Why do small businesses have difficulty in accessing bank financing?

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Abstract

This study investigates bank financing to small and medium-size enterprises (SMEs) and evaluates whether the difficulties of SMEs in accessing bank financing during a period of financial crisis are due to a reduction in the supply of credit, or to a decrease in the demand for credit. The results show that the macroeconomic setting matters: demand effects are unlikely to drive the decline in the stock of bank loans, while the supply of credit causes SMEs difficulties in accessing bank credit. During a crisis period, in particular, an increase in the risk of lenders leads to the reduced supply of credit and credit rationing (i.e. the bank lending channel). In a post-crisis period, SMEs with increased risk and decreased profits have great difficulties in securing bank loans (i.e. the borrower balance sheet channel). Taken together, these results suggest that supply effects initially emerge through the bank-lending channel and then shift to the borrower balance sheet channel over a period of financial crisis.

Keywords: bank financing; financial crises; SME finance

JEL Codes: G01; G21; G32; L26

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1. Introduction

Small and medium-size enterprises (SMEs) represent a significant part of the European economy (European Commission 2016)[1], while access to strategic resources is critical for SME performance and sustainable economic growth at national and regional levels (OECD 2017). This study investigates the role of bank credit in financing SMEs and asks two key questions: have the demand for bank credit and the supply of credit to SMEs fundamentally changed during and subsequent to recent financial crises? How have these changes affected SMEs' access to external financing?

This study contributes to an extensive extant literature on corporate financing decisions. One key strand of this research is on how access to finance operates as a growth constraint (e.g. Mascia, 2018; Ayyagani et al 2008; Beck et al 2008; Beck and Demirgüç-Kunt 2006; Romano et al., 2001)[2]. These studies suggest that for many SMEs, access to finance is hampered by a range of demand and supply-side obstacles, rather than necessarily infrastructure impediments, such as the absence of technology. Given that utilisation of external finance (e.g. from sources such as business angels, venture capital and private equity), is recipient firm-size dependent, with smaller firms showing significantly less demand for such finance (Lawless et al., 2015; Moritz et al., 2015), the focus of this study is on access to bank financing by SMEs.

The debate on the accessibility of bank financing is highly polarised: SME entrepreneurs accuse banks of not lending enough funds to small businesses (i.e. supply effects), while banks complain about the lack of strong credit demand from entrepreneurs (i.e. demand effects).

[1] According to the European Commission, SMEs are defined as firms with less than 250 employees and turnover of less than 50 million Euro or assets in balance sheet of less than 43 million Euros. We also use this definition in our study. SMEs employ two thirds of the European workforce.
See: http://www.ansa.it/documents/1415814222451_Rapporto.pdf

[2] Also, see various studies in the entrepreneurial and innovation literatures (Masiak et al 2018).

Previous studies show that the amount of credit available to SMEs has fallen sharply since the onset of the global financial crisis in 2008, but is unclear as to whether this fall is caused by reduced demand from firms or by restricted supply from lenders (Ayadi and Gadi, 2013; Popov and Udell, 2012; Kremp and Sevestre, 2013; McGuinness and Hogan, 2016). To address this issue, we investigate the experience of SMEs in Ireland seeking bank financing during and subsequent to recent financial crises. The study therefore adds to the literature on how financing choice is affected by crisis (Cowling, Liu and Ledger, 2012; Fernández, González and Suárez, 2018).

The small open economy of Ireland is worth investigating these questions due to the important role of the SME sector in the broader economy. Importantly, the unique status of the Irish economy as the only common-law country within the broader European Union which uses the common currency, means that its economic experiences are relevant to other leading common-law countries' economies (such as Canada, the United Kingdom and the United States), as well as those within the European Union itself.

Furthermore, Ireland is an interesting and important case to investigate SMEs' access to bank financing. First, new lending to SMEs declined by 82% in Ireland over the period 2008-2010 when Ireland was hit by two financial crises, namely the 2008 global financial crisis and the subsequent Euro-zone sovereign debt crisis in 2010 (ECB, 2012). Although Ireland is the country which has suffered the highest economic cost of crises in the world (Beck, 2014; Laeven and Valencia, 2010), little is known about how SMEs' access to bank credit has been restricted in such a heavily crisis-affected country. Second, Ireland incurred a strong growth in demand for credit until 2008: non-financial firms' borrowing in Ireland increased from €45 billion in 2003 to €125 billion in the first quarter of 2008 (Whelan, 2013). Much of this is attributable to house price inflation over that period, as a large number of non-construction sector SMEs demanded bank loans to seek capital gains by speculating on the property market

(Beck, 2014). The post-2010 sharp price decline in the property market inhibited property-related speculations and might contribute to reduced demand for credit. Third, Irish banks heavily rely on short-term borrowing on international inter-bank and money markets due to insufficient domestic deposits. For example, the total amount of borrowing of Irish banks rose from €15 billion to over €100 billion between 2003 and 2007, representing half of the country's GDP (Whelan, 2013). During the 2008 financial crisis, Irish regulators recapitalised Irish banks by issuing Irish sovereign bonds (Honohan, 2010; Regling and Watson, 2010; Nyberg, 2011). Subsequently, the Euro-zone sovereign debt crisis in 2010 caused a large price decline in Irish government bonds, leading Irish banks to be unable to borrow funds from the Euro-zone inter-bank market by placing Irish government bonds as collateral (Hördahl and King, 2008; Brunetti et al., 2011). Thus, it is interesting to test whether bank funding constraints induced by external shocks can limit lending to SMEs.

Our results show that the relationships between credit demand and firm-specific characteristics are largely maintained between the crisis (2008-2011) period and the post-crisis (2012-2014) period. Our evidence of demand for loans supports the pecking order theory but refutes the trade-off theory, indicating that entrepreneurs have little interest in exploiting tax benefits in an economy with low corporate taxes (a rate of 12.5%). Our demand-based analysis implies that entrepreneurs may over-estimate the availability of investment opportunities and banks' ability to advance loans during the crisis period (Fraser et al., 2015). However, our results are consistent with supply-based arguments. The supply of credit is significantly lower in the crisis period than in the post-crisis period. In the crisis period, the premium of CDS (Credit Default Swap) on Irish banks' bonds is the only variable to explain the loan approval rate, but neither do the variables of profitability, growth and risk. This evidence not only is consistent with the bank lending channel to restrict the supply of credit but also implies the absence of credit rationing. In the post-crisis period, bank loans become accessible for firms with low risk and

inaccessible for firms with high risk, consistent with the borrower's balance sheet channel at play. However, firms with sustained growth (i.e. with both realised and expected growth) have no better chance of securing loans than those either with realised growth or with expected growth, suggesting that lenders acknowledge hard information based on realised growth rather than forecasted future growth. Taken together, the shift from the banking lending channel to the borrow balance sheet channel explains SMEs' difficulties in access to bank credit in Ireland.

Overall, our study makes the following contributions to the literature. First, we address an important aspect of the debate around SME debt finance using Irish data from the EU SAFE survey, covering the period starting with the financial crash and the subsequent upswing of economic activity. Second, we demonstrate that evidence of supply-side constraints provides the most compelling reasons for the decline in the stock of SME bank loans, not a change in demand linked to economic and business fortunes. Third, we introduce the premium of CDS as a proxy for bank lending appetite which has not been widely used in an SME context. Finally, we contribute to policy discussion, particularly in the areas of the use of public resources to underpin lending activity to offset these supply-side issues and the possibility of controls to stop changes in risk appetite by banks.

The rest of the paper is organised as follows. Section 2 discusses the related literature and presents our hypotheses. Section 3 describes the dataset, variable construction and methodology. Section 4 reports the empirical results and Section 5 presents our conclusions.

2. Related literature and hypothesis development

2.1 Supply and demand effects

The literature on demand-side effects shows that entrepreneurs play an active role in evaluating the consequences of negative economic shocks on their businesses and will change financing decisions accordingly (Fraser et al., 2015; Cowling et al., 2016). In a recessionary environment, firms with sufficient financial reserves (e.g. retained earnings and cash flows) may delay investments as they anticipate that demand for their products will fall and/or that cost of capital is too high to generate positive net present value for investment projects (Vos et al., 2007; Cole and Sokolyk, 2016). This can cause a reduction in demand for external finance. However, firms with insufficient financial reserves could have relied on external finance to run their businesses. When these firms expect that additional demand is unlikely to be satisfied by banks due to forthcoming tightened credit rationing, their demand is likely to remain (Freel et al., 2012; Cowling et al. 2016; Mac an Bhaird et al., 2016). In this case, though the pecking order theory predicts the negative relationship between internal funds and demand for external finance, this relationship can be stronger during a crisis time (Myers and Majluf, 1984).

In addition, the trade-off theory also explains the reduction in demand for debt. At the heart of this theory, low leveraged firms should raise further debt to exploit tax deductable interest payments (i.e. tax shield) until the present value of the tax benefits is offset by increases in distress costs (Modigliani and Miller, 1963; Lopez-Garicia and Sogorb-Mira, 2008). When uncertainties are prevailing on the market during a bad economic time, in which the marginal utility of wealth is high, a high discount rate reduces the present value of tax shield. The exploitation of the tax benefits then becomes less attractive, leading low leveraged firms to be unwilling to increase debt and high leveraged firms to reduce debt (Frank and Goyal, 2005). Thus, the negative relationship between leverage and demand for external finance, which is predicted by the trade-off theory, can disappear in a crisis time. In sum, the change in entrepreneurs' demand for external finance can be influenced by firm-specific financial characteristics.

In contrast, the supply-based view argues that banks reduce the availability of credit to SMEs. As lending business benefits from economies of scale, smaller-sized loans to SMEs will increase lenders' costs of making and servicing these loans (Fraser, 2014; Van der Graaf et al., 2016). This cost inefficiency is also manifested by the fact that SMEs have greater information asymmetries than large firms. As a result, banks incur higher uncertainty and risks in evaluating SMEs' creditworthiness (Winborg and Landström 2001) and are less willing to lend funds to SMEs (Stiglitz and Weiss, 1981; Jaffee and Stiglitz, 1990). This willingness could be further reduced in a financial crisis when banks have to comply with increased capital requirements, leading banks to be more concerned with the signalling effect of loan repayment ability reflected in a borrower's balance sheet (e.g. Connelly et al., 2011). When lenders fairly ration borrowers, bank loans should be accessible for firms with low risk and inaccessible for firms with high risk. This mechanism is called the non-financial borrower balance sheet channel (hereafter the borrower balance sheet channel) (OECD, 2006; Ferrando et al., 2017). Supply effects can also arise from banks' own balance sheets. During tight market conditions, banks' costs and amounts of funding are dependent on their own risk. In particular, banks with low liquidity, or low capital ratios, will find it difficult and costly to attract external funds (Kishan and Opiela, 2000; Wu and Bowe, 2010; Gambacorta and Marques-Ibanez, 2011; Jimenez et al., 2012; Ferrando et al., 2017). Constrained funding sources could restrict banks' lending abilities, inducing a reduction in the supply of credit to firms, i.e., the bank lending channel. In sum, supply effects take place through two channels: the bank lending channel highlights the ability of banks to lend funds, whilst the borrower balance sheet channel emphasizes credit rationing by lenders.

Thus, the growth of small businesses can be constrained by limited access to finance (Cressy, 2002; Revest and Sapio, 2010; Fraser et al., 2015), as a consequence of asymmetric information and imperfect credit markets. SMEs lack complete and transparent information to support their

loan applications, while the acquisition of such information is costly for financial institutions. As a result, banks should charge higher prices to compensate for the risk associated with lending to SMEs. This behaviour, however, could cause adverse selection (i.e., risky borrowers secure loans). Instead, banks simply refuse to provide any finance to small firms rather than using interest rates or collateral as rationing devices (Stiglitz and Weiss, 1981; Cowling et al., 2016). Supply effects derived from lenders in periods of economic stability or growth may explain the availability of credit to SMEs – but this is likely to be half the story. Demand effects derived from firms will also emerge especially in times of financial stress. For example, the aggregated need for external finance can be dependent on overall firms' expectations for future investment (Mac an Bhaird et al., 2016; Ferrando et al., 2017). When the economy is hit by negative shocks, firms can expect that consumers would demand fewer products and services in the future. Consequently, the firms should reduce investments related to production and inventory by requiring less external finance (Vos et al., 2007; Kremp and Sevestre, 2013; Cole and Sokolyk, 2016). In addition, the lack of liquidity in financial markets caused by adverse economic shocks can increase the costs of financial intermediation between lenders and borrowers (Mac an Bhaird et al. 2016; Acharya and Viswanathan, 2011). If costs of borrowing are higher than expected, firms may delay making investments, resulting in less demand for bank credit.

The literature provides mixed evidence on whether demand or supply effects influence the availability of bank credit to SMEs. Kremp and Sevestre (2013) find that French SMEs are able to reduce inventory and investments during the 2008 financial crisis, suggesting that decreased demand is responsible for reduced bank credit to SMEs. Ozturk and Mrkaic (2014) find that increased default risk for banks in the Euro-zone reduces their abilities to issue loans and contributes to SMEs' difficulties in access to finance. Cowling et al., (2012) find that SMEs in the U.K. have experienced both a decrease in demand for credit and a decline in the supply of

credit during the 2008 financial crisis. Based on prior literature, we propose two competing hypotheses related to demand and supply effects on the availability of bank credit.

H1a: Firms demand a lesser amount of bank credit in a crisis period than in a post-crisis period.

H1b: Banks supply a lesser amount of credit to firms in a crisis period than in a post-crisis period.

2.2 Mechanisms of demand effects

If demand effects affect the availability of credit, through which channels will these effects arise? First, firms' demand for external finance depends on their internal capital resources. The pecking order theory predicts that firms should use retained profits rather than new issues of debt and, lastly, equity to fund investment (Myers, 1984). Internal funds are the preferred financing source because it largely reduces information asymmetries between managers and outside investors and is less risky than issuing debt and equity (Michaelas et al., 1999; Psillaki and Daskalakis, 2008). This theory indicates that profitability has a negative relationship with the demand for bank credit. During a crisis time, profitable firms may consider delaying investments if they expect that cost of capital is too high to generate positive NPV for investment projects (Vos et al., 2007; Cole and Sokolyk, 2016). In addition, profitable firms can develop great financial flexibility, which allows them to secure future access to bank financing when the economic condition improves (Jensen, 1986; Frank and Goyal, 2005). As such, profitable firms will have lesser demand for bank credit during a crisis period. In contrast, firms with decreased profits have exhausted internal capital and may rely on external finance to operate their businesses. These firms expect that additional demand is unlikely to be satisfied

by lenders due to forthcoming tightened credit rationing. As a result, firms with decreased profits are likely to maintain their demand for external finance (Cowling et al., 2016; Mac an Bhaird et al, 2016). We propose that the relationship between profitability and demand for external financing can be more negative in a crisis period than in a post-crisis period.

> H2a: The relationship between profitability and the demand for bank credit can be more negative in a crisis period than in a post-crisis period.

Second, firm-specific risk can also explain the demand for credit. We propose two types of risk, namely leverage risk and credit risk. Leverage risk measures the cost of financial distress associated with leverage. When firms are fully equity-financed, leverage risk and tax-shield for interest expenses are absent. The trade-off theory posits that low leveraged firms may need further borrowing to exploit tax-shield until the present value of tax savings is offset by increases in the cost of financial distress (Modigliani and Miller, 1963; Lopez-Gracia and Sogorb-Mira, 2008). This theory implies that firms with low leverage risk should have great demand for debt. Such demand, however, would be reduced during a financial crisis. As the marginal utility of wealth is high in a crisis, a high discount rate will diminish the present value of tax-shield, leading to the exploitation of tax benefits less attractive. Thus, low leveraged firms will have less or no intentions to raise external finance, while high leveraged firms have to reduce the level of debt. We propose that the relationship between leverage risk and demand for bank credit will become less negative in a crisis period

> H2b: The relationship between leverage risk and the demand for bank credit is less negative in a crisis period than in a post-crisis period.

Credit risk measures the degree of creditworthiness to fulfil financial obligations. Firms with low credit risk have strong abilities to service debts. These abilities can be derived from better production management and successful marketing strategies, resulting in adequate financial

reserves (i.e. cash flows and/or profits). Firms with these reserves may have relatively strong confidence in securing outside investment with less need for external financing, indicating a positive relationship between credit risk and the demand for bank credit. Furthermore, adequate financial reserves are more valuable in an economic downturn as these reserves are able to cover the increased cost caused by over-capacity in production (Lang et al. 1996; Kogan, 2001; Zhang, 2005; Hou et al., 2015). This can lead firms with low credit risk to have no or lesser need for external financing. We propose that the positive relationship between credit risk and demand for bank credit is strengthened during a crisis period.

> H2c: The relationship between credit risk and the demand for bank credit is more positive in a crisis period than in a post-crisis period.

Third, growth opportunities can affect firms' demand for external financing. Myers (1977) shows that firms with growth opportunities have great conflicts between shareholders and bondholders because bondholders may exploit growth opportunities at expense of shareholders' interests. To avoid such conflicts, growth firms should reduce the amount of debt. However, the reduction in debt is not the only solution. Growth firms can use short-term debt, which matures before an investment option is to be exercised, as substitutes for long-term borrowing to mitigate the agency problem (Myers, 1977). This proposition is more relevant in the small business context as much external bank financing is of a short-term nature, thereby suggesting a positive relationship between demand for bank financing and growth rates (Cassar, 2004; Lopez-Gracia and Sogorb-Mira, 2008; Cowling et al., 2012). In addition, using short-term debt allows growth firms to "shift at any time back to all equity-financing or another source of debt capital" (Myers, 1977; p.158). This shift may arise in a financial crisis when an increase in systematic bankruptcy risk threatens the interest of shareholders (i.e. shareholders have residual claims on assets after debt holders) (Jensen and Meckling, 1976), leading growth firms to reduce demand for bank credit. We propose H2d as follows.

H2d: The relationship between growth opportunities and the demand for bank credit becomes less positive in a crisis period than in a post-crisis period.

2.3 Mechanisms of supply effects

Supply effects can take place through two channels, namely bank lending and borrower balance sheet channels. The bank lending channel indicates that the strength of banks' balance sheets determines the amount of loans to be issued. When banks become more risky, low capital below a regulatory level can restrain the banks from issuing new loans. To restore lending abilities, banks have to seek additional funding sources in an inter-bank market. However, as the price of liquidity risk is high in times of turmoil on financial markets, banks with low capital and/or low liquidity will find it more difficult and costly to secure inter-bank loans. As a result, these banks have to reduce the supply of credit to firms (Kishan and Opiela, 2000; Wu and Bowe, 2010; Gambacorta and Marques-Ibanez, 2011; Jimenez et al., 2012; Ferrando et al., 2017). This funding problem becomes more severe in a country's banking system which has experienced over-lending in the private sector prior to a financial crisis (Holton et al., 2013; Beck, 2014). Consistent with this, Holton et al., (2014) find that in countries with greater levels of private sector credit, SMEs have higher rates of loan rejections. Jimenez et al. (2012) find that banks with lower capital or liquidity ratios grant fewer loans to SMEs in Spain. Thus, we propose the following hypothesis related to the bank-lending channel.

H3a: The riskiness of banks has a negative relationship with the rate of loan approval during a crisis period.

In contrast, the borrower balance sheet channel relates the supply of credit to the strength of borrowers' balance sheets (Ozturk and Mrkaic, 2014; Jimenez et al., 2012). Banks become

unwilling to grant credit to SMEs if potential borrowers incur an increase in risk. This reaction is consistent with the theoretical model of Stiglitz and Weiss (1981) in which financial institutions ration loans on the basis of factors other than price (i.e. interest rates) to avoid adverse selection. The behaviour of credit rationing reflects a bank's judgement on whether the loan proposal appears capable of generating the scale of cash flow required to repay the debt.

Prior studies show that lenders often use profitability, leverage risk, and credit risk to ration borrowers (Berger and Udell, 2006; Cowling et al., 2012; Cowling et al., 2016). Specifically, increased profitability sends a good signal to lenders about a high likelihood of future loan repayment. However, increased leverage risk and credit risk convey bad signals that firms' financial conditions are deteriorating, giving rise to the likelihood of loan default. Thus, the presence of credit rationing implies that firms' profitability will have a positive relationship with the loan approval rate while leverage risk and credit risk have negative relationships with the rate.

As the borrower balance channel and the bank lending channels are not mutually exclusive, the two channels can work jointly during a crisis time (Ozturk and Mrkaic, 2014; Fernando et al., 2017). In this case, as lenders have limited funds to issue loans, credit rationing is likely to be tightened. That is, more borrowers with high risk are denied by banks , while borrowers with low risk are less affected. The relationships between profitability, credit and leverage risk and loan approval should become stronger. However, when the two channels work independently, we expect that the banking lending channel and the borrower balance sheet channel appear in a crisis period and a post-crisis period, respectively. In particular, the relationships between profitability, credit and leverage risk and loan approval will appear in a post-crisis period but are absent in a crisis period. We propose our hypotheses as follows.

H3b: The positive relationship between profitability and loan approval and the negative relationships between credit and leverage risk and loan approval become stronger in a crisis period than in a post-crisis period.

H3c: The positive relationship between profitability and loan approval and the negative relationships between credit and leverage risk and loan approval disappear during a crisis period.

H3d: The positive relationship between profitability and loan approval and the negative relationships between credit and leverage risk and loan approval appear in a post-crisis period.

3. Data and empirical approach

3.1 Data

This study uses the EC/ECB Survey on the Access to Finance of SMEs (SAFE), and our sample firms are all from the Republic of Ireland. The SAFE data has been widely used in prior SME studies and provides comprehensive qualitative information on the demand for financing, financial structure, financial performance, and external financing channels (e.g. bank loans, overdrafts and trade credit) (e.g., Andrieu et al. 2017; Mascia and Rossi, 2017; Moritz et al 2016; Masiak et al 2017; 2018; Mac an Bhaird et al 2016; Lawless et al 2015; Moritz and Heinz, 2015; Casey and O'Toole, 2014). The surveys are conducted on a bi-annual basis with the first survey in 2009. Firms in the sample are randomly selected from the Dun & Bradstreet database. Interviewees are top-level executives including general managers, financial directors or chief accountants. The sample is stratified by firm size class, economic activity and country. The number of firms in each stratum of the sample is intentionally modified to increase the accuracy

of the survey by activity and size class. The sample sizes for each economic activity are selected to ensure adequate representation across the four largest activities: industry, construction, trade and services.

The dataset in this study covers a total of 11 survey waves from June 2009 to September 2014 (see Appendix 1). The first five survey waves from June 2009 to October 2011 are classified as the crisis period which includes the Euro-zone sovereign debt crisis in November 2010. The most recent six surveys from February 2012 to September 2014 are defined as the post-crisis period. As the occurrence of the global and regional financial crises was largely unexpected, it is our main focus to investigate how SMEs and banks respond to such unexpected events. However, when the end of our sample period is far away from event times, the responsiveness of banks and SMEs to the crises would be diminished and would induce confounding effects that are not related to unexpected events. For example, changes in SMEs' regulations in later periods (e.g. the introduction of regulations of lending to small and medium-sized enterprises in 2015(www.centralbank.ie) by the Central Bank of Ireland) will enforce lenders to prioritise SMEs' lending. As such, the increase in the supply of bank credit can be driven by the new regulations rather than external economic shocks.

3.2 Variable construction[3]

We measure a firm's need for bank credit to increase, be unchanged or decrease from the survey question -"For each of the following types of external financing (i.e. bank loans), please tell me if your needs increased, remain unchanged or decreased over the past 6 months?" Following prior studies (Casey and O'Toole, 2014; Mac an Bhaird et al. 2016), the dependent

[3] Appendix 2 provides survey questions and our variable construction.

variable *loan_demand* is coded as 3 if a firm reports an increase in demand, as 2 if a firm reports no change in demand and as 1 if a firm's demand for bank loans has decreased. We measure whether a firm has obtained a full amount or most of the applied bank credit by the question: "If you have applied and tried to negotiate for this type of financing (i.e. bank loans) over the past 6 months, did you receive all the financing you requested; received only part of the financing you requested; refuse to proceed because of unacceptable costs or terms and conditions; or have you not received anything at all?". The variable *bank_loan* is a dummy equal to 1 if a firm receives more than 75% of the requested amount from banks, and zero otherwise [4](Casey and O'Toole, 2014).

The independent variables are classified into four groups: risk, performance, growth, and ownership and sector controls. We first use a CDS (Credit Default Swap) premium to capture lending banks' riskiness. The CDS premium is the price that buyers pay to insure the return they will receive against a credit default event on bank issued bonds (i.e. an underlying asset). The CDS premium is measured by the averaged CDS monthly premium for AIB (Allied Irish Bank) and the Bank of Ireland, which are the main lenders on the credit market by providing over 95% of total lending to SMEs in Ireland (Inter Trade Ireland, 2013). The series of CDS premiums are downloaded from Thomson Reuter's Datastream to match the coverage period of each survey wave. The CDS premium[5] is employed to test whether the supply of credit to SMEs will be influenced through the bank lending channel. A higher CDS premium implies that a bank becomes more risky and attracts less external funding.

[4] In a robustness check, we define the loan approval as 100% of the applied amount in Section 4.5.
[5] The yield of 10-year Irish sovereign bonds can also be used as an indicator of the Irish economy's condition. We find that this bond yield has a correlation of 0.90 with the CDS premium, suggesting that the CDS premium and the bond yield contain the same amount of information. In addition, our results are not sensitive to either of the two variables. These results are available upon request.

We use the information on whether a firm has experienced increased or decreased interest expenditure as a proxy for leverage risk[6]. An increase in interest expense is more likely to indicate that the debt to asset ratio has increased, leading to less working capital (Petersen and Rajan, 1994; 1995). The variable *interest_up* (*interest_down*) is equal to one if a firm reports an increase (decrease) in its interest expenditures in the past 6 months, and zero otherwise[7]. The setting of two dummy variables for interest expenditure assumes that firms without any change in interest expenditure are set as a benchmark group. Then, the coefficient on each dummy variable in regressions measures the marginal effect relative to the benchmark (similar settings and interpretations are applied to other main variables). We also use changes in credit history as a proxy for credit risk. The variable *credit_up* (*credit_down)* is defined as whether a firm experiences improved (deteriorated) credit history, respectively. *credit_up* (*credit_down*) is equal to one if a firm reports that its credit history has improved (deteriorated) in the past 6 months, and zero otherwise. We use changes in profits as a performance measure, namely *profit_up* and *profit_down*. The variable *profit_up* (*profit_down*) is equal to 1 if a firm has increased (decreased) its profits in the past 6 months, and zero otherwise.

We classify growth firms into three groups: actual, expected and sustained growth. Firms with actual growth are those that have realised growth opportunities in the past. Accordingly, two dummies are introduced, namely *actual_growth_up* and *actual_growth_down*. If a firm has achieved an actual turnover growth rate over 20% in the past three years, the variable *actual_growth_up* is equal to 1, and zero otherwise. If a firm's turnover growth is negative in the past three years, *actual_growth_down* is equal to 1 and zero otherwise. We also use future turnover forecasted by managers to measure expected growth. Particularly, the variable

[6]The ideal variable is debts to assets. However, this variable is not available until the latest survey (the 11th wave) for SMEs in Ireland. Appendix A2 provides detailed variable definitions and their associated questions in the SAFE survey.

[7] Ideally, we should use the ratio of debt to asset to capture leverage risk. However, this ratio is not reported in the SAFE for Irish SMEs until the last survey in 2014.

future_growth_fast is equal to 1 if a firm forecasts its turnover to grow more than 20% per year in the next two to three years, and zero otherwise. The variable *future_growth_slow* is equal to 1 if a firm forecasts its turnover to be negative in the next two to three years, and zero otherwise. The last group includes firms with sustained growth, which is defined as those with both actual and expected growth. The variable *sustained_growth* is constructed by interacting two terms between *actual_growth_up* and *future_growth_fast*. If the dummy variable of *sustained_growth* is equal to 1, it indicates a particular firm that not only has achieved growth in the past but also aims to grow in the future.

SMEs' finance is also closely related to size, ownership and sectors (Campello et al., 2010). A variety of variables are employed to control for these effects. We use three dummies to control for firm size, namely *micro* (employees less than 9), *small* (employees between 10 and 49) and *large* (250 employees or more). Three ownership dummies are employed, namely *listed* (public shareholders as your enterprise is listed on the stock market), *family* (family or entrepreneurs) and *sole* (only one owner). We also use three sector dummies, namely *construction*, *manufacturing* (i.e. including mining and manufacturing) and *trade* (i.e. including wholesale or retail trade). Finally, the dummy *crisis* is equal to 1 for the first five survey waves, and zero for the last six survey waves.

3.3 Estimation method

Since the dataset contains qualitative information, we use an ordered probit model to estimate demand for bank credit (Holton et al., 2014; Mac an Bhaird et al., 2016). The probability that firm *i* reports its "demand for bank credit" was in the j^{th} "demand for bank credit" class, is given by the following function.

$$\Pr(Demand_i = j \mid X_i, \alpha, \beta) = \Phi(\alpha_j - X_i\beta) - \Phi(\alpha_{j-1} - X_i\beta),$$
$$j \in \{1,2,3\}, \alpha_0 = -\infty, \alpha_{j-1} \le \alpha_j, \alpha_3 = +\infty. \quad (1)$$

The vector of firm-specific characteristics (i.e. firm size, ownership, sector and fundamental variables) is given by X_i. β is a vector of parameters to be estimated. α is a vector of cuts that partition the observations into categories corresponding to different levels of demand. Thus, Eq (1) is the ordered probit model that we use to estimate the demand for credit. When we estimate determinants of bank lending, the dependent variable is binary (i.e. $j \varepsilon \{1, 0\}$), which measures whether a firm has obtained bank credit. In this case, we estimate the usual probit model which is a special case of the ordered probit model. The probabilities are assigned to outcomes based on a cumulative normal distribution function Φ. We obtain estimates of α and β by maximizing the log-likelihood function based on Eq (1).

4. Empirical results

4.1 Sample SMEs' characteristics

[Insert Table 1 & 2 about here]

Table 1 reports the distribution of Irish SMEs across 11 SAFE surveys in terms of size, ownership and sector. The first round of SAFE surveys in 2009 includes 110 firm observations. In the fourth round, the number of observations increased to 500. The table shows that mirco- and small-sized firms represent a large portion of observations across each survey wave. The sample firms are mainly from the trade and service sectors. Most of the firms are family-run businesses and entrepreneurs, while a small number of firms are public.[8]

[8] Our results remain if we exclude a small number of listed firms from the sample.

Table 2 reports summary statistics for our main variables across the crisis and post-crisis periods. We have a total number of 3,376 firm-level observations in the whole sample period. The mean of *loan_demand* in the crisis period (2.06) is nearly the same as the one (2.04) in the post-crisis period. However, the mean value of *bank_loan* is 0.47 in the crisis period against 0.61 in the post-crisis period. As firms that have secured bank loans are assigned a value of one, the mean of *bank_loan* can be interpreted as the percentage of firms that have obtained loans. Thus, the loan approval rate in the crisis period is 14% lower than that in the post-crisis period. [9] In the next row, the average CDS premium is higher in the crisis period than in the post-crisis period. We also show that 62% of the sample firms in the crisis period have experienced a decline in profits, while this percentage drops down to 42% in the post-crisis period. Finally, the percentage of firms that have achieved growth and/or intend to grow remains relatively constant across the two periods.

4.2 The whole sample period

[Insert Table 3 about here]

Given the non-linear feature of ordered probit models, our primary focus is on discussing the signs and the significance of coefficients. Columns (1) and (2) in Table 3 report the estimated coefficients for demand and supply effects, respectively, based on control variables across the whole sample period. Columns (3) and (4) include additional variables of risk, performance and growth. The key variable of interest is *crisis* in column (1) and (2). In column (1), the coefficient on the dummy variable *crisis* is statistically insignificant. This evidence indicates that demand for bank credit has no significant change between the crisis and the post-crisis

[9] We show that the difference of 14% in the loan approval rate is statistically significant between the crisis period and the post-crisis period in untabulated results.

periods, inconsistent with H1a. In contrast, the dummy variable *crisis* in column (2) is significantly negative, suggesting that the loan approval rate is significantly lower in the crisis period than in the post-crisis period. This evidence is consistent with H1b.

In column (3), we show that firms with increased leverage risk and credit risk demand more bank credit. Specifically, the positive relationship between leverage risk and demand for external finance contradicts the trade-off theory that low leveraged firms should raise further debt to exploit the tax-shield. This evidence suggests that low corporate taxes in Ireland (12.5%) discourage entrepreneurs to exploit the tax shield. The positive relationship between credit risk and the demand for bank credit suggests that firms with low credit risk are more confident about sufficient financial reserves in securing outside investment than firms with high credit risk. We also show that firms with increased profits have less demand for bank loans. This evidence is in line with the pecking order theory that firms use internal funds prior to raising debt. The three growth variables of *actual_growth_up*, *expected_growth_up* and *sustained_growth*, all have significantly positive coefficients, suggesting that firms demand short-term loans to realise growth opportunities (Myers, 1977; Cowling et al. 2012). For control variables, the results show that family owned and sole person businesses are more likely to experience a reduction in demand for credit. These firms are likely to use alternative financing channels (e.g. borrowing from family members) to substitute bank financing.

Column (4) shows the results based on supply effects. The variable *crisis* is no longer significant after including risk, performance and growth based variables, indicating that firm-specific characteristics have subsumed the variable *crisis* to explain the supply of credit. The results in column (4) also show that banks are more likely to grant funds to low risk firms that have experienced a reduction in interest expenditures and an improvement in credit history. Nevertheless, banks are more likely to reject loan applications of firms with decreased profits. In terms of growth, firms that have realised growth in the past are likely to have loan

applications approved, while firms with sustained growth have no better chance than those with realised growth or with expected growth to secure bank loans. The evidence suggests that banks ignore future growth opportunities when making loan decisions. These results are consistent with the view that banks ration borrowers based on hard financial information, i.e. realised profit and sales growth, rather than any forecasted prospect (Beck et al., 2008). For control variables, the results in column (4) show that large firms' loan applications are more likely to be approved. Firms within the manufacturing industry are more likely to secure bank loans. These firms have a large amount of tangible assets and stable cash flow and are able to convince lenders of the ability to service debts. Family and listed firms have a significantly high rate of loan approval, implying that diversified ownership structures attract bank funding. Overall, our results suggest that the demand for bank credit has not significantly changed between the crisis period and the post-crisis period but the supply of credit has.

4.3 Crisis and post-crisis analysis

In this section, we formally test our hypotheses related to specific mechanisms of demand and supply effects. First, the dummy variable *crisis* interacts with performance, risk, and growth variables to test changes in demand effects over the whole sample period. Second, we estimate demand effects in the crisis period and the post-crisis period, respectively. We also repeat these two steps to test changes in supply effects.

[Insert Table 4 about here]

Column (1) in Table 4 shows the results for demand effects over the whole sample period with the interactions, which are our main focus. The variables of *crisis*×*profit_up* and *crisis*×*profit_down* are insignificant, inconsistent with H2a. The results imply that the negative

relationship between profitability and demand for bank credit has no significant difference between the crisis period and the post-crisis period. Also, the two interaction terms (*crisis*×*interest_up* and crisis×*interest_down*) are insignificant, suggesting that the financial crisis is unlikely to affect the relationship between leverage risk and the demand for bank credit. This evidence contradicts H2b. In terms of credit risk, the results show that the two interaction terms (*credit_history_up*×*crisis* and *credit_history_down*×*crisis*) are both insignificant. These results indicate that the positive relationship between credit risk and demand for bank credit is merely affected by the financial crisis, inconsistent with H2c. The three growth variables (*actual_growth_up*, *future_growth_up* and *sustained growth*) have significantly positive coefficients, but none of the three interactions with *crisis* is significant. The evidence is inconsistent with H2d. In columns (2) and (3), we report the results based on two separate sub-periods. The variables of *interest_up*, *actual_growth_up*,and *future_growth_up* are significantly positive in both crisis and post-crisis periods. This evidence indicates that the positive relations between leverage risk, growth opportunities and the demand for bank credit have been maintained in the two sub-periods. The variables of *credit_history_up* and *credit_history_down* have significantly negative and positive coefficients in the crisis period and the post-crisis period, respectively. The variable of *profit_up* is significantly negative in both of the two sub-periods. The overall results imply that the demand for bank credit experiences no significant changes between the crisis period and the post-crisis period.

Columns (4) to (6) report the results based on supply effects. We first discuss the results over the whole sample period in column (4) with the interaction terms. The interaction term (crisis×CDS) has a significant negative coefficient, implying that increasing riskiness of banks reduces the loan approval rate during the crisis period. This result supports H3a that the supply of credit is restricted through the bank lending channel. In addition, four interaction terms are significantly negative, i.e. *crisis*×*profit_up*, *crisis*×*profit_down*, crisis×*interest_up*, and

crisis×*actual_growh_up*. These results indicate that firms with high leverage risk and low profitability have the problem of access to bank financing so do profitable firms. This evidence is hardly reconciled with tightened credit rationing during the crisis period (H3b). The results in columns (5) confirm H3a and H3c. Only is CDS significant, while risk, performance and growth variables are all insignificant. This evidence implies the absence of credit rationing in the crisis period. Column (6) shows the results in the post-crisis period. The significantly negative coefficient on the variable of *profit_down* implies a positive relation between profitability and the approval of bank credit, *Interest_up* and *Interest_down* have negative and positive coefficients, respectively, suggesting a negative relation between leverage risk and the loan approval rate. The variable of *credit_history_down* has a significantly negative coefficient. These results are consistent with credit rationing in the post-crisis period (H3d). Furthermore, the positive coefficient on *actual_growth_up* indicates that firms with realised growth are likely to get access to bank financing. These results indicate that lenders are likely to grant loans to firms with low risk but likely to deny firms with high risk, consistent with the presence of credit rationing. Overall, our supply-based analysis reveals that the supply of credit shifts from the bank lending channel to the borrower balance sheet channel.

4.4 Self-selection biases in determinants of bank-lending

One potential issue with our previous results is selection bias, as firms that did not apply for bank loans have been excluded in estimating determinants of bank lending. To deal with this issue, we use the Heckman sample selection model to control for selection bias. This procedure essentially estimates two models. The first model estimates the probability of firms applying for bank loans. The estimated probability is then used to correct the second model which estimates the probability of obtaining bank loans. In the first model, we specify the dependent

variable (*loan_app*) as a dummy to denote whether firms have applied for bank loans or not. Other independent variables are specified as the same as those in the second model. Table 5 presents the results.

[Insert Table 5 about here]

We first discuss the results based on the first stage in columns (1), (3) and (5) for the whole sample and the two sub-periods. The variables of *interest_up, interest_down, credit_history_up and credit_history_down* have positive relationships with the probability of loan application over the whole sample period as well as in the two sub-periods, indicating that entrepreneurs are less likely to ration themselves by credit and leverage risk before making applications. Firms with low leverage and credit risk also apply for loans, implying that entrepreneurs do not suffer from discouragement in borrowing. The results based on control variables show that small firms are unwilling to apply for loans, consistent with prior studies (Mac an Bhaird et al., 2016; Cowling et al. 2016). Columns (2), (4) and (6) show the second stage results. The variable CDS is only statistically significant in the crisis period (column (4)). The evidence suggests that bank funding constraints are indeed the underlying force which drives the restricted supply of credit in the crisis period. Consistent with previous results, other risk variables and four growth variables are insignificant (i.e. *actual_growth_up*, *actual_growth_down*, *future_growth_fast*, and *future_growth_down*) in the crisis period. However, the coefficient on *sustained_growth* is significantly negative, suggesting that firms with sustained growth opportunities find it more difficult than other growth firms in securing bank credit. In the post-crisis period (column (3)), lending banks are more likely to reject loan applications from firms with increased leverage and credit risk and those with decreased profits. These results suggest that banks ration borrowers on hard information, consistent with the borrower balance sheet channel over the post-crisis period. Overall, our main results are robust to selection bias.

4.5 Robustness checks

[Insert Table 6 about here]

In this sub-section, we conduct two robustness checks on our main results. First, we previously define a firm's success in accessing bank financing as when the firm receives more than 75% of the requested amount from banks. Although this rate is generous and used in previous studies (e.g. Casey and O'Toole, 2014), one may ask the question of whether our main results are robust to an alternative definition of loan approval. To address this concern, we re-define the loan approval as firms received 100% of the amount that they applied for. Then, we re-estimate supply effects and report the results in Table 6. During the overall sample period (column (1)), the coefficients on *interest_down* and *actual_growth_up* are significantly positive. Over the crisis period (column (2)), only is the coefficient on CDS significantly negative, consistent with the notion that lenders encounter great difficulties in issuing loans. However, in the post-crisis period (column (3)), firms with decreased profits, negative growth, increased interest expenses and sustained growth are more likely to be rejected for their loan applications. The overall results are consistent with our main results.

Second, we use an alternative regression model specification to estimate demand and supply effects. In particular, to evaluate the extent to which the demand for and the supply of bank credit is changed by banks' risk profiles proxied by CDS across the crisis and post-crisis periods, we include the interaction term between the crisis dummy and CDS without controls for other interaction terms. Columns (1) and (2) of Panel B in Table 6 show the results associated with demand effects and supply effects, respectively. In column (1), the coefficient on the interaction between the crisis dummy and CDS is insignificant. This evidence suggests that the demand for bank loans incurs no significant changes between the crisis period and the post-crisis period, consistent with our previous results. However, in column (2) the coefficient

on the interaction term between the crisis dummy and CDS is negative and significant, indicating that CDS may be more powerful in explaining bank lending activities in the crisis period than those in the post-crisis period. In sum, our main results are robust to an alternative definition of loan approval and model specification.

5. Conclusions

Using the EC/ECB compiled semi-annual SAFE dataset from 2009 to 2014, this study investigates small businesses bank financing in Ireland during and after financial crises. Our results show that the aggregated SMEs' demand for bank credit has no significant changes between the crisis (2009-2011) and the post-crisis periods (2012-2014), implying that demand for credit is less affected by economic conditions. However, our results indicate that the restricted supply of credit is likely to cause SMEs' difficulties in accessing bank credit, consistent with supply effects. More specifically, we find that the variable CDS is negatively related to the loan approval rate in the crisis period, implying that lenders' risk constrains their abilities to supply credit. In the post-crisis period, we show that banks are more likely to deny loan applications from risky firms. Collectively, these results suggest that supply effects initially emerge through the bank-lending channel and then shift to the borrower balance sheet channel across the crisis and the post-crisis periods.

The study provides important implications for policy makers, entrepreneurs and banks. Policy makers should focus on how to increase the supply of credit rather than how to boost the public demand for credit in the current economic environment. The findings support the Irish government's interventions in increasing the supply of credit in SME financing markets by introducing a number of SME lending support programmes. Second, entrepreneurs should become fully aware that lenders use hard financial information to ration borrowers. As such,

bank financing may not be an ideal external source for start-up entrepreneurs who lack comprehensive financial information. Instead, early stage businesses may seek other external financing sources such as venture capital and angel funds which are willing to take more risk. Finally, while lending banks can restructure and strengthen balance sheets by denying high risky firms, under-lending to the firms that have strong current financial conditions and expect to grow benefits neither the banks nor the economy. Equally important is the need to prevent banks' over-lending to property related sectors, because a credit-fuelled estate price cycle restricts lenders' ability to advance loans in a small open economy when it is hit by negative economic shocks.

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Table 1 Sample firms across 11 survey waves

Survey waves	1	2	3	4	5	6	7	8	9	10	11
ECB survey code	2009 H1	2009 H2	2010 H1	2010 H2	2011 H1	2011 H2	2012 H1	2012 H2	2013 H1	2013 H2	2014 H1
Firm size											
1-9 employees	51	30	30	200	200	200	200	200	200	200	160
10-49 employees	40	30	30	200	199	200	200	200	200	200	156
50-249 employees	10	31	30	85	85	85	85	85	85	85	143
250 employees or more	9	10	10	15	18	15	15	15	15	15	41
Sectors											
Industry	17	20	27	106	100	110	115	85	85	95	90
Construction	13	4	9	49	60	56	35	38	52	38	37
Trade	36	55	36	189	180	171	167	194	189	179	173
Services	35	12	18	141	144	148	168	168	159	173	159
Ownerships											
Public shareholders	12	17	6	34	15	21	20	35	27	23	30
Family or entrepreneurs	53	54	69	337	356	352	331	342	333	325	259
Other enterprises or business associates	5	7	8	26	25	20	29	21	15	15	24
VC or business angels	1	1	0	4	5	9	3	4	2	2	10
Yourself or another natural person	26	16	12	80	80	77	109	92	114	117	151
Other	13	5	3	15	18	16	5	3	8	15	20

Note: This table reports the distributions of sample firms across the size, ownership and sector groups. The data is from the SAFE compiled by the EC/ECB.

Table 2 Descriptive statistics

Variable name	The crisis period			The post-crisis period		
	Mean	S.D.	Obs.	Mean	S.D.	Obs.
loan_demand	2.06	0.61	1064	2.04	0.59	2312
bank_loan	0.47	0.5	206	0.61	0.45	465
CDS	385	220	1064	247	208	2312
interest_up	0.36	0.47	1064	0.31	0.46	2312
interest_down	0.17	0.38	1064	0.11	0.31	2312
credit_history_up	0.13	0.13	1064	0.23	0.42	2312
credit_history_down	0.11	0.31	1064	0.06	0.25	2312
profit_up	0.20	0.41	1064	0.31	0.46	2312
profit_down	0.62	0.48	1064	0.42	0.49	2312
actual_growth_up	0.06	0.23	1064	0.04	0.20	2312
actual_growth_down	0.23	0.41	1064	0.10	0.30	2312
future_growth_up	0.04	0.20	1064	0.04	0.18	2312
future_growth_down	0.23	0.41	1064	0.10	0.30	2312
sustained_growth	0.03	0.14	1064	0.02	0.12	2312

Note: This table reports summary statistics for main variables. The variable *loan_demand* is an indicator for changes in demand for bank credit. *loan_demand* is equal to 3 if firms have an increase in the demand for bank credit, is equal to 2 if firms have no need to increase bank credit, and is equal to 1 if firms have a decrease in the demand for bank credit. The variable *bank_loan* is a dummy variable and it is equal to 1 if firms obtain bank loans, and zero otherwise. The variable CDS is the CDS premium index averaged across sample months, which match a given survey period. The variable *interest_up* (*interest_down*) is equal to one if a firm reports an increase (decrease) in their interest expenditures in the past 6 months, and zero otherwise. The variable *credit_up* (*credit_down)* is defined as whether a firm experiences improved (deteriorated) credit history, respectively. *credit_up* (*credit_down*) is equal to one if a firm reports that its credit history has improved (deteriorated) in the past 6 months, and zero otherwise. The variable *profit_up* (*profit_down*) equals to 1 if a firm has increased (decreased) its profits in the past 6 months, and zero otherwise. If a firm has achieved an actual turnover growth rate over 20% in the past three years, *actual_growth_up* is equal to 1 and zero otherwise. If a firm's turnover growth is negative in the past three years, *actual_growth_down* is equal to 1 and zero otherwise. The variable *future_growth_fast (future_growth_slow)* is set to 1 if a firm forecasts that its turnover will grow more than 20% per year (negative growth) in the next two to three years, and zero otherwise. The dummy *sustained_growth* is equal to 1 if firms have achieved turnover growth rates more than 20% in the last three years and are also expected to grow more than 20% in the next two to three years, and zero otherwise.

Table 3 Estimating demand and supply effects

	(1)	(2)	(3)	(4)
	The overall sample period			
	demand effects	supply effects	demand effects	supply effects
Controls				
micro	0.1064	-0.0725	0.0083	-0.0066
	(1.88)*	(-0.05)	(0.14)	(-0.05)
small	0.1752	-0.1395	0.0281	-0.1357
	(1.37)	(-1.11)	(0.50)	(-1.03)
large	-0.0198	0.5284	-0.0037	0.5000
	(-0.17)	(2.07)**	(-0.03)	(1.92)**
construction	-0.0843	0.0168	-0.1492	0.0369
	(-1.12)	(0.08)	(-1.95)**	(0.17)
trade	-0.0100	0.1804	-0.0603	0.2111
	(-0.21)	(1.48)	(-1.22)	(1.68)*
manufacturing	-0.0641	0.3584	-0.0660	0.4025
	(-1.13)	(2.50)***	(-1.15)	(2.71)***
listed	0.0228	0.4844	0.0724	0.3514
	(0.22)	(1.68)*	(0.69)	(1.18)
family	-0.1076	0.2924	-0.1155	0.2924
	(-2.37)**	(2.33)**	(-2.47)***	(2.47)***
person	-0.2247	0.4867	-0.2235	0.4351
	(-1.76)*	(1.31)	(-1.73)*	(1.12)
crisis	0.0495	-0.0950	-0.0302	-0.0435
	(1.17)	(-1.85)*	(-0.67)	(-1.35)
Risk				
CDS			0.0001	-0.0002
			(0.99)	(-1.26)
interest_up			0.1486	-0.1115
			(3.35)***	(-1.78)*
interest_down			-0.1072	0.2794
			(-1.72)*	(1.84)*
creidt_history_up			-0.2600	-0.1391
			(-4.83)***	(-0.99)
credit_history_down			0.4472	-0.4290
			(4.07)***	(-2.70)***
Performance				
Profit_up			-0.0835	-0.0161
			(-1.90)*	(-0.11)
Profit_down			0.1339	-0.2761
			(2.58)***	(-1.99)**

Table 3. Continued

	(1)	(2)	(3)	(4)
	The overall sample period			
	demand effects	supply effects	demand effects	supply effects
Growth				
actual_growth_up			0.3000	0.6051
			(2.71)***	(1.84)*
actual_growth_down			-0.0156	-0.0549
			(-0.24)	(-0.31)
future_growth_up			0.2297	0.3536
			(1.96)**	(1.08)
future_growth_down			-0.1802	0.1786
			(-0.99)	(0.56)
sustained_growth			0.1687	-0.2142
			(1.95)**	(-0.32)
constant 1	-1.0123	-0.1963	-0.9786	0.0339
constant 2	0.8268	(-1.31)	0.9097	(1.20)
Pseudo R2	0.07	0.05	0.10	0.08
obs	3376	671	3376	671

Note: This table reports the regression results of the demand for bank loans and the supply of bank lending in the entire sample period (2009-2014). For demand effects, the dependent variable is *loan_demand*, which is an indicator for changes in demand for bank credit. *loan_demand* is equal to 3 if firms have an increase in the demand for bank credit, is equal to 2 if firms have no need to increase bank credit, and is equal to 1 if firms have a decrease in the demand for bank credit. For supply effects, the dependent variable is *bank_loan*, a dummy variable which is equal to 1 if firms obtain bank loans, and zero otherwise. The independent variables are firm fundamentals, the CDS premium, firm size and firm ownership. The ordered probit model is used to estimate the demand for bank loans. The probit model is used to estimate the determinants of bank-lending. Robust standard errors are employed and z-statistics are reported in parentheses. ***, **, * represent significant levels at 1%, 5%, and 10%, respectively.

Table 4. Crisis and post-crisis analyses

	(1)	(2)	(3)	(4)	(5)	(6)
		demand effects			supply effects	
	overall	crisis	post-crisis	overall	crisis	post-crisis
Controls						
micro	0.0086	0.1016	-0.0353	0.0343	0.1361	-0.1732
	(0.15)	(0.96)	(-0.50)	(0.22)	(0.51)	(-0.99)
small	0.0285	0.0654	0.0200	-0.1414	-0.2297	-0.1267
	(0.51)	(0.63)	(0.30)	(-1.02)	(-0.91)	(-0.81)
large	-0.0135	-0.2286	0.1061	0.3925	0.4427	0.4921
	(-0.12)	(-1.16)	(0.74)	(1.79)*	(0.77)	(1.65)*
construction	-0.0147	-0.2683	-0.0867	0.0415	-0.8727	0.5665
	(-1.92)*	(-2.01)**	(-1.49)	(0.40)	(-2.25)**	(2.12)**
trade	-0.0593	-0.0222	-0.0844	0.2239	-0.0034	0.2901
	(-1.20)	(-0.24)	(-1.49)	(1.64)*	(-0.01)	(1.93)*
manufacturing	-0.0687	-0.1655	-0.0308	0.3905	0.0021	0.5891
	(-1.18)	(-1.55)	(-0.44)	(2.44)**	(0.01)	(3.30)***
listed	0.0744	-0.0206	0.1210	0.4502	0.1745	0.3868
	(0.71)	(-0.11)	(0.95)	(1.43)	(0.33)	(1.04)
family	-0.1140	-0.0512	-0.1331	0.3406	0.3920	0.2347
	(-2.43)**	(-0.60)	(-2.35)**	(2.64)***	(1.65)*	(1.64)*
person	-0.2230	-0.1863	-0.2433	0.2449	0.1544	0.8679
	(-1.73)*	(-0.86)	(-1.48)	(0.56)	(0.28)	(1.35)
Risk						
CDS	0.0001	-0.0002	0.0001	-0.0003	-0.0006	0.0002
	(0.98)	(-0.77)	(1.05)	(-1.60)	(-1.98)**	(0.16)
interest_up	0.1081	0.2421	0.1152	-0.3061	0.0419	-0.1638
	(2.03)**	(3.01)***	(2.15)**	(-1.77)*	(0.19)	(-2.10)**
interest_down	-0.0937	-0.1015	-0.1058	0.1041	0.1026	0.1748
	(-1.18)	(-0.98)	(-1.32)	(0.46)	(1.35)	(1.68)*
credit_history_up	-0.2655	-0.2208	-0.2793	-0.1076	0.1035	0.2217
	(-4.32)***	(-1.97)**	(-4.50)***	(-0.56)	(0.39)	(1.45)
credit_history_down	0.3956	0.5228	0.3982	-0.4997	-0.3992	-0.5074
	(4.16)***	(4.48)***	(4.17)***	(-1.97)**	(-1.41)	(-2.50)**
Performance						
profit_up	-0.0519	-0.0907	-0.0697	0.3646	-0.0244	0.0682
	(-0.78)	(-1.75)*	(-1.68)*	(2.01)**	(-0.76)	(0.38)
profit_down	0.1681	0.3310	0.1711	0.0466	-0.3942	-0.3848
	(2.72)***	(1.34)	(2.74)***	(0.22)	(-1.60)	(-2.00)**
Growth						
actual_growth_up	0.4018	0.1517.	0.3886	0.6372	0.2286	0.4368
	(4.13)***	(1.91)*	(2.61)***	(1.99)**	(1.04)	(1.73)*
actual_growth_down	0.0201	0.0446	0.0353	-0.3274	0.3172	-0.1764
	(0.22)	(0.43)	(0.38)	(-1.04)	(1.12)	(-0.69)

Table 4. Continued

	(1)	(2)	(3)	(4)	(5)	(6)
		demand effects			supply effects	
	overall	crisis	post-crisis	overall	crisis	post-crisis
future_growth_fast	0.1859	0.3706	0.4325	0.2704	-0.3430	0.1873
	(1.70)*	(1.92)*	(2.36)**	(0.54)	(-1.53)	(0.58)
future_growth_slow	0.0319	0.1228	0.1358	0.2732	0.2163	0.0628
	(0.18)	(0.85)	(0.96)	(0.98)	(0.57)	(0.13)
sustained_growth	0.2169	0.2020	0.1862	-1.0209	0.1038	-0.0358
	(1.99)**	(1.52)	(1.89)*	(-1.87)*	(0.99)	(-0.39)
crisis	-0.0277			-0.0945		
	(-0.21)			(-1.05)		
crisis	0.0002			-0.0008		
×CDS	(0.63)			(-1.98)**		
interest_up	0.1286			-0.4566		
×crisis	(1.34)			(-1.87)*		
interest_down	-0.0068			-0.1036		
×crisis	(-0.05)			(-0.19)		
credit_history_up	0.0216			0.0568		
×crisis	(0.17)			(0.19)		
credit_history_down	0.1428			0.0775		
×crisis	(0.94)			(0.19)		
profit_up	-0.0519			-0.7050		
×crisis	(-0.78)			(-2.20)**		
profit_down	-0.1032			-0.5172		
×crisis	(-0.89)			(-1.72)*		
actual_growth_up	-0.2912			-0.3687		
×crisis	(-1.14)			(-1.71)*		
actual_growth_down	-0.0517			-0.4177		
×crisis	(-0.12)			(-1.03)		
future_growth_fast	0.0786			-0.3750		
×crisis	(0.27)			(-1.45)		
future_growth_slow	0.0974			-0.4663		
×crisis	(0.42)			(-0.66)		
sustained_growth	-0.0035			-0.6856		
×crisis	(-0.23)			(-1.27)		
constant 1	-0.9810	-1.0231	-1.0609	0.1850	0.5423	-0.1306
constant 2	0.9043	0.8057	0.8565	(2.32)*	(1.15)	(-0.41)
Pseudo R2	0.06	0.05	0.09	0.07	0.03	0.08
obs	3376	1064	2312	665	204	461

Note: This table reports the regression results of the demand for and the supply of bank loans. Columns (1) and (4) show the results over the whole sample period. Columns (2) and (5) report the results in the crisis (2009-2011) and columns (3) and (6) show the results in the post-crisis periods (2012-2014). For demand effects, the dependent variable is *loan_demand*, which is an indicator for changes in demand for bank credit. *loan_demand* is equal to 3 if firms have an increase in the demand for bank credit, is equal to 2 if firms have no need to increase bank credit, and is equal to 1 if firms have a decrease in the demand for bank credit. For supply effects, the dependent variable is *bank_loan*, a dummy variable which is equal to 1 if firms obtain bank loans, and zero otherwise.The independent variables are firm fundamentals, the CDS premium, firm size and firm ownership. The ordered probit model is used to estimate the demand for bank loans. Robust standard errors are employed and z-statistics are reported in parentheses. ***, **, * represent significant levels at 1%, 5%, and 10%, respectively.

Table 5 The Heckman selection model

	The overall period		The crisis period		The post-crisis period	
	(1)	(2)	(3)	(4)	(5)	(6)
	loan_applied	loan_approval	loan_applied	loan_approval	loan_applied	loan_approval
Controls	(1st stage)	(2nd stage)	(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
micro	-0.4206	-0.3194	-0.3650	0.2596	-0.4453	-0.2659
	(-6.13)***	(-3.93)***	(-2.92)***	(0.65)	(-5.35)***	(-2.55)**
small	-0.2773	-0.2532	-0.3456	-0.0917	-0.2473	-0.3356
	(-4.29)***	(-3.36)***	(-2.86)***	(-0.19)	(-3.19)***	(-2.67)***
large	0.0204	0.1876	-0.4517	0.5547	0.2006	0.0914
	(0.16)	(1.32)	(-1.88)*	(0.88)	(1.31)	(0.45)
construction	-0.0476	-0.0347	0.0256	-0.8430	-0.1031	0.3181
	(--0.51)	(-0.30)	(0.16)	(-1.70)*	(-0.87)	(2.07)**
trade	0.0883	0.1389	0.0582	0.0137	0.0742	0.0785
	(1.48)	(1.91)*	(0.51)	(0.05)	(1.05)	(0.92)
manufacturing	0.0323	0.1861	-0.0741	0.0361	0.0718	0.2228
	(0.47)	(2.25)**	(-0.56)	(0.13)	(0.87)	(2.07)**
listed	-0.4034	-0.1922	-0.2330	0.2202	-0.4859	0.3512
	(-3.17)***	(-1.30)	(-1.04)	(0.42)	(-3.11)***	(1.23)
family	-0.0159	0.1126	0.0845	0.3307	-0.0582	0.1594
	(-0.29)	(1.66)*	(0.82)	(1.01)	(-0.88)	(1.96)**
person	-0.2549	0.0097	0.1349	0.1048	-0.4895	0.0817
	(-1.54)	(0.05)	(0.54)	(0.18)	(-2.14)**	(1.37)
crisis	0.0254	-0.0079				
	(0.98)	(-1.17)				
Risk						
CDS	0.0002	0.0001	-0.0002	-0.0006	0.0001	-0.0002
	(1.35)	(0.77)	(-1.40)	(-1.95)**	(1.59)	(-0.86)
interest_up	0.1454	-0.3458	0.1945	-0.1143	0.1321	-0.3164
	(2.46)**	(-2.36)**	(2.20)**	(-0.17)	(1.71)*	(-2.36)**
interest_down	0.1752	0.2331	0.1930	0.2739	0.3824	0.2308
	(2.78)**	(1.87)*	(1.87)*	(0.42)	(3.25)***	(1.21)
credit_history_up	0.1083	0.0136	0.1302	0.1120	0.1107	0.0136
	(1.73)*	(0.18)	(1.65)*	(0.33)	(1.70)*	(0.18)

Table 5 continued

	The overall period		The crisis period		The post-crisis period	
	(1)	(2)	(3)	(4)	(5)	(6)
	loan_applied (1st stage)	loan_approval (2nd stage)	loan_applied (1st stage)	loan_approval (2nd stage)	loan_applied (1st stage)	loan_approval (2nd stage)
credit_history_down	0.2583	-0.1496	0.1629	-0.4582	0.1880	-0.2136
	(2.73)***	(-2.10)**	(1.94)*	(-1.52)	(2.25)**	(-1.98)**
Performance						
profit_up	0.0589	0.0705	-0.0979	-0.2411	0.0997	0.0709
	(0.84)	(0.86)	(-0.66)	(-0.64)	(1.25)	(0.68)
profit_down	0.0867	-0.0366	-0.0388	-0.0588	0.1220	-0.0901
	(1.67)*	(-0.49)	(-0.32)	(-1.43)	(1.60)	(-1.94)**
Growth						
actual_growth_up	0.0723	0.2833	-0.0032	0.3375	0.2406	0.4363
	(0.50)	(1.84)*	(-0.01)	(1.45)	(1.32)	(1.94)**
actual_growth_down	-0.0848	-0.1324	-0.0388	-0.2993	-0.0658	0.0076
	(-1.10)	(-1.36)	(-0.31)	(-1.07)	(-0.58)	(0.06)
future_growth_up	0.2108	0.3721	0.0399	0.0510	0.3581	0.1356
	(1.34)	(1.56)	(0.11)	(0.08)	(1.97)**	(0.80)
future_growth_down	-0.1468	0.0143	-0.1838	0.2109	0.0056	0.0627
	(-1.05)	(0.08)	(-0.99)	(0.45)	(0.03)	(0.25)
sustained_growth	0.0750	-0.2692	0.7382	-0.4682	-0.4330	-0.3423
	(0.28)	(-2.21)**	(1.69)*	(-2.18)**	(-1.30)	(-0.99)
constant	-1.1807	-0.1612	-0.9832	1.0297	-1.287	1.5721
	(-7.45)***	(-1.95)**	(-4.69)***	(0.56)	(3.26)***	(0.92)
obs	3376	665	1064	204	2312	461
Prob>chi2	0.00	0.00	0.00	0.03	0.00	0.00

Note: This table reports the regression results of the determinants of bank lending in the entire sample period, in the crisis (2009-2011) period and in the post-crisis period (2012-2014), respectively. The Heckman selection model is used to estimate the determinants of bank lending. The independent variables are firm fundamentals, the CDS premium, firm size and firm ownership. Robust standard errors are employed and z-statistics are reported in parentheses. ***, **, * represent significant levels at 1%, 5%, and 10%, respectively.

Table 6 Robustness checks

Panel A: Using an alternative loan approval rate to estimate supple effects			
	(1)	(2)	(3)
	The overall period	The crisis period	The post-crisis period
Risk			
CDS	-0.0001	-0.0006**	0.0001
	(-1.00)	(-2.13)	(0.86)
interest_up	-0.1180	-0.1122	-0.1748*
	(-0.16)	(-0.48)	(-1.79)
interest_down	0.3219**	0.2214	0.5241**
	(2.19)	(1.50)	(2.06)
credit_history_up	0.1571	0.0902	0.1937
	(0.81)	(0.98)	(1.26)
credit_history_down	-0.2425*	-0.1284	-0.3603**
	(-1.81)	(-0.45)	(-1.99)
Performance			
profit_up	0.1109	-0.2863	0.3789*
	(0.73)	(-0.86)	(1.69)
profit_down	-0.3461*	-0.2463	-0.4734**
	(-1.76)	(-1.60)	(-2.34)
Growth			
actual_growth_up	0.8069**	0.6239	0.8643**
	(2.51)	(1.53)	(2.00)
actual_growth_down	-0.3081**	-0.2226	-0.3995**
	(-2.51)	(-0.74)	(-1.99)
future_growth_up	0.3119	0.7803	0.3256
	(0.97)	(1.07)	(0.88)
future_growth_down	0.4315	0.4737	0.5123
	(1.42)	(0.96)	(1.09)
sustained_growth	-1.5936***	-1.0459*	-1.7643**
	(-2.88)	(-1.79)	(-2.04)
constant	0.2746	-0.2508	0.4442
Controls	Yes	Yes	Yes
obs	671	210	461
Pseudo R^2	0.05	0.04	0.10

Panel B: An alternative model specification		
	(1)	(2)
	Demand effects	Supply effects
Crisis	0.0583	0.2406
	(0.58)	(0.96)
CDS	0.0002	0.0001
	(1.32)	(0.17)
Crisis×CDS	-0.0001	-0.0008
	(-0.73)	(-1.97)**
Controls	Yes	Yes
Constant1	-0.9577	0.2258
Constant 2	0.8783	
Pseduo R^2	0.06	0.04
obs	3,376	671

Note: This table reports the regression results of robustness checks. Panel A shows the results of supply effects where the dependent variable, *bank_loan*, is equal to one if a firm receives 100% of the loan amount that it has applied for, and zero otherwise. Panel B shows the results of demand and supply effects when the crisis dummy interacts with CDS. The coefficients on control variables are omitted for brevity. The ordered probit model is used to estimate the demand for bank loans while the probit model is used to estimate supply effects. Robust standard errors are employed and *z*-statistics are reported in parentheses. ***, **, * represent significant levels at 1%, 5%, and 10%, respectively.

Appendix1 Timelines of 11 SAFE survey waves

#	Survey round	Fieldwork period	Reference period	Round
1	2009H1	17 June 2009-23 July 2009	January to June 2009	Common
2	2009H2	19 November-18 December 2009	July to December 2009	ECB round
3	2010H1	27 August-22 September 2010	March-September 2010	ECB round
4	2010H2	21 February-25 March 2011	September 2010-February 2011	ECB round
5	2011H1	22 August-7 October 2011	April-September 2011	Common
6	2011H2	29 February-29 March 2012	October 2011-March 2012	ECB round
7	2012H1	3 September-11 October 2012	April-September 2012	ECB round
8	2012H2	18 February-21 March 2013	October 2012-March 2013	ECB round
9	2013H1	28 August-4 October 2013	April-September 2013	Common
10	2013H2	20 February-24 March 2014	October 2013-March 2014	ECB round
11	2014H1	1 September-10 October 2014	April-September 2014	Common

Source: The European Commission and The European Central Bank

Appendix2 Variable Definitions

Variables	Source	Coding
loan_demand dummy	For each of the following types of external financing, please indicate if your needs increased, remained unchanged or decreased over the past 6 months?	1=decreased, 2=unchanged, 3=increased.
bank_loan dummy	If you have applied and tried to negotiate for this type of financing over the past 6 months, did you receive all the financing you requested; received only part of the financing you requested; refuse to proceed because of unacceptable costs or terms and conditions; or have you not received anything at all?	Binary variable: 1=received 75% of bank loans or received the full amount applied 0=otherwise.
profit_up dummy	Have the following company indicators (Profit) decreased, remained unchanged or increased over the past 6 months?	Binary variable: 1=profit increased, 0=otherwise. Basegroup=unchanged.
profit_down dummy	Have the following company indicators (Profit) decreased, remained unchanged or increased over the past 6 months?	Binary variable: 1=profit decreased, 0=otherwise. Basegroup=unchanged.
interest_up dummy	Have the following company indicators (Interest expense) [WHAT YOUR COMPANY PAYS IN INTEREST FOR ITS DEBT] decreased, remained unchanged or increased over the past 6 months?	Binary variable: 1=interest expense increased, 0=otherwise. Basegroup= unchanged.
interest_down dummy	Have the following company indicators (Interest expense) decreased, remained unchanged or increased over the past 6 months?	Binary variable: 1=interest expense decreased, 0=otherwise. Basegroup= unchanged.
future_growth_fast dummy	Considering the turnover over the next two to three years, how much does your enterprise expect to grow per year?	Binary variable: 1=growth over 20% per year, 0=otherwise. Basegroup= less than 20% or no growth.
future_growth_slow dummy	Considering the turnover over the next two to three years, how much does your enterprise expect to grow per year?	Binary variable: 1=become smaller (negative), 0=otherwise. Basegroup= less than 20% or no growth
actual_growth_up dummy	Over the past three years, how much did your enterprise grow on average per year?	Binary variable: 1=over 20% per year, 0=otherwise. Basegroup=
actual_growth_down dummy	Over the past three years how much did your enterprise grow on average per year?	Binary variable: 1=got smaller (negative growth), 0=otherwise. Basegroup= less than 20% or no growth
credit_up dummy	Would you say that your enterprise's credit history has improved, remained unchanged or deteriorated over the past 6moths?	Binary variable: 1=credit history improved, 0=otherwise. Basegroup= unchanged.
credit_down dummy	Would you say that your enterprise's credit history has improved, remained unchanged or deteriorated over the past 6moths?	Binary variable: 1=credit history deteriorated, 0=otherwise. Basegroup= unchanged.

Appendix2 Continued

micro dummy	How many people does your enterprise currently employ either full or part time in [YOUR COUNTRY] at all its locations?	Binary variable: 1=1-9, 0=otherwise. Basegroup=50-249.
small dummy	How many people does your enterprise currently employ either full or part time in [YOUR COUNTRY] at all its locations?	Binary variable: 1=10-49, 0=otherwise. Basegroup=50-249.
large dummy	How many people does your enterprise currently employ either full or part time in [YOUR COUNTRY] at all its locations?	Binary variable: 1=250-, 0=otherwise. Basegroup=50-249.
listed dummy	Who owns the largest stake in your enterprise?	Binary variable: 1=enterprise is listed on the stock market, 0=otherwise. Basegroup=Other enterprises or business associates.
family dummy	Who owns the largest stake in your enterprise?	Binary variable: 1=family or entrepreneurs [MORE THAN ONE OWNER], 0=otherwise. Basegroup=Other enterprises or business associates.
sole dummy	Who owns the largest stake in your enterprise?	Binary variable: 1=yourself or another natural person, one owner only, 0=otherwise. Basegroup=Other enterprises or business associates.
construction dummy	What is the main activity of your enterprise?	Binary variable: 1=construction, one owner only, 0=otherwise.
industry dummy	What is the main activity of your enterprise?	Binary variable: 1=manufacturing [also includes mining and electricity, gas and water supply], 0=otherwise.
trade dummy	What is the main activity of your enterprise?	Binary variable: 1=wholesale or retail trade, 0=otherwise.
macro_economic dummy	Thomson Reuters Datastream	Continuous variable
public_fund_up dummy	Would you say that your access to public financial support including guarantees has improved, remained unchanged or deteriorated over the past 6moths?	Binary variable: 1=improved, 0=otherwise. Basegroup=unchanged.
public_fund_down dummy	Would you say that your access to public financial support including guarantees has improved, remained unchanged or deteriorated over the past 6moths?	Binary variable: 1=deteriorated, 0=otherwise. Basegroup=unchanged.
loan_app dummy	Have you applied for a Bank loan (excluding overdraft and credit lines) in the past 6 months?	Binary variable: 1=applied, 0=otherwise.