of high financial leverage is valid only for SMEs but not for large firms, which lends support to the arguments that debt overhang is more likely to affect small firms. Besides, the impact is more pronounced for non-exporters and young firms indicating their lower tolerance to elevated indebtedness.

Another important result is that firms with high cash holdings could alleviate the adverse impact of high financial leverage. This is consistent with the precautionary motive of corporate cash holdings in the literature while points out the importance of the insurance systems for receivables to improve corporate cash management, especially for SMEs.

During the Covid-19 pandemic, policy makers have provided liquidity injections to corporates in the form of new lines of credit and loan guarantees, which have been essential to deal with liquidity shortages. On the flip side, this has further elevated the corporate indebtedness, and thus the concerns regarding the investment prospects (Ebeke et al., 2021; OECD, 2021). Given the challenging backdrop, the findings of the paper emphasize the importance of regulations that decrease vulnerabilities of corporates to financial and economic conditions, especially for emerging countries, and prevent firms from excessive debt that is potentially a drag on investment activities. However, in many emerging economies, the bank lending, which is highly vulnerable to financial conditions, is the dominant source of external finance whereas alternative sources such as equity issue is quite

limited, especially for SMEs. In Turkey, for instance there are only around 400 listed firms (71% of which are large firms) despite the significant evidence of positive impact of listing on firm growth and investment (e.g., Yarba and Yassa, 2021). In that sense, the findings of this paper highlight the importance of policies that deepen the capital markets and make equity financing more attractive.

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