The impact of reduced credit availability on corporate investment

An analysis of Portuguese non-financial corporations

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Abstract

The recent slowdown in bank lending may be amplifying the downturn of the Portuguese economy. A crucial question is to understand whether the decline in credit growth is associated with the supply or with the demand side of the market. The goal of this MSc thesis is twofold. Firstly, I want to understand how the Portuguese firms are dependent on external borrowing and the contribution of bank lending to fulfill the financing needs of the economy. Then, I attempt to measure the effects of disturbances in the bank lending channel on the real economy and for this purpose I analyze how corporate investment reacts to increases in firms' financing costs. I show that the economy relies heavily on external capital. Further, using microdata on firms' balance sheets and credit default swaps on Portuguese government debt to instrument shocks to the credit supply, I find some evidence that more financially constrained firms contract more their investment expenditures. Finally, I conclude by stating the importance of a stable and robust banking system for the recovery of the economy.

JEL classification: E44, G21, G31.

Keywords: Credit supply, external capital, financial frictions, investment equations.

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1. Introduction

The contribution of financial intermediation to economic growth was first acknowledged by Joseph Schumpeter in 1911, in *The Theory of Economic Development*. In his book, Schumpeter set bank credit at the core of the process of economic development: "With their help [credit means of payment], those who carry out new combinations can gain access to the existing stocks of productive means, or, as the case may be, enable those from whom they buy productive services to gain immediate access to the market for consumption goods" where "(…) the new combinations of means of production (…) may be described as the fundamental phenomenon of economic development" (Schumpeter (1911), pp. 73-74). Schumpeter's main argument was that technological innovation and economic progress could be improved with the help of financial intermediaries, who provide unique services in mobilizing savings, evaluating and monitoring projects, and in assessing and transferring risks, thereby facilitating economic activities.

The liberalization of the banking sector and the positive economic outlook in 1986, when Portugal joined the European Economic Community, motivated a rapid and sharp leverage period of the economy during the 90's and, in line with the Schumpeterian view, improved national wealth and prosperity. Nonetheless, some industries and even households and the government became excessively dependent on financial markets and relied heavily on external capital to finance their main activities. The increasing external financing needs of domestic non-financial corporations have been fulfilled mainly with bank credit, particularly with bank lending, making firms' capital expenditures extremely vulnerable to disturbances in the banking sector.

The financial shock and the ensuing recession exposed the main weaknesses in the economy, regarding the labor market, competitiveness and public finances. Consequently, the perceived market risk on sovereign creditworthiness has increased, leading to successive downgrades of the government rating notches by the main agencies in the market, and has threatened the ability of banks to raise external funds. The highly exposure of domestic banks to external borrowing, particularly to ECB liquidity, collateralized by sovereign debt, is an additional threat to the stability of the banking sector when the risk of sovereign creditworthiness increases. The increase in the sovereign credit risk has an adverse effect on banks' sovereign portfolios, increasing

the bank risk, and decreases the eligibility of the collateral provided in refinancing operations, thereby increasing the cost and reducing the availability of external funds. In parallel, the aggregate investment of the economy has declined further, enhancing an ongoing downward trend, which is jeopardizing the economic recovery and future growth perspectives.

The slow credit growth since 2009 may be reflected in a decrease in the availability of external funds and may be adversely affecting investment. A crucial question is to understand whether the decline in credit growth is associated with the supply or with the demand side of the market. Using Spanish data, Jimenéz, Ongena, Peydró and Saurina (2012) provide evidence that the strength of banks' and firms' balance sheets determines loan granting during crises. In line with Bernanke-Gertler or Kiyotaki-Moore seminal models, the decline in investment may reflect a deterioration of the net worth position of firms. A reduction in internal funds worsens their balance sheets and triggers a worsening of the financing conditions. As the financial accelerator emerges, the initial shock is amplified, provided capital market imperfections generate a burden for the cost of external capital. Conversely, the fall in investment may reflect a shortfall in the availability of external capital as given by shocks to the banks' supply of credit, even if the demand-side remains unaffected. A deterioration of banks' strength will have an adverse impact on their ability to grant new loans and, consequently, on the funding of investment through the bank lending channel. Furthermore, the impact should be larger for firms more dependent on bank loans or when financial frictions are more present.

The goal of this MSc thesis is twofold. Firstly, I want to understand how the Portuguese firms are dependent on external borrowing and the contribution of bank lending to fulfill the financing needs of the economy. Then, I attempt to measure the effects of disturbances in the bank lending channel on the economy and for this purpose I analyze how corporate investment reacts to increases in firms' financing costs. Firms' decisions have been shown to be influenced by credit supply shocks (Leary (2009)). Here, the author used the 1966 U.S. credit crunch to instrument shocks to the banking sector but focused on the capital structure of firms (particularly on the leverage policy). Instead, I exploit variations in CDS spreads on Portuguese debt to proxy changes in financing costs and to understand its impact on investment decisions. The higher CDS

spreads experienced after 2009 have been increasing the cost of external funds for domestic banks and act as general credit supply shocks, thereby increasing the relative cost of obtaining external capital for bank-dependent firms.

Firstly, I conclude that, on aggregate, the Portuguese economy relies heavily on bank credit to finance its activity and that the slowdown in lending growth, to the extent that is explained by the banks' balance sheets strength, is adding a burden on the recovery of the economy by hindering the funding sources of investment. However, the high heterogeneity at the firm-level, related to liquidity or to firm-specific financial frictions may not give a correct view of the potential problems that financial imperfections can have on investment decisions, motivating the use of microdata (at the firm-level) to control for different characteristics of firms. Using quarterly data for Portuguese non-financial corporations from the first quarter of 2005 to the third quarter of 2011 obtained through the ITENF ("Inquérito Trimestral às Empresas Não Financeiras" – a survey conducted by a partnership of the national statistics office and the Bank of Portugal to a sample of Portuguese firms), I conclude that the increase in sovereign CDS spreads is negatively correlated with corporate investment. Since the increase in CDS premium is highly correlated with other factors likely to adversely affect investment decisions, I tested whether this relationship is higher for more financially constrained firms. Using firm size, liquidity and leverage to proxy financial frictions, I further conclude that those firms faced with higher borrowing constraints, or that do not easily turn to internal funds during financial shocks, are more likely to contract more their capital expenditures.

This MSc thesis is organized as follows. In Section 2 I discuss the main literature on credit cycles, financial frictions and investment. I then describe the investment, financing needs and latest developments in the loan market in Portugal, in Sections 3 and 4. Section 5 carries out an empirical testing of the effects of credit supply shocks on corporate investment using firm-level data. Lastly, Section 6 concludes.

2. Literature review

Since Schumpeter, many empirical studies (see Levine (2005) for a review) have shown that financial markets do contribute to economic growth and development, providing some insight into the Solow residuals (the so-called Total Factor Productivity, that tries

to explain growth not due to the direct use of inputs in the production function). Nonetheless, the Schumpeterian view still received some criticisms, namely from Lucas, when he said that "the importance of financial matters is very badly over-stressed in popular and even much professional discussion" (Lucas (1988), p. 6).

The link between financial markets and growth is explored in detail in King and Levine (1993). Financial intermediaries contribute to an efficient allocation of capital, increasing the rate of capital accumulation and improving the efficiency with which the economy uses it. This mechanism works as they reduce the relative cost of external funds (relative to internally generated funds) with their services and contribute to smooth the inefficiency arising under incomplete markets, whenever external capital is not a perfect substitute of internal funds. In line with this idea, Rajan and Zingales (1998) find that industries relying heavily on internal capital to finance investment grow relatively slower in countries with less-developed financial systems (where the cost of obtaining external funds relative to internally generated funds is higher), whereas industrial sectors relying more on external funds expand relatively faster if the financial market is more developed.

The availability of external capital in general and of bank credit in particular, can be an important source of short-term fluctuations in economic activity (see Bernanke (1993) for a comprehensive review on the macroeconomic role of credit and the factors that underlie its creation process). The worsening of the borrowers' balance sheets and the associated increased costs of financial intermediation in the aftermath of the financial crash of 1929 certainly contributed to the Great Depression – Bernanke points it out clearly when states that "The effects of this credit squeeze on aggregate demand helped convert the severe but not unprecedented downturn of 1929-30 into a protracted depression" (Bernanke (1983), p. 257). Furthermore, had the central banks around the world not reacted promptly by easing the stance of monetary policy and providing unparalleled monetary stimuli after the bankruptcy of the Lehman Brothers in September 2008, the financial disruptions that followed the financial crisis of 2007-08 could have transformed the Global Crisis into a recession equivalent to or even worse than the Great Depression, since the world is much more globalized than it was in the 30's and the complex and innovative financial instruments spread around the global economy add to a wide systemic risk.

Moreover, during "normal times"[1], credit constraints are also a potential source of business cycle fluctuations. For instance, using a simple version of the neoclassical growth model in a small open economy, Kocherlakota (2000) argues that binding borrowing constraints may turn unanticipated negative shocks to income into large declines in savings and production, while Bernanke and Blinder (1988) show that investment and output react negatively to exogenous shocks to bank lending, which increase the cost of financial intermediation and reduce the expected net returns on investment. The classical papers of Bernanke and Gertler (1989, 1990) and Kiyotaki and Moore (1997) or the more recent one of Gertler and Kiyotaki (2010) endogeneize financial frictions by constraining the ability of borrowers to contract credit to be contingent on their net worth position (total assets minus total liabilities). During distress periods, borrowers' balance sheets are worsened (or, on another view, banks' balance sheets are heightened and financial intermediaries are constrained in their ability to obtain deposits and hence to give loans, as in the Gertler and Kiyotaki model) and the relative cost of external funds over internally generated funds increases, making the credit constraint more binding, which triggers a "financial accelerator" and further worsens borrowers' balance sheets, amplifying the business cycle. In this view, provided that net worth is likely to be procyclical (the solvency of borrowers increases during expansions), agency costs are expected to be countercyclical and, consequently, borrowers faced with relatively higher agency costs – small firms and consumers – are expected to contract more during economic downturns. The reduced spending, production and investment by these borrowers will worsen the economic downturn, hence the "accelerator" effect (Bernanke, Gertler and Gilchrist (1996)). On the other hand, beyond amplifying shocks to the business cycle, financial institutions may also instigate recessions: losses suffered by financial intermediaries may affect their ability to extend credit to the real economy and may depress consumption, investment and final output (see Iacoviello (2011)). Therefore, it is not surprising that the "credit creation

[1] To refer to the expression used by Martin Wolf, the chief economics commentator at the Financial Times, in "Why Obama's new tarp will fail to rescue the banks" in *Financial Times* February 10th, 2009.

process"[2] is at the center of the policy-makers agendas and is one of the main concerns to achieve a sustainable and solid economic recovery[3].

Financial frictions can be particularly important for corporate investment. On the field of financial constraints and economic activity, a common practice is to analyze investment-to-cash-flow sensitivities. Available evidence is consistent with a positive and significant correlation between investment and internal funds or net-worth and concludes that the correlation is even stronger for firms more financially constrained (see Hubbard (1998) for a review). The first noteworthy contribution to this debate is attributed to the work of Fazzari et al (1988), who find higher investment-to-cash-flow sensitivities in more financially constrained firms, holding constant investment opportunities, suggesting that the sensitivity of investment to cash flow is a useful measure of financial constraints (resulting in a large wedge between the costs of internal and external funds). More recent work has also been in line with these findings, as Almeida and Campello (2007), Almeida, Campello and Galvao Jr. (2010) or Gan (2007). This view has, however, been criticized by some authors: for instance, Kaplan and Zingales (1997) find the opposite relationship, that less financially constrained firms exhibit higher investment-cash flow sensitivities. Cleary, Povel and Raith (2007) try to solve this apparent paradox, arguing that firms' optimal investment is U-shaped, that is, a decrease in internal funds leads to a decrease in investment only when internal funds are sufficiently high and the cost effect (the marginal cost of external borrowing) is dominating the revenue effect of additional investment.

Another branch of the literature shows that more externally-dependent firms perform worse during banking and financial crises and that such differences do not pertain in recessions not caused by disruptions in the financial system, adding evidence of the existence of a credit channel through which credit affects the real economy. For instance, Braun and Larrain (2005) study the behavior of the production index, whereas Dell' Ariccia, Detragiache and Rajan (2008) look at gross value added, capital formation and the number of establishments. Furthermore, Kroszner, Laeven and Klingebiel (2007) find that more externally-dependent sectors contract more during

[2] Described by Bernanke (1993) as the "process by which, in exchange for paper claims, the savings of specific individuals or firms are made available for the use of other individuals or firms".
[3] See "Crédito às empresas foi tema central do exame da troika," in *Jornal de Negócios online*, February 28th, 2012.

banking crises in countries with more advanced financial systems than in countries with less-developed financial systems, even when controlling for the country's development, and that these sectors obtain relatively more external capital and grow faster in countries with more-developed financial systems during "normal" periods.

Additionally, proxying financial markets access with firm size, Gertler and Gilchrist (1994) present evidence on the business cycle of small and large firms for the U.S. manufacturing sector and find that small firms contract substantially more relative to large firms after a monetary policy tightening. This differential behavior arises because small firms, given their characteristics (financial intermediation costs are higher for younger firms, firms more exposed to idiosyncratic risk[4] and firms with lower assets' value, displaying more binding collateral-constraints – in the U.S. economy, these are indicators strongly correlated with small firms), have less access to capital markets and rely more on intermediary credit. Large firms, conversely, are more able to use direct credit, as equity or public debt and are less affected by reductions in bank credit. Furthermore, Chari, Christiano and Kehoe (2007) argue that this differential behavior between small and large firms only arises after monetary contractions; actually, there is no evidence that small firms contract more in recessions, consistent with the idea that small firms are hurt disproportionately more after monetary tightening because they have less access to capital markets.

3. National investment

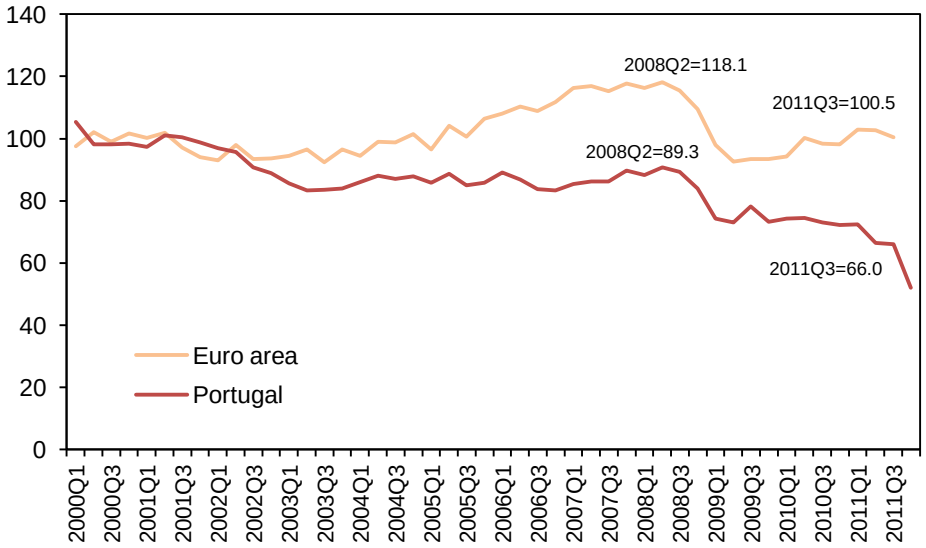
Investment is a central determinant of economic growth. Above and beyond contributing directly to an increase in the stock of national wealth, capital expenditures designed to improve the productive capacity can have a large and highly significant impact on the potential growth of an economy.

During the last decade, Portuguese real investment has been decreasing and has even initiated a sharp contraction in the last quarter of 2008. Figure 1 plots the real gross capital formation (gross investment) of the total economy for Portugal and the Euro area between the first quarter of 2000 and the last quarter of 2011, normalized by

[4] Idiosyncratic risk affects only specific securities, is opposed to the risk that affects the overall market. It can be virtually eliminated with portfolio diversification. Hence, it is likely to affect small firms in a disproportionate way.

the average investment in 2000. For instance, in the last quarter of 2011, the Portuguese economy invested roughly 33% less than the average investment in 2000, while the investment in the Euro area was approximately the same as in the beginning of that decade. In Portugal, the last quarter of 2011 was marked by an even sharper contraction in investment, as the economy struggles against austerity.

Figure 1 – Real gross capital formation, 2000=100



Sources: INE, European Central Bank and Eurostat. Investment is deflated with the GDP deflator Euro area 17 (fixed composition)

When we look at investment by unit produced, to control for fluctuations in the business cycle, the fall in investment is even more markedly: aggregate investment declined sharply from 0.29€ in the first quarter of 2000 to only 0.14€ in the last quarter of 2011. Although the ratio of investment-to-GDP contracted sharply in 2011, the financial crisis of 2008 and the European sovereign debt crisis of 2011 that triggered the subsequent worsening of firms' balance sheets, were only partly responsible for the decline in investment, as the negative trend was already on pace. A (slowly) increasing output associated with a constant nominal investment contributed to the decrease in the ratio up to 2008; however, the burst of the crisis triggered a decline in the decisions to invest and the fall of investment was greater than the decline in output in the years following.

The lack of investment in productive assets is one of the Portuguese structural problems. Economic agents have been decreasing their investments and have preferred investing in construction relatively to intangible assets or machinery that would foster an increase in national productivity and would contribute to an increase in the potential growth of the economy. The economy has plunged into a stationary path with zero growth since the beginning of the last decade – between 2001 and 2010, the total growth of real Gross Domestic Product *per capita* was only 0.7%[5] – and is now deeply depressed, still looking for the recovery path. A way out of this stationary trend can arrive through the reallocation of national savings. Therefore, it is of the utmost importance to change the incentives for investment, creating the necessary conditions and providing all the financial and infra-structural support for Portuguese firms and households to invest more and in more productive assets.

In particular, investment is fundamental to determine the rate of technological progress. Neoclassical growth models attribute the rate of economic progress to the rate of technological progress: the Solow-Swan model explicitly attributes growth in *per capita* GDP to changes in the level of technology (particularly, growth is measured by the growth rate of the labor-augmenting technological progress); in the Ramsey-Cass-Koopmans model, savings are endogeneized but long-run growth is still pinned down by technology oriented to turn workers more effective. Consequently, successful investment policies designed to improve a nations' human capital or capital expenditures intended to improve the technology in physical capital have a positive effect on the medium-to-long-run growth of an economy.

4. Financing needs and the role of bank credit

4.1 Some history

The last decade of the 20th century was marked by a rapid expansion in the Portuguese credit market. After 1986, when Portugal jointed the European Economic Community, some efforts were taken to liberalize the economy in the context of a commitment to a

[5]International Monetary Fund, World Economic Outlook Database, April 2012.

European Monetary Union. The liberalization of the credit market was in line with this framework.

Following the revolution of April 25th, 1974, the financial system was nationalized and several boundaries to interest rates and credit granted were imposed. In 1984 the government took the first steps towards the liberalization of the sector, by allowing private activity. However, only 5 years later, under the reprivatization process of the economy, the banking activity was transferred to private management: for instance, the share of credit granted to the economy by the public sector declined from 95.9% in 1984 to 83.9% in 1989 and to only 23.4% in 1997.[6]

Notwithstanding, only in 1992 the free competition in the sector was guaranteed with the end of fixed interest rates, after which the price of credit was defined by each bank, not subject to administrative controls, and with the end of upper boundaries on the amount of credit that banks could grant to the economy. The increased competition in the sector resulted in lower nominal interests on bank loans and in a better monitoring and classification of individuals according to their credit risk, as well as in better and more sophisticated strategies to attract new customers.

Considering all these factors, real other monetary and financial institutions' outstanding loans[7] (OMFI loans) expanded sharply since 1995: loans to households increased 400% while loans to non-financial corporations more than tripled (using the GDP deflator). The rapid expansion of loans in the end of the 20th century was also determined by factors on the demand-side of loans: the positive economic outlook of the time and the lower price of credit (both nominal and real, as interest rates on loans declined relatively more than the price level during that period) boosted aggregate demand for credit. The Portuguese "Great Moderation" of steady growth, low inflation and declining interest rates may have been, in parallel with the liberalization of the banking sector, the main reason for the credit expansion during this period.

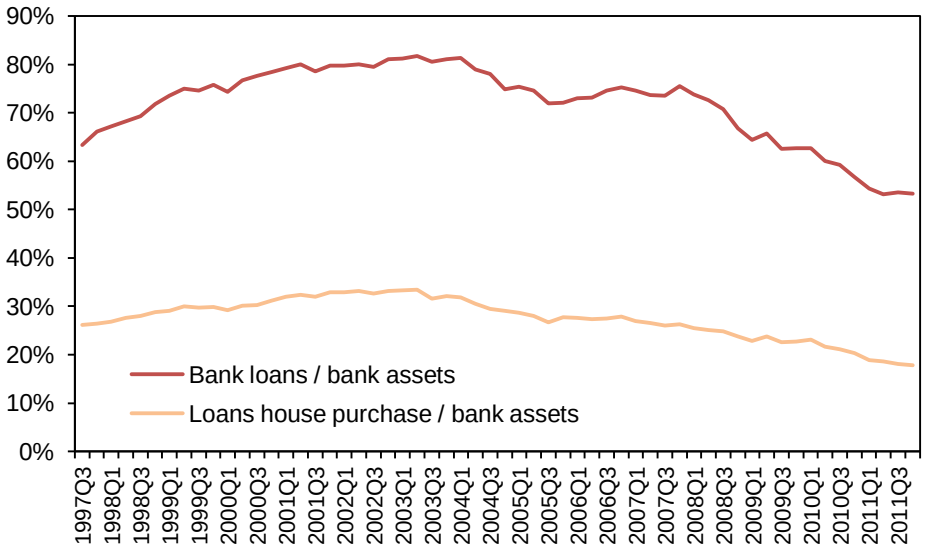
The easy access to bank credit was surely behind the increase in the economy's net borrowing position. Overall, capital expenditures (gross investment) have been

[6] See the 1997 annual report of the bank of Portugal for more details.

[7] Non-monetary financial institutions loans have also expanded in this period, but still do represent a small share of the credit market and are not able to affect significantly the real economy. The development of the market for securities certainly gave a significant contribution for economic progress; however, bank credit is the main external source of capital to finance investment, while securities financed only 1.6% of investment in 2010 ("Inquérito de Conjuntura ao Investimento", INE April 2011). Hence, I will center on the analysis of bank intermediation throughout the current work.

exceeding internal funds (gross savings), generating a persistent net borrowing position of the Portuguese economic agents at least since 1999, which has been fulfilled in part with bank loans. Bank loans are the main activity of banks in the country – in figure 2 I plot total bank loans (excluding OMFI loans) and housing loans relative to banks' assets[8] and we immediately see the importance of bank lending on banking activity. In fact, total bank loans and loans for house purchase relative to banks' assets averaged 75% and 29%, respectively, in the last 11 years.

Figure 2 – Relative share of loans on bank activity



Source: Banco de Portugal. Total banks' assets calculated through the sum of assets vis-à-vis monetary financial institutions, other financial intermediaries and financial auxiliaries, insurance corporations and pension funds, general government, non-financial corporations and households.

4.2 The importance of financial market access

The Portuguese firms have been, on average, extremely dependent on financial markets to finance their activity. A close look at the quarterly accounts of non-financial corporations released by the national statistics office (INE – Instituto Nacional de Estatística) reveals that, at least since 1999 (the first year for which this series is available online), the aggregate position of the Portuguese corporations is weak, i.e., domestic firms on aggregate are never able to finance capital expenditures with

[8] Total banks' assets calculated through the sum of assets vis-à-vis monetary financial institutions, other financial intermediaries and financial auxiliaries, insurance corporations and pension funds, general government, non-financial corporations and households.

internally generated funds. A measure of financial market dependence may be given by the financial market constraint (Chari (2012)) calculated through:

$$1 - \frac{1}{T}\sum_{t=1}^{T} \frac{\min\left(IF_t, I_t\right)}{\mathrm{I_t}} \quad ,$$

where IF_tstands for internal funds and I_t denotes investment (capital expenditures), both in period t. The index strikes at 0.46 in the Portuguese data (well above the 0.15 value found for the Euro area), meaning that, if firms have had no access to external funds (and given that they cannot retain distributed earning), investment would have fallen by 46% (in a fairly simple exercise). These calculations give an idea of the importance of financial markets for the typical Portuguese firm and for the Portuguese economy. However, they also give an idea of the risks the economy faces during economic downturns that constrain borrowing ability. If, for some reason, credit granted to the economy falls, a persistent high dependence on external funds can pose a serious threat to the Portuguese stability and strength.

The annual reports of the national statistics office release data at an industry-level (the latest refers to the year of 2009) for non-financial corporations and allowed me to construct a measure of financial dependence for each industry, after collecting data for every year (although only years 2007-2009 can be compared, as the classification of industries has changed in 2007), reported in table 1. I computed two similar indexes for each sector's financial dependence. In the first, shown in columns (2) – (4), I am using the difference between capital expenditures and available funds divided by capital expenditures. However, firms may decide to not retain distributed income; in this case, their financial dependence index has to be proxied by the excess of capital expenditures to internal funds (which are given by the difference between available funds and distributed earnings) relative to capital expenditures, i.e., this second index is equivalent to adding distributed earning to the first one, shown in columns (5)-(7).

When we look at the second measure of financial dependence, in which firms decide to distribute profits, only 6 industries – agriculture, forestry and fishing; mining and quarrying; manufacturing; construction; wholesale, sewerage, waste management and remediation activities; and information and communication – are able to finance its

capital expenditures with internal funds. On the other hand, some industries have shown a persistent need to raise external funds, as is the case of transportation and storage, real estate or education.

Table 1 – Financial dependence by industry

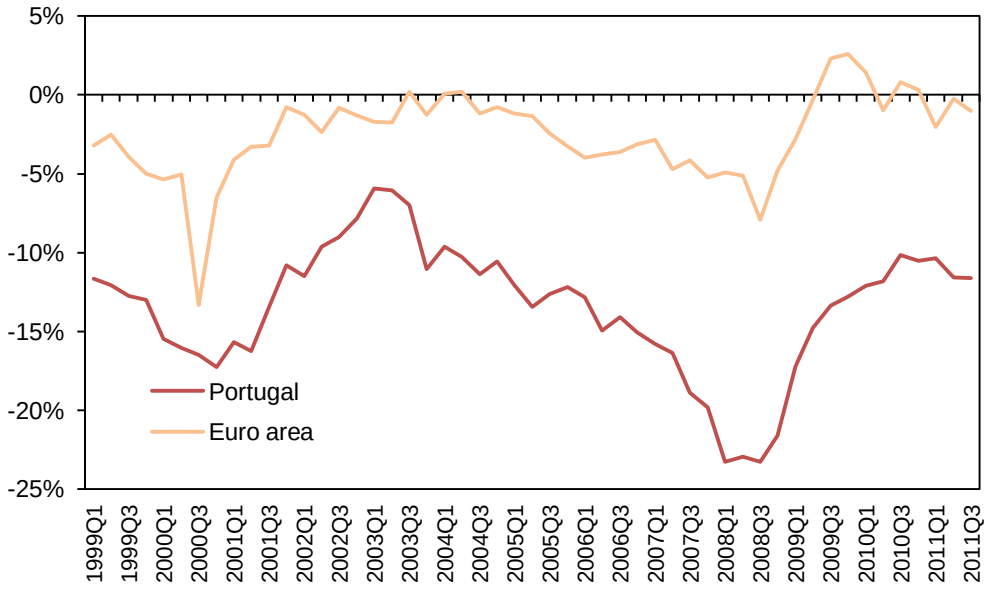
Industry	Financial dependence [a)]			Financial dependence [b)]		
	2007	2008	2009	2007	2008	2009
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture, forestry and fishing	-60.7%	81.3%	23.8%	-59.9%	81.3%	24.4%
Mining and quarrying	-68.8%	35.7%	-35.1%	-65.2%	38.2%	-30.2%
Manufacturing	-76.9%	-20.0%	-14.8%	-47.2%	3.1%	16.1%
Electricity, gas, steam and air-conditioning supply	-8.4%	-0.7%	6.9%	21.7%	24.8%	27.8%
Water, sewerage, waste management and remediation activities	51.4%	41.4%	44.0%	55.7%	48.0%	49.8%
Construction	-24.5%	41.6%	18.8%	-11.4%	55.7%	32.5%
Wholesale and retail trade, repair of motor vehicles and motorcycles	-61.0%	0.8%	-3.3%	-18.2%	28.7%	26.9%
Transportation and storage	32.8%	46.4%	26.5%	49.7%	65.2%	46.0%
Accommodation and food service activities	56.2%	76.3%	75.3%	59.2%	81.2%	78.4%
Information and communication	-54.7%	-61.1%	-63.8%	-20.5%	-16.9%	-8.5%
Real estate activities	57.3%	89.2%	67.4%	69.5%	103.1%	78.4%
Professional, scientific and technical activities	-23.2%	-110.7%	-42.8%	17.5%	-76.7%	0.3%
Administrative and support service activities	-10.6%	12.7%	-204.2%	6.5%	24.5%	-146.6%
Education	30.9%	28.7%	15.5%	37.7%	32.9%	20.0%
Human health and social work activities	29.2%	11.7%	38.8%	44.8%	32.8%	46.4%
Arts, entertainment and recreation	22.9%	77.0%	39.0%	25.3%	78.6%	42.3%
Other services activities	64.1%	80.4%	60.1%	66.4%	82.8%	64.2%
Total	-10.7%	11.7%	5.3%	12.6%	32.5%	29.2%

Source: INE. Industries classified according to the European national accounts of the Eurostat for non-financial corporations. a) Calculated as: (capital expenditures – available funds) / capital expenditures. b) Calculated as: (capital expenditures – internal funds) / capital expenditures

In 2008, the relative decrease in internal funds due to the deterioration in the economic outlook, common to almost all industries, aggravated the financing needs of non-financial corporations. The following year, the decline in capital expenditures smoothed firms' financial dependence, but even so some sectors remained highly dependent on external capital.

The difference between internal funds and capital expenditures gives the net lending (if positive) or net borrowing (if the difference is negative) position of firms. Figure 3 plots the net lending / borrowing of non-financial corporations relative to gross value added for Portugal and for the Euro area in the last decade. The differential behavior of Portuguese and Euro area firms is enormous. Indeed, while Portuguese non-financial firms have always displayed a net borrowing position, the average Euro area firms managed to gain a lender position in some (albeit few) quarters. Furthermore, the average net borrowing of Portuguese firms was higher than the worst-borrowing-position of the Euro area corporations in the period covered (13.5% and 13.0%, respectively).

Figure 3 – Net lending (+) or borrowing (-) of non-financial corporations relative to gross value added



Sources: INE, ECB. Data seasonally adjusted.

In table 2 I report the results of firms' investment surveys conducted by the INE ("Inquéritos de Conjuntura ao Investimento"). As expected, the major share of

investment is funded with firms' internally generated funds while government loans and bonds and shares only residually contribute to investment expenditures. Nonetheless, the main point worth stressing here is the relative weight of bank credit, which covered more than 25% of total expenses with investment in the pre-crisis years. This picture changes slightly in the recent years, particularly in 2010, when firms funded more than 75% of their investment with internal funds. The relative share of bank credit is falling, which raises concerns on the ability of firms to find alternative ways to finance investment and raises the question of whether the decline in credit can affect the demand for investment and exacerbate the fall in aggregate output of the economy.

Table 2 – Sources of investment funding (%)

	Internal funds	Bank credit	Bonds and shares	Government loans	E.U. funds	Other
2012 [a)]	65.2	18.7	0.3	0.5	3.3	12.0
2011 [b)]	59.1	25.7	0.3	0.4	4.9	9.6
2010	77.6	13.3	0.0	1.9	0.1	7.1
2009	54.5	26.1	1.4	1.0	1.7	15.3
2008	53.7	29.4	0.8	0.2	2.2	13.6
2007	57.0	26.9	0.3	0.2	2.9	12.7
2006	55.7	29.0	1.1	0.5	3.9	9.8
2005	58.0	29.6	0.0	1.3	4.3	6.8
2004	54.6	31.1	0.1	1.3	4.5	8.4
2003	57.0	29.1	0.5	2.3	4.7	6.5

Source: "Inquéritos de conjuntura ao investimento", INE. a) First estimate. b) Second estimate.

In this section, I showed how dependent the economy is on financial markets. In particular, bank credit has a preponderant role in the composition of external borrowing, higher for small firms. Large firms are more able to find alternative ways of funding, such as corporate bonds and shares, and do not rely so heavily on bank credit. The recent decline in outstanding credit granted to non-financial corporations is alarming, particularly for firms relying more on external funds. Although it is very difficult to predict whether the fall in outstanding credit is reflecting a lower banks' willingness to lend or a weak demand for loans, we can with great confidence state that banks can be amplifying the ongoing recession by curtailing credit that would be used to finance

investment (or even to increase the survival period of many firms). In the next section I describe the main recent trends in the loan market.

4.3 Recent developments in the market for bank loans

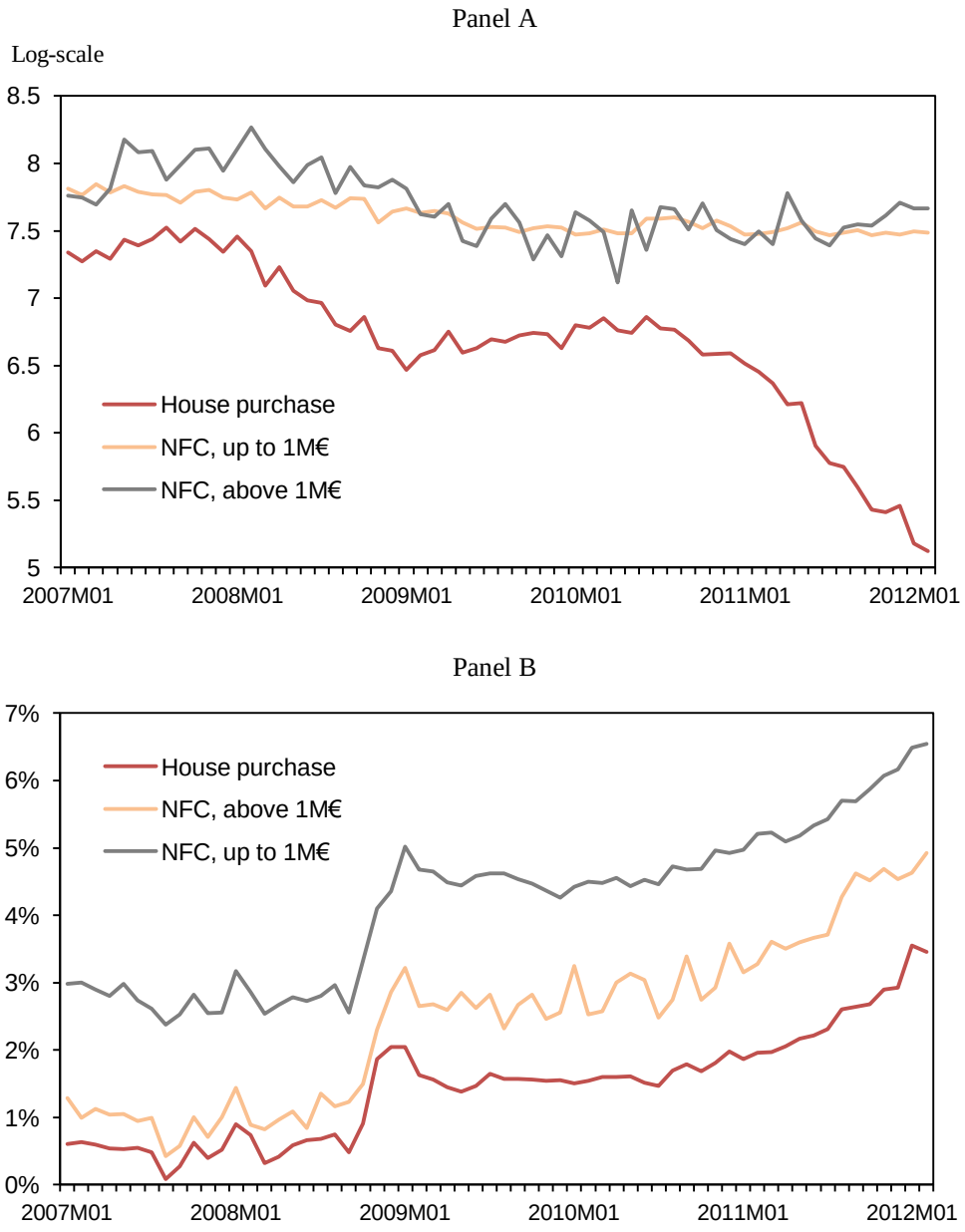
The turbulent summer of 2007 in the U.S. economy disrupted the financial system and triggered a downward spiral over the global economy. The financial crash that followed the crisis in the subprime mortgage market drove some financial institutions into bankruptcy and endangered many others; moreover, the exposure of international investors to mortgage backed securities originated with U.S. subprime loans generated spillover effects to the Western economies and the crisis which was initially limited to the U.S. suddenly had global implications. An analysis of the market for loans is important to understand the real effects of the financial shock, as it takes into account the interaction of money suppliers and economic agents.

Bank loans are determined by an equilibrium between the supply-side of the market and the demand-side – loans are supplied by monetary and financial institutions, whose main activity is to provide financial intermediation between savers and borrowers, and are demanded by households and non-financial corporations (other monetary and financial institutions can also demand loans from each others, although such loans are mainly short-term, usually oriented to fulfill temporary liquidity needs). Thus, a fall in outstanding loans can be justified either by a fall in supply or by a fall in demand (or both).

The financial sector in Portugal did not experience major problems in 2007. Its banking sector remained solid for a longer period and continued its activity without major interferences. The first signals for concern emerged in the beginning of 2008, when new loans granted[9] started falling relative to previous periods – see figure 4, panel A. While this decline is more visible in the market of loans for house purchase, at the same time new loans to non-financial corporations also started a downward trend.

[9] Data only available for new loans granted to all euro area residents.

Figure 4 - New loans granted and loan interest rates



Source: Banco de Portugal. Note: data seasonally adjusted. Panel A: new loans granted to euro area residents. Panel B: spreads between interest rates on new loans granted by other monetary financial institutions resident in Portugal and the 3-month Euribor. NFC stands for non-financial corporations.-

The spreads between loan rates and the 3-month Euribor rose substantially after the collapse of the Lehman Brothers in September 2008 (figure 4 – panel B). The increase in the spreads reflects a fall in money market rates, consequent on the decision of the European Central Bank to decrease the main refinancing operations rate, but also reflect an increase in the rate that banks charge to its customers. Indeed, loan rates charged in

loans to small and medium enterprises in Portugal (average of 8.06% in February 2012) are the highest of the Euro area, even above the price on loans charged in Greece (7.94%) or Ireland (6.01%)[10]. The increase in the cost associated with the service of debt will be a burden on the ability of these firms to access external funds and can be reflected in a fall in investment spending.

Non-performing loans rose substantially since the beginning of the crisis, confirming banks' reasons for concern on borrowers' default. The increase in non-performing loans and in defaulting loans was greater for small and medium enterprises, which is one of the reasons behind the high loan rates charged on these firms. Notwithstanding, the increased spreads may instead be a reflection of the worsening of banks' balance sheets and may not be related to the demand-side. In addition, the uncertainty associated with turbulent periods is also reflected in the increased cost of financial intermediation. Asymmetric information is likely to increase, leading to higher agency costs. Good projects are hardly distinguished from riskier projects and banks may curtail credit even to projects with positive net present value.

The decline in new loans granted may be crucial for investment expenditures of non-financial corporations, particularly for firms whose internally generated funds are insufficient to cover all the desired expenditures and require external capital. Therefore, it is important to understand the role of this decline on investment. Particularly, investment may be falling simply because the crisis worsened balance sheets and firms are forced to cut back capital expenditures; alternatively, firms may desire to invest but are not able to raise external capital to fund its projects as banks are less willing to lend, charging a higher price for credit (higher interests and collateral or lower loan maturities). In this case, some firms may be hurt not by their low competitiveness, but rather because banks are curtailing credit even to viable firms.

In fact, the number of firms stating that obtaining bank credit is a main factor limiting investment rose from 9.9% in 2006 to 29.2% in 2011; and the number of firms reporting difficulties in raising bank credit as the main factor limiting investment increased from 2.7% in 2006 to 11.2% in 2011 ("Inquéritos de Conjuntura ao Investimento", INE). These numbers are suggestive of a real effect of bank lending on real economic activity, holding constant desired investment and firms' internal funds.

[10] See "PME Portuguesas estão a pagar o crédito mais caro da zona euro", in *Diário Económico* April 4th, 2012.

In the next sections I will use firm-level data to get a closer view of the potential effects of the lending slowdown in corporate investment. Starting by describing the main determinants of investment decisions, I then study how it reacts to shocks to credit supply.

5. Firm-level evidence

5.1 From macro to micro data

The aggregate financing needs and investment of the economy may not give a correct view of the potential problems that financial imperfections can have on investment decisions, i.e., the former analysis only provides a superficial idea of the importance of financial market access for investment. Particularly, by looking at aggregate data, it is not possible to predict whether a firm is decreasing its investment simply as a result of a decrease in investment opportunities or a fall in internally generated funds or whether the firm is cutting back its capital expenditures because it lost access to external funds. Furthermore, the assumption of a representative firm does not allow researchers to understand why investment differs across firms and how likely it is that a shock to financial markets triggers a different reaction between firms.

There is a higher heterogeneity among firms, related to liquidity, productivity and financial constraints, that is determinant to the demand for investment. Such differences can only be captured using micro-level or firm-level data. Furthermore, with data on firms' balance sheets, one can control for changes in individual internal funds and growth opportunities to predict whether fluctuations in investment are associated with reduced availability of external capital or with weaker balance sheets.

5.2 Modeling investment

Each firm's investment decision is a function of liquidity and investment opportunities. For example, Fazzari, Hubbard and Petersen (1988), trying to explain the behavior of financial frictions on corporate investment, run regressions of the type:

$$(I/K)_{i,t} = f(\frac{X}{K})_{i,t} + g(\frac{CF}{K})_{i,t} + u_{i,t},$$

where $I_{i,t}$ denotes investment in plant and equipment for firm i during period t; $K_{i,t}$ is the book value of capital stock in the beginning of period t; the functions $f(\frac{X}{K})_{i,t}$ and $g(\frac{CF}{K})_{i,t}$ are functions of variables to control for investment opportunities and cash flow from firms' operations (used to measure internal liquidity), respectively, for each firm in every period; and $u_{i,t}$ is an error term to capture all factors that affect investment not related to investment opportunities or to the availability of internal funds.

The most widely used proxy for investment opportunities in investment equations is the Tobin's Q (Fazzari, Hubbard and Petersen (1988); Almeida and Campello (2007) or Gan (2007)), defined as the market value of assets over the replacement value of assets[11]. However, there is no agreement on the literature that Q's value is a good proxy for investment growth opportunities, as its construction relies on the market value of debt (not often publicly traded) and given that the book value of assets does not necessarily coincide with the replacement value. Nonetheless, Adam and Goyal (2008) compare the performance of this and three other commonly used proxy variables for investment opportunities: the market-to-book equity ratio; the earnings-price ratio; and the ratio of capital expenditures to net plant property and equipment at the beginning of the period. They conclude that Tobins' Q is the proxy for investment opportunities that performs better, although it is not flawless.

The finding of higher investment-to-cash-flow sensitivities for more financially constrained firms may provide a good argument in favor of using cash flows to proxy future investment opportunities. The majority of the above cited literature on financial frictions states that in periods when profits and the associated operating cash flows increase, the net worth position of firms rises and the cost of obtaining external funds falls, allowing firms to invest more. However, the increase in profits (and in cash flows) may forecast higher investment opportunities that the firm would not have with lower internal funds. In this case, the excess sensitivity of investment to cash flow is not only attributed to financial imperfections but reflects also growth opportunities for investment (e.g., see Gilchrist and Himmelberg(1995)).

[11] The market value of a company is computed by external investors regarding future economic outlook, including future investment opportunities. Thus, a higher market value relative to the replacement value of assets is a forward looking measure for firms' growth and investment.

It should now be clear that the decision to invest cannot be analyzed at a macro or aggregate level. Since it relies on a combination of firm-specific factors, as liquidity and investment opportunities, it should be carefully examined using firm-level data.

5.3 Hypothesis and empirical methodology

The motivation for the current work relies on the assumption that a firm's financial status is crucial for real investment decisions, as opposed to the perfect-information world of Modigliani and Miller (1958), where real firms' decisions are independent of its financial structure, such as availability of internal funds or leverage. In perfect capital markets, the debt structure of the firm is irrelevant, provided that internal funds are perfect substitutes of external capital, and the sensitivity of investment to cash flow should not differ across firms.

Modigliani and Miller results do not apply to the real world, as there is a cost disadvantage of external relative to internal capital, motivated by asymmetric information or agency costs between the lender and the borrower. In this case, the availability of internal funds is likely to affect investment spending and the cost advantage of internal funds is higher the higher is the cost of raising external capital relative to internally generated funds.

The definition of financially constrained firm should be clear. The definition employed by Cleary (1999) is doubtless: "a firm is classified as financially constrained if the cost or availability of external funds precludes the company from making an investment it would have chosen to make had internal funds been available". Or, the other way around, a firm is financially unconstrained if it has unrestricted access to any amount of external capital. If capital market imperfections lead to an increase in the relative cost of external funds, firms will miss attractive growth opportunities and invest less that its first-best optimum.

Some firms are more financially constrained than others, and this is the reason that may motivate different investment reactions to shocks on the credit supply. During periods of distress, when banks are curtailing credit to the economy, more financially constrained firms struggle harder to obtain new loans (the price of credit should increase disproportionately to these firms) and should cut more their investment expenditures, given that the change from external to internal finance is costly. In the next section I

describe in more detail the reasons that motivate different reactions of investment to reduced credit availability and provide examples of the commonly used proxies to measure financial constraints.

5.3.1 Differential effects

During any economic downturn, credit is not expected to fall proportionately to all agents. Instead, it should decline more to borrowers faced with higher agency costs or with weaker balance sheets. In particular, following an adverse shock to the economy, credit flights to borrowers more solvent and more likely to be less hurt – there is a "flight to quality" (Bernanke, Gertler and Gilchrist (1996)); thus, borrowers more credit constrained (or more financially constrained) should contract earlier in the downturn and should shrink sharply. A firm is more financially constrained than another if 1) it requires more external capital or 2) if it has a greater cost disadvantage of external funds. However, there is no general agreement in the literature on the best proxies for financial constraints.

My main hypothesis and motivation for this MSc thesis is that banks can have real effects on economic activity. To test this hypothesis, I will try to perceive the impact of credit supply shocks on corporate investment, motivated by the idea that a negative shock to the ability of banks to borrow in money markets is reflected in a tightening of bank credit to households and firms. Or, in other words, I want to investigate whether a shock to the sources of firm funding, reflected in a great cost disadvantage of external funds over internal funds, affects real investment decisions.

However, the finding of a negative effect of credit supply shocks on corporate investment may not truthfully constitute evidence on the existence of a bank lending channel having real effects on the economy. The declining investment may be associated with factors not related to the reduction in credit availability. If these other factors (e.g., a fall in firms' profits stemming from a contraction in aggregate demand) are somehow correlated with shocks to the credit supply, then a negative relationship between credit curtailing and declining investment naturally emerges.

Therefore, to see the impact of bank lending on economic activity, we have to look at differential responses to adverse macroeconomic shocks. If bank lending is a determinant source of funding for investment, borrowers' reaction to the shock should

be stronger the larger are the constraints on the ability to contract new loans or the heavier is the reliance on credit, i.e., shocks on credit supply should have a greater impact on firms more financially constrained. With this idea in mind, I will test for the presence of a differential effect of credit supply shocks using three alternative approaches for sorting firms according to their financial status, as described below.

Firm size. Small firms are typically younger and less known, they do not have much of a track record nor reveal information in a detailed way, and generally present weaker balance sheets or higher idiosyncratic risk, which results in larger information asymmetries between these firms and potential public investors. Consequently, small firms can rarely borrow in public capital markets and find bank relationships more valuable (e.g., Petersen and Rajan (1994)), making them more vulnerable to credit supply shocks. Conversely, large firms should be less affected by a decrease in credit availability since they can easily turn to public capital markets. In order to use firm size as a proxy for financial frictions, each period I rank firms based on their number of workers, which is strongly correlated with firms' sales: large firms must have more than 250 workers, small firms must have less than or exactly 50 workers while medium firms are all others[12].

Leverage policy. Highly-leveraged firms should struggle more to repay old debts and to find good profitability opportunities when the burden of debt becomes too high. In periods of distress, these firms are under increasing pressure due to the high costs associated with debt and are expected to contract more than low-leveraged firms. Consequently, the risk of insolvency and bankruptcy is higher and firms might find it more difficult to obtain external capital; therefore leverage should be a good proxy for financial constraints, particularly when the economy is in a downturn. I proxy firm's leverage in every period by outstanding bank debt divided by the sum of outstanding bank debt and equity. Financially constrained firms are those in the top of the distribution.

[12] Note that the official classification of firm size matches the number of workers with annual revenues. However, constructing a variable for annual sales would require firms to enter the sample all quarters per year, and that would exclude many firms from my sample. Nevertheless, workers alone are a good proxy for firm size, as workers and annual revenues are strongly correlated (correlation of 0.57 in my data for 4885 firm-year observations).

Liquidity. A similar criterion is obtained using liquidity to proxy firms' independence of external capital. The presence and severity of financial constraints should be inverse to liquidity as firms with more liquid assets should be less affected by shocks on banks' credit supply and make use of their assets to offset the decline in the availability of credit. Hence, the last proxy for financial frictions is calculated through the ratio of cash holdings-to-capital stock. Contrasting to the previous case, more financial constrained firms are those in the bottom of the distribution.

Table 3 reports Pearson's correlation coefficients for the three alternative proxies for financial constraints and the respective *p*-values. The correlation's coefficients range from -0.16 to -0.06 and all are statistically significant at the 1-percent level. These values imply that I am not picking up the same information with the alternative proxies, i.e., each variable is measuring unique information regarding financial frictions.

Table 3 – Correlations of financial constraints criteria

	Financial constraint criteria		
	Size	Leverage policy	Liquidity
Size	1		
(*p*-value)			
Leverage policy	-0.0783	1	
(*p*-value)	(0.00)		
Liquidity	-0.1582	-0.0621	1
(*p*-value)	(0.00)	(0.00)	

See the text for the definitions of the criteria used to proxy financial constraints. The proxy for liquidity in this table was calculated with K^{*m} (see the "Data description" Section or Appendix A.1). Pearson's correlation coefficient estimates are reported with significance levels in parenthesis below.

One issue that may still be unclear is the difference between demanded (or desired) investment and the effective (or realized) investment, and what is the role of financial frictions over this gap. The next section deals with this question.

5.3.2 Demanded vs. effective investment

Optimal desired investment is the investment that maximizes firm$i$'s value for a given stock of initial capital[13]:

$$V(K_{i,t}) = \max E_0\{\sum_{t=0}^{\infty} \beta^t \left[\pi(K_{i,t}) - C(I_{i,t}, K_{i,t}) - p_t I_{it}\right]\}$$

subject to the capital accumulation constraint:

$$K_{i,t+1} = I_{i,t} + (1 - \delta_i)K_{i,t}$$

The value of firm i in each period t is defined as the maximum expected value of future profits derived from the existing sock of capital minus the cost associated with the investment given by the relative price p_t of investment and minus the cost of adjusting the current capital stock $C(I_{i,t}, K_{i,t})$ to incorporate the new stock of capital given by investment spending – this should not be critical for the problem, although you might consider as an example the case of a firm that invests in a new software and has to adjust all its computers so they can run it. This definition already incorporates the role of internal liquidity and the expected net return of future investment (measured by expected future profits associated with available capital stock), assuming that the price of investment is equal to all firms. The investment resulting from the first-order conditions for the problem corresponds to the desired investment.

However, when internal funds are not enough to cover desired capital expenditures, firms have to raise external funds. Provided that external funds are imperfect substitutes of the low-cost internally generated cash flows, there will be an extra term adding to the price of investment, reflecting the cost of raising external capital. There is no reason to assume a firm-constant cost, as the cost of obtaining external funds, beyond being a function of the lender's ability to supply funds, may further depend on firm-fixed characteristics, as its current leverage, its net worth position or the likelihood with which the firm and the lender do not have the same information regarding the solvency

[13] I am closely following the notation used in Hubbard (1998), albeit in a simpler version (ignoring exogenous shocks to profits and to the cost-adjustment function).

of the firm or regarding the desired investment project (i.e., whether there is asymmetrical information between the firm and the lender). Therefore, investment is also a function of the unobserved ability to raise external capital. I say unobserved since, although we can idealize that some firms have easier access to external capital, there is no direct and countable measure for that.

When the price of investment becomes too high, as when the cost of obtaining external funds increases above the expected return on investment (and hence the net expected return will be negative), the firm may find that is optimal to delay its investment plans. The increase in the cost of external capital and in turn in the price of investment may be associated with shocks on the lenders' capacity to borrow or to supply its own funds or with the aggravation of firm characteristics that result in a greater wedge between external and internal cost of funds. In these cases, effective investment will be smaller than the desired investment (and can actually be zero).

Summarizing, the equilibrium investment results from the interaction of the demand for investment with the firm's ability to obtain external funds. Hence, it is not possible to measure desired capital expenditures that did not take place due to the increased cost of obtaining external capital, as we only observe the equilibrium outcome. Then, in order to overcome this identification problem and estimate the real effects of the bank lending slowdown, I will allow investment to react differently to credit supply shocks in firms classified according to their financial status. The finding of a differential effect would be sufficient *per se* to recognize the adverse effects of the reduced credit availability on the real economy.

5.4 Using credit default swaps to instrument credit supply shocks

Thus far I have been describing financial imperfections and how firms differing in their access to financial markets may react differently to shocks on credit supply, but have focused little on describing these shocks. Briefly, anything that alters the normal circulation of bank lending may be considered a shock on bank intermediation and is likely to directly affect real economic activity through the lending channel. An increase in the perceived risk of sovereign creditworthiness is likely to result in higher associated costs and lower availability of bank funding, threatening the strength of banks' balance sheets, who in turn are forced to curtail credit granted to the economy.

The financial crisis and the consequent global economic downturn in 2008 endangered the fiscal sustainability of public accounts across advanced economies, including Portugal. During 2009-11, the Portuguese budget deficit and public debt soared reflecting the effects of automatic stabilizers and the fiscal stimuli provided to the real economy to mitigate the ensuing recession. Furthermore, the crisis unveiled the country's main weaknesses in the labor market, competitiveness and public finance, triggering the ongoing sovereign debt crisis.

There has been a clear change in the composition of banks' liabilities. The share of deposits and short-term wholesale debt has been decreasing, contrasting with an increase in the relative weight of European Central Bank funding (see BIS (2011)). The central bank's role of "lender of last resort" has mitigated an aggressive contraction of banks' balance sheets and has prevented a credit crunch. This shift in the composition of banks' liabilities towards central bank liquidity has reflected an increase in the costs of alternative ways of funding. For instance, the average interest rate on retail deposits rose in 2010 – reflecting an increased competition for bank deposits so that banks can strengthen their balance sheets and meet the core Tier I capital ratio[14] of 9% by 2011 and 10% from 2012 onwards, as agreed in the memorandum of understanding established with the ECB and the IMF – and forced the central bank of Portugal to set up a ceiling on the rates bank can offer.

The perceived sovereign creditworthiness was engendered, resulting in successive credit rating downgrades by the three main rating agencies in the market – Fitch, Moody's and Standard & Poor's. The deterioration in sovereign creditworthiness was strongly correlated with bank risk and adversely affected banks' funding costs, acting as shocks on the ability of credit to grant new loans. Two fundamental mechanisms emerge: a direct effect of sovereign risk on banks' portfolios; and an indirect effect via the collateral channel, as I will describe later in this section.

First, there is a direct effect stemming from increases in sovereign risk on banks' sovereign portfolios, to the extent that external investors are concerned with the strength of banks' balance sheets. The numbers of the BIS report are elucidative of national banks' exposure to Portuguese sovereign securities – almost 60% of total banks' equity.

[14] Defined as the ratio of core capital to risk-weighted assets, thereby providing a measure of bank risk.

The deterioration in sovereign creditworthiness entails a greater risk to banks more exposed to public debt, with adverse effects on their ability to raise external funds.

Secondly, there is an indirect affect arising trough the collateral channel: banks often borrow against government bonds, that is, they provide sovereign securities as collateral to obtain liquidity from central banks, from private repo markets[15] or to issue covered bonds[16]. Therefore, an increase in the market expected probability of sovereign default triggers a fall in the eligibility of the collateral and jeopardize banks' funding capacity. In some cases, public bonds are only eligible as collateral if rated above junk-grade – due to this criterion, the ECB decided to relax in July 2011 its collateral requirements of investment-grade rating by a major agency to continue accepting government bonds of the peripheral countries in exchange for ECB loans.

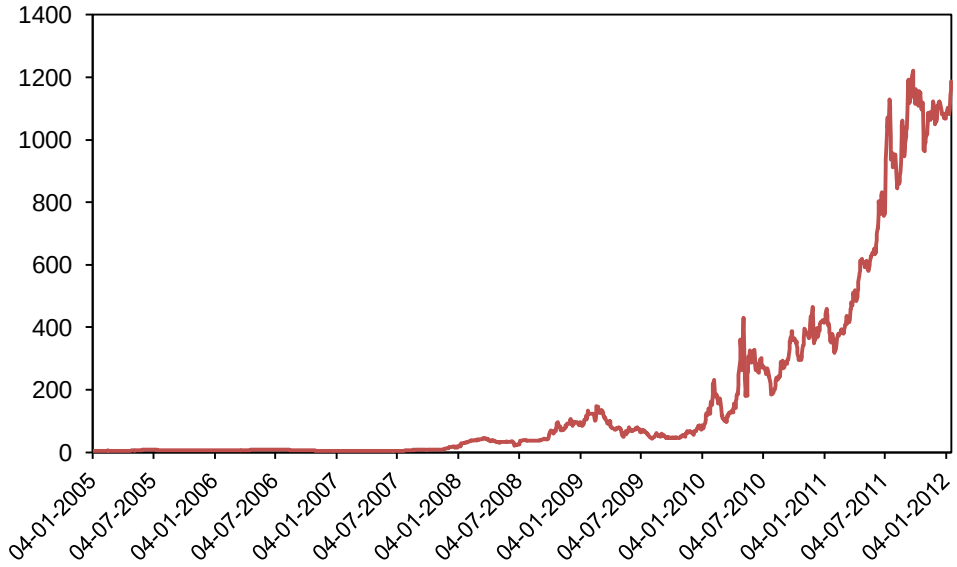
I will use Credit Default Swaps (CDS) premium on government bonds to proxy the deterioration in sovereign creditworthiness. CDS are financial derivatives specific of the issuer that provide the buyer with insurance against the risk of default of fixed income products. The buyer pays the seller regular payments (the spreads) and in exchange receives a payoff in the case of default – there is a swap in the risk of default of the insured security from the holder of the security to the seller of the CDS. Consequently, an increase in sovereign CDS premium reflects a higher probability of default, which is associated with a higher sovereign risk.

The idea underlying this reasoning is simple: an increase in the price that government bond holders have to pay to get protected reflects an increase in the perceived risk of sovereign default which in turn directly affects banks' ability to borrow in money markets through the mechanisms stated above. Furthermore, increases in sovereign CDS spreads are closely linked to rating downgrades of government debt (e.g., Furceri and Gomes (2011)), which in turn may likely anticipate rating downgrades of banks and cause banks to pay higher spreads for their borrowing, as national banks' ratings do not generally exceed its sovereign rating. In the last two years, sovereign CDS experienced a pronounced increase, starting in the end of 2008 with the burst of the financial crisis, as shown in figure 5.

[15] In private repo markets securities are exchanged for cash loans, with a commitment to repurchase ("repo") the security at a future date.

[16] In the case of covered bonds issuance, the bond is secured by the collateral when the originator defaults or becomes insolvent.

Figure 5 – Credit default swaps for the Portuguese government, Euro



Source: Bloomberg. Credit default swaps for 5.year senior government bonds.

5.5 Model specification

In line with the literature on financial frictions and investment, I will use a linearization of the investment equation presented in Section 5.2 as my baseline regression, as follows:

$$\left(\frac{I}{K}\right)_{i,t+1} = \alpha_i + \beta_1 \left(\frac{CF}{K}\right)_{i,t} + \beta_2 \left(\frac{cash}{K}\right)_{i,t} + \gamma \log\left(CDS\right)_{\mathrm{t}} + quarter \times industry\ dummies + \varepsilon_{i,t}$$

Investment is measured by capital expenditures (if positive) or capital cutbacks (if negative) during period t and $K_{i,t}$ denotes the beginning-of-period capital stock; CF and $cash$ stand for operating cash flow generated between periods $t-1$ and t [17] and for deposits and cash holdings available in period t, respectively. The term α_i captures all firm-fixed effects that do not vary with time, as location, industry (this is the main reason why I did not allow firms to change industries, as under this hypothesis I am able to remove industry-specific effects that are associated with firms and held constant over time), the probability of firm i being selected to answer the ITENF survey (see next

[17] Due to data limitations on taxes and on depreciation, I was only able to get a proxy for cash flows from operations. I defined this proxy as the difference between sales and all operating costs (cost items of goods sold and materials consumed, provisions and external services used in the production process).

section) or firms' time-invariant technology – all these firm-fixed effects will be consistently removed with fixed effects estimation. Seasonal effects are controlled by the interaction of quarterly and industry dummies: with this specification I am controlling for all seasonality, even if the seasonal effects differ across industries.

The addition of cash holdings to the baseline regression, when most of the empirical work on corporate investment use only operating cash flows, is consistent with the findings of Denis and Sibilkov (2010), who argue that cash holdings can be valuable when cash flows are insufficient to meet firms' demand for capital expenditures. Consequently, cash holdings constitute an additional independent source of investment funding and should be included to control for internal liquidity. In table 4 I plot Pearson's correlation coefficient between cash and operating cash flows and I find that the correlation is higher for more financially constrained firms, supporting the view that constrained firms are more likely to save cash out of cash flow from operations to mitigate the adverse effects of financial frictions (Almeida, Campello and Weisback (2004)). Cash-cash flow correlations range from 0.02 to 0.47, indicating that cash holdings contain more information than the change in cash flows, even for more financially constrained firms.

Some measure for investment opportunities, as Tobin's Q, would be important to include in the regression, to control sources of differential investment rates. However, the majority of national firms is not publicly traded and it is not possible to construct any measure based on the market value. Consequently, my model lacks the existence of a control for future investment growth.

Table 4 – Correlations of operating cash flows and cash for the alternative proxies for financial constraints

	Size		
	Small firms	Medium firms	Large firms
Pearson's correlation	0.1022	0.0200	0.0787
P-value	(0.00)	(0.13)	(0.00)
	Leverage policy		
	0-25 percentiles	25-75 percentiles	75-100 percentiles
Pearson's correlation	0.0925	0.0463	0.2493
P-value	(0.00)	(0.00)	(0.00)
	Liquidity		
	0-25 percentiles	25-75 percentiles	75-100 percentiles
Pearson's correlation	0.4178	0.4661	0.0158
P-value	(0.00)	(0.00)	(0.30)

See the text for the definitions of the criteria used to proxy financial constraints. The proxy for liquidity in this table was calculated with K^{*m} (see the "Data description" Section or Appendix A.1). Pearson's correlation coefficient estimates are reported with significance levels in parenthesis below. Regarding the leverage and liquidity financial constraints criteria, firms are sorted by the referred percentiles of the distribution of these variables.

5.6 Data description

I will be using a sample of a dataset consisting of quarterly information spanned from the first quarter of 2005 to the third quarter of 2011 on non-financial corporations' balance sheets matched with the Central Credit Register (CRC in Portuguese). The CRC is a database managed by the Bank of Portugal consisting of information reported by institutions extending credit on firms' credit records, including credit granted and potential credit liabilities representing irrevocable commitments (lines of credit). Data on firms' balance sheets is obtained through mandatory surveys (ITENF – "Inquérito Trimestral às Empresas Não Financeiras") conducted by a partnership of the national statistics office and the central Bank of Portugal to a selected sample of all Portuguese non-financial firms (hence, I am using a sample from a sample of all firms). The consistency of data is subject to the potential criticism that managers may not truthfully report information on the firm balance sheet. However, I do not find misreporting as a serious problem for the reason that the surveys are mandatory and because managers can be held responsible if information is found to be misreported. Data for sovereign

CDS is for 5-year Portuguese government bonds (historical monthly-close – Euro), downloaded from Bloomberg.

Requiring firms to provide observations for the whole period of my sample would have undoubted advantages in terms of consistency and stability of the data. However, imposing this rule would raise enormous survivorship biases. Instead, I only require that firms report information on two consecutive quarters to enter my sample (this comes from the definition of the model). This may lead to obvious biases when comparing different firms, although the use of firm-level variables mitigates the biases.

Since I do not have data for capital expenditures, I calculated investment by subtracting the capital stock in t to the capital stock in $t+1$ (the capital stock is calculated by the sum of tangible and intangible assets). With this definition for investment, I am ignoring depreciation (indirectly assuming it to be 0) and I am allowing (net) investment to be negative, as in cases where firms sell part of the existing stock of capital. Of course that the analysis of gross investment would be more revealing of financial frictions, as in some situations internal funds may even be insufficient to replace depreciated capital. However, data for depreciated capital appears with too many missing values in the database and I do not find useful to assume depreciation rates, as they may diverge a lot even within industries, depending on firms' characteristics, as the level of technology. Therefore, I will ignore depreciation and interpret all the results on the basis of net investment.

In 2010, the Portuguese government changed the national accounting system, replacing the old Official Chart of Accounts (POC) by the new Accounting Standardization System (SNC), in order to synchronize the national accounting standards with those of the European Union. Reflecting this change, the stock of tangible and intangible assets declined sharply from the last quarter of 2009 to the first quarter of 2010 without any economic fundamental, just motivated by the new accounting rules. Consequently, the capital stock as I am measuring it cannot be compared in the two periods of the sample (before and after 2010Q1). The simplest and reckless solution to this problem would be to ignore the period 2010-2011, but by doing that I would be removing the principal period of credit rationing from the sample. Instead, I propose two ways to adjust the capital stock as measured by the new system to the old method, described in detail in Appendix A.1. Simply put, one assumes that all

the capital that is no longer counted either in the tangibles or in tangibles grows at the same rate of the capital stored in these two accounts from 2010Q1 onwards - $K_{i,t}^{*m}$; while the other assumes that the capital no longer counted in tangibles or intangibles does not grow - $K_{i,t}^{*a}$. I dropped all observations where the capital stock is 0.

Some firms have changed industry during the period covered. To control for this effect I assumed that the industry where each firm is in is a time-invariant decision, or, in other words, I set every firm to belong throughout the sample to the last observed industry.

In order to minimize the numerous missing observations in my database, I assumed that: firms reporting sales but missing on services provided do not provide services, and vice-versa; firms reporting tangible assets but missing on intangibles do not have intangibles and the other way around; and that reserves' value for firms reporting equity and missing on reserves is 0, and vice-versa (equity is broadly defined as equity plus reserves). This procedure greatly reduced the non-response bias and does not seem implausible: it is reasonable to assume that a firm with a large amount of sales and not reporting services provided either: just sells goods and do not provide services, or did not separate sales from services in the answers given in the reports (and the same for tangible and intangible assets and for equity and reserves).

The final sample consists of 1410 non-financial corporations from 2005Q1 to 2011Q3: 831 small firms, 477 medium firms and 268 large firms, which corresponds to a share of large firms of approximately 17%. This result suggests that my sample is biased towards large corporations, since according to the last report on Portuguese firms released by the INE (referring to the year 2009) the share of large firms corresponded to only 0.8% of the total firms in Portugal.

Table 5 presents firm sample statistics according to the alternative financial constraint criteria. The mean investment rate is increasing with leverage and policy, consistent with the idea that firms with more available funds invest more. Cash flows and cash holdings (relative to the stock of capital) are higher for small firms, providing evidence that cash is more important for these firms since they are less able to raise external capital. However, cash holdings are higher for low-leverage firms – these firms are less exposed to bank debt and rely more on internal funds. The finding of higher cash holdings for more liquid firms comes from the sorting of firms into this criterion.

Table 5 – Sample statistics according to the financial constraint criterion

	Financial constraint criteria		
	Size		
	Small firms	Medium firms	Large firms
Investment rate	0.015	0.012	0.016
	(0.090)	(0.084)	(0.079)
Operating cash flow	0.052	0.031	0.035
	(0.196)	(0.138)	(0.122)
Cash holdings	0.341	0.138	0.118
	(0.468)	(0.292)	(0.255)
	Leverage Policy		
	0-25 percentiles	25-75 percentiles	75-100 percentiles
Investment rate	0.009	0.014	0.02
	(0.086)	(0.080)	(0.094)
Operating cash flow	0.048	0.041	0.033
	(0.189)	(0.149)	(0.162)
Cash holdings	0.363	0.185	0.154
	(0.482)	(0.343)	(0.323)
	Liquidity		
	0-25 percentiles	25-75 percentiles	75-100 percentiles
Investment rate	0.011	0.013	0.020
	(0.078)	(0.079)	(0.103)
Operating cash flow	0.022	0.030	0.082
	(0.094)	(0.131)	(0.246)
Cash holdings	0.004	0.069	0.746
	(0.003)	(0.054)	(0.473)

See the text for the definition of financial constraints. Investment rate defined as the growth rate of the capital stock from period t to $t+1$ and censored to 1- and 99-percent of the distribution. Operating cash flow and cash holdings scaled by capital stock in period t and censored to 5- and 95-percent. Capital stock adjusted to the SNC-accounting system by using K^{*m}(see Appendix A.1).

5.7 Results

The results for my baseline regression are reported in table 6[18]. Cash holdings are statistically significant even at the 1-percent level and, as expected, the coefficient

[18] In this table I reported the findings for the two methods used to adjust the capital stock. However, for sake of simplicity and space, I will only report the results for K^{*m} from now onwards. The statistical

associated with credit default swaps is negative and very significant: on average, it is expected that a 10% increase in sovereign CDS spreads reduces the investment rate by 0.041-0.046 percentage points, holding constant internal funds. Apparently, this result may seem economically insignificant, but remembering from table 5 that the mean investment rate for the (sampled) economy ranges from 0.009 (0.9%) to 0.020 (2%), the impact of the increase in CDS premium appears quite significant[19].

Table 6 – Baseline results

Dependent Variable	Adjusted capital stock used	
$Investment\ rate_{t+1}$	K^{*m}	K^{*a}
$Operating\ CF_t$	0.011*	0.008
	(0.006)	(0.005)
$Cash_t$	0.033***	0.027***
	(0.006)	(0.005)
$logCDS_t$	-0.456***	-0.405***
	(0.074)	(0.051)
Fixed effects	Yes	Yes
R^2	0.024	0.026
N	15,660	15,660

Notes: ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Quarterly * industry dummies included but not reported for simplicity. Operating cash flows and cash holdings were censored to the 5- and 95-percentiles of the distributions; investment only censored to the 1- and 99- percentiles. All variables scaled by capital stock are multiplied by 100. Standard errors in parenthesis are robust for heteroskedasticity.

In the baseline regression I am assuming that firm-fixed effects are not orthogonal to the regressors. If, for instance, firm fixed characteristics are uncorrelated with cash flows or cash holdings, then a model with random effects instead of fixed effects would generate more efficient estimates and would be more appropriate. In table 7 I report the

significance of the results remains the same. In the "Main limitations" Section I describe in more detail the main differences between the two methods.

[19] The results remain robust when I censor the variables used to 1- and to 10-percent in each tail of the distribution.

coefficients resulting from two separate regressions, one with fixed effects and the other with random effects. The impact of the increased sovereign risk, given by increases in sovereign CDS, is smaller when assuming orthogonality between firm-random characteristics and the regressors. However, the p-value for the Hausman specification test (0.00) rejects random effects as consistent even at the 1-percent level, confirming the model with fixed effects is more appropriate.

Table 7 – Hausman-specification test

Dependent Variable $Investment\ rate_{t+1}$	Firm fixed effects	Random effects
$Operating\ CF_t$	0.011**	0.015***
	(0.005)	(0.004)
$Cash_t$	0.033***	0.012***
	(0.004)	(0.002)
$logCDS_t$	-0.456***	-0.368***
	(0.055)	(0.049)
R^2	0.024	0.020
N	15,660	15,660
Hausman statistic = 136.72		
Pvalue = 0.0000		

Notes: ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Quarterly dummies * industry dummies included but not reported for simplicity. Operating cash flows and cash holdings were censored to the 5- and 95-percentiles of the distributions; investment only censored to the 1- and 99-percentiles. All variables scaled by capital stock are multiplied by 100. Capital stock adjusted to the SNC-accounting system by using K^{*m} (see Appendix A.1). Conventional standard errors in parenthesis.

As mentioned previously, this result does not directly point to the conclusion that bank lending has real effects on economic activity, as increases in sovereign CDS premium may be certainly capturing more effects than shocks on credit supply. This is the reason that motivates separate regressions for firms sorted on *a priori* proxies for financial constraints. Only if we find a stronger impact for more financially constrained firms we find evidence on real effects of financial frictions.

More interesting results are reported in tables 8-10. Each table contains the coefficients on cash flows, cash holdings and sovereign CDS for separate regressions, according to the alternative criteria for financial frictions. I also include in the last column the estimated coefficients from a differences-in-differences (DiD) regression, which consists in one regression for all firms adding as regressors interaction terms between sovereign CDS and the groups subject to the differential effects. This regression allows testing the statistical significance of investment reactions to shocks to credit supply across the financial status of firms.

In table 8, using size to proxy financial frictions, we see that the investment of firms assumed to be *a priori* more financial constrained – small and medium firms – react more to cash holdings, providing evidence that these firms are indeed less able to raise external capital and are more sensitive to fluctuations in internal funds. More interestingly for the purpose of the current work, when the perceived risk of sovereign creditworthiness increases, motivating a contraction in banks' credit supply, small and medium firms are those registering a sharper decline in capital expenditures, holding constant cash flows and cash holdings. The fall in large firms' investment rate is less pronounced and only significant at a 5-percent level. This result is consistent with the hypothesis that the bank lending channel can have real effects on the economy: those firms that are less likely to obtain external financing contract relatively more after a tightening of bank credit. The results obtained with the DiD estimation support this economic intuition albeit are statistically weak (the DiD estimator is only significant at the 1-percent level to medium firms, indicating that only the decline of these firms' investment is statistically significant relative to the fall in large firms' investment – given by the coefficient on CDS alone – after increases in sovereign CDS spreads).

Two mechanisms may be are underlying these findings: first, a decline in banks' willingness to lend may not be proportional to all borrowers. Actually, banks may be changing their relative preference for borrowers, increasing the share of loans granted to large firms, that display more repayment guarantees and exhibit higher net worth, and might be decreasing loans granted to small and medium firms, as the probability of repayment is lower. Furthermore, even if banks' credit curtailing is proportional to all firms, the investment of large firms may be less affected as these firms are more able to

raise external funds in alternative markets, e.g. by issuing bonds and shares, and should be less constrained by a decline in bank lending.

Table 8 – Determinants of net investment rate, by firm size

Dependent Variable	Financial constraint criteria: size			
$Investment\ rate_{t+1}$	Small	Medium	Large	DiD estimation
$Operating\ CF_t$	0.009	0.010	0.006	0.010*
	(0.007)	(0.017)	(0.019)	(0.006)
$Cash_t$	0.024***	0.055***	0.029*	0.033***
	(0.006)	(0.018)	(0.017)	(0.006)
$logCDS_t$	-0.606***	-0.505***	-0.256**	-0.319***
	(0.146)	(0.115)	(0.121)	(0.102)
$logCDS_t \times small\ firms$	-	-	-	-0.183
				(0.157)
$logCDS_t \times medium\ firms$	-	-	-	-0.215*
				(0.121)
Fixed effects	Yes	Yes	Yes	Yes
R^2	0.021	0.056	0.029	0.024
N	6,649	5,817	3,822	15,660

Notes: ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Quarterly dummies * industry dummies included but not reported for simplicity. Operating cash flows and cash holdings were censored to the 5- and 95-percentiles of the distributions; investment only censored to the 1- and 99-percentiles. All variables scaled by capital stock are multiplied by 100. Capital stock adjusted to the SNC-accounting system by using K^{*m} (see Appendix A.1). Standard errors in parenthesis are robust for heteroskedasticity. Size is defined by the number of workers: firms with less than 50 workers are small firms and with more than 250 workers are large; medium firms are all others.

Investment-to-cash flow sensitivities are in line with those of the main empirical literature on investment equations when using the leverage policy of firms to proxy financial frictions, as shown in table 9. This finding suggests that more leverage firms are more financially constrained to the extent that their investment decisions are more sensible to fluctuations in operating cash flow (and in cash holdings), which in turn suggest that these firms are less able to raise external funds. However, I do not find a

differential effect for the investment rate of high-leveraged firms when sovereign risk increases. This result can be evidence that leverage *per se* may not be a good proxy for financial frictions in a model that lacks some forward looking measure at the firm-level. High leverage may not reflect credit frictions if firms' growth prospects remain positive, as the ability of firms to repay old debt may not be jeopardized.

Table 9 – Determinants of net investment rate, by firm leverage

Dependent Variable	Financial constraint criteria: leverage			
$Investment\ rate_{t+1}$	0-25 percentiles	25-75 percentiles	75-100 percentiles	DiD estimation
$Operating\ CF_t$	-0.016	0.016*	0.033***	0.010
	(0.011)	(0.009)	(0.013)	(0.006)
$Cash_t$	0.028***	0.034***	0.045*	0.034
	(0.007)	(0.010)	(0.023)	(0.006)
$logCDS_t$	-0.529***	-0.302***	-0.536***	-0.573***
	(0.140)	(0.097)	(0.195)	(0.096)
$logCDS_t \times Group[25-75]_t$	-	-	-	0.149
				(0.095)
$logCDS_t \times Group[75-100]_t$	-	-	-	0.223*
				(0.130)
Fixed effects	Yes	Yes	Yes	Yes
R^2	0.036	0.028	0.041	0.024
N	3879	7863	3918	15,660

Notes: ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Quarterly dummies * industry dummies included but not reported for simplicity. Operating cash flows and cash holdings were censored to the 5- and 95-percentiles of the distributions; investment only censored to the 1- and 99-percentiles. All variables scaled by capital stock are multiplied by 100. Capital stock adjusted to the SNC-accounting system by using K^{*m} (see Appendix A.1). Standard errors in parenthesis are robust for heteroskedasticity. Leverage is defined as the ratio of bank debt / (bank debt + equity). Separate regressions for firms in the 0-25, 25-75 and 75-100 percentiles of the leverage distribution.

Table 10 – Determinants of net investment rate, by firm liquidity

Dependent Variable	Financial constraint criteria: liquidity			
$Investment\ rate_{t+1}$	0-25 percentiles	25-75 percentiles	75-100 percentiles	DiD estimation
$Operating\ CF_t$	0.0003	0.018*	0.005	0.011*
	(0.021)	(0.010)	(0.008)	(0.006)
$Cash_t$	-0.366	0.053**	0.035***	0.033***
	(0.663)	(0.024)	(0.008)	(0.007)
$logCDS_t$	-0.496***	-0.450***	-0.211	-0.487***
	(0.124)	(0.094)	(0.200)	(0.087)
$logCDS_t \times Group[25-75]_t$	-	-	-	0.051
				(0.067)
$logCDS_t \times Group[75-100]_t$	-	-	-	0.052
				(0.130)
Fixed effects	Yes	Yes	Yes	Yes
R^2	0.038	0.025	0.032	0.024
N	3937	7847	3876	15,660

Notes: ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Quarterly dummies * industry dummies included but not reported for simplicity. Operating cash flows and cash holdings were censored to the 5- and 95-percentiles of the distributions; investment only censored to the 1- and 99-percentiles. All variables scaled by capital stock are multiplied by 100. Capital stock adjusted to the SNC-accounting system by using K^{*m} (see Appendix A.1). Standard errors in parenthesis are robust for heteroskedasticity. Liquidity is defined as the ratio of cash holdings-to-capital stock. Separate regressions for firms in the 0-25, 25-75 and 75-100 percentiles of the liquidity distribution.

Lastly, I find that firms with relatively more liquid assets do not appear to be statistically affected by shocks to the credit supply, contrasting to firms in the bottom of the liquidity distribution (table 10). This result constitutes additional evidence that the bank lending channel have a strong impact on real economic decisions and is likely to be amplifying the current economic downturn. When the perceived sovereign risk increases, triggering a tightening of bank credit, firms with relatively lower liquid assets are not able to turn to internal funds. The impact of the shock should differ within these firms according to the ability to raise bank loans, although on average we see a negative reaction of investment to the decline in banks' willingness to lend. The DiD estimators

seem to support this view, suggesting that the adverse effect of the increase in sovereign CDS premium is declining in liquidity, although the significance of the results is statistically weak.

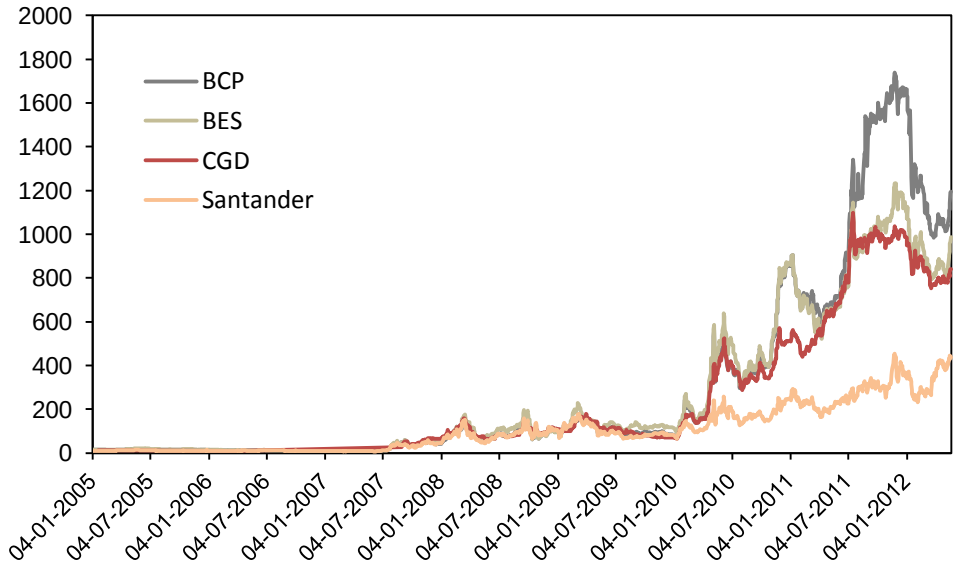
5.8 Robustness checks

Next, I present two robustness tests in order to assess to what extent the estimates shown rely on the hypothesis made about the effect of sovereign CDS on credit supply and about the sensitivity of investment to internal funds.

5.8.1 Banks' credit default swaps

The increase in the market perceived risk of sovereign creditworthiness is strongly correlated with bank risk, as shown in Section 5.4. The 5-year senior corporate bonds CDS of the main Portuguese banks – Banco Espírito Santo, Caixa Geral de Depósitos, Millenium BCP and Santander Totta – have also increased sharply, associated with the movement in sovereign CDS[20], as shown in figure 6.

Figure 6 – Main Portuguese banks' credit default swaps, Euro



Source: Bloomberg. Credit default swaps for 5-year senior corporate bonds.

[20] Bloomberg data on BPI 5-year corporate bonds CDS was only available for a very short period of time.

The increase in sovereign CDS only acts as a shock on credit supply to the extent that bank risk is correlated with sovereign risk. Although this seems to be the case, given the extremely exposure of domestic banks to sovereign risk, the CDS on banks' debt may provide a more direct measure of restrictions to credit supply.

I ran all the regressions in tables 8-10 using a non-weighted average of the main bank's CDS on 5-year senior debt instead of using sovereign CDS and plot the coefficient associated with it in table 11, according to each financial status criterion. All the results, including the significance and magnitude of this coefficient, remain the same for the alternative proxies for financial constraints, except for the effect of CDS on the investment rate of firms in the top of the liquidity distribution. This effect remains insignificant but is cut by half in magnitude, which provides additional evidence on the hypothesis that credit supply adversely affects relatively more the investment rate of firms with lower liquid assets.

Table 11 – Banks' CDS coefficient results in net investment regressions

Financial constraint criteria:	$logBanks'CDS_t$		
	Small firms	Medium firms	Large firms
Size	-0.568***	-0.493***	-0.266**
	(0.139)	(0.123)	(0.128)
	0-25 percentiles	25-75 percentiles	75-100 percentiles
Leverage policy	-0.499***	-0.334***	-0.509**
	(0.150)	(0.100)	(0.201)
Liquidity	-0.468***	-0.502***	-0.098
	(0.129)	(0.096)	(0.195)

Notes: Banks' CDS in period t calculated as a non-weighted average of Banco Espírito Santo, Caixa Geral de Depósitos, Millenium BCP and Santander Totta's CDS. Reported coefficients of regressions similar to tables 8-10, using banks' CDS instead of sovereign CDS (see these tables' notes for a definition of the variables used). ***, ** and * indicate statistical significance at the 1-, 5- and 10-percent (two tail) t-test levels, respectively. Standard errors in parenthesis are robust for heteroskedasticity.

5.8.2 Changing sensitivity of investment to internal funds

So far, I have been working under the assumption that the sensibility of investment to internal funds is the same during "normal" and crisis periods for all firms. One

hypothesis that should be analyzed is whether credit supply shocks change the sensibility of investment to operating cash flow and cash holdings. In other words, one might expect firms to react more to internal funds to offset the slowdown in bank lending. If this is the case, firms are turning more to internal funds and the effect associated with the increase in sovereign CDS spreads is mismeasured.

To this end, I added the interaction terms $Operating\ CF_t \times logCDS_t$ and $Cash_t \times logCDS_t$ to the baseline regression and ran regressions for the groups of firms classified by their financial status, as in tables 8-10. This result would suggest that the sensitivity of investment to cash flow and cash holdings is increasing with the shocks to credit supply. However, I did not find any economic or statistically significant result (not reported), which seems to lead to the conclusion that the sensibility of investment do not react to reduced credit availability.

Note that, in practice, these regressions are similar to a differences-in-differences-in-differences (DiDiD) methodology since I am adding a variation layer for internal funds above the already differential regressions according to firms' financial status[21]. Hence, this estimation is too data-demanding and would require great sampling variation to obtain consistent estimates.

6. Main limitations

The main limitation of this MSc thesis is related to the data used. Firstly, the series used to measure the capital stock of firms was artificially adjusted from the first quarter of 2010 onwards. The method that I used throughout the work to adjust the capital stock to the SNC, albeit reducing considerably the gap between the series before- and after-2010, still leaves some problems, as it does not completely eliminates the gap. The second method used to adjust K_t has the property that is reduces the gap further, but does not allow the capital stock excluded from the new accounting system to change, which might seem implausible. The statistical significant of all the results found remains the same when using this method, although the magnitude of the differential effects is considerably lower.

[21] They do not correspond exactly to the DiDiD estimation as I ran separate regressions for firms sorted by their financial status criteria, allowing the sensibility of investment to cash flow and cash holdings to differ across firms.

Furthermore, although the gap is almost invisible for the aggregate economy, it is still present particularly for small firms, which may limit all the results obtained. To account for this effect, I ran all the regressions only for the period 2005Q1-2009Q4 (using the original stock of capital) and compared small with large firms. The DiD is still negative (albeit remains statistically insignificant), meaning that small firms cut more their capital expenditures when sovereign CDS premium increases, although the magnitude of the effect is smaller.

Additionally, the statistical significance of the DiD estimator is always to weak. Although I found a greater impact of credit supply shocks on the investment of more financially constrained firms when running separate regressions, this result seems statistically insignificant for all the firms simultaneously.

7. Concluding remarks

One challenging scenario to policy makers is the existence of a credit crunch in the economy. In a seminal study of the effects of financial distress in the U.S. recession in 1990, Bernanke and Lown define a bank credit crunch as a "significant and leftward shift in the supply curve for bank loans, holding constant both the safe real interest rate and the quality of potential borrowers" (Bernanke and Lown (1991), p. 207). The importance of financial intermediation for the economy made the lack of credit one of the central points in the 3rd review of the Economic Adjustment Program for Portugal. Although the risks of a credit crunch are limited, further developments must be closely followed to prevent this scenario.

As far as I am aware, there is no empirical study to show the implications of the recent lending slowdown in the real economy for the Portuguese case. This work tries to begin to fill that gap. The decline in outstanding credit throughout the last two years was certainly caused by demand factors, such as the weakness of firms' balance sheets. However, banks' balance sheets strength may also have had an impact on this slowdown, thereby reducing the availability of credit and endangering the recovery of the economy. The lack of credit may constrain investment but also consumption and even the survivorship of some firms. Consequently, some firms may become insolvent due to the reduced availability of bank credit and not by lack of competitiveness. In this

research work I showed that, on aggregate, the Portuguese non-financial corporations rely heavily on bank credit to maintain their current activity. Furthermore, I showed that firms that are likely to face higher credit constraints to raise new loans or that rely more on bank-credit contract more their investment after shocks to the credit supply that tighten the availability of money in the economy.

These findings raise important policy implications. Firstly, the banking sector is likely to be amplifying the negative downturn of the economy in case of balance sheets' distress – those firms that cannot turn to internal funds to finance their activity will be adversely affected by the reduced availability of credit and will enhance the ongoing recession. Hence, efforts should be done to reinforce the solvency and liquidity mechanisms in the banking system, mitigating the adverse effects of the bank lending channel on economic recovery. Secondly, the new capital adequacy requirements can have adverse macroeconomic effects and should be carefully reviewed. In particular, the minimum Core Tier 1 ratio of 10 per cent by the end of 2012 and the gradual reduction of the credit-to-deposits ratio to 120 by the end of 2014, in the context of the deleveraging process of the banking sector, may act as an additional burden to the economy.

The €12 billion Bank Solvency Support Facility created within the memorandum of understanding on specific economic policy conditionality approved to Portugal may provide a good reinforcement of liquidity and alleviate the capital adequacy requirements but does not preclude the adverse effects of the credit-to-deposits ratio requirement. Furthermore, policy makers should endeavor to channel European Central Bank liquidity to the real economy. The resort of Portuguese banks to ECB funding soared since the beginning of the crisis but it is not being targeted to the economy. In conclusion, I believe it is of the utmost importance that policy makers assure a stable and robust banking system in order to assist the recovery of the economy.

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Appendix

A.1 SNC-adjusted capital stock

Using the tangible and intangible accounts to measure capital stock during the period 2005-2011 raises one (serious) problem. In 2010Q1 the accounting system changed from the Official Chart of Accounts (POC – Plano Oficial de Contabilidade) to the Accounting Standardization System (SNC – Sistema de Normalização Contabilística) and affected the two accounts that I am using to measure firms' capital stock.

Some of the main changes involve a reduction or even a complete removal of the goodwill, installation costs and R&D expenses from the intangible assets account and impairment losses of some assets' net value from the tangible assets account. Therefore, between 2009Q1 and 2010Q4 the raw capital stock series exhibited a sharp decline without any economic fundamental. Due to data limitations (in particular, lots of missing observations on the least aggregate accounts of firms' balance sheets), I am not able to directly convert the two accounting rules and to directly compare the capital stock before and after the first quarter of 2010.

In order to correct this structural change, I could have introduced a dummy variable for the first quarter of 2010 to capture the effects of the change in the accounting system, thereby mitigating the unfounded large fall in investment in this quarter. However, such dummy variable would not correct the increase in the relative value of cash flows and cash holdings to the capital stock from 2010Q1 onwards. Instead, I propose two ways of adjusting the capital stock recorded with the new system to the old one[22].

With the first proposed adjusted value for the capital stock $K_{i,t}$ of firm i in the beginning of period t, which I will call $K_{i,t}^{*m}$, I assume that all the capital that is no longer counted either in the tangibles or in tangibles accounts, grows at the same rate of the capital stored in these two accounts from 2010Q1 onwards – the m stands for multiplicative, as I am assuming a multiplicative effect over $K_{i,t}$.

Formally, $K_{i,t}^{*m}$ is given by:

[22] Neither of the two conversions is free of problems, however. Nonetheless, I prefer to work with an adjusted series than to completely ignore the period 2010-2011, which is the most crucial for my study on the effects of credit supply over corporate investment.

$$K_{i,t}^{*m} = \begin{cases} K_{i,t}, & t < 2010Q1 \\ K_{i,t-1}, & t = 2010Q1 \\ (1+\gamma_{i,k})K_{i,t-1}^{*m}, & t > 2010Q1 \end{cases},$$

where K_t is used to represent the capital stock stored before the first quarter of 2010 under the POC accounting system and γ_k stands for the quarterly growth rate of the capital stock. Note that with this specification I am assuming that the capital stock did not grow in the first quarter of 2010 or, similarly, that net investment was 0. This may seem odd, but including a dummy variable for this period in all the regressions to test the robustness of the results to this hypothesis did not change the main conclusions. The coefficients found for the dummy were negative but non-significant and did not affect the magnitude of the other coefficients.

In the second method, I am simply adding the fall in the capital stock from 2009Q4 to 2010Q1 to the new capital stock $K_{i,t}^{*a}$. With this I am assuming that the excluded stock of capital does not grow:

$$K_{i,t}^{*m} = \begin{cases} K_{i,t}, & t < 2010Q1 \\ K_{i,t-1}, & t = 2010Q1 \\ K_{i,t} + (K_{i,2009Q4} - K_{i,2010Q1)}, & t > 2010Q1 \end{cases}$$

With these two methods I am ignoring the hypothesis that the capital that is no longer stored in the tangible and intangible accounts may have fallen or may have risen more than the capital recorded with the new accounting system. However, there is no reason to suspect that the excluded capital had a large differential evolution (examples of the main excluded capital were provided above).

I can use these conversion rules when all firms report information on their balance sheets both before and after the change in the accounting system. When firms only enter my database before 2010Q1 there is no problem, as the capital stock of these firms is always accounted with the old standards. However, for those firms surveyed only after this period, I do not have a straightforward way to adjust the capital stock of these

firms. I excluded these firms from the sample (264 small firms, 137 medium and 47 large). Prior to this decision, I tried to construct a measure to convert the capital stock of these firms based on the average industry decline in K between 2009Q1 and 2010Q1 adjusted for the size of each firm. Although the results of the regressions were generally unchanged, this procedure may be controversial and hence I opted to drop from the sample those firms that only appear after the first quarter of 2010.