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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 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 does not seem to materially affect it.

JEL Classification: C33, D22, E22
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The views presented herein are those of the authors and do not necessarily represent the official views of Bank of Slovenia or of the Eurosystem.

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1. Introduction

Private-sector investment remained depressed in many countries even several years after the outbreak of the global financial crisis (henceforth, GFC) in 2008. The reasons behind this are multiple and identifying them is not a trivial issue. In the euro area, private-sector investment has only recently approached its pre-crisis levels. Comparing the growth of private-sector investment to the aggregate economic activity at the euro area level, the dynamics of the former only slightly lag behind output. At the country level, however, the picture is different and very heterogeneous. Despite the fact that, in most countries, private-sector investment is broadly in line with the overall economic activity, some countries display substantial gaps between the two.

In Slovenia, which also suffered a severe domestic banking crisis in 2012-2013, 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 its average figure, which was 22 percent of GDP over the 1996-2004period, when the Slovenian economy was performing more-or-less at its potential. Given that non-financial corporations (henceforth, NFC or firms) undertook 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 are 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 might be heterogeneous among firms with different characteristics, such as their size or sectoral specialization. The financial accelerator theory, developed and described by Bernanke, Gertler and Gilchrist (1996), is a theoretical framework that can facilitate the investigation of this underlying relationship.

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 aproxy 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, namely, that the balance sheet effects are expected to be stronger during downturns than booms and 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 as well as 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 after

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 focused either on the study of aggregate data on representative or 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, 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 that 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 the hypothesis that the strength of the latter differs by industry/sector. For the purpose of this study, we use a comprehensive dataset on 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 and downward part of the business cycle. Moreover, almost 85% of the sample consists of SMEs, a figure that is more representative for the actual business environment in Slovenia. In terms of value added, this figure represents over 62%, while over 72% of employment is generated by SMEs (European Commission, 2016).

The rest of the paper is organised 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 accessible reference. The author reviews five statistical models of business investment spending (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 outperforms its competitors. Each model enjoys periods when it best approximates the course of aggregate investment spending; highlighting the reasons of a vast variety of investment models.

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 to be stronger in downturns and affectingsmall firms more in comparison to larger firms. He provides evidence in favour of the asymmetric working of the financial accelerator both regarding its differential impact over the business cycleand in respect to firm size. However, direct evidence of the effect of balance sheet strength is weak. The author recognises 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 firms' investment decisions. They find that firms with high growth opportunities are less severely affected but they exhibit higher dependence on debt maturity structure, with high percentage of long-term debt in total debt significantlyreducing their investment.

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

Using a large-scale company-level panel dataset on Spanish firms in the 1985-2001 period, Hernando and Martínez-Carrascal (2008) find strong evidencethat financial position is important in explaining corporate investment spending decisions. In particular, debt service burden and a measure of profitability are found to have significant effects, displaying robustness compared to alternative model specifications. Martínez-Carrascal and Ferrando (2008) test firms' investment decisions based on panel data from 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 animportant role in firms' investment dynamics. Martínez-Carrascal and Ferrando (2008) also summarise there levant literature through 2008 that provides 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, Farinha and Prego (2013) find that 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, these conclusions confirm the nature of the double asymmetry of the financial accelerator. Goretti and Souto (2013) find additionalevidence of a negative relationship between firms' investment rates and their debt burden based on a sample of aggregated firm-level data for euro area countries in the 2000-2011 period. The authors' analysis also points to possibly asymmetric effects beyond certain levels of indebtedness.

Kalemli-Ozcan, Laeven and Moreno (2019) build on the works of Whited (1992), Bond and Meghir (1994) and Lang, Ofek and Stulz (1996). These authors show that modelling the relationship between firms' debt and investment improves standard investment models and adds to the discussion of the effect that debt has on investment. They also rely on more recent literature that adds additional explanatory variables of investment decisions, such as sovereign default risk proxied by sovereign credit risk ratings (Gennaioli, Martin and Rossi, 2014). Other linkages to firms' investment developments have been studied as well. The effect of guarantees or bank bailouts is an indirect linkage that can arise at times, when the government backstops the financial system. This was studied by Laeven and Valencia (2013), concluding that bailouts can significantlyadd to the increase of sovereign debt and sovereign risk. Acharya, Dreshcler and Schnabl (2014) reach similar conclusions. Gennaioli, Martin and Rossi (2013) and Acharya and Steffen (2015) also find 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. These authors 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 explaining the dynamics offirm investment in the wake of the GFC. Kalemli-Ozcan, Laeven and Moreno (2019) find that the economic policies that target the financial conditions of firms more directly might be more suitable in reducing debt overhang and stimulating the real economy. Their results also point to possible dangers of over-reliance on short-term debt to finance investment during good times.

Overall, from this certainly non-exhaustive review of 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 firms' general indebtedness or leverage, such as the ratio of debt over assets, 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, which are frequently found to significantly affect firm investment decisions, are firm's debt maturity and interest burden. The former measure is proxied by short- or long-term debt as fractions 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, the effect being larger during downturns and more severe for small firms.

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

3. Data and methodology

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 observa-

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.

tions 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 five employees, those classified as other than non-financial corporations (financial firms, government-related, etc.), as well as those belonging to NtoS sector by NACE classification[4] are dropped from the sample. Moreover, since size is considered an important variable, firms with no information about their size are also excluded from the analysis. It should be noted that for the classification of firms' size the Republic of Slovenia Companies Act (ZGD-1), Article 55 is observed (see Appendix for a detailed description).

In addition to the previous sector- and size-related conditions, problematic observations are discarded. Any negative asset (total, tangible and intangible), sales or debt component (total, short-term and long-term debt) are removed from the sample. The application of the aforementioned conditions reduce 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 expenditure merely matches the depreciation of existing capital equipment. However, in this case, the former will be zero, thus making it a more relevant variable for 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 ($PA_{i,t}$). 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, can not 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

3. The original dataset's sector coverage includes every NACE Revision 2 classification of economic activities from A to S sectors, the most 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), whichaccount for more than 70% of the original sample 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 service activities (S).
5. Referredas *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).

$SG_{i,t}$ are trimmed at 5%, 1%, 1% and 2%, respectively. For the case of $LTR_{i,t}$, no trimming is necessary because the *kurtosis* ≤ 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. Table 1 presents descriptive statistics of the sample over the whole period.

Table 1. Summary statistics of variables used

Variable	Mean	St. dev.	Median	Minimum	Maximum	N
$IK_{i,t}$	6.833	32.722	-1.988	-43.321	162.680	125,676
$SG_{i,t}$	7.569	25.888	4.248	-50.745	129.651	136,561
$DA_{i,t}$	59.870	27.489	60.898	5.376	186.813	163,700
$LTR_{i,t}$	31.740	24.502	27.058	0.001	100.000	108,006
$PA_{i,t}$	8.378	8.080	5.806	0.115	50.104	128,450

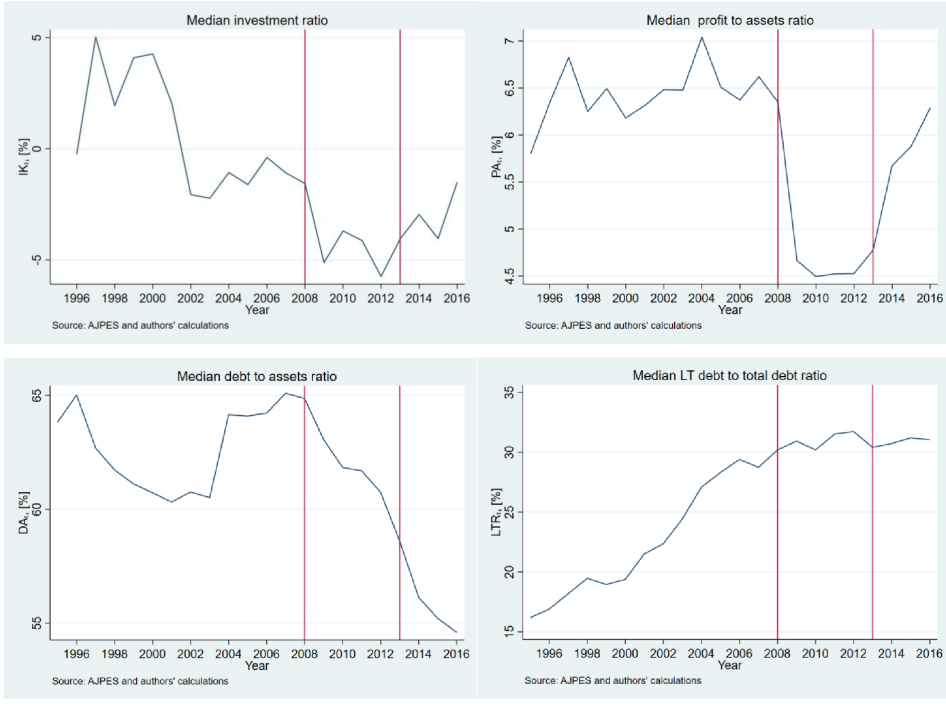
Source: AJPES.

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 variables through time is plotted. In addition to full-sample results, categorisation by firm size and sectoral specialisation are also considered, revealing some interesting patterns.

The charts in Figure 1 present, in an apparent way, the grim situation that firms faced 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 gradually increasing 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 coinciding with the economic recovery in Slovenia. This upward trend continued to 2016 resulting in the recovery of profitability to its pre-crisis figures. Debt-related indicators also exhibit interesting patterns.
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 stabilised during the same period. These patterns continue until the end of 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.

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

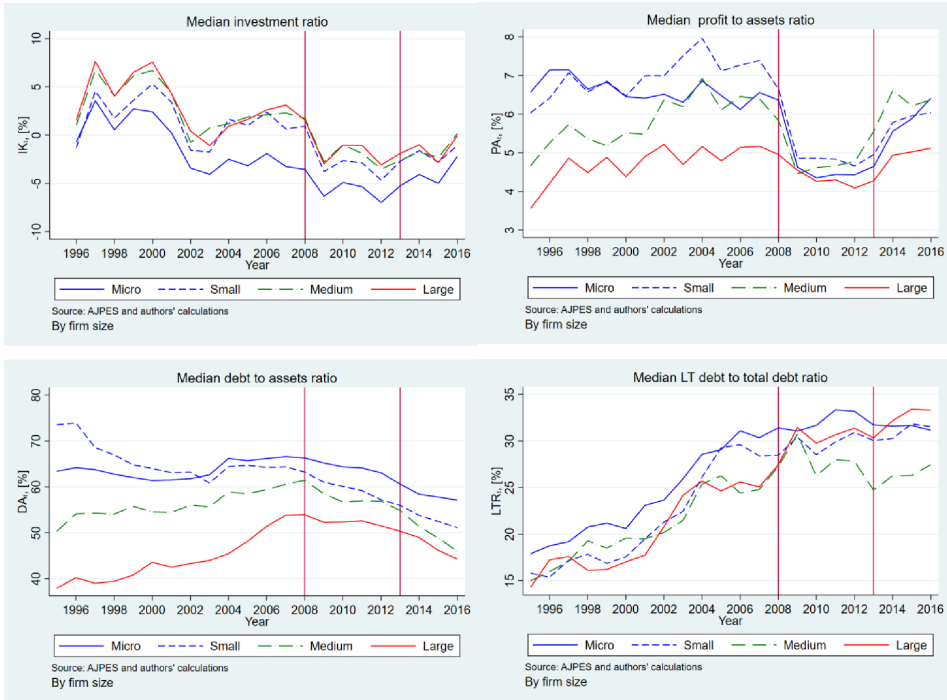
Figure 1. Median evolution of the variables over the entire firm sample



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

In Figure 2, one can see several similarities, but also notice differences, among firms of different sizes regarding their investment behaviour, debt dynamics and profitability. 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 others, as shown by the red, solid line in Figure 2).This trend reversed after 4 years, at the start of the economic recovery period in 2013 and recovered back to 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 exhibiting relatively stable profitability, while the second group of small and medium firms shows an upward trend roughly until 2007. The results in Figure 2 suggest that debt accumulation and firms' de-leveraging are quite heterogeneous over different size classes.

Figure 2. Median evolution of variables by firm size

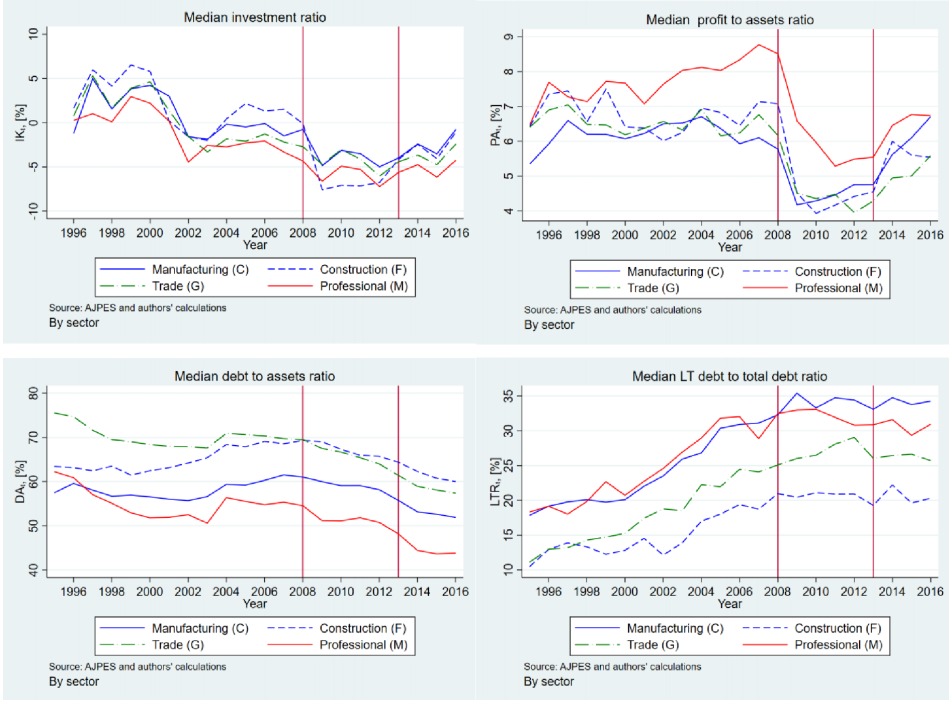


Note: Vertical lines are placed at 2008, at the beginning of the GFC, and at 2013, at the end of the GFC in Slovenia.

As forthedebt to assets variable, the highest growth of all size classesbefore the GFC is observed for large firms. They exhibit an increase of about 12 percentage points in the decade preceding 2008. On the contrary, small firms' leverage is declining practically 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 in the post-crisis period. In fact, de-leveraging is most intense for 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, the steepest decline occurring in the last 3 years. Finally, long-term debt to total debt ratio shows a quite similar evolution before 2008 for every size category, a pattern that also holds after this time, except for medium sized firms. As seen in Figure 2, during the post-crisis period, long-term debt to total debt ratio remained relatively stable for every size class except formedium sized firms, as the long-term debt to total debt ratio was decreasing from 2009 until 2013. Data on

the second component of total debt[8], i.e., short-term debt, indicate that, during this period, medium-sized firms slightly increased short-term debt, depicted as a share in the total debt. However, after 2013, the aforementioned increase halted resulting in stabilisation of long-term debt evolution.

Figure 3. Median evolution of variables by firm sectoral specialisation



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

In Figure 3 the evolution of (median) investment, debt and profitability dynamics by firm sectoral specialisation 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, non-missing, investment observations. It is evident that 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 evolution also exhibits a high degree of similarity among different sectors, as does the long-term debt ratio. Finally, firms' (de)leverage evolution shows some mild clustering between two groups: wholesale and retail

8. Not shown here but available upon request.

trade, repair of motor vehicles and motorcycles (G) and professional, scientific and technical activities (M), on the one hand, and manufacturing (C) and construction (F) on the other. Nevertheless, the differences between these two groups are small.

Methodology

For the quantitative analysis of the significance and the direction of correlation between firm investment, 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[9]. The specification of the baseline model is described in Equation 1.

$$IK_{i,t} = \alpha SG_{i,t-1} + \beta \boldsymbol{X}_{i,t-1} + d_t + u_i + \epsilon_{i,t} \ , \tag{1}$$

Where the term $IK_{i,t}$ denotes investment of firm i at time t, $SG_{i,t-1}$ denotes sales growth at time t-1, while the term $\boldsymbol{X}_{i,t-1}$ 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 $\varepsilon_{i,t}$ represents 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, i is 1,2,...21665 and t is 1995, 1996,...2016.

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 ($\boldsymbol{X}_{i,t-1}$) 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, four classes are used, according to the criteria described in detail in Appendix, micro-sized firms being the reference group. Finally, the sector dummy variable includes 12 different sectors referring to agriculture, forestry, and fishing[10]. The estimation results of various specifications are presented in the following sections.

9. We also considered a dynamic panel data regression setup with the Arellano-Bond GMM estimator (Arellano and Bond, 1991), as a robustness check. However, the dynamic model diagnostics are weak, which has a negative impact on inference from that model.
10. 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).

4. 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,of the alternative model specifications.

Baseline model

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

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)	(0.005)
$DA_{i,t-1}$	-0.088***		
	(0.009)		
$LTR_{i,t-1}$		-0.134***	
		(0.008)	
$PA_{i,t-1}$			0.406***
			(0.024)
Observations	104,128	74,733	84,988
R^2	0.036	0.042	0.040
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01.

The estimated coefficients presented in Table 2 are statistically significant and their signs are broadly in line with findings from most of the literature. The estimation results show that increases infirm's leverage *DA* (Model 1), as well as increases in long-term debt to total debt ratio *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, as expected, 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.

Significance of the crisis regime

Similar to the relevant 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 significant determinants of investment during financial crises, an interaction term is added in Equation 2.

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

where the term $Crisis_{t-1}$ 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)	
$PA_{i,t-1} \times$			0.402***
			(0.027)
$PA_{i,t-1} \times Crisis_{t-1}$			0.15
			(0.042)
Observations	104,128	74,733	84,988
R^2	0.037	0.042	0.040
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Crisis dummy takes the value 1 between 2009 and 2013 and 0 elsewhere.

As seen in Table 3, the results are mixed. 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. This is evident by the statistically significant coefficient of the multiplicative term *DA* x *Crisis*, which adds to the negative effect of firms' leverage in non-crisis times. On the other hand, 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. The authors' rationale is that having shorter debt maturity is considered beneficial during normal times; however, this reverses when the economy is in crisis period. 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 these two interaction variables (*LTR* and *PA*) are statistically insignificant and, therefore, the results should be treated with caution.

Significance of the firm's size

Another source of asymmetry in the working of the financial accelerator stems from firms' size. This is related to information asymmetries, which are more easily reduced by large compared to small firms. Thus, access to credit is limited to the latter impeding their investment growth. Moreover, large firms are expected to be more capable of accessing 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

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

where $Size_i$ is the size category of firm *i* (micro, small, medium or large; see Appendix 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	104,128	74,733	84,988
R^2	0.036	0.042	0.041
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Micro-firms are the reference group.

The results presented in Table 4 speak in favour of firm-size related asymmetry of the financial accelerator. We set the micro-sized firms as the reference group. For every balance sheet variable, the respective 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 micro-sized ones, while for profitability *PA* the (positive) link is even stronger. Interestingly, medium-sized firms' leverage interaction coefficient is also positive and statistically significant[11], indicating that leverage for this size class is also more weakly connected to their investment growth compared to that of the reference group of micro-sized firms. On the other hand, the small-sized firms' leverage *DA* interaction coefficientis small and statistically insignificant, meaning that the leverage effect of small-sized firms does not differ from the leverage effect on micro-sized firms. Another interesting finding is that, in addition to large firms, 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 are differences in the relationships between leverage, debt maturity and profitability and firms' investment behaviour across different sectors.

Significance of firm's sectoral specialisation

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

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

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 coefficient. Estimation results are reported in Table 5.

11. 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)
$DA_{i,t-1}$	-0.31		
	(0.054)		
$DA_{i,t-1} \times SectorH$	-0.186***		
	(0.067)		
$LTR_{i,t-1}$		-0.20	
		(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	104,128	74,733	84,988
R^2	0.036	0.042	0.041
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. NACE sector A are the reference group. In order to keep the table size small, only statistically significant interaction terms are presented.

The results presented in Table 5 suggest that, by and large, the relationship between firm investment and balance sheet positionexhibits some heterogeneity across different sectors. For the case of profitability *PA* (Model 3) not even a single sector exhibits statistically significant differences from the reference group – sector A. 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), while other sectors do not exhibit significant differences from the reference group. The results from Model 2 indicate that the link between debt maturity *LTR* and investment shows the widest 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)related firms, while for those from the remaining 6 sectors differences from the reference group 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 a 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 clearer when examined in respect to firms' size. In particular, large firms exhibit a less strong connection between their debt-related balance sheet positions and investment compared to micro-sized ones. Finally, results from a sectoral analysis indicate that, in general, there are insignificant differences in the aforementioned relationship across different sectors. A possible exception is associated with the role of debt maturity, which it is found to be more strongly linked to firm investment for almost half of the sectors examined.

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

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Appendix

The following passage is an English translation of the Article 55 from the 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 implementing 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:

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

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

- fewer than an average of 10 employees in a financial year;
- fewer than an average of 10 employees in a financial year;
- annual turnover under EUR 2,000,000; and
- asset value underEUR 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:

- fewer than an average of 50 employees in a financial year;
- annual turnover under EUR 8,800,000; and
- asset value under 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:

- fewer than an average of 250 employees in a financial year;
- annual turnover under EUR 35,000,000; and
- asset value under 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, or 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.