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Corporate Leverage and Investment in Portugal

João Mário F. Duque, José Henrique Gonçalves and Ana Martins

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Abstract

This analysis aims at assessing the decrease of investment induced by an increase in debt of an excessively indebted corporate sector in Portugal, testing empirically the relationship between corporate indebtedness and investment. The results show evidence of a negative relationship between firms' investment-to-capital ratio and their indebtedness over the period 2010-15. This type of relation between these variables suggests the need for companies to deleverage. Results also point to asymmetric effects beyond a certain threshold level of indebtedness, namely a debt-to-asset ratio of 45.6%, because greater access to debt can help increase investment levels, but excess leverage can reverse these benefits by raising corporate vulnerabilities. Relationship between debt and investment was also tested along firm sector to deepen the role of firm sector heterogeneity and a negative relationship was also found in the three major sectors (*Wholesale and retail, Manufacturing and Construction*).

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1. Introduction

Indebtedness of Portuguese non-financial corporations grew significantly since the accession of Portugal to the Euro Area. This is mainly the reflection of the sharp reduction in interest rates resulting from the convergence process which led to a noticeable increase in lending - an idea that is corroborated by Gebauer et. al (2017) which stands that corporate debt increased rapidly in many peripheral euro area countries in the years before the financial crises and the build-up of debt was largely driven by easy access to credit.

Following the global crisis and the sovereign debt crisis suffered by the peripheral euro area countries, the financing conditions of Portuguese companies deteriorated sharply (interest rates faced by Portuguese companies increased strongly in 2011 and 2012 and ECB Survey on the Access to Finance of Enterprises results also pointed out to a more restrictive credit offer in Portugal between 2009 and 2012) which had a recessive impact on the economy, notably through the contraction of investment.
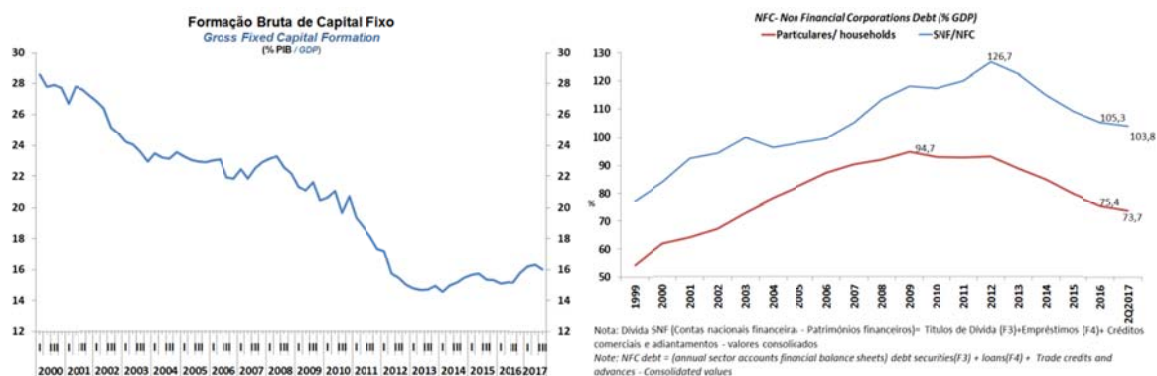
This analysis aims to be an econometric exercise that intends to assess the decrease of investment induced by the increase in corporate sector debt in Portugal, testing empirically the relationship between corporate indebtedness and investment. This objective stems from the fact that there is no agreed method of measuring over-indebtedness and the size of deleveraging needs, discussion for which we hope this study will contribute to.

Using firm-level data, our empirical results show evidence of a negative relationship between firms' investment-to-capital ratio and their indebtedness over the period 2010-15. This type of relation between these variables suggests the need for companies to deleverage.

Results also point to asymmetric effects beyond a certain threshold level of indebtedness. The reason is that greater access to debt can help increase investment levels, but excess leverage can reverse these benefits by raising corporate vulnerabilities.

This paper is organized as follows: section 2 presents the theoretical framework of the analysis, section 3 the adopted methodology, section 4 describes the data and presents the descriptive analysis, section 5 shows the empirical results and section 6 presents conclusion remarks.

2. Literature review

Assuming a world with perfect capital markets, a neoclassical approach reflecting Modigliani-Miller theorem (1958), capital structure does not affect investment decisions. However, market failures, as asymmetrical information between firms and financial intermediaries, establish a link between the corporate financial standing and investment. Firms with weak balance sheets may have limited availability of external financing and are, thus, more likely than financially healthy firms to experience large contractions in investment (Goretti and Souto, 2013).

The literature on the relationship between corporate indebtedness and investment is significant. Some authors sustain that the need to repair balance sheet weaknesses to make financing costs lower may lead to increasing savings to the detriment of investment (Myers, 1977). Similar works as Fazzari et al. (1988) provide empirical results of linkages between financial ratios and investment interpreting this as being consistent with the presence of financing constraints on the investment of firms. Also, Farinha (1995) concludes that the availability of internally generated funds affects investment decisions of firms (except for large firms), Kyotaki et al. (1997) show that increases in leverage could lower investment and Barbosa et al. (2007) found a negative relation between firms financial pressure and their investment. Also Cecchetti et. Al (2011), ECB (2013) and Kalemli Ozcan et al. (2015) point out that corporate indebtedness in euro area countries inhibits investment when debt levels are excessively high. Several other empirical studies find evidence that high corporate leverage can have negative effects on investment (such as Benito and Hernando, 2007, Martinez-Carrascal and Ferrando, 2008; Pal and Ferrando, 2010; Barbiero et al., 2016).

Other branches of the literature focus on the additional accelerating effects of sales and financial factors on investment. The latter draw attention to the aggravation of the adverse shocks to the economy made by the worsening of credit market conditions. Based on the work of Fazzari et al. (1988) and Bernanke et al. (1999), Vermeulen (2000) find evidence of a financial accelerator effect and shows that weak balance sheets tend to raise adverse shocks on firm investment. The analysis of Farinha (1995) and Barbosa et al. (2007), using a sales-accelerator specification, also show that firms financial structure affect their investment decisions.

Deepening the complexity of the relationship between indebtedness and investment, in addition to identifying the existence of a relationship between companies' balance sheet and their level of investment, some literature shows that this relationship is not linear. The rationale combines literature of the negative effect of debt on investment and some literature that identifies potentially positive effects of debt on investment, since not only debt allows to finance investment projects debt may it can also give rise to tax advantages as compared to other sources of financing (Modigliani and Miller, 1963) and it can reduce internal costs incurred from asymmetric information or conflicts of interest between shareholders and managers (Ross, 1977; Grossman and Hart, 1982). Commonly this literature stands that there is a

threshold effect. Jaeger (2003) finds leverage effects on corporate investment for Germany and the US, particularly if leverage exceeds a certain threshold. Gunduz (2004) investigates potential leverage threshold effects of Portuguese firms finding strong evidence that the firm' balance sheet composition has an impact on investment. Hernando and Martinez-Carrascal (2008) provide firm-level evidence for Spanish firms of threshold effects, indicating that a negative impact of indebtedness on investment exists only above the 75th percentile of indebtedness. Coricelli et al. (2010) identifies a threshold level of leverage (for a group of emerging European countries) beyond which further increases in leverage lower TFP growth. Cecchetti et al. (2010) based on a sample of 18 OECD countries find evidence that corporate debt becomes a drag on growth for levels beyond 90 percent of GDP. Goretti and Souto (2013) assess the drag on investment engendered by corporate sector debt overhang in periphery countries and find a negative relationship between firms' investment-to-capital ratio and their debt but also a non-linear behavior of the interaction of these two variables (finding strongly negative effects of debt on investment once the debt to equity threshold exceeds the 25th percentile). Gebauer et. al (2017) find a threshold effect on euro area periphery (that was innovative by deriving the threshold with statistical inference instead of testing it in a exogenously determined way) above a debt-to-asset ratio of 80-85 percent.

3. Methodology

We propose to empirically test the relationship between investment and corporate sector balance sheet in Portugal, in the period 2010-2015. Our analysis is based on the work by Goretti and Souto (2013) and we follow a panel-data approach to test if firms' investment decisions are affected by their financial structure. We also use a panel data approach to test for the existence of non-linearities in the relationship between investment and debt if this exceeds certain threshold levels.

The specification for our investment equation is as follows:

$$IK_{it} = \alpha + \beta IK_{it-1} + \gamma SK_{it-1} + \overline{\delta} D_{it-1} I\{D_{it-1} \geq \tau\} + \underline{\delta} D_{it-1} I\{D_{it-1} < \tau\} + \varepsilon_{it}$$

IK_{it} (Investment to Capital Ratio)

IK_{it-1} (Lagged Investment to Capital Ratio)

SK_{it-1} (Lagged Sales to Capital Ratio)

D_{it-1} (Lagged Debt)

$I = \{1 \text{ if } D_{it-1} \geq \tau; 0 \text{ if } D_{it-1} \leq \tau \}$-

i – Index firms

τ – Threshold

t – time period

The dependent variable IK is the investment-to-capital ratio (gross investment in tangible assets over tangible assets). Debt is proxied by the standard leverage measure debt to assets and also (alternatively) by ICR (Interest Coverage Ratio - EBITDA over total interest expenses), since there is no commonly agreed method to measure over-indebtedness (Gebauer et al, 2017). The specification includes the lagged sales-to-capital ratio SK (turnover over the tangible assets) to control for sales-accelerator effects.

The coefficient δ is the parameter that measures the sensitivity of the investment rate to changes in the debt variable. Rejecting the null hypothesis (δ equal to zero, underlying the perfect capital market theory) indicates that firms' investment decisions are affected by their financial structure. The coefficient sign is expected to be negative.

Since the specification of the model introduces lag of the dependent variable to control for endogeneity, the standard fixed effect estimator is inconsistent. Following Goretti and Souto (2013), in order to address this issue, we use the GMM two-step system estimator by Blundell and Bond (1998), and we apply Roodman (2003) stata module. Applying first differences to the initial specification removes the fixed effects and produces an equation that can be estimated by instrumental variables (we used lags of the independent variables as instruments).

The Generalized Method of the Moments (GMM) consists of the determination of θ (a vector of parameters to be estimated) that minimizes $\bar{g}$ (an objective function) so it estimates the parameters that better approximate this function to zero (the closer to zero this function is, the more optimized will be the vector of parameterers to be estimated). Two sets of variables that can explain the behavior of Y (in this case Investment) are considered, the first denoted by X (the dependent variables), which values can be perfectly observed, and the other defined by Z which corresponds to the instrumental variables, i.e., those which are correlated to explanatory variables of Y but which values are not easily observable.

In these assumptions, Y conditioned to X, Z and θ follow a certain statistical distribution. Usually the Gaussian is the most common. $g(Y, X, Z, \theta)$ is defined as a function (not necessarily linear) on the variables and the parameters, for which the expected value is always equal to zero as shown below:

$$E[g(Y, X, Z, \theta)] = 0$$

For the method of the moments theory, the estimator of $E[g(Y, X, Z, \theta)]$ is given by

$$\bar{g} = \frac{1}{T} \sum_{t=1}^{T} g(Y_t, X, Z, \theta)$$

Relative to the estimation of the threshold we followed the work by Girma (2005) that introduces a threshold regression approach due to Hansen (1996). We follow this methodology that consists of a minimization problem (conditioned to the significance of the parameters and signal change) solved by a grid search over the following 393 quantiles $\{1.00\%, 1.25\%, 1.50\%, ..., 98.75\%, 99\%\}$, but instead of using the conditional OLS we chose, following Hwan (2014), the GMM criterion function J given by:

$$J = T\bar{g}_T' W_T \bar{g}_T$$

Given the variable Y (Investment) observed at different moments of the time $t = 1, 2 \ldots T.$ and W_T the weighted matrix that initially equals the identity matrix (or any positive definite matrix).

Also, we allow for the threshold variable D_{it-1} to be endogenous, and develop a two-step GMM estimation. The vector (with dimension 6 – 2010 a 2015) of the sample moment conditions is given by[1]:

$$\bar{g}_n(\theta) = \frac{1}{n}\sum_{i=1}^{n} g_i(\theta)$$

The moment equation is $g_t(\theta) = x_t\big(y_t - x_t'(\theta)\big)$ and W_T is the weighted matrix that initially equals the identity matrix (or any positive definite matrix, as previously mentioned).

The one step GMM takes $W_T = I$ and computes a preliminary GMM estimate. The two-step GMM evaluates the weighting matrix several times until the estimator achieves asymptotic efficiency. Essentially, the idea of GMM is to set the vector $\bar{g}_T$ to zero for some W_T, minimizing J.

4. Data and descriptive analysis

This analysis uses INE microdata of Integrated Enterprise Accounts System (SCIE) database (information from Informação Empresarial Simplificada - IES) which collects balance sheet and financial statements from all Portuguese corporate firms in the Portuguese Economy. The analyzed period is 2010 until 2015.

One of the main benefits of using IES microdata is the possibility of capturing the heterogeneity of the different companies. It allows to analyzing not only average effects but also to perform a more detailed analysis, in which asymmetric effects on subgroups can be analyzed.

We focus on private non-financial indebted firms (self-employed individuals were excluded) and removed all firms that have less than five workers (following Barbosa and Pinho, 2016). We include firms belonging to 12 sectors (see annex for further detail) covering the primary sector, manufacturing, construction, trade and service industries. Observations that did not have positive values of debt, tangible fixed assets and interest paid were removed from the database. Observations with negative total assets or negative business turnover were also dropped. Firms that did not appear in the dataset for a minimum of three consecutive years were removed (following Barbosa et al. (2007) and Farinha (2013)). For econometric purposes (according to Farinha et al. (2013)) only firms with positive gross operating income (measured by EBITDA) were considered. This condition is necessary in order to preserve the monotonicity of the relation between the interest burden ratio and firms' financial standing - the interest burden resulting

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[1] T-Number of periods. $\bar{g}_n(\theta)$- Average of $g_t(\theta)$

from a negative operative income with a large absolute value is lower than the interest burden resulting from a negative operating income with a small absolute value.

Also, following Farinha et al. (2013), to deal with outliers and extreme variations, we excluded firms that had an increase in fixed assets of more than 500% or a decrease bigger than 75%. Furthermore, observations below (and above) the 5th (and 95th) percentile of the relevant variables were winsorized. Consequently, the data used in this study are an unbalanced panel of 118.213 observations, corresponding to 30.921 firms observed in the period between 2010 and 2015.

Summary Statistics of regression variables					
	Mean	Std. Deviation	25th Percentile	Median	75th Percentile
IK: Investment to capital ratio	0,19	0,24	0,01	0,09	0,29
SK: Sales to capital ratio	12,8	18,3	2,3	5,2	13,6
DA: Debt to asset ratio	0,28	0,17	0,13	0,26	0,40
ICR: Interest Coverege Ratio	23,3	38,2	3,3	7,6	21,4

Note: IK: Investment to capital ratio (gross investment in tangible assets over tangible assets); SK: Sales to capital ratio (turnover over tangible assets); DA: Debt to assets ratio (financial debt over total assets); ICR: Interest coverage ratio (EBITDA over total interest expenses)

This section is divided into two parts. The first one aims to present the overall behavior of the variables in study whereas the second part intents to graphically illustrate possible relationships between the hypothetical explanatory variables and the investment level.

To understand how each indicator behaves, two graphs were plotted for each variable. The first one presents the percentiles 10, 25, 75 and 90, as well as the median for time spanned between 2010 and 2015. This illustration is especially relevant when variables follow asymmetric distributions as it is known to happen with financial ratios. The second graph will consider the median by year of each variable given the size of the firm (micro, small, medium and large).

Graph 1 shows that the Portuguese firms with the 10% and 25% lower investment values tend to have almost null investment ratios. For the other percentiles it is noticeable a sharp decrease between the years of 2010 and 2012, with a slight rebound thereafter. The spread between the firms with the lower and the higher levels of investment was in 2015 narrower than it was in 2010. Graph 2 presents a slightly different picture. If in Graph 1, every type of firm had a similar decrease, Graph 2 hints that the bigger the firm, the more able it was to deal with the crisis. So much so that if in 2010 small, medium and large firms had roughly the same median level of investment, in 2015 there is a clear stratification by size.

Graph 1 - Percentiles of IK

Graph 2 - Median of IK by firm size
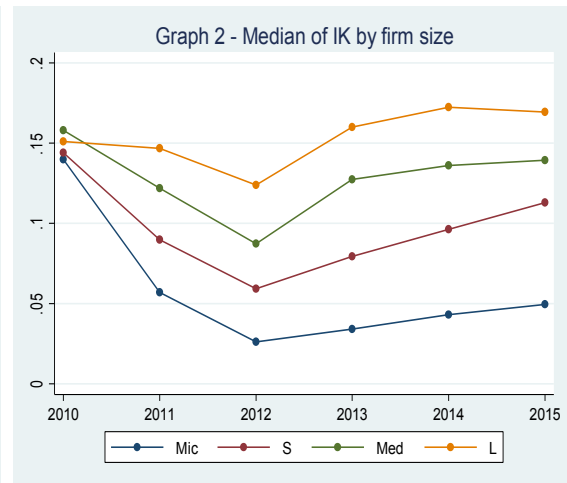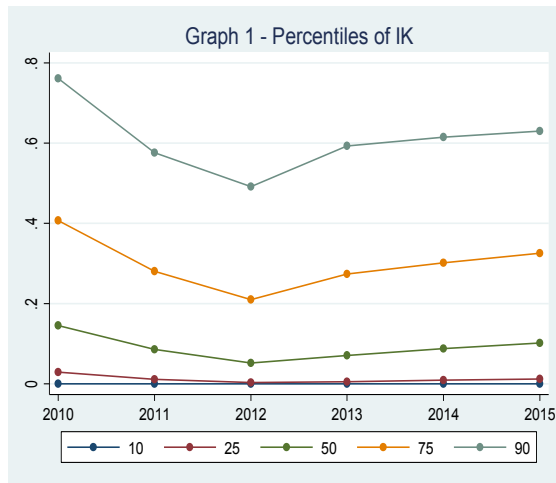
The next two pair of graphs displays the indebtedness level as measured by the debt to assets ratio. Graph 3 and 4 show the slow deleveraging of Portuguese firms, especially noticed in the latter graph. Furthermore, the latter also shows that this deleveraging was more prominent in large firms, whereas micro and small firms increased their leverage after 2013. Medium firms are also the ones with the highest values of leverage, especially when compared to all the other firm sizes that had roughly the same level of indebtedness at the end of 2015.

Graph 3 - Percentiles of DA

Graph 4 - Median of DA by firm size
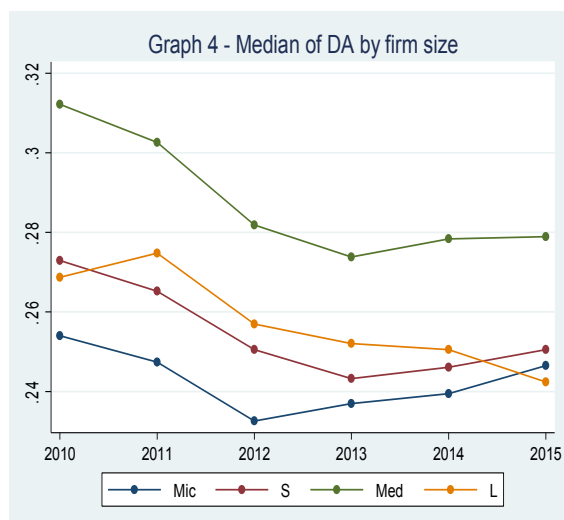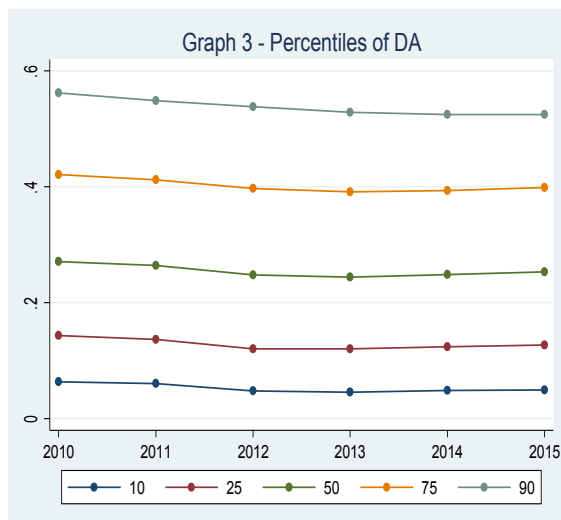
The interest coverage ratio (a complementary measure that also allows measuring debt overhang) plotted in graphs 5 and 6 also shows how the crisis has affected the economy in 2011 and 2012, having firms at that time lower results when comparing to the interest expenses. However, thereafter this ratio increased, hinting a lower level of financial pressure, possibly explained by the aforementioned

deleveraging. Even though larger firms ended with a higher interest coverage ratio in 2015, the firm size doesn't appear to be a relevant factor to determine the financial pressure incurred.
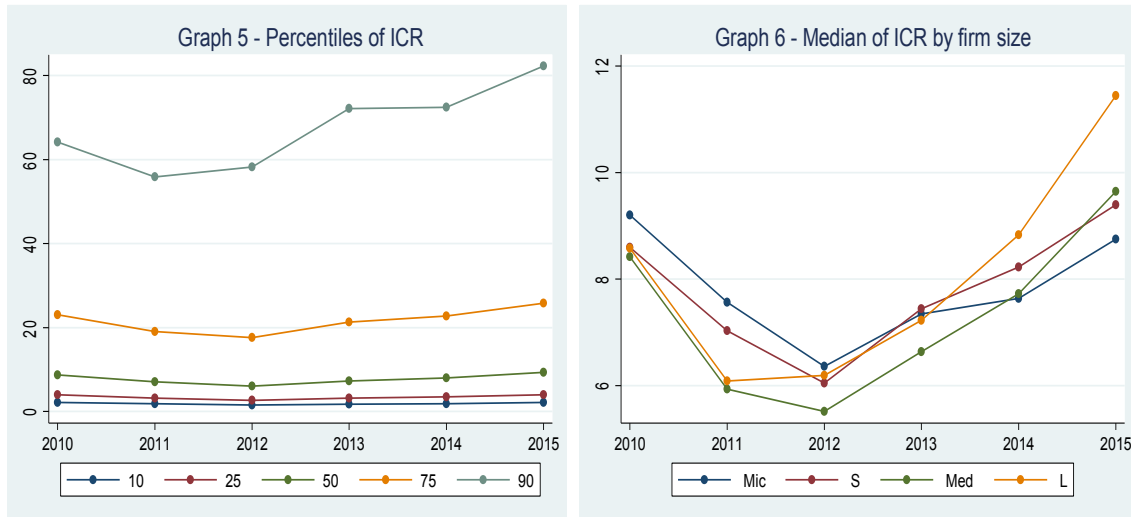
The second part of this analysis shows how the explanatory variables will affect investment. To do so, each variable was split into three groups: the low group (which comprises firms with levels below the 10th percentile of the variable), the medium group (that grouped firms with levels between the 45th and 55th percentiles) and the high group (that corresponded to firms with values higher than the 90th percentile). Afterwards, the median of investment was taken to each specific group.

Graph 7 shows that firms with lower and average levels of indebtedness level will tend to have higher levels of investment than the firms with high debt. Graph 8 presents similar results, but in this case investment is completely stratified by the ICR ratio, with lower levels of financial pressure firms (high ICR level) presenting higher levels of investment. Finally and for controlling purposes, graph 9 also indicates that sales to capital directly affect the ability of a firm to invest.

Graph 8 - IK by ICR level   Graph 9 - IK by SK level
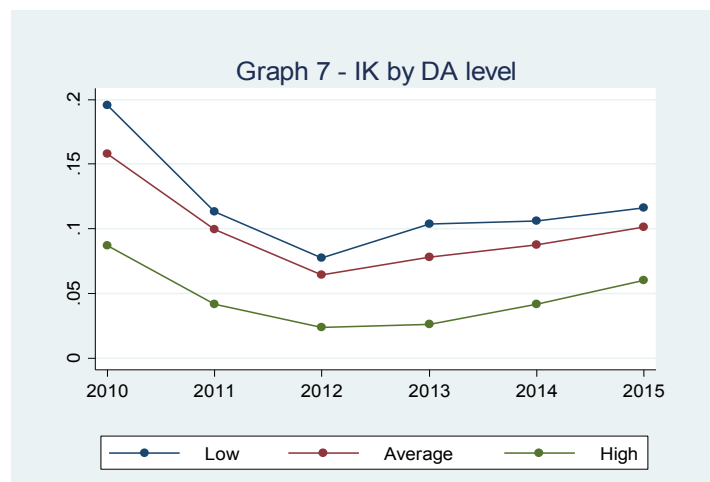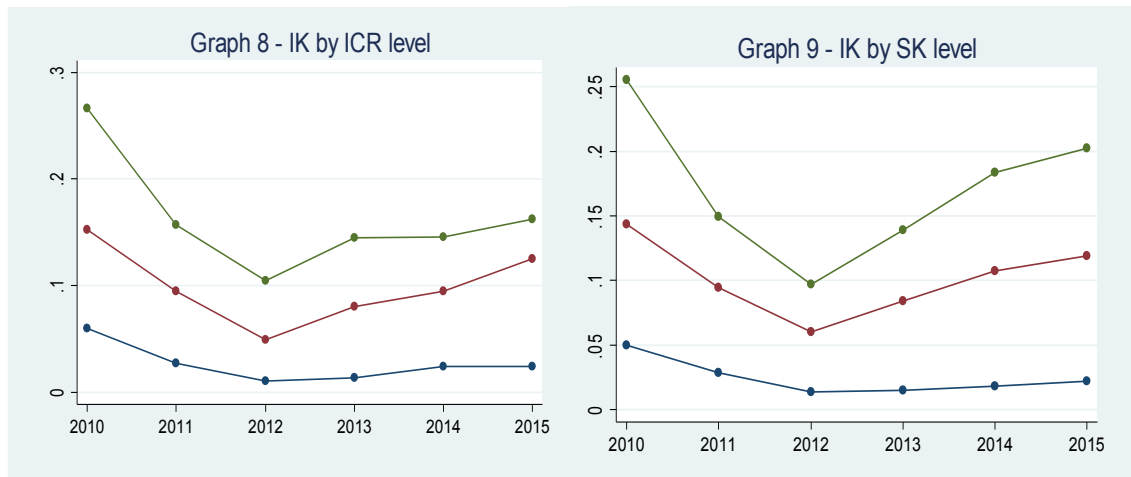
5. Results

The results confirm the existence of a negative coefficient which demonstrates the negative relation between leverage and investment. Namely, a 1 percentage point increase in company's debt to assets ratio is related to a 0,076 percentage point decline in investment (as a share of capital stock). Also as expected, sales to capital ratio have a statistically significant positive relation with investment accounting for the existence of a sales accelerator effect (although not very accentuated).

There is no evidence of second-order serial correlation of the first-differenced residuals (according to the Arellano-Bond test) and the regression passes the Hansen test of over-identifying restrictions. The absence of second order serial correlation of the Sargan test at conventional confidence levels indicate that there are no problems with the model specification and the validity of instruments used.

	D=DA	
	(1)	(2)
Constant	0,183***	0,043*
Ik_{it-1}	0,075***	0,102***
Sk_{it-1}	0,000021***	0,006***
D_{it-1}	-0,076***	
$D_{it-1}I\{D_{it-1}<\tau\}$		0,311**
$D_{it-1}I\{D_{it-1>}\tau\}$		-0,082***
AR(1) Test	-64,80***	-63,35***
AR(2) Test	0,05	1,46
Sargan Test	1373,75***	1574,77***
Hansen Test	606,73***	725,31***
Firms	30921	
Obs.	118213	

Note: Dynamic panel data with GMM two-step system estimator. ***, **, * indicates significance at 1, 5, and 10 percent level.

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As a second step, we test the existence of asymmetric effects between investment and corporate debt. We find evidence of non-linearity once the debt to asset threshold exceeds 45.6% (the 82nd percentile). The estimates suggest that for relatively low leverage levels indebtedness can support firms' investment behavior, as shown by the positive coefficient. But they also suggest there is excessive leverage in a considerable amount of firms, with 22.5 percent of firms recording leverage above the threshold.

Then we conduct further regressions along firm sector to deepen the role of firm sector heterogeneity on the type of link between leverage and investment. We show results for the three largest sectors in the sample, namely *Wholesale and retail*, *Manufacturing* and *Construction*. These sectors account for 73% of the observations in our sample.

	Wholesale and retail		Manufacturing		Construction	
	(1)	(2)	(1)	(2)	(1)	(2)
Constant	0,1499***	0,067***	0,2***	0,054**	0,24***	0,135***
Ik_{it-1}	0,0582***	0,093***	0,081***	0,115***	-0,0031	0,106***
Sk_{it-1}	,0000415**	0,004***	0,00013***	0,011***	-1,17E-06	0,004***
D_{it-1}	-0,0272		-0,151***		-0,142***	
$D_{it-1}I\{D_{it-1}<\tau\}$		0,021		0,186*		
$D_{it-1}I\{D_{it-1}>\tau\}$		-0,088		-0,354***		-0,112***
AR(1) Test	-37,12***	-38,86***	-34,96***	-36,16***	-19,78***	-23,89***
AR(2) Test	-0,33	0,5	0,2	0,63	-1,49	0,77
Sargan Test	435,50***	466,19***	420,54***	432,88***	314,20***	289,63***
Hansen Test	223,15***	228,52***	231,81***	207,76***	182,54***	145,54***
Firms	9970		8496		3904	
Obs.	38556		33845		13690	

Note: D=DA

We find a negative relationship between debt and investment in all these sectors, although there is some heterogeneity in the results. Leverage thresholds estimates for the two biggest sector (*Wholesale and retail* and *Manufacturing*) are in high percentiles (95th and 92th percentile, respectively) while that of *Construction* is found very soon in the sample (in the 5th percentile). These thresholds correspond to debt to asset values of 59.4% in case of *Wholesale and retail*, 54.4% in case of *Manufacturing* and 2.6% in the case of *Construction* (the proportion of companies that are above the threshold are 9.1%, 12.9% and 90.8% in these sectors, respectively[2]). This low threshold in *Construction* suggests a high debt overhang level of the firms across virtually the entire sector in this period.

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[2] In 2015 the proportion of companies that are above the threshold are 17.4% for the whole economy, 5.2%, 8.1% and 93.4% in *Wholesale and retail*, *Manufacturing* and *Construction* , respectively

In line with the previous conclusions, debt overhang is found to reduce investment wether proxied by debt to assets or interest coverage ratio (ICR) and we also find evidence of non-linearity if we proxy debt with ICR (Interest coverage ratio - EBITDA over total interest expenses). We find evidence of non-linearity once ICR exceeds 1,48.

	D=ICR	
	(1)	(2)
Constant	0,163***	0,130***
Ik_{it-1}	0,068***	0,076***
Sk_{it-1}	0,000023***	0,005***
D_{it-1}	0,00000016***	
$D_{it-1}I\{D_{it-1}<\tau\}$		-0,405***
$D_{it-1}I\{D_{it-1}>\tau\}$		0,0002***
AR(1) Test	-64,03***	-33,79***
AR(2) Test	-0,48	-0,79
Sargan Test	1179,03***	991,6***
Hansen Test	333,19***	482,48***
Firms	30921	
Obs.	118213	

Note: Dynamic panel data with GMM two-step system estimator. ***, **, * indicates significance at 1, 5, and 10 percent level.

6. Concluding remarks

This paper aims to assess the relationship between debt and investment in Portugal in the period between 2010 and 2015. We use firm – level data to account for this link and for possible non-linearities. Our analysis also intends to endogenously determine a debt threshold.

Our empirical results show evidence of a negative relationship between firms' investment-to-capital ratio and their indebtedness over the period 2010-15. The estimations suggest that there is a threshold in the relationship between debt and investment, and that, when debt exceeds it, it holds back investment. This level is found in the debt-to-asset ratio of 45.6%. Both the existence of a threshold and the negative relationship between debt and investment are robust to different ways of measuring debt overhang (Debt-to-assets or Interest Coverage Ratio). Thus, our results show that the constraint is not only the level of Debt-to-asset ratio but also the low capacity to service debt (measured by ICR).

However, we find evidence of heterogeneity across the major sectors. The negative impact of debt on investment is much more transversal in *Construction* as opposed to *Manufacturing*. This suggests that the deleveraging effort should be differentiated not only according to the level of indebtedness but also taking into account the sector of activity.

Overall, these results support that there is over-indebtedness in the portuguese corporate sector and suggest the need to deleverage to support more investment. However, the dimension of deleveraging needs should be differentiated according to the level of indebtedness and sector of activity. This differentiated behavior between sectors, with industry showing a more positive situation than construction (with a higher threshold and a much lower percentage of companies above it) may result from the fact that it is a more external market oriented sector, a fact that may have dampened the effects of the crisis that occurred in Portugal during the analyzed period. Also, measures such as those included in Program Capitalizar (RCM 81/2017, 8th of June 2017) also contribute positively to increased investment by contributing to the deleveraging of companies through the replacement of financial debt by capitalization.

Acknowledgements

Annex

Data Description - Sectors Used (according to NACE):

A - Agriculture, forestry and fishing

B - Mining and quarrying

C - Manufacturing

D - Electricity, gas, steam and air conditioning supply

E - Water supply, sewerage, waste management and remediation activities

F - Construction

G - Wholesale and retail trade; repair of motor vehicles and motorcycles

H - Accommodation and food service activities

I - Transportation and storage

J - Information and communication

M- Professional, scientific and technical activities

N- Administrative and support service activities

Following the criteria of Statistical classification of economic activities in the European Community (NACE):
http://ec.europa.eu/eurostat/documents/1965800/1978839/NACEREV.2INTRODUCTORYGUID
ELINESEN.pdf/f48c8a50-feb1-4227-8fe0-935b58a0a332

Description of the variables

IK: Investment to capital ratio (gross investment in tangible assets over tangible assets)

SK: Sales to capital ratio (turnover over tangible assets)

DA: Debt to assets ratio (financial debt over total assets)

ICR: Interest coverage ratio (EBITDA over total interest expenses)

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