Determinants of firm investment: Evidence from Slovenian firm-level data

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Abstract

This paper examines the role of corporate balance sheet positions in determining Slovenian firms' investment behaviour. The analysis is based on the theoretical framework of the financial accelerator which suggests that firms' financial positions influence their real behaviour. The underlying hypotheses of the financial accelerator are tested, namely its asymmetric effect during crises and in respect to firms' size. In addition, the existence of differences in the relationship between the balance sheet variables and investment across various sectors is examined. The results indicate that indeed balance sheet strength is an important determinant of Slovenian firms' investment behaviour. Moreover, this relationship is affected by a firm's size but the effect of the crisis or its sectoral specialization do not seem to materially affect it.

Keywords: Firm investment; financial accelerator; firm-level data;
JEL Classification: C33, D22, E22.

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1 Introduction

Private-sector investment remained depressed and low in many countries even after several years since the outbreak of the global financial crisis in 2008 (henceforth GFC). Why is that so, it is not easy to answer. In the Euro area, the private-sector investment has only recently approached to the pre-crisis levels. Comparing the growth of private-sector investment to the aggregate economic activity at the Euro area level, the dynamics of private-sector investment only slightly lagged behind the Euro area output. At the country level, however, the picture is different and very heterogeneous. Despite the fact that in most countries the private-sector investment was broadly in line with the overall economic activity, some countries displayed substantial gaps in private-sector investment.

In Slovenia, which also suffered a severe domestic banking crisis in 2012-2013 period, the private-sector investment displayed a sluggish performance in the aftermath of the GFC, reaching only 16.6 percent of GDP in 2016. This compares unfavourably to the average private-sector investment of 22 percent of GDP over the period of 1996-2004, when Slovenia's economy was performing more-or-less at its potential. With non-financial corporations (henceforth NFC or firms) undertaking the bulk of private-sector investment, this paper aims to uncover firm-specific factors that have affected NFC investment in Slovenia from the mid-nineties until recently.

The identification of firm investment determinants and the analysis of the relationship between a firm's investment decisions and its financial standing is particularly important for the assessment of an economy's outlook. It is reasonable to assume that such relationship is not constant over the business cycle and can be heterogeneous among firms with different characteristics such as firms' size or sectoral specialization. A theoretical framework which can facilitate the investigation of the aforementioned underlying relationship is the financial accelerator theory developed and described by Bernanke, Gertler and Gilchrist (1996).

In the context of the financial accelerator theory it is argued that a firm's financial position influences its real decisions. In particular, due to asymmetric information, a firm's access to financing depends on its balance sheet strength which acts as proxy of its health and viability. Thus, an initial shock combined with a weak balance sheet will impair a firm's credit access and, as a consequence, affect its investment decisions. An important feature of the financial accelerator is the so-called double asymmetry: balance sheet effects are expected to be stronger during downturns than in booms and be more severe for small than large firms (Gertler and Gilchrist, 1993; Oliner, Rudebusch and Sichel, 1995).

A number of studies using Slovenian firm-level data have found a link between a firm's financing structure and size and firm financial performance, including investment spending. Ralyea (2016) and Damijan (2017) found that that the investment activity of Slovenian firms became more sensitive to their level of indebtedness following the GFC. Similarly, Gabrijelčič, Herman and Lenarčič (2017) found a significant negative effect of leverage on Slovenian firm performance. In all these studies, a fixed-effects

regression technique was applied to a "standard" model of firm investment to estimate the pre- and post-GFC effect of indebtedness on firm performance/investment. IMAD (2014) has also analysed the impact of corporate indebtedness on gross capital formation and GDP growth using firm-level data within a smooth-transition structural vector autoregression framework.

A substantial part of the early literature on the subject has focused either on the study of aggregate data on "representative" or on large firms. However, both approaches can result in biased results by averaging out and thus obscuring the underlying processes. In particular, large firms are less likely to be affected by informational asymmetries and therefore be able to enjoy better access to financial markets and ultimately maintain a stable investment behaviour compared to the small and medium sized ones (SME).

Our paper analyses investment behaviour of Slovenian NFCs in order to investigate its association with weak balance sheets, something which has become to be known as the "financial accelerator" theory (Bernanke, Gertler and Gilchrist, 1996) on firm investment decision. In addition to the examination of the doubly asymmetric nature of the financial accelerator, we complement the paper by testing a hypothesis if the strength of the latter differs by industry/sector. For the purpose of this study we use a comprehensive dataset on the balance sheet and income statement information. It covers more than 20 years of annual data (from 1995 to 2016) thus including parts of both the upward as well as the downward part of the business cycle. Moreover, almost 85% of the sample consists of SMEs, a figure that is more representative to the actual business environment in Slovenia, as more than 62% of value added and over 72% of employment are generated by SMEs (European Commission, 2016).

The rest of the paper is organized as follows. Section 2 provides a selective review of the literature on firm investment determinants. Section 3 describes the data used and elaborates on the method and model specification used for the analysis. Section 4 presents the empirical results and Section 5 concludes.

2 Literature

Several studies have tried to empirically investigate the determinants of firm investment. Despite the heterogeneity in country and time coverage a set of common variables seems to emerge, augmented with additional, study-specific indicators. For an early summary of the main models, the work of Kopcke (1985) provides an accessible reference. The author reviews five statistical models of business investment spending (the accelerator, neo-classical, Q model, cash flow, and autoregression) and assesses them using quarterly investment data from 1956-79 for large U.S. firms. Kopcke (1985) concludes that no model consistently surpasses its competitors. Each model enjoys periods when it best approximates the course of investment spending at the aggregate, so a variety of investment models exist.

In an often cited paper on firm financing constraints, Fazarri et al. (1988) provide a solid theoretical underpinning of the rationale behind the impact of a firm's financial structure on its investment. Consistent with the firm "financing hierarchy" theory, Fazarri et al. (1988) argue that asymmetric information between a firm's managers and potential creditors induces potential providers of external finance to demand a premium for supplying funds relative to the cost of internal financing (cash flow and retained earnings). The authors test for the existence of firm financial constraints using three different empirical specifications of firm investment demand: the Q, accelerator and neo-classical models over a sample of large, publicly-traded U.S. firms that is split into different groups depending on their retention policies. The authors provide evidence that a firm's financial position affects its investment spending.

Vermeulen (2002) uses a sample of 112 "representative" firms (from AMADEUS database[1]) from 4 European countries to test the hypotheses underlying the financial accelerator theory, namely that balance sheet positions are significant determinants of firm investment and its double asymmetry aspect. Vermeulen (2002) finds the financial accelerator being stronger in downturns and affecting more severely small firms. He provides evidence in favour of the asymmetric working of the financial accelerator both regarding its differential impact over the business cycle, as well as in respect to firm size. However, direct evidence of the effect of balance sheet strength are weak. The author recognizes that this could be due to the use of data on "representative" firms which could result in downwardly biased results.

Bond et al. (2003) use panel data on manufacturing firms in four European countries from 1979-89 and two different investment equations, a reduced-form error-correction model and an Euler-equation specification, to explore and compare the effects of financial constraints on firm investment. Their approach relies on sample splitting (separate regressions run for each country) to tease out whether investment sensitivity to cash flow reflects expectations about future profitability or financing constraints.

In two related studies Aivazian, Ge and Qiu (2005a), Aivazian, Ge and Qiu (2005b) study the impact of leverage and debt maturity structure on firm investment. They evaluate the Q model on a sample of US and Canadian firms and show that firms' leverage has a significant impact on its investment decisions. They find that firms with high growth opportunities are less severely affected but they exhibit a higher dependence on debt maturity structure with high percentage of long-term debt in total debt reducing significantly their investment.

Using a large-scale company-level panel dataset on Spanish firms in the period 1985 - 2001, Hernando and Martínez-Carrascal (2008), find strong evidence that financial position is important in explaining corporate investment spending decisions. In particular, debt service burden and measure of profitability are found to have significant effects and be robust to alternative model specifications. Martínez-Carrascal and Ferrando (2008) test firms' investment decisions based on the panel data from

[1]https://www.bvdinfo.com/en-us/our-products/company-information/international-products/amadeus

a large sample of NFCs in six euro area countries (Belgium, Germany, France, Italy, the Netherlands and Spain). The results indicate that profitability (cash flow), net indebtedness and interest burden play a role in firms' investment dynamics. Martínez-Carrascal and Ferrando (2008) also summarize the literature through 2008 that finds empirical evidence on the impact of leverage on investment.

In their study Farinha and Prego (2013) examine the effect of Portuguese firms' financial standing on their investment decisions. Using panel data on a sample spanning from 2006 to 2011 they find that the balance sheet strength has indeed significant explanatory power in corporate investment behaviour. Debt burden, cost of capital, firm indebtedness and profitability affect firms' investment rates. Moreover, in line with other studies, they confirm the nature of the double asymmetry of the financial accelerator. Goretti and Souto (2013) additionally find evidence of a negative relationship between firm's investment rate and their debt burden based on a sample of aggregated firm-level data for Euro area countries in the period of 2000-2011. Their analysis also points to possibly asymmetric effects beyond certain levels of indebtedness.

Kalemli-Ozcan, Laeven and Moreno (2019), on which we partly rely on, build upon the works of Whited (1992), Bond and Meghir (1994) and Lang, Ofek and Stulz (1996). They show that modelling the relationship between firms' debt and investment improves standard investment models and adds to the discussion of the effects that debt has on investment. They also rely on more recent literature that adds additional explanatory variables of the investment decisions, such as the sovereign default risk increases and sovereign ratings downgrades (Gennaioli, Martin and Rossi, 2014). Other linkages to firms' investment developments were studied as well. Regarded as a more indirect linkage that can arise in times of the government backstoping the financial system Laeven and Valencia (2013) study the effects of guarantees or bank bailouts. They conclude that bailouts can add significantly to the increase of sovereign debt and sovereign risk. Acharya, Dreshcler and Schnabl (2014) find similar conclusions. Gennaioli, Martin and Rossi (2013) and Acharya and Steffen (2015) find also that weaknesses in the banking sector reinforce sovereign-bank linkages. The so-called moral suasion could represent another possible linkage and appears when governments force banks to hold risky government bonds (Ongena, Popov and Van Horen, 2016; Altavilla, Pagano and Simonelli, 2017; Becker and Ivashina, 2018).

The study of Kalemli-Ozcan, Laeven and Moreno (2019) highlights the importance of the role of firm leverage, debt maturity, and weak bank balance sheets in determining firms' investment. They find that firms with higher leverage reduce investment more compared to their low-leverage peers. Moreover, this effect is stronger when these firms are linked to weak banks. Additionally, firms which rely on short-term borrowing suffer from rollover risk and consequently decrease their investment more. Again this effect is stronger when these firms are linked to weak banks. Kalemli-Ozcan, Laeven and Moreno (2019) complement the existing literature by focusing on aggregate demand, banks' financial health, and sovereign-bank linkages in order to explain the dynamics of the GFC. They find that economic policies that more directly target the financial conditions of firms might be more suitable in reducing the debt

overhang and stimulating the real economy. Their results also point to the possible dangers of an over-reliance on short-term debt to finance investment during good times.

Overall, from this certainly non-exhaustive review of the literature on firm investment, certain variables are repeatedly and robustly found to affect firm's investment behaviour. These primarily include the lagged value of investment, a variety of indicators proxying the general indebtedness or leverage of firms such as the ratio of debt over assets, its sales growth rate or its ratio over capital and some measure of profitability such as gross operational profits or income as a fraction of total assets. Additional indicators of balance sheet strength that are frequently found to significantly affect firm investment decisions are its debt maturity as well the interest burden. The former measure is proxied by short- or long-term debt as a fraction of total debt obligations while the latter by the ratio of interest payments over gross revenues. Finally, in line with the underlying hypotheses of the financial accelerator theory, several studies have identified statistically significant asymmetric behaviour during different phases of the business cycle as well as in respect to firm size with the effect being larger during downturns and more severe for small firms.

Guided by the findings of the literature, this study aims to investigate further the effect of "weak balance sheets" using a detailed dataset of Slovenian firm-level data for the period from 1995 to 2016.

3 Data and methodology

3.1 Data

The analysis in this paper makes use of data from the balance sheets and profit and loss accounts of individual Slovenian companies, gathered by the Agency for Public Legal Records and Legal Services (AJPES).[2] The dataset consists of annual observations from 1995 until 2016, originally covering 118,100 firms and 19 sectors of the Slovenian economy.[3]

Before proceeding with the analysis, the original dataset is pre-processed and cleaned. Firms with fewer than 5 employees, those classified as other than non-financial corporations (financial firms, government-related etc.) as well as those belonging to N to S sector by NACE classification[4] are dropped from the sample. Moreover, since size is considered to be an important variable, firms with no information about their

[2]The AJPES database includes all Slovenian firms excluding those undergoing bankruptcy proceedings which are no longer obliged to submit their annual reports and hence are not included in the database as of the year when they filed for bankruptcy.

[3]The original dataset's sector coverage includes every NACE Revision 2 classification of economic activities from A to S sectors with the more populated ones being manufacturing (C), construction (F), wholesale and retail trade, repair of motor vehicles and motorcycles (G) and professional, scientific and technical activities (M) accounting for more than 70% of the original sample's observations.

[4]Administrative and support service activities (N), public administration and defence, compulsory social security (O), education (P), human health and social work activities (Q), arts, entertainment and recreation (R) and other services activities (S).

size are also excluded from the analysis. It should be noted for the classification of firms' size is followed the Republic of Slovenia Companies Act (ZGD-1), Article 55 (see Appendix A for a detailed description).

In addition to the previous sector- and size-related conditions, problematic observations are discarded. Asset components (total, tangible and intangible), sales and debt components (total, short term and long term debt) with negative values are not considered in the analysis. The application of the aforementioned conditions reduces the size of the original sample from more than 100,000 to 21,665 individual firms.

Following Lang, Ofek and Stulz (1996) and Kalemli-Ozcan, Laeven and Moreno (2019), net investment rate is used[5], computed as the annual change in capital stock (i.e. the sum of tangible and intangible assets minus depreciation) as a ratio of lagged capital stock ($IK_{i,t}$). The rationale of using net instead of gross investment is that the latter will be positive even if investment expenditures merely match the depreciation of existing capital equipment. However, in this case the former will be zero, thus making it a more relevant variable about firms' future productivity. Firms' balance sheet strength is proxied by the following variables which are widely used by the literature.[6] Leverage is captured by the ratio of total debt to assets ($DA_{i,t}$), debt maturity is proxied by the fraction of long-term debt to total debt ($LTR_{i,t}$) and profitability is defined as the ratio of operating profits to total assets ($PA_{i,t}$). The annual percentage growth of net sales ($SG_{i,t}$) is used to control for growth opportunities since market-based proxies such as Tobin's Q cannot be used. Finally, all variables are trimmed at the appropriate level in order to exhibit a sample kurtosis below 10 as in Kalemli-Ozcan, Laeven and Moreno (2019). Therefore, $IK_{i,t}$, $DA_{i,t}$, $PA_{i,t}$ and $SG_{i,t}$ are trimmed at 5%, 1%, 1% and 2% respectively. For the case of $LTR_{i,t}$ no trimming is necessary because the $kurtosis \leq 10$ condition already holds. It should be mentioned that capital and net sales series are deflated using the equipment-specific price deflator for gross fixed capital formation.

In Table 1 are reported the descriptive statistics of the sample over the whole period.

Table 1: Summary statistics of the variables used

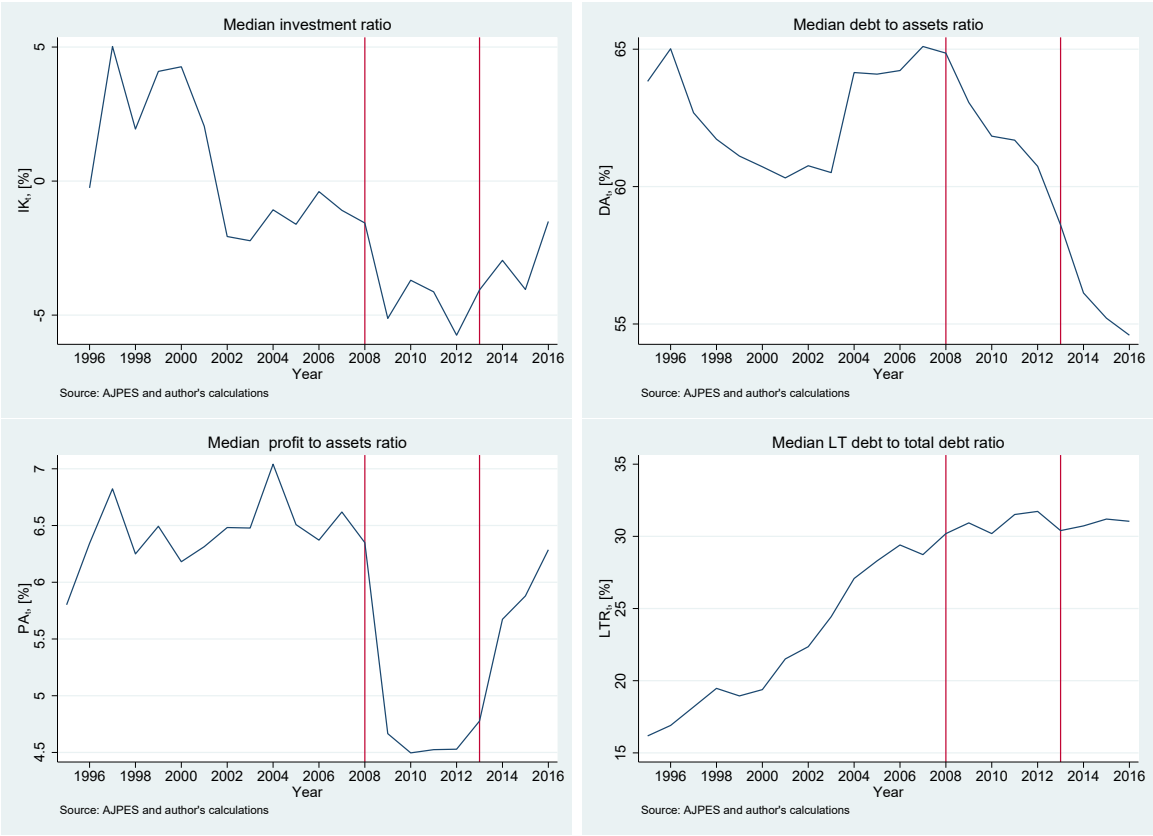
Variable	Mean	St. Dev	Median	Minimum	Maximum	N
IK	6.833	32.722	-1.988	-43.321	162.680	125676
SG	7.569	25.888	4.248	-50.745	129.651	136561
DA	59.870	27.489	60.898	5.376	186.813	163700
LTR	31.740	24.502	27.058	0.001	100.000	108006
PA	8.378	8.080	5.806	0.115	50.104	128450

[5]Referred as *investment* for brevity for the remainder of the study.

[6]Just to name a few: Lang, Ofek and Stulz (1996), Giannetti and Ongena (2012), Chodorow-Reich (2014), Kalemli-Ozcan, Laeven and Moreno (2019).

While summary statistics in Table 1 provide an overall picture, a more revealing one is shown in Figures 1 to 3, where the evolution of the variables through time is plotted. In addition to full-sample results, categorization by firm size and sectoral specialization are also considered, uncovering some interesting patterns.

Figure 1: Median evolution of the examined variables over the whole firm sample



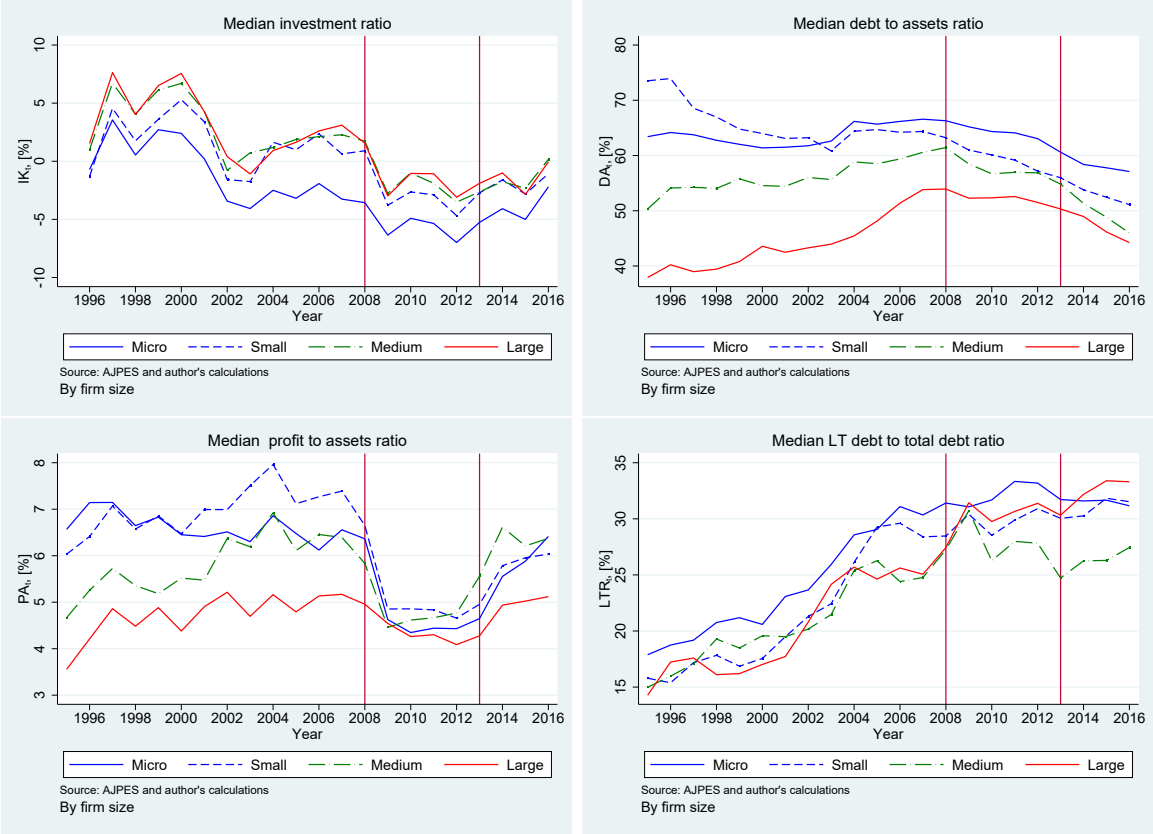
Note: The vertical lines are placed in 2008, at the beginning of the GFC, and in 2013, at the end of the GFC in Slovenia.

The charts in Figure 1 present in an apparent way the grim situation that firms were faced with after the onset of the GFC and their reactions in terms of investment and leverage. After a drop from its initially high levels, median investment[7] dropped in 2002 and remained relatively stable until 2008 when it began to decline. Until 2012 investment remained depressed while from 2013 started to gradually increase almost reaching its pre-crisis levels in 2016. Median profitability (more precisely the ratio of profits to assets) exhibits a striking pattern. At the beginning of the GFC it plummeted by almost 2 percentage points and stayed at this low level for 4 years until it began to rise again in 2013 together with the economic recovery in Slovenia. This upward trend continued up to 2016 resulting in the recovery of profitability to its pre-crisis figures. Interesting patterns are also exhibited by the debt-related indicators.

[7]Average investment follows a similar pattern, only exhibiting an upward level shift of roughly 10 percentage points.

Total debt to assets ratio showed a sharp decrease starting in 2008, while the long-term component of debt (as a share of total debt) stopped increasing and stabilized at the same period. These patterns continue until the right end of the respective charts indicating the existence of a prolonged de-leveraging behaviour by firms which, as of 2016, is still ongoing. In Figure 2 the same set of results is plotted by firm size.

Figure 2: Median evolution of the examined variables by firm size



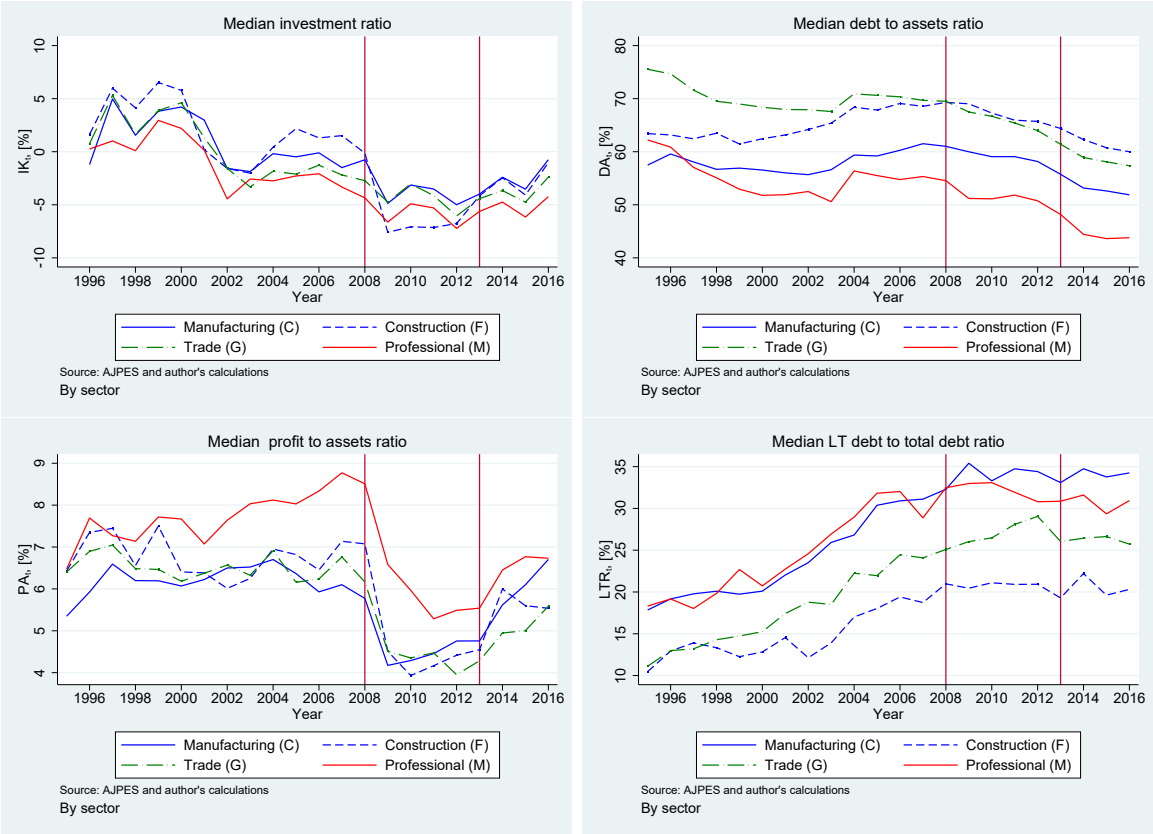
Note: The vertical lines are placed in 2008, at the beginning of the GFC, and in 2013, at the end of the GFC in Slovenia.

One can see several similarities but also notice differences among firms of different sizes in Figure 2 regarding their investment behaviour, debt dynamics and profitability. As is displayed in Figure 2, firms behave in a largely similar way as regards their investment decisions irrespective of their size. Apart from a, generally expected, difference in the levels of micro firms' investment, the patterns (and even the levels of the rest) are similar for every firm size. Regarding profitability, firms exhibit some rather time-dependent similarity dynamics. After 2008 firms of every size experienced a drop in their profitability levels (although large firms were less affected compared to the others as the red, solid line in Figure 2 shows) which after 4 years reversed at the start of the economic recovery period in 2013 and recovered to their 2008 levels in 2016. However, before the GFC two different groupings are present in terms of profitability growth; the first group includes large and micro firms which have exhibited relatively

stable profitability, while the second group of small and medium firms has showed an upward trend roughly until 2007. The results in Figure 2 suggest that debt accumulation and firms' de-leveraging is quite heterogeneous among different size classes. As regards to debt to assets variable, the highest growth before the GFC among all size classes is observed for large firms. They exhibited an increase of about 12 percentage points in the decade preceding 2008. On the contrary, small firms' leverage is declining practically for over the last 20 years, perhaps with a small exception during the three-year period between 2004 and 2007. Nevertheless, that period is characterised by an excessive increase of debt across the board. Medium and micro sized firms fall between the former cases displaying mild growth in leverage (around 7 percentage points) during the pre-crisis period, followed by a decline post-crisis. In fact, de-leveraging is most intense for the medium-sized firms which reduced their median debt to assets ratio by more than 15 percentage points from almost 61% in 2008 to about 45% in 2016 with the steepest decline happening in the last 3 years. Finally, long-term debt's share of total debt shows a quite similar evolution before 2008 for every size category, a pattern that holds also after with the exception of medium sized firms. As can be seen in Figure 2, in the post-crisis period long-term's debt share of total debt remained relatively stable for every size class but the medium one which declined from 2009 until 2013. Data on the second component of total debt[8], short-term debt, indicate that during this period medium-sized firms increased slightly this component's share in the total. However, after 2013, the aforementioned increase halted which resulted in the stabilization of long-term debt's evolution.

[8]Not shown here but available upon request.

Figure 3: Median evolution of the examined variables by firm sectoral specialization



Note: The vertical lines are placed in 2008, at the beginning of the GFC, and in 2013, at the end of the GFC in Slovenia.

In Figure 3 the evolution of (median) investment, debt and profitability dynamics by firms' sectoral specialization is plotted. From the 12 sectors considered in the study, only the 4 largest are shown which, combined, account for more than 77% of the final sample's non-missing investment observations. As is evident, the largest impact of the crisis was on construction firms which reduced their investment by around 7 percentage points immediately after 2008. However, in general, the dynamics are similar across sectors. Profitability's evolution also exhibits a high degree of similarity among different sectors, as does long-term debt ratio. Finally, firms' (de)leverage evolution shows some mild clustering between two groups: wholesale and retail trade, repair of motor vehicles and motorcycles (G) and professional, scientific and technical activities (M) on one side and manufacturing (C) and construction (F) on the other. Nevertheless, the differences between these two groups are small.

3.2 Methodology

For the quantitative analysis of the significance and the direction of correlation between firm investment a standard fixed-effects panel data regression is used. The reason of choosing the fixed-effects panel data regression model is straightforward since

we control for specific firm characteristics. The specification of the baseline model is described in Equation 1

$$IK_{i,t} = \alpha SG_{i,t-1} + \beta \mathbf{X}_{i,t-1} + d_t + u_i + \epsilon_{i,t} \quad (1)$$

where the term $IK_{i,t}$ denotes investment of firm i at time t, $SG_{i,t-1}$ is sales' growth at time $t-1$, while the term $\mathbf{X}_{i,t-1}$ represents the measure of firm's financial position (i.e. leverage defined as total debt to assets $DA_{i,t-1}$, debt maturity proxied by long-term debt to total debt $LTR_{i,t-1}$ or profitability defined as operating profits to total assets $PA_{i,t-1}$). The term d_t represents the time fixed effect, while the term u_i is the unobserved, firm fixed effect and $\epsilon_{i,t}$ is the error term. It is assumed that the variation of user cost of capital is controlled by the inclusion of firm and time fixed effects. As previously mentioned for $i = 1, 2, ..., 21665$ applies and for $t = 1995, 1996, ..., 2016$ applies.

Besides the baseline specification in Equation 1, two additional specifications are considered in order to examine the hypotheses underlying the financial accelerator, namely its asymmetric working during financial crises and in respect to firms' size. The third specification aims at examining the existence of differences in the strength of the financial accelerator among various sectors. This is done by introducing interaction terms between balance sheet variables ($\mathbf{X}_{i,t-1}$) and the crisis, size and sector dummies respectively. In particular, the crisis dummy variable takes the value of 1 from the year following the start of the GFC until the end of the banking crisis period in Slovenia in 2013. Regarding the firm size are used the 4 size classes according to the criteria described in detail in Appendix A, with micro-sized being the reference group. Finally, the sector dummy variable includes 12 different sectors the reference of which is agriculture, forestry and fishing[9]. The estimation results of the various specifications are presented in the following sections.

4 Empirical results

This section is dedicated to the description of the empirical results of the fixed effect panel data regression model. First we provide the results of the baseline model and subsequently on the alternative model specifications.

4.1 Baseline model

The results of the estimation of the baseline specification are reported in Table 2.

[9]The sectoral categories include the following NACE Revision 2 classification of economic activities: agriculture, forestry and fishing (A), mining and quarrying (B), manufacturing (C), electricity, gas, steam and air conditioning supply (D), water supply, sewerage, waste management and re-mediation activities (E), construction (F), wholesale and retail trade, repair of motor vehicles and motorcycles (G), transporting and storage (H), accommodation and food service activities (I), information and communication (J), real estate activities (L) and professional, scientific and technical activities (M).

Table 2: Baseline regression results

Variable	Model 1	Model 2	Model 3
$SG_{i,t-1}$	0.077***	0.072***	0.053***
	(0.005)	(0.005)	(0.006)
$DA_{i,t-1}$	-0.088***		
	(0.009)		
$LTR_{i,t-1}$		-0.134***	
		(0.008)	
$PA_{i,t-1}$			0.406***
			(0.024)
Observations	104128	74733	84988
R^2	0.036	0.042	0.040
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Standard errors in parentheses are clustered at the firm level.
***/**/* indicates significance at the 1%/5%/10% level.

The estimated coefficients presented in Table 2 are statistically significant and their signs are broadly in line with the findings from most of the literature. The estimation results show that increases in firm's leverage DA (Model 1) as well as increases in long-term's share of total debt LTR (Model 2) are linked with a detrimental effect on investment. The latter result is in line with the findings of Kalemli-Ozcan, Laeven and Moreno (2019) which indicate that having shorter debt maturity is considered beneficial. On the contrary to the detrimental effects on investment, as expected, the profitability PA (Model 3) is positively associated with investment. Overall, the results of the baseline model imply the existence of the financial accelerator mechanism suggesting that firms' balance sheet positions are especially important determinants of their investment decisions. In the next subsections, we examine the asymmetrical nature of the financial accelerator given different states of the economy, firm size and sector.

4.2 Importance of crisis regime

As in literature (for instance Vermeulen, 2002) we hypothesize that the periods of economic downturns can impose asymmetries in the financial accelerator effects on firms. In order to study the asymmetric nature of the financial accelerator, namely the hypothesis that firms' balance sheets are more important determinants of investment during financial crises, an interaction term is added in Equation 2

$$IK_{i,t} = \alpha SG_{i,t-1} + \beta \mathbf{X}_{i,t-1} + \gamma \mathbf{X}_{i,t-1} \times Crisis_{t-1} + d_t + u_i + \epsilon_{i,t} \tag{2}$$

where the term $Crisis_t$ represents the crisis dummy variable assuming the value of 1

between 2009 and 2013 (both ends included) and 0 elsewhere. The estimation results are reported in Table 3.

Table 3: Financial accelerator and crisis regime

Variable	Model 1	Model 2	Model 3
$SG_{i,t-1}$	0.077***	0.072***	0.053***
	(0.005)	(0.005)	(0.006)
$DA_{i,t-1}$	-0.071***		
	(0.009)		
$DA_{i,t-1} \times Crisis_{t-1}$	-0.057***		
	(0.009)		
$LTR_{i,t-1}$		-0.135***	
		(0.009)	
$LTR_{i,t-1} \times Crisis_{t-1}$		0.002	
		(0.010)	
$PA_{i,t-1}$			0.402***
			(0.027)
$PA_{i,t-1} \times Crisis_{t-1}$			0.015
			(0.042)
Observations	104128	74733	84988
R^2	0.037	0.042	0.040
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Standard errors in parentheses are clustered at the firm level.
$Crisis_t$ dummy is 1 between 2009 and 2013 and 0 elsewhere.
***/**/* indicates significance at the 1%/5%/10% level.

As seen in Table 3 the results are mixed. On one side, the coefficient of firms' leverage DA is almost twice as large during financial crises indicating a stronger (negative) relationship between investment and leverage in economic downturns. On the other side, the results for the remaining variables have the expected signs but are not statistically significant. The positive sign of the debt maturity LTR interaction variable during the crisis period is in line with the results from Kalemli-Ozcan, Laeven and Moreno (2019) who associate it with higher debt roll-over risks during turbulent times. Their rationale is that having shorter debt maturity is considered beneficial during normal times but this reverses when the economy is in crisis mode. Moreover, a positive sign of the profitability PA interaction variable indicates that its (positive) relationship with investment is even stronger during economic downturns. However, both coefficients of the latter interaction variables (LTR and PA) are statistically insignificant and therefore the results should be treated with caution.

4.3 Importance of firm's size

Another source of asymmetry in the working of the financial accelerator stems from firms' size. This is related with information asymmetries which are more easily reduced by large firms compared to small ones. Thus, access to credit is limited to the latter impeding their investment growth. Moreover, large firms are expected to be more able to access alternative sources of financing, hence their balance sheet positions should have a smaller impact on their investment behaviour. In order to test this hypothesis, Equation 3 is augmented with the respective firm-size interaction terms

$$IK_{i,t} = \alpha SG_{i,t-1} + \beta \mathbf{X}_{i,t-1} + \beta_{size} \mathbf{X}_{i,t-1} \times Size_i + d_t + u_i + \epsilon_{i,t} \tag{3}$$

where $Size_i$ is the size category of firm i (micro, small, medium or large; see Appendix A for details) and β_{size} the associated coefficients. The estimation results are reported in Table 4.

Table 4: Financial accelerator and firm size

Variable	Model 1	Model 2	Model 3
$SG_{i,t-1}$	0.077***	0.072***	0.053***
	(0.005)	(0.005)	(0.006)
$DA_{i,t-1}$	-0.107***		
	(0.012)		
$DA_{i,t-1} \times Small_i$	0.032		
	(0.019)		
$DA_{i,t-1} \times Medium_i$	0.046*		
	(0.025)		
$DA_{i,t-1} \times Large_i$	0.064**		
	(0.031)		
$LTR_{i,t-1}$		-0.137***	
		(0.012)	
$LTR_{i,t-1} \times Small_i$		-0.011	
		(0.019)	
$LTR_{i,t-1} \times Medium_i$		0.013	
		(0.022)	
$LTR_{i,t-1} \times Large_i$		0.057**	
		(0.025)	
$PA_{i,t-1}$			0.334***
			(0.031)
$PA_{i,t-1} \times Small_i$			0.191***
			(0.055)
$PA_{i,t-1} \times Medium_i$			0.119
			(0.079)
$PA_{i,t-1} \times Large_i$			0.252**
			(0.112)
Observations	104128	74733	84988
R^2	0.036	0.042	0.041
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Standard errors in parentheses are clustered at the firm level.
Micro-sized firms are the reference group.
***/**/* indicates significance at the 1%/5%/10% level.

The results presented in Table 4 speak in favour of the firm-size related asymmetry of the financial accelerator. For every balance sheet variable the respective β_{size} coefficient is positive and statistically significant for large firms. For debt-related variables such as the DA and LTR interaction variables this result suggests that their relationship with investment is less strong for large firms compared to the micro-sized ones, while for profitability PA the (positive) link is even stronger. Interestingly, medium-sized firms' leverage DA interaction coefficient is also positive and statistically signifi-

cant[10] indicating that leverage for this size class is also more weakly connected to their investment growth compared to that of the reference group's. Another interesting finding is that, in addition to large firms, the profitability seems to be a more important determinant of small firms' investment growth compared to micro and medium-sized ones. Finally, the next subsection investigates whether there exist differences in the relationship between leverage, debt maturity and profitability and firms' investment behaviour across different sectors.

4.4 Importance of firm's sectoral specialization

This subsection examines the possible existence of differences in the relationship between balance sheet variables and firm investment by sector. For that purpose the balance sheet indicators $\mathbf{X}_{i,t-1}$ in Equation 4 are interacted with a sectoral dummy variable assuming 12 different values, one for each sector

$$IK_{i,t} = \alpha SG_{i,t-1} + \beta \mathbf{X}_{i,t-1} + \beta_{sector} \mathbf{X}_{i,t-1} \times Sector_i + d_t + u_i + \epsilon_{i,t} \qquad (4)$$

where $Sector_i$ is the NACE Revision 2 sector that firm i is classified into (letter classification A, B, C, D, E, F, G, H, I, J, L and M) and β_{sector} the associated interaction's coefficient. The estimation results are reported in Table 5.

[10] Albeit smaller in absolute terms compared to that for large firms.

Table 5: Financial accelerator and firm sector

Variable	Model 1	Model 2	Model 3
$SG_{i,t-1}$	0.077***	0.072***	0.053***
	(0.005)	(0.005)	(0.006)
$DA_{i,t-1}$	-0.031		
	(0.054)		
$DA_{i,t-1} \times SectorH$	-0.186***		
	(0.067)		
$LTR_{i,t-1}$		-0.020	
		(0.060)	
$LTR_{i,t-1} \times SectorC$		-0.130**	
		(0.061)	
$LTR_{i,t-1} \times SectorF$		-0.123*	
		(0.069)	
$LTR_{i,t-1} \times SectorG$		-0.115*	
		(0.062)	
$LTR_{i,t-1} \times SectorH$		-0.201***	
		(0.068)	
$LTR_{i,t-1} \times SectorJ$		-0.144**	
		(0.069)	
$PA_{i,t-1}$			0.396
			(0.271)
Observations	104128	74733	84988
R^2	0.036	0.042	0.041
Firm FE	yes	yes	yes
Year FE	yes	yes	yes

Standard errors in parentheses are clustered at the firm level.
NACE sector A firms are the reference group.
In order to keep table size small only the statistically significant interaction terms are presented
***/**/* indicates significance at the 1%/5%/10% level.

The results presented in Table 5 suggest that, by and large, the relationship between firm investment and their balance sheet positions is statistically similar across different sectors. This is especially evident for the case of profitability PA (Model 3) where not even a single sector exhibits statistically significant differences from the base group. Similarly, in the case of Model 1, leverage DA seems to have a stronger (more negative) relationship with investment only for firms belonging to the transportation and storage sector (H). The results indicate that the link between debt maturity LTR (Model 2) and investment shows some sectoral differentiation. In particular the relationship is stronger (and more negative) for manufacturing (C), construction (F), wholesale and retail trade, repair of motor vehicles and motorcycles (G), transporting and storage (H) and real estate activities (J) firms while for those from the rest 6 sectors differences from the reference group's are not statistically significant.

5 Conclusions

This paper examines the role of firm balance sheets and their relationship with investment behaviour. The findings of the analysis point in the direction of the financial accelerator mechanism underlying firm investment in Slovenia. The double asymmetry of this mechanism is less evident as regards to its working during financial turmoil but it is more clear when examined with respect to firms' size. In particular, large firms exhibit a less strong connection between their debt-related balance sheet positions and investment compared to the micro-sized ones. Finally, results from a sectoral analysis indicate that, in general, there are not significant differences in the aforementioned relationship across different sectors. A possible exception is associated with the role of debt maturity, where it is found to be more strongly linked with firm investment for almost half of the sectors examined.

Understanding of the effect of firm balance sheet positions in firm investment decisions can have interesting policy implications. In particular, promoting the strengthening of firms' financial positions during booms will help alleviate the impact of adverse events should they occur. Also, more directed policies can be devised in order to enhance the resilience of those firms who are affected the most during downturns. These could focus either on specific, vulnerable sectors or more broadly on micro-sized firms. Finally, targeted policies promoting alternative sources of financing instead of bank credit could be implemented with the additional benefit of decreasing related risks to the banking sector.

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A Appendix

The following passage is an English translation of the Article 55 from Republic of Slovenia's Official Gazette 65/2009 14.8.2009 Companies Act (ZGD-1) defining the criteria of each firm size class.

Article 55
(Micro, small, medium-sized and large companies)

(1) For the purposes of the application of this Act, companies shall be classified as micro, small, medium-sized and large on the annual balance sheet cut-off date, in accordance with the following criteria:

- its average number employees in the financial year;
- its net proceeds from sales; and
- the value of its assets.

(2) A company that satisfies any two of the following criteria shall be deemed a micro company:

- it has less than an average of 10 employees in a financial year;
- it has less than an average of 10 employees in a financial year;
- it has an annual turnover of less than EUR 2,000,000; and
- the value of its assets is less than EUR 2,000,000.

(3) A small company shall be a company other than a micro company, as defined in the preceding paragraph, and shall meet any two of the following criteria:

- it has less than an average of 50 employees in a financial year;
- it has an annual turnover of less than EUR 8,800,000; and
- the value of its assets is less than EUR 4,400,000.

(4) A medium-sized company shall be a company other than a micro company, as referred to in paragraph (2) of this Article, or a small company, as referred to in the preceding paragraph, and shall meet two of the following criteria:

- it has less than an average of 250 employees in a financial year;
- it has an annual turnover of less than EUR 35,000,000; and
- the value of its assets is less than EUR 17,500,000.

(5) A large company shall be a company which is neither a micro company, in accordance with paragraph (2) of this Article, nor a small company, in accordance with paragraph (3) of this Article, nor a medium-sized company, in accordance with the preceding paragraph.

(6) Under the criteria referred to in the preceding paragraphs, companies shall be classified as micro, small, medium-sized and large on the basis of data for two consecutive financial years at the annual balance sheet cut-off date.

(7) The provisions of this Act and other regulations relating to small companies shall also apply to micro companies unless otherwise regulated by this act and other rules.

(8) For the purposes of this Chapter, large companies shall at all times be deemed to include the following:

- banks;
- insurance companies;
- stock exchanges;
- companies obliged to prepare a consolidated annual report in accordance with Article 56 of this Act.