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Credit tightening and financial debt sustainability: a panel approach to Italian firm-level data

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Abstract

The aim of this paper is to examine how the macroeconomic shock caused by the sovereign debt crisis of 2012, through its impact on credit markets, was transmitted to the debt sustainability of Italian manufacturing firms. Using original panel data on 12,103 firms and adopting a fixed effects strategy I test the existence and the impact of the bank lending and balance sheet transmission channels on corporate debt sustainability. I find proof of the presence of a bank lending channel effect. Moreover, I am able to identify firm level characteristics and qualitative variables which appear to play a role in determining firms' debt sustainability, thus also finding evidence on the balance sheet channel. The present work can provide some basis for the design of policies targeting credit market issues, which can arise following a similar macroeconomic shock.

Keywords: Panel data, corporate distress, bank lending, credit rationing

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1. Introduction

Much research has been devoted to investigating the transmission of macroeconomic shocks to the real economy. From a policy design point of view, understanding the mechanism through which macroeconomic impulses are propagated to microeconomic entities is necessary in order to be able to design adequate response policies when crises arise. This is the main rationale behind researching the impact of the most recent macroeconomic crises on one of the pillars of the real economy: the manufacturing firm. This paper focuses in particular on the most recent sovereign debt crisis' possible effects and its interaction with firms' characteristics in determining financial debt sustainability of Italian firms.

The consequences of the global financial crisis in 2008 and the subsequent European sovereign debt crisis have been disastrous for the Italian economy, which is still trailing behind other European countries in terms of recovery. The entire manufacturing sector (especially small and medium sized firms) underwent a "shock-therapy" which resulted in a quick restructuring of the entire Italian firms' panorama. The recession of 2009 mostly affected Italian firms through a general decrease in turnover (and profits) due to the slowing down of the global economy and lower demand both home and abroad (European Commission Autumn Forecasts, 2008). After the shock to firms' profitability caused by the trade slowdown following the global financial crisis and economic stagnation within the country, there was only one short year of respite before the sovereign debt crisis started to unfold. Weaker firms were rapidly wiped out, especially due to bankruptcy, a process which was accelerated by the sudden tightening of the credit market. Such a shock to the productive system created not only tangible damage in terms of firms exiting the market, but it also negatively impacted surviving firms' trust in the economy and their propensity to invest. The fact that it is really complicated to uncover the exact transmission dynamics of macroeconomic crises to firms' activities has made it even more difficult to implement properly targeted policies to overcome the recession and give impulse to growth. In my analysis I will try to focus mainly on the second, most recent crisis. First of all because, unlike the global financial crisis, which stemmed from the bursting of the United States housing bubble, the sovereign debt crises originated in Europe and it more closely involved the Italian real economy in terms of policy responses. Secondly, the transmission channels of the sovereign debt crisis to the Italian real economy can more easily be identified and analyzed, as documented in the literature section.

1.1 A short overview on the sovereign debt crisis in Italy

The recent Eurozone sovereign debt crisis was unleashed in the spring of 2010 following the discovery of irregularities in Greece's financial reports. These manipulated reports had previously been presented to the European Union as proof of Greece's stable financial situation and been used as a basis to let the country into the Union. Uncovering these malfeasances in Greek accounts and bringing to light the actual situation was like opening a Pandora's box. Greece's rapidly deteriorating financial situation, exacerbated by a remarkably high public debt and the inability to place Greek sovereign securities on the market, forced Greek authorities to turn to the European Union and the IMF for help. The requested assistance came in the form of bailout funds for financial relief which would allow Greece to resume payments to creditors and to access financial markets again. The bailout money was granted under the condition that the Greek government implement a set of systemic reforms to strengthen the Greek economy and make its debt/GDP ratio more sustainable. These measures, however, did not provide a permanent solution to the Greek problem and the debt crisis quickly spread, first to Ireland in November 2010 and then to Portugal in April 2011: both countries also received bailout funds from the IMF and the EU. During this first phase of the crisis a contagious wave of financial turmoil and speculation hit all the peripheral countries of the Eurozone, including Italy. At this stage, the difference between the yield of 10year maturity BTPs[1] and German Bunds (the so-called "spread") remained quite stable between 150 and 200 basis points, basically in line with the main macroeconomic fundamentals (A. Di Cesare et al, 2012).

Another phase of the crisis took off during the summer of 2011, immediately after the so-called Troika (European Commission, IMF and ECB[2]) announced the approval of a second plan of assistance to Greece. The involvement of private investors (Private Sector Investment – PSI) in this second bailout plan triggered a panic frenzy among international investors. From this moment on, the BTP-Bund spread started increasing and became a lot more volatile. The increase in volatility affected not only the Italian sovereign bonds market but also that of all other peripheral countries (Greece, Spain, Portugal and Ireland). The spread between Italian and German sovereign bond yields, which in the first semester of 2011 had fluctuated around 200 basis points, suddenly increased to a range of 300 to 400 basis points in early July, reaching a maximum of over 550 points November 9 (Bloomberg, data downloaded on October 7, 2016) with interest rates climbing higher than 7% for due dates within the year. Financial market investors, who for years had underestimated peripheral countries' sovereign risks, thus leading spreads around the Euro Area to become practically null, suddenly started overestimating such risks, driving spreads to levels which were excessively high compared to the underlying economic fundamentals

[1] Buoni del tesoro poliennali - Italian sovereign bonds
[2] European Central Bank

(Visco, 2012). Investors' primary worries with regard to Italy's credit risk were the country's high public debt (over 120% of GDP in 2011) and low growth forecasts (Busetti and Cova, 2013). These two indicators deteriorated even more due to the negative feedback loop triggered by the increase in spread: higher yields on sovereign debt led to more debt and pessimistic growth forecasts.

The worsening of financial tensions during the second half of 2011 led to a steep decline in Italian banks' funding conditions. Italian intermediaries' capacity to collect commercial paper, interbank loans and certificates of deposit was drastically reduced and at the same time their ability to resort to the bond market was impaired. Banks difficulties were driven directly by the increase in interest rates, but also indirectly by a worsening of their balance sheet conditions due to the large amount of Italian bonds owned by them (the value of which decreased when spread increased). To make matters worse, during the second semester of 2011, the 3 leading credit rating agencies worldwide - S&P, Moody's and Fitch ratings - downgraded Italian sovereign debt (Moody's changed its rating from AA2 to A2, Fitch from AA- to A+ and S&P from A+/A-1+ to A/A-1) thus leading to an additional decrease in Italian banks' borrowing capacity and amplifying the severity of the crisis spillovers to the real economy (Almeida et al., 2014). The difficulties encountered by financial intermediaries caused a ripple effect in the Italian credit market where, already by December 2011, firms witnessed a credit contraction of around 20 billion euros (Visco, 2012). The average rate on short term bank loans to firms, which before summer were similar to those observed in Germany and in the Euro Area as a whole, were respectively 1,0 and 0,7 percentage points higher (Albertazzi et al, 2012). The disastrous macroeconomic conditions hindered the effectiveness of conventional monetary policy solutions and risked having a huge negative effect on the real economy (Visco, 2012). The intervention of the ECB in December 2011, through a large injection of liquidity into the system, allowed tensions to diminish and spreads to temporarily decrease (see graph in Appendix). Another element which contributed to a temporary decrease in spread and in market volatility was the resignation of then Prime Minister Silvio Berlusconi, who was deemed "unsuitable" for his position, as he was considered as the representation of the corrupt Italian political caste and a source of political instability by many influential observers and media (the Economist, an unquestionably influential magazine, published very critical articles in 2003, 2006, 2011 and more recently in 2013). After Berlusconi's resignation Mario Monti was given the task of leading a technocratic government in order to implement the necessary austerity measures to weather the crisis. Monti, very pro-European and more aligned with Germany's policy stance, tried to appease the markets by complying with European Commission requests of reform (Financial Times, 5th December 2011).

During 2012 the spread continued to fluctuate around very high levels, always between 300 and 500 basis points, until reaching a new peak over 500 points in July 2012, notwithstanding three austerity oriented

reform packages implemented by the new Monti government in the hope to restore confidence on the financial markets (Cencig, 2012). On July 26th, 2012, while the turbulence in financial markets was bringing Greece and all of Europe closer to the edge of collapse, the famous "whatever it takes" speech by ECB governor Mario Draghi allowed tensions to deflate. The governor's speech constituted a turning point in the crisis: by suggesting the willingness of the ECB to act through additional unconventional monetary policy measures, Draghi managed to instill new confidence in sovereign debt markets and placate some of the fears fueling the crisis and the speculation. After that moment, the spread started to gradually decrease and its movements became less sudden, until it reached pre-crisis levels in 2015 (under 100 basis points).

1.2 The repercussions of the crisis on the Italian real economy

In Italy, the impact of the sovereign debt crisis and in particular the repercussions of the increase in the spread have been perceived throughout every economic sector and seem to have hit in one way or the other all economic entities. The increase in spread immediately damaged banks' liquidity and their ability to borrow. The decrease in the value of Italian sovereign bonds caused Italian banks to struggle to comply with the new capital ratio requirements (the European Banking Authority required that banks increase their capital ratios to 9% by June 2012) and at the same time to keep up the supply of loans (Allen and Moessner, 2012). This difficult situation is well represented also by the results obtained from the Italian Bank Lending Survey (BLS), which is normally carried out 4 times a year and involves 8 major Italian credit institutes representing over 2/3 of the Italian credit market. Banks participating in the survey are asked to evaluate several criteria regarding the supply of loans to firms and households both for the current month and for the following three months (the answers to the survey are then summarized using two equivalent indicators, of whom only one is reported and used in this paper for convenience, see tables and explicative note in the appendix). From the Italian BLS it is clear how the Italian credit market went through a significant tightening especially in January 2012. In particular, banks declared an increased bank margin, both intended as the spread between a base rate and the rate applied to riskier loans and as the difference between a reference market rate and the average applied to all firm loans. Credit officials also report the application of tougher criteria to select loan recipients and to evaluate which interest rate to charge. Another salient fact emerging from the survey is that the values taken by the index regarding the decrease in credit supply are larger than those measuring the expansion in demand for credit, which suggests that the development of the credit market for firms during the sovereign debt crisis was shaped more by supply rather than by demand factors. Even though supply factors have been more determinant, it is necessary to mention that a deceleration in credit demand and overall worsening of credit quality

indeed concurred in shaping the credit market (Bank Lending Survey, Bank of Italy, more on the BLS in the "description of variables" section).

The Italian real economy was not only hurt directly by the increase in sovereign bonds yields, but the "economic mood" also suffered greatly. Surveys on entrepreneurs' confidence and expectations on the economic system and investment conditions showed a very pessimistic climate. In particular, considering the time period from 2008 until 2014 and calculating the year average for firm's confidence, the lowest value is obtained for the year 2012 when the average confidence index was only 80% of what it was in 2010 (values retrieved from ISTAT[3]. See Appendix for details).

During the recessionary period of 2011-2012, and in the following years, the banking system was deeply affected in its capacity to provide loans and in its liquidity conditions. The Financial Stability reports published by the Bank of Italy (available on the Bank of Italy website starting from 2010) point out quite clearly that the difficult situation Italian banks found themselves in during the sovereign debt crisis contributed greatly in completely overturning the weak improvements of the credit market which were surfacing in 2010. Especially in 2012, the difficult context of bank lending to firms during the crisis is highlighted: "..The contraction in bank lending towards the end of 2011 reflected the credit supply constraints arising at the time from the instability of the sovereign debt market; the resulting pressures on bank liquidity prompted intermediaries to tighten their lending policies, thereby accentuating the deceleration in lending caused by the fall in demand of households and firms. The dynamic of lending is also affected by the worsening of credit quality.." (Financial Stability Report No. 3 – 2012, Bank of Italy). Italian firms were therefore not only suffering from a decrease in turnover caused by the global slowdown of 2008 and a general deterioration of balance sheet variables affecting their ability to pay for bank debt, but they were also facing a strong supply side effect of tightening and increase in interest rates. This credit aspect of the crisis deeply affected firms impairing their ability to grow and in many cases to survive.

As pointed out in Del Giovane et al (2013), where supply factors play a role in credit developments, in order to design effective policy responses, it is essential to assess whether the development of credit markets depends on the deterioration of borrowers' creditworthiness or on the worsening of banks' balance sheets, in connection with monetary tightening. The spread crisis of 2011/2012 constitutes a good experiment to carry out this type of assessment for the Italian credit market. In fact, the increase in the sovereign spread between Italian and German sovereign bonds can in some sense be considered almost as an exogenous event and fueled primarily by negative market sentiment and irrational fear of contagion rather than by underlying fundamentals (De Grauwe and Ji, 2014). By 2011, Italy had already

[3] ISTAT is the Italian National Statistics Bureau.

been experiencing low growth rates for quite a few years and Italian public debt had always been particularly high compared to other European countries (Bofondi, Carpinelli and Sette, 2013). Overall there had been no fundamental changes in any of the main economic indicators of the country. On the contrary, the Italian banking system appeared more solid than that of other European countries, also thanks to the low level of derivative financial instruments on bank balance sheets (IMF 2010 Article IV consultation on Italy).

Much of the debate around policy solutions since the outset of the crisis has been focused on the need for incentives to offset the effects of the credit crunch which started strangling Italian firms soon after the spread began to climb. The Euro system provided additional liquidity to the banking system in the second half of 2011 (in particular through the LTRO – Long Term Refinancing Operation) trying to revive the struggling credit market. In spite of the austerity reforms implemented at the national level and of the powerful monetary policy impulses sent by the European Central Bank, the Italian recovery was sluggish and it still has not completely taken off today: growth has in fact been far below the European average in years following the crisis. Starting from 2013, in particular, many incentives targeting manufacturing firms' have been implemented in order to help small and medium-sized firms invest and push credit demand (for example fiscal policies designed to incentivize investments in capital goods). However, growth, investments and confidence data is still not showing marked improvements. This situation is exacerbated by geopolitical uncertainty at the global level, which increases the risk of new recessionary episodes. This context of uncertainty and stagnation makes it even more important to understand what the transmission channels of credit markets shocks on real economic entities have been in order to implement ad hoc stimulus policies (or understand whether current policies are addressing the right issues).

The research presented in this paper aims at shedding some light on the impact of macroeconomic conditions, working through the so-called bank lending channel, on firms' debt sustainability, while controlling for firms' characteristics, which instead could contribute to changes in debt sustainability through the balance sheet channel. Capturing the determinants of firms' short-term ability to service debt is relevant from a policy perspective since corrective actions can be put in place before actual distress sets in (De Socio and Michelangeli, 2015). In order to carry out this type of assessment, I utilize firm level balance sheet data collected by Intesa Sanpaolo, Italy's first commercial bank (more on the dataset in the methodology section). The dataset includes firms from all manufacturing sectors, for which data is available for the period 2008-2014. I will be using both financial statement variables for each firm and some qualitative data such as the area where the firm is incorporated, the sector of activity etc. It is important to include firms' characteristics to measure the impact of macroeconomic events on debt

sustainability also because such phenomena are unlikely to have uniform effects across firms (Bougheas et al, 2006). Being able to use a microeconomic approach to study business cycle effects on the real economy allows for a deeper understanding of transmission mechanisms of monetary shocks and leads to more precise estimates of the impact of macroeconomic phenomena on microeconomic entities. To be more precise, my research questions are:

- Is there evidence of a bank lending transmission channel of the sovereign debt crisis on Italian firms' debt sustainability when controlling for the balance sheet channel?
- What are the magnitude effects of the two channels of transmission? What could this entail from a policy perspective?

The paper is organized as follows: in section 2 a literature review is presented, section 3 is dedicated to the methodology and sample description. Results are presented in section 4, section 5 concludes.

2. Literature

The rationale behind the investigation presented in this paper, which is to be kept in mind as the literature is reviewed, is the following: as explained in the previous section, the shock caused by the increase in the spread between BTP and Bund sovereign bonds can be considered as a shock analogous to a sudden tightening of the monetary policy stance towards Italy. During the sovereign debt crisis, both the cost and supply of credit from banks to firms were negatively affected, the negative impact on firms' debt sustainability could both be determined by the macroeconomic shocks' impact on credit markets (bank lending channel) and by the deterioration of firm specific characteristics (balance sheet channel). The literature presented below provides evidence on the existence of various transmission channels for monetary shocks/sovereign debt crises as well as on the effect that monetary tightening has on credit markets for firms and its interaction with firm specific characteristics.

2.1 The credit channel of monetary policy transmission

One of the theories on the transmission mechanism of monetary policy events to the real economy (or at least one of the explanation for the augmented effect on the real economy of monetary policy events) is that of the "credit channel", which is investigated, among others, by Bernanke and Gertler in their 1995 paper "Inside the Black Box: the credit channel of monetary policy transmission". According to the

authors' interpretation, the credit channel is composed of two separate transmission channels: the balance sheet channel and the bank lending channel.

The balance sheet channel is based on the theoretical prediction that the external finance premium facing a borrower should depend on the borrower's financial position, which is also the rationale behind empirically testing for the effect of firm's characteristics such as revenues, profitability, size, leverage, collateral and so on, on the sustainability of bank debt. It is important to note that the fluctuations in the quality of borrowers' balance sheets can amplify and propagate monetary shocks, a phenomenon referred to as the "financial accelerator" (Bernanke, Gertler and Gilchrist, 1996). The balance sheet channel is originated because increases in the market interest rate (due to monetary policy changes or macroeconomic shocks such as a sovereign debt crisis) affect the financial positions of borrowers both directly and indirectly. Interest expenses of borrowers are directly affected (more specifically they increase in case of monetary tightening), reducing cash flows and weakening borrowers' financial position, while at the same time asset prices decline, diminishing the value of collateral. Indirectly, since a monetary tightening affects customers' spending, a manufacturing firm could experience a decrease in revenues while fixed costs do not adjust in the short run, this leads to a "financing gap" which can negatively influence firms' creditworthiness (Bernanke and Gertler, 1995). Generally, recessionary episodes will impact firms' financial statements variables in some way, making it harder to service debt payments due.

The bank lending channel instead focuses on the increase of the external finance premium (which is the difference in cost between funds raised externally, by issuing equity or debt, and funds generated internally by retaining earnings) caused by a shift in the supply of intermediated credit, particularly loans by commercial banks. The supply of credit (and its cost) by banks might be negatively affected for two reasons: firstly, because when open-market interest rates rise, credit terms become more onerous and secondly because the balance-sheet channel is active also for financial institutions. In the specific case of the recent sovereign debt crisis, the sudden increase in Italian sovereign bonds' yields meant an immediate decrease in the value of those securities. Since Italian banks were the primary holders of such assets, a big decrement in their value lead to a significant impairment in their capital and reserves. When this type of situation arises, banks' capacity to access funds in order to make loans is hindered and bank-dependent borrowers are forced to seek funds at a higher cost or are unable to obtain funds at all (Atanasova and Wilson, 2004).

The framework of this paper rests on the premise of the existence of these two channels of transmission and their interpretation as presented in Bernanke and Gertler, 1995. Based on these theoretical premises,

the empirical research conducted in this work aims at disentangling the effect of the bank lending channel from the effect of firms' own specific characteristics (balance sheet channel) on firms' debt sustainability. The literature review presented below is divided into two sections according to the type of methodological approach chosen by the authors, it includes evidence on the impact of macroeconomic shocks on credit markets and both on the bank lending and on the balance sheet channel, giving some hints as to which firm characteristics might be most important in determining credit conditions.

2.2 Evidence from macro data

Quite a few recent papers try to quantify the outcomes of the 2011-2012 crisis on the Italian real economy by adopting a macro perspective. In particular, this approach was followed by several Italian economists from the Bank of Italy who focused primarily on the aggregate effects of the crisis on GDP, industrial production, investments and, more importantly for this paper, credit markets. Neri and Ropele (2013) chose to employ a factor augmented vector autoregressive model to measure the macroeconomic impact of the sovereign crisis on a subset of euro zone countries. They find that a negative and unexpected shock to sovereign debt tensions, in addition to causing an increase in sovereign spreads in peripheral countries, also results in heterogeneous credit conditions. According to the authors, sovereign debt crises have a direct impact on the banking sector and thus on the economy at large. Albertazzi et al. (2013), instead, examine the repercussions of the crisis on the activities of Italian banks. They quantify the effect of the tensions on the market for Italian sovereign debt, proxied by the level of the 10 year BTP-Bund spread, on the cost of funding for Italian intermediaries and also on the cost and availability of lending to firms and households. As is pointed out in Albertazzi et al.:" Italy is an especially good case for studying the effects of the sovereign risk on the banking sector. First, in Italy the causal relationship between the difficulties of the sovereign market and those of the banking sector during the current crisis is clear: unlike other European countries (Ireland, and, to a large extent, Spain), problems originated in the public sector and then spilled over to the banking system. This suggests that the sovereign spread can indeed be considered as an exogenous variable. Second, the impact of the transmission of sovereign debt market tensions to the banking sector is likely to be sizeable in Italy, due to the high level of public debt and to the heavy exposure of Italian banks on sovereign debt bonds" these conclusions reinforce the intuition behind the workings of the bank lending channel and the balance sheet channel for financial institutions. Albertazzi et al. also find that changes in the BTP-Bund spread significantly affect banks' funding costs and also have a direct effect on the dynamics of corporate lending. Specifically, the authors calculate that a 1 percentage point increase in spread is associated with a 0.7 percentage point reduction in the annual growth rate of the amount of loans to firms. Furthermore, the effect that the BTP-Bund spread exerts

on loans to firms is found to be significant. The authors estimate that this effect largely mirrors the increase of the marginal cost of financing. Edda Zoli (2013), investigates the determinants and "pass-through" from Italian sovereign spreads to banks' funding costs and lending conditions. She finds that about 30-40% of the increase in sovereign spreads is transmitted to firm borrowing rates within three months and 40-60% within six months. According to Zoli, the turmoil experienced during the sovereign debt crisis is associated with a credit slowdown especially for smaller firms. Busetti and Cova (2013) conduct a counterfactual analysis to measure the macroeconomic impact of the sovereign debt crisis on the Italian economy. They conclude that the loss in GDP amounts to 6.5 percentage points in 2012-2013. The fall in investments reflects primarily the worsening of the credit market for financing, while the fall in consumption is mostly due to the uncertainty and the diminishing of "confidence" of firms and households. The authors also conclude that the main factor causing the decrease in confidence and the increase in uncertainty has been the raise in BTP-Bund spreads.

2.3 Evidence from micro data

Another strategy which can be adopted to investigate the impact of macroeconomic and firm specific factors (and the interaction between the two) on firms' activities and financial health indicators, entails the use of micro data. This "micro-approach" is also followed in the present paper. Bofondi, Carpinelli and Sette 2013) study the effect of the increase in Italian sovereign debt risk on credit supply considering a sample of 670,000 bank-firm relationships between December 2010 and December 2011. They find that Italian banks tightened credit supply and in particular, that their interest rates were 15-20 basis points higher after the outbreak of the crisis. Moreover, the authors conclude that not only Italian banks were hit more harshly than foreign banks present in Italy, but also that Italian firms were not able to compensate the reduction of credit from Italian banks by borrowing more from foreign ones. Gonzalez, Lopez and Saurina (2007) examine access by Spanish firms to external financing over the period from 1992 to 2002 by using panel data and including both macroeconomic variables, such as business cycle and interest rates, and firm characteristics. Taking into account the fact that the supply of loans (external financing) is likely to vary with shocks to the macroeconomic environment and to monetary policy, the authors are able to pinpoint several firm-level characteristics such as size, collateral, riskiness, age and profitability which are determinant for firms in order to access credit. Most importantly, they find that monetary policy conditions have a greater impact on smaller, riskier and younger firms, hinting to these features as possible drivers of the balance sheet channel. Iyer, Lopes, Peydrò, Schoar (2012) study the effect of the 2007/2009 crisis on the supply of loans to firms using loan level data for the entire Portuguese banking sector. The authors' results suggest that firms generally are not able to perfectly

substitute decreases in credit supply from banks that were negatively affected by the crisis neither with credit from other banks which were less affected nor with other sources of financing. These findings, therefore, indicate that negative liquidity shocks to banks (propagated through the bank lending channel) can have a large effect on firms' ability to access credit, especially if these firms are small. This result is particularly relevant for Italy, where most firms are very small and where bank loans are the most common form of financing: in Italy, bank debt accounts for almost two-thirds of firms' financial debt and only very large firms resort issuing bonds (Caselli et al, 2013). Bougheas et al. (2006) investigate how firm specific characteristics influence the response to monetary contractions using a large panel of 16,000 UK firms. In their econometric design, in addition to firm's balance sheet and other characteristics, the authors include year dummy variables in order to control for macro factors affecting demand (one for each year of the period considered) and they also use the base rate and the short-long spread to indicate monetary policy tightness. Bougheas et al. show that the most financially vulnerable firms are affected by monetary tightening to a higher degree as credit supply decreases. The effect induced by a tightening in monetary policy probably gives us a lower bound estimate of the negative effect of a sovereign debt crisis. In both contexts market interest rates increase, but in the latter case this increase is not implemented in a calculated manner by a central bank, it generally is caused by an underlying weakness in the country's economic fundamentals and it is paired with an economic activity slowdown. Intuitively, it is expected that the crisis element would amplify the negative effects perceived by firms when there is a rise in interest rates. As a matter of fact, Bougheas et al. predict that the effects of a tightening in monetary policy will be stronger during periods of low economic activity (such as during a crisis). Atanasova and Wilson (2004) investigate the impact of changes in monetary policy on the supply of bank credit to small and medium sized firms in the UK. To conduct their research, the authors use panel data on small and medium size UK firms for the period 1989-1999. In addition to using firm characteristics as explanatory variables, Atanasova and Wilson also include dummies for each year of the period considered to capture the effect of the interest rates. The coefficients estimated from the model are consistent with the existence of a credit channel of monetary policy transmission: when monetary policy is tight, banks lower their supply of loans and the availability of external finance to bank-dependent borrowers is greatly reduced. They also find that small firms are the hardest hit in a tight monetary policy scenario. Del Giovane et al (2013) use micro data to document the importance of the bank lending channel by investigating credit developments in Italy during the Lehman Brothers and sovereign debt crises. Their findings are fourfold: first of all, while normally the Italian credit market functions like a standard imperfect competition model, the authors find that during phases of tension there is credit rationing. Secondly, supply restrictions have a big impact on lending, both when they are generated by banks' balance-sheet constraints and when they are caused by an increase in perceived borrower risk (which can be translated into deteriorating firms' balance sheet values for example). Third, while the tightening of the credit market during the sovereign

debt crisis reflects the shock perceived by all banks due to a widening sovereign spread, it does not stem from idiosyncratic bank funding problems. Lastly, the role of supply is estimated to be more relevant during the sovereign debt crisis primarily due to banks' funding difficulties. As regards the cost of credit specifically, the tightening of the credit market appears to have caused a quarterly rise of around 70 basis points at the peak of the sovereign debt crisis in the last quarter of 2011 (compared to around 30 basis points at the end of 2008). The cumulative effect over the crisis period is calculated at around 220 basis points, of which about a third came during the global crisis and two thirds during the sovereign debt crisis.

The ratio financial expenses/EBITDA[4] which is an indicator of firms' debt sustainability, is employed by De Socio and Michelangeli (2015) to model Italian firm's financial vulnerability using microeconomic panel data and macroeconomic indicators in the same regression. The indicator has also been used by the Bank of Italy (2011) and IMF (2013b) for Italian firms and by IMF (2013a) to analyze the debt overhang in European countries. The latter three papers focus on balanced panels, just like the present work. The financial expenses/EBITDA indicator is also used in Bonaccorsi di Patti et al. (2014) in their paper analyzing the role of leverage in firm solvency. The authors findings confirm that firms' financial structure can be a powerful amplifier of macroeconomic shocks. In particular, leverage[5] impacts firms' chances of survival during a recession and it also weakens the balance sheet of banks that lend to these firms, thus affecting banks' ability to provide credit. Bonaccorsi di Patti et al. also point out how important it is in terms of policy design to understand whether the firms' financial structure magnifies their vulnerability to macroeconomic shocks.

From the literature results presented above it can be inferred that the bank lending and balance sheet transmission channels do not work in isolation: they instead often interact and reinforce each other. Therefore, when investigating one of these two mechanisms, it is always necessary to somehow control for the other one. The purpose of the analysis presented in the present paper is to contribute to the empirical evidence answering questions regarding the interaction macroeconomic shocks, credit markets and firms' debt sustainability.

[4] EBITDA is here intended as a measure of firm profitability, EBITDA stands for earnings before interest taxed depreciation and amortization.
[5] The leverage that firms have in the year prior to the beginning of a recession.

3. Methodology

3.1 Description of sample and identification strategy

The sample of firms used in this paper comes from a larger proprietary dataset belonging to Intesa Sanpaolo, Italy's first commercial bank. The original dataset contains observations for the period 2008 to 2014, it includes data on over 350,000 firms from all sectors of the economy (including the service sector) and it is unbalanced, meaning that firms are allowed to enter or exit the dataset depending on whether they become bankrupt or close their lines of credit with the bank (or for some other reason the bank does not have financial statements for that given firm), therefore generating gaps in the panel. The variables included in the dataset are both financial statement variables and other variables (numerical and qualitative) such as: amount of patent applications presented to the EPO, foreign direct investments, sector of activity, location etc.

In order to carry out the research presented in this paper, I decided to filter the original dataset using various criteria. First of all, the final dataset used for the analysis contains only firms for which observations are available throughout the entire period considered. All firms for which there were time gaps in the data are filtered out creating a balanced panel dataset. The fact that the gaps in the panel are eliminated means that those firms that were more heavily hit by the crisis, which possibly went bankrupt, are excluded from the analysis (more on this in section 3.5). Nevertheless, since I do not know for sure the reason why firms exit the panel and this could be caused by a simple lack of data, I prefer working with a balanced dataset. I also exclude those firms not belonging to the manufacturing sector: generally, when studying the real economy, it is more common to focus on the industrial sector, which is especially relevant in this case, being Italy one of the most industrialized countries in Europe. Furthermore, financial statements of service firms are not analogous to those of manufacturing firms and in general the two typologies of firm are not directly comparable because of the extremely different types of activities they carry out. The diverse role that service and manufacturing firms have within the economy entails different investment strategies, capital structures and relationships with the banking system. Therefore, in order to present coherent results, I narrow my focus on manufacturing firms, which are of primary importance for the Italian economy.

Another typology of firms which is not included in the sample is foreign subsidiaries. I exclude foreign owned firms because they are unlikely to be deeply affected by the Italian sovereign debt crisis as they can more easily borrow from foreign banks or could also receive funds from their parent company.

Very small firms are also excluded because their level of borrowing tends to be negligible and often exhibits an "anomalous" behavior. The criteria used to filter the smallest firms out is turnover: I exclude those firms with a turnover lower than 150,000 euros per year and also those with a turnover lower than 2 million euros in 2008. By doing this I am excluding pre-crisis micro firms whose financial statements are not always reliable (less strict criteria are enforced and there is no revision of accounts). However, I allow firms' turnover to vary in the following recessionary years: the 150,000-euro threshold is only imposed to exclude firms going through bankruptcy proceedings. Filtering turnover in this way therefore still enables me to consider firms whose conditions notably worsened during the period considered, while working with a balanced panel and reliable balance sheet data. The resulting filtered sample is made up of 12,103 firms.

Having such a large balanced panel of firms of all sizes, spread out throughout the national territory and carrying out very diverse activities allows me to exploit firms' heterogeneity by controlling for firm fixed effects. As mentioned above, it is important to keep in mind some peculiarities of the Italian industrial panorama when interpreting the results obtained from the analysis of this sample: predominance of small and medium sized firms, strong reliance on bank credit for firms' financing within the framework of a complex and sometimes unique tax system. The conclusions reached through this analysis will have internal validity as applies to the Italian case, but could also be of value, both in terms of results and methodology, for other European countries which face a similar economic context and experience a prevalence of the manufacturing sector over other sectors of the economy. For example, France or Germany have a very strong manufacturing/industrial sector (German and French firms, however, are on average larger and less indebted than Italian ones).

3.2 The model

The empirical strategy followed in this paper features three main fixed effects panel regressions that can be summarized as follows:

(1):

$$finexp\_EBITDA_{i,t} = \beta_0 + \beta_1 \log\left(EBITDA_{i,t-1}\right) + \beta_2 Leverage_{i,t-1} + \gamma_t(year) + \beta_3 maturity_{i,t-1} + \beta_4 \log\left(turnover_{i,t-1}\right) + \beta_5 acid\_test_{i,t-1} + \beta_6 collateral_{i,t-1} + u_i + \varepsilon_{i,t}$$

(2):

$$finexp\_EBITDA_{i,t} = \beta_0 + \beta_1 \log(EBITDA_{i,t-1}) + \beta_2 Leverage_{i,t-1} + \beta_3 crisis * leverage_{i,t-1} + \gamma_t(year) + \beta_4 maturity_{i,t-1} + \beta_5 \log(turnover_{i,t-1}) + \beta_6 acid\_test_{i,t-1} + \beta_7 collateral_{i,t-1} + u_i + \varepsilon_{i,t}$$

(3):

$$finexp\_EBITDA_{i,t} = \beta_0 + \beta_1 \log(EBITDA_{i,t-1}) + \beta_2 Leverage_{i,t-1} + \beta_3 maturity_{i,t-1} + \beta_4 \log(turnover_{i,t-1}) + \beta_5 acid\_test_{i,t-1} + \beta_6 collateral_{i,t-1} + \delta bank\_margin_t + u_i + \varepsilon_{i,t}$$

Where the *i* subscript is the panel identifier and stands for each firm, while the subscript *t* is the time identifier for each year of the panel. The variable u_i represents non-observed heterogeneity in the sample and $\varepsilon_{i,t}$ is the error term. In the model outlined above the main variable of interest is the bank_margin variable (proxying for the bank lending channel), other firm specific variables are included to control for the balance sheet channel. The same fixed effects regressions are carried out splitting the firms' sample according to area. I preferred to divide the sample into subgroups instead of using areas' fixed effects and sectors' fixed effects because in that case the panel dimension of firms would have been lost. Firms' fixed effects are likely to be more important than area or sector fixed effects. Also, there are only 4 areas and 22 sectors, therefore the results would have been quite imprecise. In order investigate the sectorial component I also run a regression where I introduce the interaction term: EBITDA*Sector to understand whether different EBITDA patterns across sectors are significant in determining debt sustainability. The fixed effects regressions tell us which variables are more important in determining firms' debt sustainability during a crisis period, so it is possible to understand whether the debt sustainability indicator was influenced more by firms' characteristics, proxying for the balance sheet channel, or by macroeconomic events transmitted through the bank lending channel.

3.3 Description of variables

The dependent variable in the fixed effects regression is financial expenses/EBITDA (abbreviated in the analysis as finexp_EBITDA), a commonly used indicator of debt sustainability which is defined and

monitored, among others, by the Bank of Italy. The numerator captures the effect of credit conditions, since it includes the impact of both the level of debt and its cost, while the denominator reflects the effect of the business cycle on operating profitability. Moreover, this indicator is the inverse of the interest coverage ratio (EBITDA/interest expenses) which is used by the IMF global financial stability report between 2013 and 2015 (De Socio and Michelangeli, 2015). The interpretation of the value of the indicator is the following: as the numerical value of financial expenses/EBITDA increases, debt sustainability worsens. This can be due changes in the denominator (profitability) or in the nominator (financial expenses). Therefore, I will try to control for the denominator effect in my regression by including the lagged value of EBITDA as an explanatory variable. Both the bank lending and the balance sheet channel work through the credit market. Consequently, in order to investigate their effect on debt sustainability, one should focus on the nominator of the dependent variable: financial expenses.

The variable Leverage_ represents the leverage indicator calculated as total financial debt/(total financial debt+capital) and indicates the level of financial indebtedness of the firm. It is possible to identify two years of "crisis" or at least of negative business cycle impact on the dependent variable (as later confirmed by the results of both regressions). Since I suspect that leverage matters more in determining firms ease of obtaining credit during a recession, I create the dummy variable "crisis" which takes value 1 in years 2009 and 2012 and I interact it with leverage in equation (2). I do this to check whether there is an additional effect of leverage during crisis years. In order to interpret whether firm leverage had a different impact on sustainability during adverse business cycle years, the coefficient of the interaction variable (leverage*crisis) needs to be summed to the coefficient of the firm-level variable. The variable acid_test, defined as (current assets – inventories)/current liabilities, instead controls for firms' short term liquidity.

Turnover1_ controls for firm size: due to the use a fixed-effects strategy in my regression I am not able to insert dummy variables for number of people employed (identifying a firm as "small", "medium" or "large") to control for firm size as these would be eliminated by the within group transformation when the fixed effect estimator is implemented (the within group transformation calculates the deviations from the group mean by subtracting it from each observation, this is why dummy variables which do not vary over time disappear). I carried out a few elaborations on the raw turnover value reported on firms' balance sheets in order to obtain the most representative value possible. First of all, I downloaded the index of production prices provided by ISTAT: this data series is indexed to 2010 and provides values at production for each sub-sector of the economy (to the 3-digit level of classification according to the NACE-rev2 classification system). For each firm in the database I also know which sub-sector it belongs to, depending on what it produces. I then merged the production price index information for each year and economic subsector in the panel with the main dataset and I deflated the turnover of each firm

depending on the production price index of its sector of activity. The benefit of transforming turnover through this elaboration is that it makes its numerical value more comparable across firms belonging to different sectors of the economy and facilitates comparisons over time since it eliminates part of the price effect caused by business cycle trends.

The variable "Maturity" indicates the proportion of short term bank debt that the firm is holding. It is defined as the ratio of short term bank debt to total bank debt. The rationale behind controlling for this variable is that firms holding a higher fraction of short term debt are more heavily affected by an increase in interest rates, because subject to variable rates, and by adverse business cycle conditions in general. "Collateral" controls for the amount of tangible fixed assets that the firm owns and that could be provided as security to the bank in case the loan is not repaid: these are calculated as the sum of land, plants and machinery. All balance sheet variables are introduced in first lag and (especially for the variable leverage) it is important to keep in mind that the value reported reflects the firm's situation at the beginning of the year. The rationale behind using lagged variables to control for firms' characteristics is that in a given year the interest rate charged by banks is based on the analysis of firms' previous year financial statements as current year values will not be available until 31st December of the same year.

The dummy variables for each year (yr*) are included to control for business cycle conditions throughout the period considered, they therefore should capture the effect of the recession in broad terms (or the impact of economic conditions in general). Initially, I tried to proxy for macroeconomic conditions using the variable std_spread which is the yearly standard deviation of the BTP-Bund spread. The rationale behind using the standard deviation and not the average of the spread as a proxy is the BTP-Bund spread had many violent, sudden movements during the years of the crisis thus alternating very high values (over 500 basis points) and "regular" values (100-200 basis points). These movements were daily and increased the uncertainty on financial markets greatly. However, since I am using balance sheet yearly data in my regression, I would have to use an average of the spread or its standard deviation calculated over the entire year, which still does not faithfully represent the situation of turmoil and greatly underestimates the impact that market turbulence had on debt sustainability. Consequently, one of the reasons why I decided to use year dummies to capture business cycle conditions (instead of using the yearly standard deviation of spread) is that, even if the macroeconomic shock which hit Italy derived from the spread, the year dummies are more "complete" as a measure of all macroeconomic conditions.

To measure more precisely the effect of the bank lending channel on debt sustainability I use the variable bank_margin. The latter is the yearly average of an indicator reported in the Italian Bank Lending Survey conducted every trimester by the Bank of Italy, which is submitted to the heads of credit Italy's 8 biggest

credit groups. The survey is composed of several questions about credit market conditions for firms and households and aims at capturing supply side changes in credit as they are perceived by credit providing institutions. Answers to the survey can take on a numerical value which can range from a minimum of -100, indicating a relaxing of criteria used to provide credit, and +100 which instead indicates a severe tightening of credit or harsher criteria used before granting credit (depending on the question asked). The set of numerical indicators used to create the variable bank_margin is taken from question 3B of the survey: "How did bank margin on average risk loans behave in the last trimester?". Bank margin is here the differential between the base refinancing rate and the rate applied on firm loans. 100 corresponds to a big increase in the margin (a tightening of credit) and -100 to a decrease in the margin. The trimestral values are then averaged over the year to obtain the variable used in the regression. Note that the scale over which the bank_margin variable is measured is bigger than that of the other variables, therefore running the regression with the bank margin indicator measured with the original scale leads to coefficients which are significant, but hard to interpret because of their magnitude. Consequently, I decided to rescale the variable by dividing its values by 100, in order to obtain a measurement scale more similar to that of other variables (-1 to +1) and more easily interpret bank_margin coefficients. The reason why this proxy for the bank lending channel has been selected as a dependent variable instead of just using each firms' interest rate calculated from financial statements (financial expenses/total bank debt) is that the interest rate variable extrapolated from firms' financial statements is a very "dirty" variable. Italian financial statements do not have a "pure" interest item, the item reported is "financial expenses": which includes interest paid on types of debt other than bank debt, for example towards suppliers or owners that have provided credit to the firm. Official firm level data on bank loans' interest rates is not available, therefore I am use an economy-wide variable such as the bank_margin proxy. However, bank_margin is related only to the credit market and not the economy in general, which makes it a more restrictive measure of the bank lending transmission channel than both spread and year dummies and allows me to "zoom-in" on this particular aspect of transmission.

3.4 Summary Statistics

Below I report the overall summary statistics for the main variables of interest, the appendix includes statistics by year and by area. The most striking detail of the summary statistics presented in this section is the high level of leverage present on average in the sample. High leverage is a structural feature of Italian firms mostly due to the fact that Italy is characterized by a very high percentage of small and medium sized firms compared to other advanced countries.

Summary statistics:

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.303	0.072	0.164	0.312
Leverage	0.846	0.792	0.911	0.965
Turnover	19295.440	3648.178	6978.265	15423.290
EBITDA	1762.420	269.000	565.000	1316.000
People Employed	59	16	29	55
Acid_test	1.000	0.676	0.881	1.149
Maturity	0.655	0.448	0.701	0.922
Collateral	4080.338	0.000	931.000	3730.000
Profit_loss	527.612	7.000	56.000	254.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros. Statistics are calculated on 7 years of observations for all firms in the sample.

Smaller firms cannot rely on the market as a source of financing and have no other choice than to rely on bank credit in order to grow. This particular aspect of the Italian economy explains why Italy, entering the global financial crisis, had on average the highest corporate leverage among large European countries. Since 2008, after the global recession scare, the trend at the European level has been of a general de-leveraging in all countries (De Socio and Finaldi Russo, 2016). The deleveraging process is advancing very slowly in Italy due to the reasons explained above and this lends even more importance to the theme of debt sustainability of firms in the country.

The average firm in the sample is quite small, this can be inferred looking at the median of the variable "People Employed". The typical firm employs about 29 people and there are even so-called "unipersonal" firms composed of just 1 person. Even firms at the 75th percentile in terms of people employed have around 55 employees. The mean value calculated is slightly higher (59 people) due to the presence of big industrial groups such as FIAT. Having such a wide range of firm sizes consequently leads to a large range of EBITDA and turnover values in the sample. From the mean of the variable maturity we can deduce that, on average, firms are a little bit more exposed on short-term debt which is usually riskier because generally subject to variable rates. Median values confirm this tendency of being more exposed to short term debt. Collateral varies a lot across the sample because of the different type of activities carried out by the firms included in the dataset. Intuitively, a small firm manufacturing furniture or artisanal leather products will have a lot less collateral available than a machinery manufacturer.

Finexp_EBITDA and EBITDA only take positive values because I have cleaned the main sample by excluding negative values. The rationale behind this is that it is important to include the first lag of

EBITDA (after having applied a log transformation) to control for present time EBITDA fluctuations, which can be large from one year to the next and directly impact the dependent variable. I am including the EBITDA at (t-1) following the same criteria as for the other balance sheet variables – namely that a firm can only present its previous year balance sheet for bank scrutiny when trying to obtain credit. Moreover, I would not be able to include EBITDA at time t, because I would incur in serious endogeneity problems since the same value is at the denominator in the dependent variable. In order to include the log of EBITDA in the regression I cannot have negative values of EBITDA because these would create missing values when taking the log. Even though my main regression only includes firms with positive EBITDA[6], firms making losses are still included in the sample. In fact, the minimum value of the profit_loss variable (not reported in the table above) is -93,163 million euros.

Summary statistics tables by area and by year for the main variables of interest can be found in the Appendix. Statistics by year show that the debt sustainability indicator is on average higher in 2008, 2009 and 2012, the crisis years. However, for 2009 this result is most likely driven by a "denominator effect" as we can see that EBITDA is on average much lower for this year due to the global slowdown caused by the financial crisis. This denominator effect partly explains the difference between the two crises' impacts on the Italian real economy. While the global financial crisis of 2008-2009 mostly influenced profitability, the sovereign debt crisis primarily affected the numerator of the dependent variable in the fixed effects regression: financial expenses linked to higher interest rates and credit market tightening, which can be driven both by the balance sheet or the bank lending channel. Leverage is quite stable throughout the period considered, if anything, there is a slight deleveraging over time, in line with the evidence found in the literature (see De Socio and Finaldi Russo, 2016). In terms of firms deemed "not sustainable" by the Bank of Italy, the highest percentage of them is found in 2008, 2009 and 2012.

Focusing on firms' statistics disaggregated by area the most noticeable feature in the dataset is the great disparity in the number of firms based in different areas of the country: while the two northern macro-regions count over 4000 firms each, the central and southern area only comprise respectively 1921 and 1179 firms. This is why I combine South and Center together in my fixed effects regression by area in order to have comparable numbers. The data on the number of firms by area alone provides some hints as to the economic divide between the North and the South of Italy and the different statistics on financial statement variables explain why it is important to split up the sample to carry out an additional analysis by area. The sustainability indicator (financial expenses/EBITDA) is, on average, higher for the center and the south, pointing to an apparently lower sustainability of debt in these areas. Mean turnover and

[6] EBITDA is in fact still a variable calculating "gross" profit. Once interest, taxes etc. are subtracted from it, net profit could be negative (even if the EBITDA>0)

EBITDA are instead significantly higher in the northern areas. The median number of people employed is quite similar in all regions, while the mean is higher in the northern regions, indicating the presence of some large industrial groups in these areas (such as Fiat or Ferrero). It is also possible to calculate statistics by firm sector of activity. First of all, not all sectors are represented by the same number of firms, with the two most representative sectors (fabricated metal products and machinery and equipment) being considerably larger in our sample, which reflects their importance in the national economy. Nevertheless, firms belonging to every manufacturing sectors are present in the sample. In terms of average debt sustainability, firms seem not to differ too much across sectors: financial expenses/EBITDA (the dependent variable of the fixed effects regression) ranges from a minimum of 0.188 (pharmaceutical sector) to a maximum of 0.381 (manufacture of furniture).To better understand how many observations in my sample actually are unsustainable I use the threshold defined by De Socio and Michelangeli from Bank of Italy and define a firm as "unsustainable" for a certain year if its debt sustainability ratio is higher than 0.5 (De Socio and Michelangeli, 2015). I calculate summary statistics for sustainable and unsustainable firms. There are 8580 unsustainable observations, 10,1% of total observations.

Sustainable debt firms:

Variable	Mean	25th percentile	Median	75th percentile
Finexp_EBITDA	0.171	0.064	0.142	0.257
Leverage	0.840	0.782	0.907	0.963
Turnover	19560.26	3769.356	7241.356	15864.23
EBITDA	1888.191	308.000	626.000	1427.000
People Employed	59	16	30	56
Acid_test	1.028	0.697	0.905	1.178
Maturity	0.651	0.437	0.698	0.924
Collateral	4077.143	0.000	949.000	3780.000
Profit_loss	600.263	12.000	72.000	295.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Unsustainable debt firms:

Variable	Mean	25th percentile	Median	75th percentile
Finexp_EBITDA	1.469	0.571	0.697	1.026
Leverage	0.896	0.858	0.940	0.976
Turnover	16963.530	2874.528	5080.959	11320.03
EBITDA	654.921	90.000	191.000	425.000
People Employed	52	14	24	44
Acid_test	0.757	0.545	0.701	0.888
Maturity	0.693	0.532	0.730	0.910
Collateral	4108.464	0.000	766.000	3352.000
Profit_loss	-112.137	-133.000	-8.000	18.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Subdividing the sample by dummy variable status highlights the differences between sustainable and unsustainable firms. Turnover and EBITDA are on average lower for unsustainable firms just like acid_test and number of people employed. Maturity shows that unsustainable firms are usually more exposed to short term debt while finexp_EBITDA shows us that, while sustainable firms are quite homogeneous (mean and median are similar), unsustainable firms are not. Leverage does not present big differences between the two groups.

Differences among sectors are maybe more noticeable when looking at the percentage of firms with unsustainable debt in each sector. Tables outlining the percentage of unsustainable firms for the entire time period and only for the crisis years (2009-2012) are reported in the Appendix. The most important take-away from these numbers is that all manufacturing sectors witnessed an increase in the % of firms "to be monitored" during crisis years, with the notable exception of the pharmaceutical sector, which not only has the lowest average of financial expenses/EBITDA, but also the lowest percentage of unsustainable firms both for the entire period and for the crisis years. While all sectors (apart from pharmaceuticals) were hit negatively by the crisis in terms of debt sustainability, the magnitude of the impact seems to have been heterogeneous with some sectors experiencing a more serious worsening in firms' conditions and a stronger increase in the percentage of entities with unsustainable debt within the sector.

3.5 Possible issues

One of the main problems encountered when mixing macroeconomic and microeconomic variables in a panel data regression is frequency. Microeconomic variables such as those obtained from financial statements have a yearly frequency while macroeconomic variables related to debt yields have a much higher frequency. Therefore, putting together variables of a different nature makes it necessary to transform macroeconomic variables that have a monthly or even daily frequency (like the actual BTP-Bund time series or the trimestral bank_margin values) in yearly data. The negative consequence that this mismatch in frequencies can have is that a big part of the effect on real economy created by the volatility of the macroeconomic variable and the liquidity crisis is lost because macro variables are evened out over a given year. Therefore, estimates obtained using this type of data will tend to underestimate the real impact of sudden macroeconomic variables changes, in our case market turmoil and bank liquidity problems created by the increase in spread. The second possible problem that could be detected in the regression design is the "survivorship bias" which is introduced when using a balanced panel of firms.

The effects of the business cycle variables in particular are likely to be underestimated because some of the firms that were most heavily hit exited the sample.

3.5 Robustness check

Using the log of EBITDA in the fixed effects regression leads to the exclusion of those firms which display a negative EBITDA on their balance sheet. This could possibly increase the survivorship bias introduced when balancing the panel. I therefore carry out also a robustness check where I control for the first lag of EBITDA and turnover by using the profitability margin MG=EBITDA/turnover. This way I do not need to take the log of EBITDA and I can also include firms with a negative EBITDA. In the appendix I report summary statistics including firms with negative EBITDA and a robustness check where I carry out the fixed effects regression including also firms with a negative EBITDA and controlling for changes in EBITDA using the ratio EBITA/turnover.

4. Results

In order to correctly interpret the results, it is important to keep in mind that the dependent variable indicates debt sustainability and when the indicator grows it means that debt becomes less sustainable. Therefore, a positive coefficient sign will indicate that the explanatory variable has a positive impact on the dependent variable and therefore a negative impact on debt sustainability of the firm. Ideally, firms will want to keep this indicator as low as possible to have good chances of being able to meet their debt-related financial expenses for the year. By controlling for firm specific financial statement variables, it is possible to account for a possible balance sheet channel effect. The firm level variables which seem to be most significant throughout the analysis are leverage, EBITDA and turnover. Leverage appears to be extremely important in determining debt sustainability: as expected, the coefficient for leverage has a positive sign, therefore as leverage grows so does the dependent variable (leading to a deterioration in debt sustainability).

Regression results:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
EBITDA_log L1.	0.118***	0.119***	0.115***
	(0.026)	(0.026)	(0.026)
Leverage_ L1.	0.189***	0.140***	0.181***
	(0.039)	(0.042)	(0.039)
Maturity L1.	-0.015	-0.002	0.003
	(0.058)	(0.058)	(0.060)
Turnover1_log L1.	-0.159***	-0.159***	-0.072*
	(0.047)	(0.047)	(0.038)
Acid_test L1.	-0.003	-0.003	-0.002
	(0.005)	(0.005)	(0.005)
Collateral L1.	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Crisis_leverage		0.169***	
		(0.061)	
Bank_margin			0.145***
			(0.028)
_cons	0.807**	0.853**	0.031
	(0.348)	(0.349)	(0.263)
yr2008	0.000	0.000	
	(omitted)	(omitted)	
yr2009	0.083***	-0.060	
	(0.029)	(0.048)	
yr2010	-0.093***	-0.093***	
	(0.023)	(0.023)	
yr2011	-0.027	-0.027	
	(0.024)	(0.024)	
yr2012	0.050**	-0.094**	
	(0.023)	(0.048)	
yr2013	0.006	0.006	
	(0.020)	(0.020)	
yr2014	0.000	0.000	
	(omitted)	(omitted)	
sigma_u	0.754	0.754	0.757
sigma_e	1.697	1.6974	1.697
rho	0.165	0.165	0.166

legend: * p<0.1; ** p<0.05; *** p<0.01

Note: Sigma_u is the standard deviation of u_{it} (the unobserved heterogeneity term), while sigma_e is the standard error of ε_t. Rho is the fraction of variance due to u_{it}.

The definition of leverage used in this paper is leverage=debt/(debt+capital), which means that the value of leverage is always smaller than 1. Therefore, since leverage is calculated as a ratio that can only vary between 0 and 1, its impact on financial expenses/EBITDA will always be smaller than the number indicated by the coefficient in the regression. Intuitively, given that yearly mean values of leverage oscillate between a maximum of 0.853 (in 2011) and a minimum of 0.835 (in 2014), it is possible to imagine that

a change from the situation in 2011 to that in 2014 will lead to an impact of (0.853-0.835) * 0.189=0.003 on a dependent variable which on average over the whole period considered has a value of 0.303. In conclusion, leverage is highly significant as a variable but its actual impact on the debt sustainability indicator is likely to be small because this is a structural variable whose value was already quite high before the crisis and that has undergone minimal changes over time. According to the results reported in column (2), where the interaction variable crisis*leverage is added, there is evidence of a stronger impact of leverage on firms' debt sustainability was during crisis years. The coefficient of the interaction between leverage and crisis is even larger than that of leverage alone, suggesting that during adverse business cycle periods this particular firm characteristic weighs heavier in determining the dependent variable and is probably more closely scrutinized by banks when deciding which interest rate margin to apply on loans.

Lagged EBITDA has a positive coefficient which is very counterintuitive for two reasons. First of all, in general, one would expect that the better the firm profitability (of which EBITDA is an indicator) the easier it will be for said firm to manage its financial expenses. Secondly, the indicator of debt sustainability has EBITDA as its denominator, so it is quite surprising that lagged EBITDA would have a positive effect since the higher this year's EBITDA is the lower the indicator value (the better debt sustainability). What this could indicate is that there is either no correlation between EBITDA at t-1 and at t, or that this correlation is negative over the period considered, thus explaining the coefficient sign. An additional explanation for the positive EBITDA coefficient could be that this result is driven by differences among sectors since some of them are characterized by structurally high or low EBITDAs. To investigate these possible effects, I create and introduce in the regression an interaction variable EBITDA*sector (results included in the Appendix). The results from this regression show that the positive coefficient of lagged EBITDA could, in some cases, actually be due to sector differences. In fact, significant EBITDA*sector interactions generally completely counterbalance the positive EBITDA coefficient, thus leading to an overall effect of EBITDA which is actually negative or close to zero for some sectors this is true for sectors such as Food, Beverages, Wearing apparel, Wood, Paper and Computer and Electronics). The positive EBITDA coefficient found in the main regression could therefore be driven by a composition effect related to sectors.

Turnover has a negative coefficient, which is in line with both my expectations and the findings reported in the literature. The larger a firm is, the lower the interest rate applied by banks when providing a loan (a larger firm will generally have more collateral, higher margins and probably better guarantees for repayment). It could also be that higher turnover is correlated with higher EBITDA for the next year (the denominator of the dependent variable), however I am controlling for the first lag of EBITDA, therefore the lagged EBITDA coefficient should be capturing this effect. Another reason why a higher

turnover could be allowing larger firms to better control their debt sustainability is that size increases firms' negotiating power with banks when discussing loan agreements. Finally, larger firms have higher chances of seeking financing on the market and issue bonds (although this is not as common in Italy as in other developed countries). It is quite surprising that the coefficient for the variable maturity is not significant for any of the fixed effects regressions reported below, since short term debt is usually riskier and a higher proportion of short term debt on a firms' balance sheet usually entails higher financial expenses as well. Acid_test and collateral also appear not to be significant, a possible explanation could be that liquidity (acid_test) is generally low throughout the sample of firms during the crisis and that the effect of collateral is captured by turnover (as an indicator for size).

Year dummies capture the effect of overall economic conditions on debt sustainability over a given year. When interpreting year dummies' coefficients, it is necessary to remember that they provide an indication as to which year presented more favorable or less favorable macroeconomic conditions in general. The bank lending channel effect is not isolated when using year dummies. From the regression results reported in column (1) it is inferred that there were two years during which the economic conditions were not conducive to maintaining a good debt sustainability, these can also be identified as the "crisis" years: 2009 and 2012. The year 2010 emerges as a "bounce-back" year, between the two crises. This is also confirmed by GDP growth statistics which document how Italy fell into recession in 2009 while growing again in 2010 (Istat). In column (2), the introduction of the crisis*leverage interaction leads the 2009 dummy to lose its significance and 2012 obtains a negative coefficient sign. This could be because the entire effect of the business cycle for the crisis years is captured by the interaction variable.

The bank_margin coefficient is significant and indicates the presence of a bank lending channel of transmission from the macroeconomic level to debt sustainability of microeconomic entities. In terms of magnitude, the coefficient of bank_margin is slightly smaller than that of leverage, but (although the two variables are measured on a similar scale, thanks to the transformation previously operated on bank_margin values) bank_margin undergoes more abrupt changes than leverage over the years, thus potentially having had a bigger impact on dependent variable movements over the period considered. To be more precise in estimating the effect of bank margin changes on debt sustainability: the improvement in bank margin between 2012 and 2014 was 0.563 which multiplied by the coefficient reported in column (3), 0.145, produces an estimated impact of 0.082 on the dependent variable. This would imply that the magnitude of the effect of the bank lending channel on firms' debt sustainability is on average larger than that of leverage. However, leverage does not account for the whole balance sheet channel, it is just one of the possible characteristics influencing debt sustainability.

I carried out the same set of regressions dividing up my sample by macro region. I identified 3 areas: Center-South, North-East and North-West. Firms located in central and southern Italy are aggregated together because of the lower number of firms present in the two regions. The results obtained (reported in full in the Appendix) partly confirm the findings of the main regression, even though some differences among geographic areas emerge. While the results obtained for the "Center-South" and "North-West" areas are mostly in line with those of the baseline model, those for the "North-East" area present some surprising findings. First of all, for firms located in this area of the country maturity seems to be indeed important in determining debt sustainability (this variable is instead not significant for other areas): the coefficient obtained in the regression is significant and indicates that a higher proportion of short term debt (maturity was defined as short term debt/total debt) makes firms' debt less sustainable. This could be due to a higher exposure to short term debt for the firms in the area. This could be caused either by structural factors or by different bank's policies. In fact, the North-East is characterized by a relatively high proportion of small "local banks" which are strongly linked to regional industrial districts and, although local banks are themselves riskier than larger banks operating nationwide, they provide credit usually at lower interest rates (Stefani et al, 2016). This peculiarity could be in some way affecting the estimates for the North-East area as local banks might be following different criteria for allocation of credit (for example give more importance to maturity and less to leverage). Moreover, for firms located in the north-eastern area of the country turnover and EBITDA also seem not to be significant in determining debt sustainability. In the Center-South and North-West areas instead balance sheet determinants of debt sustainability appear to be the same as in the main model.
Year dummies differ in their significance across areas, which could indicate that firms located in different geographic areas might have felt the consequences of the crisis at different points in time. Finally, the coefficient for bank_margin in column 3) is significant and has a positive sign in all three regressions by area (although the coefficient is lower for Center-South firms), which confirms the findings of the main regression that, controlling for firm characteristics, macroeconomic conditions acting through the bank lending channel have an impact on debt sustainability of firms. In conclusion the results of regressions by area suggest that, while different balance sheet characteristics could be relevant for different areas, all firms suffer from increases in bank margin.

The robustness check regression carried out for the fixed effects regression including firms with negative EBITDA is reported in the appendix. The results confirm the importance of leverage, and bank_margin. The year dummy 2009 is not significant anymore, while 2011 and 2012 (the years of the sovereign debt crisis are significant). In order to carry out this regression I had to use slightly different controls, specifically I had to use MG (operative margin = EBITDA/turnover), which, against my expectations,

does not appear to be significant. The introduction of a different control variable is probably the reason why turnover and the dummy for 2009 are no longer significant.

5. Conclusion

The first and most general conclusion to be reached through the analysis presented in this paper is that the global financial crisis in 2009 and the recent sovereign debt crisis in 2011-2012 both have had an impact on firms' debt sustainability. The evidence for this is provided by the significance of year dummies' coefficients for those years when economic conditions worsened/improved more abruptly, which suggests that business cycle changes play a role in determining corporate debt sustainability.

This first conclusion allows me to narrow my focus and try to isolate the effect of the bank lending propagation mechanism. I proceed by proxying for the bank-lending channel using the bank_margin variable and inserting it into my regression instead of using year dummies. I conclude that the significance and the sign of the bank_margin coefficient indicates the presence of a bank lending channel through which the shock caused by the increase in spread is transmitted to banks, thus leading to a tightening in the credit market (higher interest rates on loans in particular). It is possible to assert that, to some extent, tougher credit conditions imposed by banks channeled the shock of the increase in spread directly towards firms' financial debt sustainability. A considerable portion of the impact on debt sustainability depended on an increase in financial expenses, which is linked to the increase in interest rates due to the spread crisis.

With regard to the balance sheet channel there are various characteristics which concur in determining debt sustainability. First of all, size: smaller firms generally have worse debt sustainability and will therefore be more at risk during a recession. Moreover, firms with higher leverage (more specifically firms which already have high leverage when the crisis begins) will on average have a harder time servicing debt. This would suggest that deleveraging should be supported by policy as well. Geographical areas and sectors of activity also seem to play a role in shaping corporate debt sustainability, indicating that it could potentially be important to design different policies depending on these two characteristics. In terms of magnitude, even though some firm specific variables, for example leverage, and bank_margin coefficients are more or less the same, the bank_margin variable representing the bank lending channel is subject to quicker changes. This higher volatility and sensitivity to macroeconomic events means that the bank lending channel is probably the biggest culprit in determining the worsening of debt sustainability during a crisis.

Proof on the workings of the credit channel allows policy makers to focus on the design of measures that target this particular propagation mechanism. Aiming policies directly towards solving credit market-related problems during a recession, instead of concentrating on other types of incentives, can prove beneficial in fostering firms' survival. This can be done for instance by stimulating the supply of credit from banks towards specific categories of firms which appear to have suffered the most on account of credit tightening. For example, these could be small firms, firms located in disadvantaged (economically "weak") areas or belonging to sectors of the economy that are physiologically at risk in terms of sustainability. The negative effects of the macroeconomic crisis on credit markets propagated through the bank lending channel can instead be targeted by focusing on easing credit conditions by helping banks facing their financing needs without having to decrease supply or increase interest rates. This channel can however only be moderately influenced by fiscal policy (decided by the Italian government) since the main tools to target bank lending are linked to central bank monetary policy (decided by the ECB) and fiscal measures related to banks' activities are tightly regulated by the EU.

Knowing that macroeconomic conditions are transmitted also through the credit channel ultimately means that in order to protect the real economy from negative monetary shocks this propagation mechanism always needs to be addressed. This aspect of transmission of macroeconomic shocks to microeconomic entities' fundamentals can be considered as common in most developed countries where credit markets are well-functioning and banks play an important financing role. Even though the Italian case has some peculiarities (high proportion of small firms, strong predominance of the manufacturing sector and high dependency on bank financing), this analysis can provide a hint as to what the important determinants of debt sustainability could be also in other developed European countries ,which could come to face similar conditions in the future.

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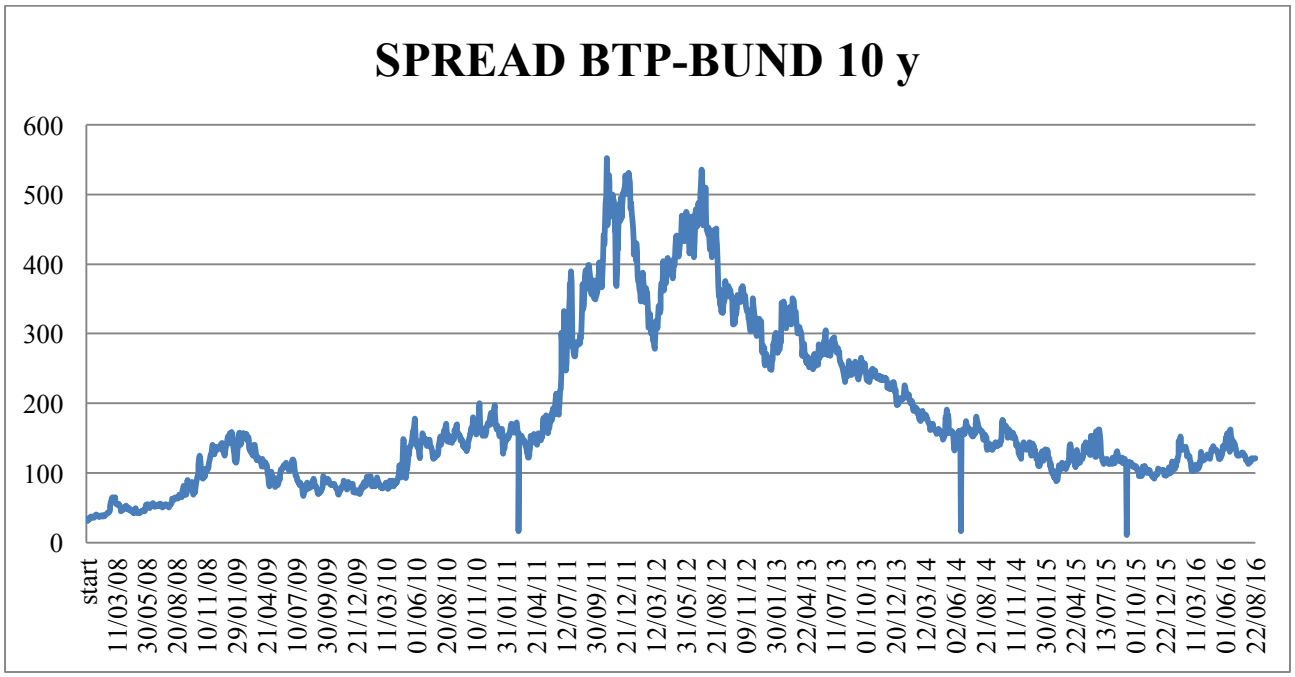
Appendix

BTP-Bund spread line graph 2008-2016:



Source: Bloomberg, data downloaded on October 7, 2016.

Confidence of Italian firms in the economic conditions, year averages:

Year	*Confidence index*
2008	96,258
2009	88,342
2010	99,983
2011	94,800
2012	80,667
2013	84,800
2014	93,833

Source: ISTAT – www.istat.it

Bank Lending survey trimestral results:

Explicative note on calculation of index:

The reference date used in the table coincides with the month following the trimester during which the data is collected. The "net percentage" is given by the difference between the percentage of answers indicating a variation with a certain sign (for example, a "tightening in criteria" or an "increase in demand" or an "increase in the share of rejected requests") and the percentage of answers indicating a variation of the opposite sign (a "relaxing of criteria" or a "decrease in demand" or a "decrease in the share of rejected requests"). The range of variation of the index goes from -100 to 100.

Question 3_ terms and conditions practiced by your bank for the approval of loans and the opening of credit lines to firms.

question 3(B) margins: bank margin (i.e. the differential with a market reference rate) on loan average (increase in margin=tightening; decrease in margin = relaxing)	
Jan-2008	20
Apr-2008	77.8
Jul-2008	37.5
Oct-2008	75
Jan-2009	62.5
Apr-2009	75
Jul-2009	37.5
Oct-2009	25
Jan-2010	12.5
Apr-2010	0
Jul-2010	-12.5
Oct-2010	0
Jan-2011	12.5
Apr-2011	37.5
Jul-2011	25
Oct-2011	62.5
Jan-2012	87.5
Apr-2012	37.5
Jul-2012	25
Oct-2012	25
Jan-2013	12.5
Apr-2013	12.5
Jul-2013	0
Oct-2013	-12.5
Jan-2014	0
Apr-2014	-12.5
Jul-2014	25
Oct-2014	-12.5

Source: Bank Lending Survey, Bank of Italy. Last updated July 2016.

Bank_margin variable, annual values:

2008	52.6
2009	50
2010	0
2011	34.4
2012	43.8
2013	3.1
2014	-12.5

Source: Author's rendering of Bank Lending Survey, Bank of Italy data. Last updated July 2016.

Summary statistics by year:

2008:

Firms: i =12103

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.354	0.115	0.230	0.386
Leverage	0.852	0.801	0.915	0.967
Turnover	18558.020	3695.299	6846.735	14733.54
EBITDA	1698.293	287.000	562.000	1258.000
People employed	56.922	15	28	53
Acid_test	0.955	0.672	0.854	1.080
Maturity	0.684	0.487	0.746	0.962
Collateral	3838.292	23.000	1004.000	3534.000
Profit_loss	433.316	7.000	56.000	236.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2009:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.378	0.083	0.175	0.330
Leverage	0.845	0.787	0.910	0.964
Turnover	15455.330	3095.634	5741.662	12473.500
EBITDA	1518.671	233.000	474.000	1120.000
People employed	56.760	15	28	53
Acid_test	1.010	0.686	0.896	1.160
Maturity	0.642	0.415	0.684	0.928
Collateral	3993.675	15.000	1064.000	3652.000
Profit_loss	375.608	0.000	37.000	195.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2010:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.207	0.057	0.125	0.241
Leverage	0.849	0.795	0.913	0.966
Turnover	17651.710	3472.289	6537.000	14190.820
EBITDA	1690.729	266.000	544.000	1262.000
People employed	58.090	16	29	54
Acid_test	0.996	0.693	0.892	1.146
Maturity	0.634	0.406	0.672	0.906
Collateral	3991.971	0.000	821.000	3630.000
Profit_loss	522.454	9.000	61.000	261.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2011:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Mediuan*	*75th percentile*
Finexp_EBITDA	0.272	0.069	0.148	0.277
Leverage	0.853	0.801	0.916	0.966
Turnover	20323.120	3881.135	7364.711	16213.11
EBITDA	1796.683	278.000	581.000	1327.000
People employed	59.411	16	29	55
Acid_test	0.973	0.672	0.871	1.117
Maturity	0.653	0.452	0.697	0.907
Collateral	4116.379	0.000	837.000	3762.000
Profit_loss	537.5795	7.000	54.000	241.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2012:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.337	0.075	0.178	0.339
Leverage	.847	0.793	0.912	0.966
Turnover	20502.720	3800.407	7363.801	16344.270
EBITDA	1749.038	260.000	564.000	1315.000
People employed	60.219	16	30	56
Acid_test	0.998	0.666	0.876	1.154
Maturity	0.665	0.470	0.712	0.920
Collateral	4153.686	0000	843.000	3806.000
Profit_loss	577.471	9.000	62.000	270.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2013:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.287	0.063	0.157	0.308
Leverage	0.839	0.783	0.908	0.963
Turnover	21006.660	3822.804	7510.036	16796.020
EBITDA	1875.116	282.000	608.000	1418.000
People employed	60.367	16	30	56
Acid_test	1.021	0.670	0.886	1.179
Maturity	0.662	0.464	0.709	0.920
Collateral	4172.691	0.000	792.000	3812.000
Profit_loss	568.725	7.000	55.000	263.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

2014:

Firms: i = 12103

Variable	*Mean*	*25th percentile*	*Medium*	*75th percentile*
Finexp_EBITDA	0.290	0.056	0.147	0.295
Leverage	0.835	0.779	0.905	0.963
Turnover	21570.510	3940.881	7783.325	17631.070
EBITDA	2008.406	289.000	641.000	1534.000
People employed	61.719	17	30	58.000
Acid_test	1.052	0.674	0.901	1.224
Maturity	0.648	0.441	0.690	0.909
Collateral	4295.669	0.000	1049.000	3935.000
Profit_loss	678.127	10.000	72.000	334.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Percentage of firms with unsustainable debt/to be monitored, by year:

Year	*Number of observations*	*Observations with unsustainable debt*	*%*
2008	12103	1725	14.153%
2009	12103	1484	12.261%
2010	12103	701	5.792%
2011	12103	888	7.337%
2012	12103	1452	11.997%
2013	12103	1194	9.865%
2014	12103	1098	9.072%

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Summary statistics by area:

Area1 = Center

Firms: i=1921
Years: t=7

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.346	0.087	0.188	0.342
Leverage	0.849	0.802	0.914	0.964
Turnover	16655.260	3648.092	6827.142	13951.56
EBITDA	1496.361	250.000	507.000	1164.000
People employed	53.45869	15	28	53
Acid_test	1.023461	0.691	0.898	1.160
Maturity	.6796588	0.488	0.793	0.945
Collateral	2948.102	0.000	477.000	2722.000
Profit_loss	458.991	7.000	49.000	218.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Area 2= North East

Firms: i=4129
Years: t=7

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.276	0.064	0.148	0.290
Leverage	0.846	0.794	0.912	0.965
Turnover	21671.090	3679.89	7158.007	16374.42
EBITDA	1996.792	261.000	563.000	1372.000
People employed	64.655	17	30	56
Acid_test	0.983	0.669	0.870	1.131
Maturity	0.660	0.446	0.709	0.935
Collateral	4401.472	0.000	816.000	3612.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Area 3=North-West

Firms: i=4874
Years: t=7

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.301	0.067	0.157	0.302
Leverage	0.845	0.789	0.911	0.966
Turnover	19583.390	3639.546	7010.881	15600.700
EBITDA	1804.360	280.000	590.000	1372.000
People employed	59.804	16	29	56
Acid_test	1.011	0.680	0.885	1.164
Maturity	0.651	0.446	0.695	0.913
Collateral	4211.553	0.000	1023.500	3963.000
Profit_loss	509.4306	6.000	56.000	255.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Area4=South

Firms: i=1179
Years: t=7

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.339	0.106	0.217	0.364
Leverage	0.841	0.778	0.904	0.962
Turnover	14087.040	3595.115	6620.368	14377.520
EBITDA	1201.737	286.000	573.000	1203.000
People employed	47.244	16.000	29.000	51.000
Acid_test	0.981	0.659	0.876	1.135
Maturity	0.615	0.402	0.649	0.865
Collateral	4258.044	0.000	1833.000	4875.000
Profit_loss	248.351	9.000	50.000	191.000

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Fixed effects regression - Center-South of Italy:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
EBITDA_log L1.	0.115***	0.115***	0.105***
	(0.040)	(0.039)	(0.040)
Leverage_ L1.	0.191***	0.138*	0.188**
	(0.191)	(0.078)	(0.073)
Maturity L1.	-0.125	-0.125	-0.117
	(0.161)	(0.161)	(0.164)
Turnover1_log L1.	-0.195**	-0.194**	-0.092
	(0.083)	(0.083)	(0.063)
Acid_test L1.	-0.020	-0.020	-0.019
	(0.015)	(0.016)	(0.014)
Collateral L1.	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Crisis_leverage	-	0.173	-
		(0.140)	
Bank_margin	-	-	0.114**
			(0.054)
_cons	1.311*	1.351*	0.420
	(0.707)	(0.714)	(0.538)
yr2008	(omitted)	(omitted)	-
	0.000	0.000	
yr2009	0.030	-0.117	-
	(0.053)	(0.088)	
yr2010	-0.126***	-0.126***	-
	(0.033)	(0.033)	
yr2011	-0.025	-0.024	-
	(0.050)	(0.050)	
yr2012	0.058*	-0.089	-
	(0.034)	(0.121)	
yr2013	0.033	0.034	-
	(0.032)	(0.032)	
yr2014	(omitted)	(omitted)	-
	0.000	0.000	
sigma_u	0.774	0.774	0.772
sigma_e	1.709	1.709	1.710
rho	0.170	0.170	0.169

legend: * p<.1; ** p<.05; *** p<.01

Fixed effects regression - North-East of Italy:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
EBITDA_log L1.	0.051	0.051	0.048
	(0.033)	(0.033)	(0.033)
Leverage_ L1.	0.116***	0.060	0.119***
	(0.044)	(0.056)	(0.042)
Maturity L1.	0.106*	0.104*	0.126**
	(0.056)	(0.056)	(0.059)
Turnover1_log L1.	-0.006	-0.007	0.042
	(0.056)	(0.056)	(0.044)
Acid_test L1.	0.003	0.002	0.004
	(0.007)	(0.007)	(0.007)
Collateral L1.	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Crisis_leverage	-	0.218***	-
		(0.078)	
Bank_margin	-	-	0.153***
			(0.042)
_cons	-0.223	-0.164	-0.667*
	(0.507)	(0.502)	(0.381)
yr2008	(omitted)	(omitted)	-
	0.000	0.000	
yr2009	0.124***	-0.062	-
	(0.046)	(0.060)	
yr2010	-0.042	-0.042	-
	(0.030)	(0.031)	
yr2011	-0.010	-0.009	-
	(0.025)	(0.025)	
yr2012	0.042	-0.143**	-
		(0.057)	
yr2013	0.009	-0.010	-
	(0.025)	(0.025)	
yr2014	(omitted)	(omitted)	-
	0.000	0.000	
sigma_u	0.655	0.654	0.665
sigma_e	1.445	1.445	1.445
rho	0.170	0.170	0.175

legend: * p<.1; ** p<.05; *** p<.01

Fixed effects regression - North-West of Italy:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
EBITDA_log L1.	0.179***	0.179***	0.172***
	(0.054)	(0.054)	(0.053)
Leverage_ L1.	0.258***	0.221***	0.246***
	(0.084)	(0.085)	(0.084)
Maturity L1.	-0.048	-0.049	-0.025
	(0.088)	(0.088)	(0.089)
Turnover_log L1.	-0.265***	-0.266***	-0.153**
	(0.092)	(0.092)	(0.076)
Acid_test L1.	0.011	0.008	0.008
	(0.024)	(0.024)	(0.024)
Collateral L1.	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Crisis_leverage	-	0.119	-
		(0.102)	
Bank_margin	-	-	0.157***
			(0.051)
_cons	1.334**	1.374**	0.327
	(0.574)	(0.576)	(0.432)
yr2008	(omitted)	(omitted)	-
	0.000	0.000	
yr2009	0.083*	-0.018	-
	(0.050)	(0.093)	
yr2010	-0.117**	-0.117**	-
	(0.045)	(0.045)	
yr2011	-0.044	-0.043	-
	(0.046)	(0.046)	
yr2012	0.052	-0.049	-
	(0.048)	(0.076)	
yr2013	-0.013	-0.013	-
	(0.039)	(0.039)	
yr2014	(omitted)	(omitted)	-
	0.000	0.000	
sigma_u	0.837	0.837	0.831
sigma_e	1.877	1.877	1.878
rho	0.166	0.166	0.164

legend: * p<.1; ** p<.05; *** p<.01

Finexp_EBITDA by sector:

Sector	*Mean*	*25th percentile*	*Median*	*75th percentile*	*Number of observations*
Food	0.289	0.085	0.189	0.346	N = 9947 n = 1421 T = 7
Beverages	0.291	0.092	0.192	0.342	N = 1512 n = 216 T = 7
Textiles	0.332	0.079	0.181	0.351	N = 3017 n = 431 T = 7
Wearing Apparel	0.343	0.090	0.201	0.361	N = 2842 n = 406 T = 7
Leather Products	0.287	0.076	0.176	0.311	N = 3101 n = 443 T = 7
Wood	0.308	0.107	0.202	0.362	N = 2163 n = 309
Paper	0.255	0.064	0.137	0.267	N = 2667 n = 381 T = 7
Print&Media	0.299	0.073	0.170	0.318	N = 1757 n = 251 T = 7
Chemicals	0.274	0.074	0.156	0.296	N = 4032 n = 576 T = 7
Pharmaceuticals	0.188	0.041	0.110	0.205	N = 609 n = 87 T = 7
Plastic	0.298	0.064	0.152	0.294	N = 5922 n = 846 T = 7
Non-metallic mineral products	0.407	0.086	0.187	0.336	N = 4116 n = 846 T = 7
Basic metals	0.365	0.068	0.158	0.304	N = 2583 n = 369 T = 7
Metal products	0.301	0.066	0.153	0.292	N = 15701 n = 2243 T = 7
Computers&Electronics	0.291	0.060	0.145	0.287	N = 2170 n = 310 T = 7
Electrical equipment	0.285	0.061	0.143	0.289	N = 3178 n = 454 T = 7
Machinery&Equipment	0.263	0.057	0.142	0.290	N = 11515

					n = 1645 T = 7
Motor vehicles	0.298	0.077	0.176	0.331	N = 1519 n = 217 T = 7
Other transport equipment	0.320	0.070	0.143	0.274	N = 784 n = 112 T = 7
Furniture	0.381	0.092	0.190	0.343	N = 3297 n = 471 T = 7
Other manufacturing	0.338	0.089	0.192	0.343	N = 2289 n = 327 T = 7

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Percentage of firms with unsustainable debt/to be monitored, by sector:

Sector	*Number of observations*	*Observations with unsustainable debt over (2008-2014)*	*Number of observations for crisis years*	*Observations with unsustainable debt during crisis years (2009, 2012)*	*% unsustainable observations over the whole period*	*% unsustainable during crisis years (2009,2012)*
Food	9947	1098	2842	317	11.039%	11.154%
Beverages	1512	200	432	62	13.228%	14.352%
Textiles	3017	419	862	152	13.888%	17.633%
Wearing Apparel	2842	375	812	120	13.195%	14.778%
Leather Products	3101	294	886	101	9.481%	11.400%
Wood	2163	282	618	100	13.037%	16.181%
Paper	2667	213	762	69	7.987%	9.055%
Print& Media	1757	181	502	69	10.302%	13.745%
Chemicals	4032	354	1152	107	8.780%	9.288%
Pharma	609	23	174	5	3.777%	2.874%
Plastic	5922	533	1692	187	9.000%	11.052%
Non-metallic mineral products	4116	479	1176	142	11.638%	12.075%
Basic metals	2583	239	738	101	9.253%	13.686%
Metal products	15701	1417	4486	533	9.025%	11.881%
Computers &Electronics	2170	204	620	76	9.401%	12.258%
Electrical Equipment	3178	298	908	111	9.377%	12.225%
Machinery& Equipment	11515	1063	3290	404	9.231%	12.280%
Motor vehicles	1519	159	434	64	10.467%	14.747%
Other transport equipment	784	75	224	24	9.566%	10.714%
Furniture	3297	426	942	136	12.921%	14.437%
Other manufacturing	2289	308	654	317	13.456%	48.471%

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Fixed Effects regression with EBITDA*sector interaction:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
EBITDA_log L1.	0.219**	0.220**	0.210*
	(0.109)	(0.0110)	(0.109)
Leverage_ L1.	0.181***	0.134***	0.174***
	(0.040)	(0.042)	(0.039)
Maturity L1.	-0.019	-0.020	-0.002
	(0.059)	(0.059)	(0.061)
Turnover_log L1.	-0.163***	-0.164***	-0.078**
	(0.048)	(0.048)	(0.039)
Acid_test L1.	-0.002	-0.003	-0.002
	(0.005)	(0.005)	(0.005)
Collateral L1.	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Crisis_leverage	-	0.168***	-
		(0.061)	
Bank_margin	-	-	0.138***
			(0.028)
_cons	0.909**	0.955**	0.156
	(0.361)	(0.362)	(0.279)
yr2008	0.000	0.000	-
	(omitted)	(omitted)	
yr2009	0.079***	-0.064	-
	(0.028)	(0.048)	
yr2010	-0.091***	-0.091***	-
	(0.045)	(0.022)	
yr2011	-0.028	-0.028	-
	(0.022)	(0.024)	
yr2012	0.048**	-0.095**	-
	(0.023)	(0.048)	
yr2013	-0.006	-0.006	-
	(0.020)	(0.020)	
yr2014	0.000	0.000	-
	0(omitted)	(omitted)	
*EBITDA*Food*	-0.203*	-0.204*	-0.205*
	(0.111)	(0.111)	(0.111)
*EBITDA*Beverages*	-0.208*	-0.209*	-0.209*
	(0.111)	(0.111)	(0.111)
*EBITDA*Textiles*	-0.115	-0.114	-0.109
	(0.114)	(0.114)	(0.114)
*EBITDA*Wearing Apparel*	-0.245**	-0.246**	-0.243**
	(0.116)	(0.116)	(0.116)
*EBITDA*Leather Products*	-0.119	-0.121	-0.113
	(0.118)	(0.118)	(0.118)
*EBITDA*Wood*	-0.243**	-0.244**	-0.239*
	(0.123)	(0.123)	(0.123)
*EBITDA*Paper*	-0.207*	-0.207*	-0.203*
	(0.114)	(0.114)	(0.114)
*EBITDA*Print&Media*	-0.240*	-0.242*	-0.236*
	(0.125)	(0.125)	(0.126)

*EBITDA*Chemicals*	-0.091	-0.093	-0.094
	(0.128)	(0.128)	(0.129)
*EBITDA*Pharmaceuticals*	-0.208*	-0.210*	-0.204*
	(0.111)	(0.111)	(0.110)
*EBITDA*Plastic*	-0.119	-0.120	-0.117
	(0.124)	(0.124)	(0.124)
*EBITDA*Non-metallic mineral products*	-0.158	-0.158	-0.167
	(0.181)	(0.181)	(0.181)
*EBITDA*Basic metals*	0.136	0.137	0.145
	(0.186)	(0.186)	(0.187)
*EBITDA*Metal products*	-0.006	-0.007	0.001
	(0.129)	(0.129)	(0.129)
*EBITDA*Computers&Electronics*	-0.217*	-0.218*	-0.212*
	(0.116)	(0.116)	(0.117)
*EBITDA*Electrical equipment*	-0.014	-0.016	-0.011
	(0.235)	(0.234)	(0.235)
*EBITDA*Machinery&Equipment*	-0.155	-0.156	-0.149
	(0.111)	(0.111)	(0.111)
*EBITDA*Motor vehicles*	-0.141	-0.141	-0.135
	(0.112)	(0.112)	(0.112)
*EBITDA*Other transport equipment*	-0.085	-0.084	-0.089
	(0.134)	(0.134)	(0.135)
*EBITDA*Furniture*	0.067	0.067	0.072
	(0.204)	(0.134)	(0.205)
*EBITDA*Other manufacturing*	0.000	0.000	0.000
	(omitted)	(omitted)	(omitted)
sigma_u	0.977	0.977	0.983
sigma_e	1.700	1.700	1.670
rho	0.249	0.249	0.251

Source: Author's rendering of ISID (Intesa Sanpaolo Integrated Database) data.
Note: Turnover, EBITDA and collateral values are expressed in thousands of euros.

Summary statistics including firms with negative EBITDA:

Observations: N = 101754
Firms: i=16965
Years: t=7

Variable	*Mean*	*25th percentile*	*Median*	*75th percentile*
Finexp_EBITDA	0.217	0.059	0.165	0.335
Leverage	0.843	0.785	0.909	0.964
Turnover	20257.070	3373.73	6403.250	14247.970
EBITDA	1326.073	184.000	441.000	1079.000
People Employed	63.366	16	29	55
Acid_test	0.995	0.642	0.848	1.112
Maturity	0.667	0.464	0.716	0.939
Collateral	4165.256	0.000	808.000	3629.000
Profit_loss	269.157	-4.000	32.000	183.000

Fixed effects regression including firms with negative EBITDA:

Finexp_EBITDA	*(1)*	*(2)*	*(3)*
MG	0.084	0.084	0.088
L1.	(0.348)	(0.348)	(0.348)
*Leverage_*	0.239**	0.227*	0.245**
L1.	(0.120)	(0.126)	(0.120)
Maturity	0.043	0.043	0.026
L1.	(0.078)	(0.078)	(0.077)
Acid_test	0.007	0.007	0.007
L1.	(0.011)	(0.011)	(0.011)
Collateral	0.000	0.000	0.000
L1.	(0.000)	(0.000)	(0.000)
Crisis_leverage		0.037	
		(0.208)	
Bank_margin			0.166**
			(0.072)
_cons	-0.112	-0.103	-0.086
	(0.136)	(0.142)	(0.131)
yr2008	0.000	0.000	
	(omitted)	(omitted)	
yr2009	0.054	0.023	
	(0.060)	(0.162)	
yr2010	0.026	0.026	
	(0.047)	(0.047)	
yr2011	0.101**	0.101**	
	(0.044)	(0.044)	
yr2012	0.174***	0.143	
	(0.063)	(0.192)	
yr2013	0.010	0.010	
	(0.051)	(0.052)	
yr2014	0.000	0.000	
	(omitted)	(omitted)	
sigma_u	2.200	2.200	2.200
sigma_e	5.403	5.403	5.403
rho	0.142	0.142	0.142

legend: * p<.1; ** p<.05; *** p<.01