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Bank-lending constraints, trade credit and alternative financing during the financial crisis: Evidence from European SMEs

Eddie Casey[a1] and Conor M. O'Toole [b,c,*2]

a Irish Fiscal Advisory Council, Whitaker Square, Sir John Rogersons' Quay, Dublin 2, Ireland.

b Economic Analysis Division, Economic and Social Research Institute, Whitaker Square, Sir John Rogersons' Quay, Dublin 2, Ireland.

c Department of Economics, University of Dublin, Trinity College, College Green, Dublin 2, Ireland.

Abstract

Using euro area firm-level data since the recent financial crisis, we test whether bank-lending constrained small- and medium-sized enterprises (SMEs) are more likely to use or apply for alternative external finance including trade credit, informal lending, loans from other companies, market financing (issued debt or equity) and state grants. Our constraint indicators identify both credit-rationed firms and firms that self-ration due to high lending costs. We find that credit-rationed firms are more likely to use, and apply for trade credit. This increases with firm size and age. We also find that constrained firms are more likely to use informal lending or loans from other companies. but find no evidence that bank-constrained SMEs apply for, or use market finance. Smaller, self-rationing borrowers are more likely to apply for grant finance. Finally, we find that firms denied credit for working capital tend to turn to trade credit, while informal and inter-company lending tends to act as a substitute for bank investment loans.

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[1] Eddie.casey@fiscalcouncil.ie; +353 (0)1 863 2005
[2] Conor.otoole@esri.ie; +353(0)1 863 2135
* Corresponding author.

1. Introduction and background

The nature of the recent financial crisis in Europe has brought to the fore concerns regarding firms' capacity to access traditional bank lending. This issue has been well documented in the case of small- and medium-sized enterprises (SMEs).[3] Against this backdrop, a number of papers have focused on testing the determinants and effects of bank lending constraints on firms since the onset of the crisis (see for example, Popov and Udell, 2012; Jimenez et al., 2012; Campello et al., 2010; Artola and Genre, 2011; Ferrando and Greisshaber, 2011). However, less research has been undertaken on the relationship between bank lending and alternative sources of finance.

In this paper, we test whether bank lending constraints in times of crisis increase firm demand for alternative forms of external finance . We use firm-level data on SME access to finance from the ECB/EC Survey on Access to Finance for small-and medium-sized Enterprises (SAFE) covering a key part of the financial crisis period between 2009 and 2011 across 11 euro area members. We make the following contributions. First, we determine whether bank lending constrained SMEs are more likely to: 1) be end-users of trade credit, informal lending, loans from other companies, market financing or government grants and 2) be more likely to apply for trade credit or other external financing. Our estimates of financial constraints distinguish between two types of constrained firms: a) credit-rationed firms (firms where loan applications are rejected outright) and b) self-rationing borrowers (firms that do not apply due to high lending costs). We also explore whether or not these effects differ by firm age, size, and ownership as well as testing whether country specific heterogeneity is present in the relationship.

Our identification strategy controls for endogeneity by using lagged indicators of bank-lending constraints, while firm-level heterogeneity is controlled for by using a panel probit model with random effects. In light of the substantive literature on determinants of alternative finance usage, we include a number of control variables in our empirical model to control for firm creditworthiness, quality and risk. Specifically, we split firm risk and quality into two separate categories: a) trading quality, demand and production risk and b) financial risk. To control for the former, we include controls for firm profitability, historical and predicted sales growth, business outlook and labour and non-labour costs. To control for financial risk, we include indicators for changes in firms' capital positions, debt to asset ratios, interest expenses and credit histories.

Our research is most closely linked to existing literature considering the relationship between bank constraints and alternative finance. This includes the interrelationship between bank lending, trade credit, market financing, informal or other loans and state grants. In particular, our research is linked to the literature on the usage of trade credit (see for example, Demirguc-Kunt and Maksimovic,

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[3] In this paper, we refer to an SME by the standard European Commission definition, providing a comparable reference group across the European Union. See http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/.

2001; Bougheas et al., 2009; Aktas et al., 2012;, Wu et al., 2012.) A key strand of the literature focuses on the effect of firm quality or firm-specific risk on the usage of non-bank financing, especially trade credit.[4] The seminal work of Petersen and Rajan (1994; 1995; 1997) tests the effect of business relationships, investment opportunities, cash flow and industrial sectors on trade credit availability.[5] Controls examined include firm age and size as proxies for investment opportunities. Profitability and sales growth are also included. The ratio of income to total assets acts as a control for cash flow and limited liability as a control for firm-ownership structure. Their findings indicate that older, larger and more profitable firms tend to make fewer late payments. By contrast, highly indebted debt firms are found to be more likely to make late payments.

Similar findings on trade credit determinants emerge from research by Wilson and Summers (2002) and Giannetti et al. (2008) who highlight the importance of demand characteristics and firm creditworthiness in influencing the terms attached to trade credit as well as the ultimate end-usage of such facilities. Klapper et al. (2011) find that larger and more creditworthy buyers receive contracts with extended maturities. Using US data, Aktas et al. (2012) find evidence that trade credit usage is affected by investment quality measured using z-score values, returns on assets and abnormal returns. Ng et al. (1999) also test the determinants of the terms attached to trade credit, finding that these are determined by information availability and buyer creditworthiness.

Moving from the determinants of trade credit to actual end-usage, our work is most closely aligned to the research linking trade credit and bank lending (see Mateut (2005) for a survey of trade credit and monetary transmission). We investigate the demand of bank-constrained firms for trade credit during times of financial stress. Our examination specifically covers firms that either: a) increase accounts receivable or b) apply to suppliers to use trade credit facilities following a shock to bank credit access. Theoretical research in this area (see Petersen and Rajan, 1994; 1995; Biais and Gollier, 1997; Burkart and Ellingsen, 2004) suggests that when liquidity is relatively unrestricted, firms tend to favour financing activities using relatively cheaper bank debt. As liquidity dries up, however, firms are found to have a propensity to complement bank lending with trade credit. Petersen and Rajan (1995) indicate that, when confronted with bank lending constraints, firms are more inclined to borrow from more expensive non-institutional sources provided that investment returns exceed the cost of funding from alternative credit providers. Burkart and Ellingsen (2004) find that, where banks are rationing credit, suppliers are often better positioned to provide credit. Again, this arises due to relative advantages in overcoming firm-related moral hazard and information asymmetries. Support for this is provided by Petersen and Rajan (1997) who note that suppliers' implicit equity stakes in various firms can help overcome associated information difficulties, enabling them to provide lending to otherwise credit-constrained firms.

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[4] We would like to thank an anonymous referee for suggesting the link to this literature and its inclusion in our motivation. We would also like to thank the referee for suggesting additional controls for firm risk and quality.
[5] Trade credit availability in Petersen and Rajan (1994) measures trade credit as late payments and discounts.

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In subsequent work, Petersen and Rajan (1997) find that firms tend to employ trade credit to a greater degree when credit from financial institutions is constricted. Similar findings are presented in Nilsen (2002), where small firms are shown to substitute trade credit for bank credit in the face of bank lending shocks. Mateut et al. (2006) present a model which links trade credit to monetary policy activity. Their a priori prediction that monetary tightening is followed by reductions in volumes of bank lending in contrast to volumes of trade credit is confirmed in an empirical analysis of UK firms. Yang (2011) also finds that during periods of monetary tightening, trade credit can act as a substitute for bank credit, whereas periods of monetary easing appear to show the two financing types as complementary. Huang et al. (2011) find evidence of substitution of trade credit for bank credit displaying counter-cyclical pattern using Chinese data. Carbó et al. (2013) find increased dependence on this form of financing for firms that are credit constrained using data for Spain. Garcia-Appendini and Montoriol-Garriga (2013) find that accounts payable increase for constrained firms during the current crisis in the US. Elsewhere, Ferrando and Mulier (2013) find that financially constrained firms are more likely to use trade credit as part of their overall growth strategy. Finally, our research bears some connection to the work of Love et al. (2007) who test the effects of trade credit during financial crises in East Asia. They identify that trade credit usage increases immediately after crises and gradually tails off afterwards.

In addition to trade credit, our research also focuses on other additional forms of alternative finance for bank credit. These include informal lending, loans from shareholders, loans from other companies, market financing and government grants. Their usage and availability has significant implications for financial stability and macroeconomic growth, especially in the context of continuing loan impairments, bank balance sheet deleveraging and more stringent regulatory capital requirements. Indeed, the forthcoming Basel III framework may result in traditional bank lending to European SMEs remaining subdued in the medium term and Wehinger (2012) notes that, in such an environment, new forms of financial intermediation will be required.

Our focus first lies with informal lending and shareholder loans whose usage may be more prevalent among micro-sized firms, with family members more likely to provide capital to support certain businesses.[6] The literature on the relationship between informal credit and bank credit is not well developed, primarily focusing on developing economies (See Xiao and North, 2013 for example). Brealey et al. (2010) note that other financing alternatives, on average, are found to be just as important as traditional bank finance in terms of usage, although large firms in higher income economies show a greater prevalence of traditional financing compared to those in low income economies. Firm age is also significant, with Chavis et al. (2010) using World Bank survey data to show that younger firms typically rely more on other financing alternatives than on bank finance for both short-term (working capital) and long-term (new investment) financing. In part, these findings

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[6] Given our data it is not possible to split out informal sources from other shareholders loans or loans from other companies. This is discussed in more detail in Section 3.

are likely to reflect that smaller firms may represent greater risk, with growth more uncertain and loans more difficult to monitor. Reflecting the risks attached to smaller firms and the lack of access to traditional lending more generally, Allen et al. (2005; 2012) show that non-state, non-listed firms in China and India rely more on alternative financing channels such as funds from family and friends in order to finance activity. Saeed (2009) finds that shifting from informal to formal bank finance is associated with improved economic growth outcomes.

Turning to market-oriented financing, such as equity, and debt issuance, much of the research has focused on larger firms and less so on SMEs, which is a contribution of our research. A seminal study in this field is provided by Kashyap et al. (1993) who test the relationship between monetary policy and credit conditions. They find that tighter monetary policy lead to shifts in firms' mix of external finance whereby commercial paper usage increases when bank lending availability diminishes. Leary (2006) finds that bank-dependent firms shift towards equity when bank debt is scarce. The research highlights the fact that supply frictions in credit markets are important determinants of corporate capital structures, particularly for more bank-dependent firms.

The final financing type we consider is whether bank-constrained firms are more likely to use government grants or subsidised loans. There is an extensive international literature on the functioning of policy measures for SME credit such as credit guarantee schemes and the subsequent usage of these (Lewisky, 1997; Cowling, 2003; Beck et al., 2010, Oh et al., 2009; Kang et al., 2009). This includes a forthcoming report by the OECD. Honohan (2010) notes that every multilateral development bank and all but a small minority of OECD economies have some form of credit guarantee scheme, while Beck et al. (2010) provide a typology of such schemes covering 56 developed and developing countries. Given the policy measures available for SMEs, to our knowledge, this is the first paper that links bank constraints to the usage of grant financing in a pan-European panel dataset covering the period since the recent financial crisis.

Despite the considerable literature that exists at present, there are a number of ways in which this paper brings additional insight to research on bank lending constraints. A key strength is the sample itself, which covers 11 countries with a heterogeneous representation of SMEs including firms with both sole trader and non-limited ownership structures. These are not included in widely used samples based on firm incorporation sources, such as Amadeus or Compustat. The sample also provides richer within-country and cross-country variation relative to single country studies like that of Garcia-Appendini and Montoriol-Garriga (2013) and Carbo et al., (2013). The fact that the data captures the euro area during a key period of the recent financial crisis also entails a rich sample. Differences in the severity and duration of banking crises across member states as well as varying levels of financial development and disparate financing structures are also reflected in the dataset. A study focusing on the euro area should provide additional insights to the discussion of credit constraints and alternative financing and can add to the comprehensive work of Love et al. (2007).

This paper further contributes to existing literature by directly measuring financing constraints based on firms' applications for credit as well as by measuring borrower's own self-rationing (i.e. firms that reject loans on the basis of high costs). Direct information on whether or not firms applied for and actually used trade credit can also be elicited from the data, enabling us to capture latent demand as

well as actual end-usage. It is notable that this methodology for measuring financing constraints has not previously been used to test the relationship between trade credit and bank lending.[7]

Linking credit constraints to the probability of using alternative finance, our findings suggest that credit-rationed firms are 9 per cent more likely to use trade credit than non-constrained firms, with effects stronger for both older and larger firms. The findings are statistically-significant and the positive relationship is robust to controls for a variety of country- and firm-level variables including controls for firm risk. The findings are in line with Nilsen (2002), Mateut et al. (2006), Carbo et al. (2013) and Garcia-Appendini and Montoriol-Garriga (2013) highlighting increased trade credit usage by credit-constrained firms. Focusing on other external financing types, we find that credit-rationed firms are 4.5 per cent more likely to use informal lending, other company or shareholder loans. We also find that younger firms are much more likely to use this category of alternative finance as are larger firms. Self-rationed firms are nearly 8 percent more likely to use this financing type. We find no evidence that credit-rationed SMEs are more likely to use market-based financing following a shock to traditional bank lending. Interestingly, for grant usage, we find a negative and significant link in the case of credit-rationed and self-rationed firms. These findings may suggest that the current suite of policies available for SME financing both at a national level and on a pan-European basis are not adequately targeted at firms facing actual constraints. It may also be the case that firms rejected for bank loans or firms which self-ration on the basis of costs may subsequently decide against pursuing grant aid.

On the demand for alternative financing by bank-constraints firms, we find that credit-rationed firms are 9 per cent more likely to apply for all non-bank financing alternatives, while self-rationing firms are nearly 18 percent more likely to apply for non-bank financing. Separating applications into trade credit and all other financing alternatives, reveals that credit-rationed firms tend to apply for trade credit facilities whereas self-rationed firms apply for other forms of alternative financing. Dividing credit-rationed firms into those who applied for investment loans and those who applied for working capital facilities indicates that alternative forms of financing, aside from trade credit, are seen to be demanded by credit-rationed firms seeking investment finance only. This suggests that trade credit is the main bank credit substitute for working capital purposes. We also find that applications for all alternative financing by constrained firms increase with firm size.

Finally, given the very different impacts of the recent financial crisis on the real economies of different euro area members, we explore cross-country heterogeneity in the effect of credit-rationing on the usage of, and applications for, alternative financing. Specifically, we are interested in exploring whether there are systematic differences in crises countries that remain when country-specific and firm-quality effects are controlled for. For example, while constraints may be higher in crisis countries, such bank rejections may reflect the accurate re-pricing of firm-specific risk by financial institutions as opposed to banking reductions in credit supply at the country level. Our

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[7] More details on our data and methodology are outlined in Section 3.

results indicate that the estimated marginal effects of being credit-constrained on using alternative finance are not systematically higher in crises countries. In the case of those countries where the impacts of the crisis were most acute, however, we do find an increase in the effect of bank lending constraints on applications for alternative financing. However, these effects lessen when we control for firm-specific quality.

These results suggest that while the demand for alternative finance such as trade credit may increase during crises periods, credit suppliers appear to respond by re-evaluating risk at the firm level in the allocation of finance. This reflects the environment of heightened default risk and macroeconomic conditions unsupportive of business performance.

The rest of this paper is structured as follows: Section 2 outlines the methodology and the data. Section 3 presents the empirical results and Section 4 concludes.

2. Data and methodological approach

2.1 Data and measuring financial variables

To test our main hypotheses, we use the SAFE data collected by the European Central Bank (ECB) on a bi-annual basis as well as that collected by the European Commission (EC) on a biennial basis for a wider sample. Beginning in 2009, this survey is designed to capture timely and accurate information on the financing of firms and their interaction with, and usage of, different financing technologies. Its main aim is to provide input into ECB monetary policy decision making and ensure effective monitoring of transmission mechanisms across the euro area. The survey contains information on the general characteristics of the firm, on the use of bank, market or other external financing, and their views on the general economic and credit outlook.[8]

Importantly for our research, the SAFE survey contains detailed information on the use of specific alternative external financing technologies. Our focus is on firms that use alternative financing as well as on firms that apply for alternative financing. In terms of firms usage of finance, the survey distinguishes between the following types: retained earnings, grants or subsidised bank loans, bank overdrafts, credit lines or credit card overdrafts, bank loans, trade credit, other informal or company loans (from informal sources, family or related company or shareholders), leasing/hire purchase/factoring, debt securities, subordinated loans, and equity financing. Our investigation is limited to four groups as outlined in Table 1: a) trade credit, b) informal or other company loans, c) market financing and d) grants or subsidised bank loans. Each of these indicators are binary and take the value of 1 if the firm uses them in the past six months and 0 otherwise. We have grouped debt securities, subordinated debt and equity financing into a market financing category as each type requires the SME seeking credit to interact with a formal external financing market. As our interest is

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8   For more information see ECB SAFE Questionnaires available on www.ecb.int.

in how firms deal with shocks to lending activity by banks, we do not focus on the factoring/hire purchase/ leasing as many of these facilities are provided by traditional banks.

Table 1: Definition of Alternative Finance Variables

Indicator	Definition
(a) Trade credit	Indicator = 1 if firm used trade credit or in the past 6 months. Indicator = 0 otherwise.
(b) Informal financing or other company loans	Indicator = 1 if firm used informal financing, loans from shareholders or related companies in the past 6 months. Indicator = 0 otherwise.
(c) Market financing	Indicator = 1 if firm used equity, issued debt securities, or subordinated loans in the past 6 months. Indicator = 0 otherwise.
(d) Grants or subsidized bank loans	Indicator = 1 if firm received grant finance or subsidized loans from the state in the past six months. Indicator = 0 otherwise.
Apply Alternative Finance (Apply_AF)	Indicator = 1 if firm applied to use either trade credit or other external finance (non-bank loans, factoring, debt, equity or leasing) in the past 6 months. Indicator = 0 otherwise.
Apply trade credit (Apply_TC)	Indicator = 1 if firm applied to use trade credit in the past 6 months. Indicator = 0 otherwise.
Apply other alternative financing (Apply_Other)	Indicator = 1 if firm applied to use other external finance (non-bank loans, factoring, dept, equity or leasing) in the past 6 months. Indicator = 0 otherwise.

Source: Author's calculations using ECB SAFE data

The second group of indicators that we focus on relate to firms applications for alternative finance. In the SAFE survey, apart from applications for traditional banking credit, firms are asked did they apply for 1) trade credit facilities or 2) other non-bank external financing. Using these data, we develop three additional indicators which are outlined in Table 1. The first, Apply_AF, takes the value of 1 if firms used or applied for either trade credit or other external financing in the past six months. The second and third are binary variables for whether or not the firm specifically applied for trade credit (Apply_TC) or other external financing in the past six months (Apply_Other).

Having developed indicators of alternative finance usage, the next step is to identify whether or not firms face binding financing constraints. A major difficulty stemming from the wider literature on estimating credit constraints concerns the identification of constrained firms. While the literature draws on a number of methodologies to identify constrained firms,[9] many papers use direct survey questions concerning the firms' perceptions of credit constraints and their experience in accessing external credit (Clark et al., 2006; Beck et al., 2006). In recent years, the usage of survey data is

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[9] Other methodologies tend to fall into one of two categories. The first typically involves estimating the relationship between measures of internal funds (such as cash stock or cash flow) and outcome variables (investment, inventory management or firm growth) (Fazzari et al., 1988; Chirinko, 1993; Hubbard, 1998; Love, 2003; Guariglia, 2008; O'Toole et al., 2014; Ryan et al., 2014). The second typically uses wider financing information on borrowings, net worth, and liquidity management to proxy for the financial position of the firm (Bond and Mehir, 1994; Whited, 1992; Whited and Wu, 2005).

becoming more established due to concerns about the correctness of identification using other methods (see Kaplan and Zingales (1998) for a critique) as well as the increasing availability of large representative survey datasets with direct access to finance information.

In this paper, we are concerned with the survey-based methodology for credit constraint identification. Using data from the SAFE survey, we follow the approach in Bigsten et al. (2003), Byiers et al. (2010), Hansen and Rand (2011), Popov and Udell (2012) and O'Toole (2012) and attempt to directly identify firms with difficulties accessing formal bank credit. Table 2 outlines our definitions of credit constraints which are drawn from a number of different SAFE questions. The main question we draw on relates to loan applications and denials. Firms are asked if they applied for bank loans and, if so, whether they were a) rejected outright, b) given between 75 per cent and 99 per cent of the application, c) given between 1 per cent and 74 per cent of the credit or d) rejected the offer due to the interest offer rate being excessive. Our benchmark constraint, follows both Byiers et al. (2010) and O'Toole (2012) and identifies firms as constrained if they applied for and were denied credit as defined by a or c above. We refer to this group of firms as *credit-rationed*. As in previous research (Byiers et al., 2010), we do not classify firms as constrained if they report refusing loans on the basis that the interest rate offered was too high as this may indicate that they do not have positive Net Present Value (NPV) investment projects that can be undertaken profitably at the current market cost of capital. Instead, we follow Popov and Udell (2012) and include an additional category which captures firms who applied for and were offered finance but declined the loan offer due to the cost of the interest or the associated terms and conditions. In theory, some firms "self-ration" due to the perceived unacceptability of related costs, while financial institutions may also engage in credit-rationing on the basis of price, not-quantity. In any case, our second category of financially constrained firms should capture firms credit constrained through price-based rationing by banks.

To provide additional insight into the behaviour of credit-rationed firms, we build on the main definition and make two refinements to test for robustness. We test whether firms that were rejected credit for investment finance react differently to firms that applied for working capital facilities. We therefore subdivide credit-rationed firms into two additional categories. Ones is for firms credit-rationed in terms of investment (rationed firms who applied for term loan financing and who indicated they had a demand for external credit for fixed investment purposes). These firms can be seen as active investors who would have potentially undertaken capital- or productivity-enhancing investment if the credit had not been rejected. This indicates that they have some positive NPV opportunities that they are willing to commit to in the current environment. Second, we provide a definition for firms that are constrained for working capital financing only. In this case we limit the application criteria to firms that applied and were denied for bank overdrafts, credit lines or credit card overdrafts.[10]

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[10] This captures standard working capital financing facilities.

Table 2: Credit Constraint Definitions

Constraint	Definition
Credit-Rationed (Denied Finance)	Firms are defined as constrained if they applied for bank loans, bank overdrafts, credit lines or credit card overdrafts but were refused finance or received less than 75 per cent of the amount sought.
Cost Too High (Self-rationing)	Firms are defined as constrained if they applied for bank loans, bank overdrafts, credit lines or credit card overdrafts and were made an offer, but rejected the offer due to the cost being too high.
Additional credit rationing constraints	
Credit-Rationed (Denied Finance for Investment)	Firms are defined as constrained if they applied for bank loans but were refused finance or received less than 75 per cent of the amount sought and have indicated that they undertook some investment in the period.
Credit-Rationed (Denied Finance for Working Capital)	Firms are defined as constrained if they applied for bank overdrafts, credit lines or credit card overdrafts, but were refused finance or received less than 75 per cent of the amount sought

Source: Author's calculations using ECB SAFE data

2.2 Summary statistics

To test the effects of bank lending constraints on alternative finance usage, we focus our attention on 11 countries in the euro area.[11] The SAFE survey was conducted in various waves since 2009.[12] The same firms were re-surveyed across countries where possible. This provides us with a panel data set of firms across the various survey waves. However, the firm identifiers are not currently available for waves six, seven and eight. In this regard, our analysis is limited to the firms from the five waves over the period January 2009-September 2011 where panel data is available.[13] Our sample size covers approximately 5,800 observations across the 11 euro area members. The number of firms across each of the euro area countries is presented in Table A1 in Annex 1. It can be seen that the survey contains more observations for the bigger economies in order to be sufficiently representative for these countries. Germany, Spain, France and Italy each account for about 15 -20 per cent of the total firms in the sample. The coverage for the smaller euro area nations is more limited for our panel data sample.

In all our of analysis, we include firms that answered "don't know" to questions on alternative finance and applications for lending facilities. This is included for statistical purposes due to the fact that as we are dealing with very small sample sizes, removing these firms may have a particularly detrimental effect on the representativeness of the data. We have therefore decided to include

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[11] The countries included are Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands and Portugal. Too few observations in panel data were available for other euro area members.

[12] The survey waves are wave 1 (Q1,Q2 2009), wave 2 (Q3,Q4 2009), wave 3 (March-Sept 2010), wave 4 (Sept 2010-Feb 2011), and wave 5 (April to Sept 2011).

[13] Panel data is required for our identification strategy. Additional details are discussed in Section 3.3.

these in the analysis as not reportedly being credit constrained or using /applying for alternative finance.[14]

Table A2 in Annex 1 presents a breakdown of the number of firms by age, size, sector, and firm ownership for our sample. The majority of firms in the sample have been established for over 10 years (73 per cent) whereas only 1.5 per cent of the sample are start ups (less than 2 years). These characteristics have implications for our analysis as we would expect established firms to have more developed relationships with both suppliers and financial institutions (as discussed in Section 2). In terms of the sectoral breakdown, over 34 per cent of firms are in the services sectors (business services, transport and real estate), 25 per cent in the wholesale and retail trade, 28 per cent in Industry and the remainder in construction. In terms of size breakdown, there is a reasonably even split across micro, small and medium sized enterprises at 32 per cent, 35 per cent and 36 per cent of firms respectively. We take these size classes as they are defined in the survey.[15] The final firm characteristic of interest is firm ownership. It is expected that firms with differing ownership would, a priori, have very different potential access to alternative financing. For example, larger listed SMEs would be able to access market financing more readily sole traders or family firms. In the sample, the majority of firms are either family or privately owned or sole traders (54 per cent and 24 per cent respectively). An additional 14 per cent are subsidiaries or owned by other business associates. Fewer than 4 per cent are publicly listed with a further 1 per cent using venture capital or business angel financing.

Having provided a general review of the data, we now focus on the measures of alternative external finance. Table 3 presents the mean value across countries for our sample of the indicators for the share of firms in the last six months that use trade credit, informal financing or other company loans, market financing or grant financing. The country with the highest reported usage of trade credit is Ireland, a country which has simultaneously experienced a severe banking crisis and sovereign debt funding crisis. The second highest usage is in Finland at 66 per cent followed by Greece at 61 per cent. The country with the lowest reported usage of trade credit is France at just 15 per cent of firms. In terms of informal or other company loans, the highest usage is in the Netherlands at 22 per cent followed by Finland and Belgium at 18 per cent. France, Italy and Greece indicate the lowest use of these financing types. In terms of market financing, Greece indicates the highest usage at 50 per cent with Portugal reporting the lowest at 3 per cent. Grant or subsidised loan financing is highest in Spain and Portugal and lowest in the Netherlands. To a large degree, these variations are a

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[14] However, it could be argued that these firms should be omitted. We therefore repeat out analysis with these firms removed as a robustness check. The results and summary charts are available from the authors on request. The results are virtually identical to those if these firms remain.

[15] Firms have been classified as in the ECB official data according to number of employees: micro firms have between 1 and 9 employees, small firms between 10 and 49, medium-sized firms between 50 and 249 and large firms have 250 or more.

reflection of how the broader financing mix in euro area economies can be structured quite differently.

Table 3: Country means for share of firms using alternative finance

	Trade credit	Informal or Other company	Market financing	Grants
AT	32%	14%	19%	18%
BE	30%	18%	12%	18%
DE	19%	16%	22%	16%
ES	42%	13%	5%	27%
FI	66%	18%	9%	14%
FR	15%	7%	7%	15%
GR	61%	8%	50%	21%
IE	75%	15%	12%	11%
IT	41%	9%	7%	19%
NL	40%	22%	14%	7%
PT	35%	10%	3%	26%

Source: Authors calculations using ECB data
Note: Statistics calculated on estimation sample so as to
provide context for results.

The second set of indicators that we focus on relate to applications for alternative financing. These are presented in Table 4.

Table 4: Country means for share of firms applying for alternative finance

	Apply_AF	Apply_TC	Apply_Other
AT	21%	15%	9%
BE	13%	8%	8%
DE	16%	8%	11%
ES	37%	32%	13%
FI	12%	4%	10%
FR	19%	8%	14%
GR	26%	22%	8%
IE	30%	26%	7%
IT	27%	22%	9%
NL	15%	11%	7%
PT	21%	17%	7%

Source: Authors calculations using ECB data
Note: Statistics calculated on estimation sample so as to
provide context for results.

The country with the highest level of applications for alternative finance by firms is Spain at 37 per cent. This is followed by Ireland at 30 per cent, Italy at 27 per cent, Greece at 26 per cent and Portugal at 21 per cent. Both Spain and Ireland have suffered major banking sector crises which have

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required significant recapitalization through state intervention. A main aim of this paper is to see if economies where banking sector stresses have been more severe have subsequently witnessed an increased firm-dependence on alternative finance. Italy, Greece and Portugal have also had difficulties in sovereign financing markets with the latter two currently in official financing programmes. The country with the lowest share of alternative finance applications is Finland at 12 per cent. A lower rate of firms requiring a switch to alternative finance could be expected in Finland as the economy has weathered the economic and financial crisis relatively better than other economies to date. These summary statistics in general would suggest that in those economies most affected by banking sector and sovereign debt crises, firms tend to have high levels of applications for alternative financing. Looking across the applications, it seems that the majority of these are for trade credit. The application rates for trade credit are much higher across the board than for all other external financing.

The final summary statistics we present relate to the indicators of bank financing constraints. The mean values across waves four and five for core and periphery economies are presented in Figure 2.

Table 5: Country means for indicators of credit constraints

	Credit-rationed	Cost too high
AT	1.8%	0.9%
BE	3.1%	0.4%
DE	3.9%	0.5%
ES	12.3%	1.6%
FI	0.7%	0.0%
FR	7.7%	0.6%
GR	12.4%	0.7%
IE	12.5%	0.8%
IT	8.4%	1.1%
NL	3.2%	0.6%
PT	7.1%	0.6%

Source: Authors calculations using ECB data
Note: Statistics calculated on estimation sample so as to
provide context for results.

Using the baseline constraint, "credit-rationed", we find that the highest level of financing constraints is in Ireland, Greece, and Spain at over 12 per cent of all firms respectively. Italy, Portugal and France are at 8 per cent, 7 per cent and 7.7 per cent respectively. The country with the lowest level of bank lending constraints is Finland at less than 1 per cent of firm's credit-rationed. This confirms our initial expectations that economies which weathered the financial crisis relatively more mildly would be less prone to firms being subject to credit constraints. In Table A5 in Annex 1, the mean values for the sub-groups of credit-rationed firms are presented: a) credit-rationed for investment and b) credit-rationed for working capital financing. Focusing on constraints for fixed investment, the picture is similar with the so-called 'periphal economies' showing the highest levels: Spain is the highest at 6.5 per cent, then Greece (6.2 per cent), Ireland (5.9 per cent), followed by

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Portugal (4.3 per cent). The mean values for the working capital lending constraint (CC3) also show a similar pattern. Ireland is the most constrained in this respect at 10.2 per cent, followed by Spain and Greece at 6.6 per cent and 6 per cent, respectively. For both of these constraints measures, the lowest are reported in Finland and Austria. Again, this conforms to our initial expectations that the severity of the financial crisis would have a positive effect on subsequent credit constraints.

Focusing on the "self-rationing" borrowers (i.e. those firms that are offered bank loans, but reject these due to perceived high costs denoted here as "cost too high"), the differences are far less pronounced, albeit a relatively similar pattern still emerges. On this basis, 1.6 per cent of firms are constrained in Spain, 1.1 per cent in Italy, 0.8 per cent of firms in Ireland and 0.7 per cent of firms in Greece. .. Austrian firms are also found to be marginally more constrained in this sense (0.9 per cent), but unlike volume-based rationing as reflected in outright rejections, this may merely be a reflection of the re-pricing of risk.

Overall, the summary statistics for the bank lending constraint measures indicate that a high proportion of the firms in European peripheral nations face such constraints, with those economies where banking or sovereign stresses have been most intense following the financial crisis typically showing greater shares of firms subjected to credit-rationing. The results also demonstrate the considerable variation across countries in the euro area.

2.3 Research hypotheses, empirical model, and identification strategy

Given our contribution to the literature, there are a number of hypotheses that we test. Firstly, we test the following:

H1: *Bank constrained firms are more likely to use or apply for alternative financing, including trade informal or other company loans, market financing or grants.*

This hypothesis captures the potential substitution effect between bank and other credit as has been previously documented in the literature. However, as SMEs are very heterogeneous, and their financing requirements change across their life cycle, it could be expected that the substitution between bank credit and alternatives differs depending on firm characteristics. We focus on three specific firm characteristics that are listed as important determinants of SME financing in the literature: firm age, size and ownership (Beck et al., 2006). As a number of papers (Nilsen, 2002; Garcia-Appendini and Montoriol-Garriga, 2013) find that larger firms are more likely to be given trade credit relative to small firms, we therefore test the following additional hypotheses:

H2: Younger *bank constrained SMEs are more likely to use informal or other loans while older bank constrained firms are more likely to use trade credit.*

H3: *As firm size increases, constrained firms are more likely to use or request trade credit relative to informal loans or grant finance.*

H4: *Firms with relatively more market-oriented ownership are more likely to use market financing in the event of bank credit rejection.*

Considering these hypotheses, it should be possible to glean additional insights into the relationship between bank and non-bank finance during financial crises.

In both of the main empirical equations we estimate, our dependent variables are binary, which requires the use of a probability choice model. We use a probit approach assuming a normal distribution for the functional form. Therefore, in the first case, we model the effect of bank lending on both the usage of, and applications for, each alternative finance as for firm i, in country j at time t as:

$$\Pr\big(AF\,(\text{Var})_{ijt}\big) = \Phi\big(\theta CC_{ijt-1} + \boldsymbol{\beta} \boldsymbol{X}_{ijt} + \boldsymbol{\mu} \boldsymbol{Q}_{ijt} + \lambda \boldsymbol{Z}_{jt} + \kappa_j + c_i + \tau_t\big)$$

where CC indicates either the measure of credit constraints (credit rationing or discouraged borrowers), $\boldsymbol{X}_{ijt}$ is a vector of standard firm-level controls, $\boldsymbol{Q}_{ijt}$ is an additional vector of firm level controls for firm creditworthiness, quality and risk and $\boldsymbol{Z}_{jt}$ is a vector of country controls. We also include country and firm fixed effects as well as time effects in the error term.

Our main concern in terms of the correct identification of our research hypotheses is potential contemporaneous endogeneity between firms usage of alternative external finance or application for alternative finance and the existence of bank lending constraints. For example, within the six month windows that we observe in our data, a firm may have applied for bank finance due to a shock to the availability of its alternatives, such as trade credit. In this case, the trade credit shock would be driving the bank credit application and therefore the relationship is endogenous. To identify this relationship correctly and rule out any such endogeneity, we exploit the panel nature of our data and include the lagged values of the bank lending constraints in our analysis.

Our main hypothesis concerns the coefficient θ on the constraint variable. Our a priori expectations would suggest a positive effect ($\theta > 0$): if bank financing constraints increase, firms may turn to alternative non-bank finance. The selection of the firm-level controls in $\boldsymbol{X}_{ijt}$ draws on existing research that estimates the determinants of firm financing choices (Love, 2003; Beck, 2006; Beck, 2008a; Beck, 2008b; O'Toole, 2012). This research suggests that much of the between-firm variation in financial structure can be explained by firm age, ownership, and size. Firm age and size are also used in Petersen and Rajan (1994; 1995) to control for investment opportunities. They also note the effect of ownership structures which should be reflected in limited liability and associated risk-taking by managers. We therefore include binary indicators for age, size and ownership in our firm control vector. To capture the effect of the firm's operating conditions on its demand for alternative finance, we include two controls for its view on the general economic outlook and its current profit growth. Outlook is measured as a binary indicator for whether the firm believes the current outlook has improved and profit growth is a binary variable for firms who noted increased profit growth over the past six months. Sectoral controls are also included in all regressions.

Vector $\boldsymbol{Q}_{ijt}$ contains control variables which are specifically included to capture the degree of risk, creditworthiness and firm quality that may impact either the usage of, or applications for, alternative financing. The literature cited in Section 1 (Petersen and Rajan, 1994; 1995; 1997; Biais and Gollier, 1997; Ng et al., 1999; Wilson and Summers, 2002; Gianetti et al., 2008; Aktas et al., 2012) highlights a number of important firm-specific risk and quality controls that should be

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included, over and above age, size, ownership and profitability which are included in vector X_{ijt}. To capture these effects, we include two sets of variables: a) to control for firm quality and production risk and b) to control for financial risk.[16] To control for historical firm growth, we distinguish between very fast growth firms, medium and low growth firms as well as firms whose turnover is falling. We include binary indicators for whether the firm's turnover grew very fast in the past six months (over 20%) and an indicator for whether the firm's sales declined in the past in the past six months. To capture future cash flows or sales growth, we also include binary indicators for firms who expect future growth to be greater than 20 per cent and firms who expect future sales declines. These four indicators are in line with controls included in Petersen and Rajan (1994, 1995). To capture risk relating to firms non-financial cost and production structure, we include an indicator for firms whose labour and non-labour costs increased in the previous six months.

To capture financial risks and account for firm creditworthiness, a number of additional variables are included. We include an indicator for firms whose interest expense increased in the past six months, an indicator for firms whose debt to asset ratio increased in line with Petersen and Rajan (1994, 1995), a binary variable for firms whose own-capital position deteriorated and indicator for firms whose credit history has worsened over the past six months. Including these variables should capture the degree of creditworthiness, borrower financial risk and financial health that would determine the extent to which trade credit would be demanded or be forthcoming from suppliers.

In the vector Z_{jt}, we include a number of macroeconomic factors that we believe may affect the credit environment and the requirement of the firm to turn to alternative finance. Following Holton et al. (2012), we include GDP growth, the ratio of private sector credit to GDP, the yield on the 10 year sovereign bond, and the CDS rate on the largest bank in each country. GDP is included to capture the effects of the overall macroeconomic climate and the potential existence of profitable investment opportunities for all firms in the economy. A credit to GDP ratio is included to control for potential debt overhang effects, which, especially in the current crisis, could potentially reduce future investment and demand for finance by firms[17]. Sovereign bond yields and bank CDS levels are included to capture potential frictions and strains in financial markets. It is expected that countries in which financial markets are subject to greater strain and uncertainty may be more likely to have to turn to alternative financing.

As noted, the SAFE dataset contains a panel of firms within the euro area and a cross-section of firms across the euro area. In estimating the effect of bank lending constraints on alternative finance usage, we wish to exploit the panel nature of the data to capture time-varying effects as well as controlling for firm-level heterogeneity. We therefore run a panel probit model with random effects

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[16] As our data is drawn from survey information, we do not have continuous data available on firm variables. We therefore include binary indicators for different firm categories to distinguish groups of firms with difference risk and quality.

[17] For a review of the effects of debt overhang on investment see Hennessy (2004), Moyen (2007) and Hennessy et al. (2007).

to control for firm heterogeneity in the sample of euro area countries.[18] Finally, we use cluster robust standard errors to control for potential heteroscedasticity and serial dependence across groups in the error structure. The selection of the clustering groups is specific to the particular regression undertaken and is indicated in the regression output.

3. Empirical results

In this section, we present the main findings of our empirical research. We first test the effect of bank lending constraints on firm's usage of alternative financing, then consider the effect of constraints on applications for alternative finance. Finally we explore country specific heterogeneity in these effects.

3.1 Bank lending constraints and alternative finance usage

Overall effects

Table 6 presents the marginal effects from a random effects model across the panel of euro area countries. The sample includes 5,840 firms across the waves of the survey. In all regressions, we include firm controls, country dummies, and time controls. All regressions include the controls for firm quality and risk as outlined in Section 2. Standard errors are robust to heteroscedasticity and are clustered at the country-wave level. The first columns present the results of the effects of (a) credit-rationing and (b) self-rationing on firms usage of trade credit, then the results for alternative forms of financing are presented. These include informal or other company loans, market financing and grants. In this discussion for clarity, we use the phase "cost too high" to indicate the group of self-rationing firms who rejected loan offers due to costs or associated terms and conditions. We use the age groups provided in the SAFE data which are categories based on years in operation. These are: 1) 10 years or more, 2) 5 to 9 years, 3) 2 to 4 years and 4) less than two years. All variables are in period t data except for the constraint measures which enter with a one period lag. In terms of the base categories for the firm controls, manufacturing is the omitted category for the sectoral variables, publicly-listed firms for ownership, micro-sized firms for size and greater than 10 years for the age controls.

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[18] As a robustness check we have tested the use of a logistic model to ensure that our results are not sensitive to the selection of the distributional assumptions. The main results hold in all cases and the output is available on request from the authors.

Table 6. Effect of Financing Constraints on Alternative Finance Usage - Panel Probit Model With Random Effects – Marginal Effects

	Trade Credit		Other loans - informal or company		Market financing		Grants	
	1(a)	1(b)	2 (a)	2 (b)	3 (a)	3 (b)	4 (a)	4 (b)
Credit-Rationed$_{t-1}$	0.092***		0.045**		0.004		-0.032**	
Cost Too High$_{t-1}$		0.058		0.079*		0.012		-0.094***
Controls for Firm Risk and Quality								
Profit growth	0.056***	0.055***	0.011	0.011	0.023**	0.023**	-0.005	-0.004
Outlook	0.047**	0.047**	0.015	0.015	0.005	0.005	0.024	0.024
Past growth +20%	-0.014	-0.014	-0.006	-0.007	0.019	0.019	0.039	0.038
Future growth +20%	0.024	0.023	0.060**	0.060**	0.060	0.060	0.009	0.010
Turnover down past	0.064**	0.065**	-0.005	-0.005	0.010	0.010	-0.032*	-0.032*
Turnover down future	-0.064	-0.062	-0.007	-0.006	-0.008	-0.008	-0.002	-0.004
Production costs increase	0.007	0.007	-0.005	-0.005	-0.017	-0.017	0.006	0.005
Financial costs up	0.046**	0.050**	0.027***	0.029***	0.022**	0.022**	0.074***	0.074***
Increased debt to asset ratio	0.051***	0.054***	0.046***	0.046***	0.030**	0.030**	0.072***	0.071***
Capital position worsened	0.010	0.010	0.017	0.016	0.025*	0.025**	-0.017	-0.016
Credit history worsened	0.011	0.016	0.020*	0.022**	-0.008	-0.008	0.040*	0.039*
Additional Firm Controls								
Construction	-0.031	-0.031	-0.026**	-0.025*	-0.021*	-0.021*	-0.024	-0.024
Trade	-0.023	-0.023	-0.026**	-0.026**	-0.020**	-0.020**	-0.029*	-0.029**
Services	-0.126***	-0.125***	-0.020*	-0.020*	-0.014*	-0.014*	-0.035***	-0.036***
Family-owned	-0.002	-0.002	-0.062**	-0.062**	0.015	0.015	0.020	0.021
Other firms or business	0.023	0.022	-0.016	-0.018	0.013	0.012	-0.026	-0.024
VC or BA	0.047	0.049	-0.039	-0.038	0.006	0.006	-0.004	-0.004
Sole trader	-0.030	-0.029	-0.078***	-0.078***	-0.005	-0.005	-0.035	-0.035
Other	-0.155***	-0.154***	-0.048	-0.048	0.034	0.034	0.025	0.025
5 to 9 years	-0.010	-0.008	-0.007	-0.006	0.018	0.018	-0.010	-0.010
2 to 4 years	-0.040	-0.036	0.017	0.019	0.024	0.024	-0.009	-0.011
Less than 2	-0.086*	-0.087*	0.059	0.054	-0.002	-0.003	0.154**	0.158**
Small	0.038**	0.039**	0.011	0.011	0.007	0.007	0.047***	0.046***
Medium	0.090***	0.090***	0.034***	0.034***	0.014	0.014	0.068***	0.068***
N	5,840	5,840	5,841	5,841	5,876	5,876	5,841	5,841

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP.
* p<0.10, ** p<0.05, *** p<0.01

Considering the effect of credit rationing on using trade credit in column 1(a), we find firms that were denied bank financing are 9 per cent more likely to use trade credit. The result is statistically significant at the 1 per cent level. Moving to column 1(b) and focusing on firms constrained on a "cost too high" basis, it can be seen that the effect is not statistically significant. This result highlights the substitutability of trade credit for bank credit when constraints relate to volume based-credit rationing. It also highlights the supportive role that firms play as liquidity providers, particularly in times of economic crisis. However, when the rationing is cost- or price-based we do not find a relationship between trade credit usage and bank constraints. This evidence also suggests that, controlling for firm risk, quality and other general characteristics, there is a positive effect of bank constraints on trade credit usage.

Focusing on the controls for firm quality and risk, we find that firms who face increasing debt to asset burdens or increased financial costs are more likely to use trade credit facilities, as are firms whose turnover fell in the past six months. In terms of the effect of additional control variables on using trade credit, firms that indicate profit growth in the last six months are 6 per cent more likely to use trade credit, as are firms which indicated a positive business outlook. Firms in the service sector are nearly 13 per cent less likely to use trade credit relative to the manufacturing sector firms. Both small- and medium-sized firms are more likely to use trade credit than micro-sized firms by approximately 4 per cent and 9 per cent, respectively. That micro-sized firms are less likely to use trade credit is an intuitive finding given that larger firms may be expected to represent less risk to suppliers of trade credit.

Moving to columns 2(a) and 2(b) focusing on informal or other company loans, we find that credit-rationed firms are 4.5 per cent more likely to use this financing type and firms classified as "cost too high" are 7.9 per cent more likely to turn to this financing type as an alternative. Both results are significant at the 5 per cent and 10 per cent levels respectively. While it would be more insightful if the data allowed for splitting these groups to consider informal and other company loans separately, it is clear that constrained firms are more likely to draw on either of these sources as an alternative part of their financing mix.

On the control variables, we find that firms facing increased interest costs or increasing debt to asset ratios are more likely to use informal sources, as are firms who expect improved future growth prospects. This finding suggests that highly indebted firms that have been rejected or priced out of additional bank-lending are more likely to turn to either informal lending or loans from other companies when growth prospects are expected to ameliorate. The control variables affecting usage of informal or other company loans also indicate that firms in construction, trade and services are all circa 2 per cent less likely to use this financing type than manufacturing firms with the results significant at the 5 per cent, 5 per cent and 10 per cent levels, respectively. Interestingly, we find that family or business partner owned firms are circa 6 per cent less likely to use informal or other company loans relative to publicly listed firms, though results may be influenced by the presence of other company loans as part of this category. This finding is significant at the 5 per cent level. Similarly, sole traders are nearly 8 per cent less likely to use this financing type with the result

significant at the 1 per cent level. Medium-sized firms, by contrast, are found to be 3.4 percent more likely to use this financing type.

Columns 3(a) and 3(b) test the effect of constraints on usage of market financing. Unlike trade credit and informal or other company loans, we do not identify any effect of either being credit-rationed or self-rationed on the use of market financing. The usage of market financing is also found to be greater for firms in the manufacturing sector compared to those in construction, trade or services, while firms reporting profit growth are 2 per cent more likely to use market financing On this basis, we fail to find any evidence of firms that are subject to bank-lending constraints responding by availing of formal market financing. This finding highlights the lack of substitutability amid an already high dependence on traditional bank lending in the euro area (European Commission, 2013) and it partly reinforces the case for creating a more diverse financing environment.

The final alternative financing type that we consider is grant aid. Following the onset of the current crisis, a wide range of SME financing policy supports have been introduced in OECD economies (Honohan, 2010). These include various equity financing schemes as well as widely available credit guarantee schemes. If these schemes are providing an effective policy response to credit constraints, we would expect to find some propensity for increased usage of such instruments among credit-constrained firms. In columns 4(a) and 4(b), the results of the effect of constraints on grant aid are presented. Contrary to expectations, we find a negative and significant link between credit rationing and grant usage. These findings are interesting and may suggest that the current suite of policies available for SME finance both at a national level and on a pan-European basis are not adequately targeted at firms facing actual constraints. It may also be the case that firms rejected for bank loans or firms that self-ration on the basis of costs may subsequently decide against pursuing grant aid. However, a lack of data on the specific type of scheme's in our dataset limits the policy implications of this finding.

Marginal effects by age, size and ownership

Given that SMEs are a very heterogeneous grouping of firms, and to provide a more granular insight into the effect on constraints on using alternative finance, we have calculated the marginal effects using the above model for different values of important firm characteristics. Beck et al. (2006) indicate that, for SMEs, firm age, size, and ownership are good predictors of the varying degrees to which financing constraints may exist. We therefore estimate the marginal effects for different firm groupings using these key characteristics. As we do not find any relationship between credit constraints and the usage of market financing, these marginal effects are insignificant and are not reported.

In Table 7, we present the results of the marginal effects estimations. We estimate the effect of being constrained on alternative finance usage first for different age groups of firms. One expectation might be that older firms will be more likely to use trade credit when bank-constrained. This is due to the fact that older, more established firms are found to be more reliant on trade credit (Klapper et al., 2010). We find some evidence in support of this hypothesis. While the difference across the groups for trade credit is relatively small, the marginal effect of credit-rationed borrowers

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on trade credit usage is nearly 1.3 per cent higher for firms over 10 years in operation relative to start ups (under 2 years). The marginal effect is circa 9.3 per cent for the older than 10 year group and 8 per cent for firms less than 2 years in operation.

From hypothesis H2, our a priori expectation that younger bank constrained firms are more likely to use informal loans or grant finance relative to older firms. The results are in line with our expectations. We find that the effect of constraints is larger for younger firms: for credit-rationing ("cost too high") the effect is 4.4 per cent (7.7 per cent) for over 10 years in operation relative to 7.3 (12.0) per cent for firms less than 2 years in operation. In terms of grant usage among credit-rationed firms, the negative effect of constraints is higher for the youngest firms relative to all other groupings. For self-rationed firms, however, the effect is strongest for older firms.

Table 7: Marginal Probabilities of Constraints on Alternative Finance Usage for Values of Covariates - Random Effects Profit Model

	Trade credit		Informal or other company loans		Grants	
	Credit-rationed	Cost too high	Credit-rationed	Cost too high	Credit-rationed	Cost too high
Age						
10 years or more	0.093***	0.059	0.044**	0.077*	-0.032**	-0.095***
5 to 9 years	0.092***	0.059	0.040**	0.071*	-0.030*	-0.088***
2 to 4 years	0.087***	0.056	0.054**	0.095*	-0.030**	-0.087***
Less than 2	0.080***	0.050	0.073**	0.120*	-0.055*	-0.187***
Size						
Micro	0.086***	0.055	0.035**	0.063*	-0.024**	-0.067***
Small	0.092***	0.059	0.043**	0.075*	-0.034*	-0.099***
Medium	0.097***	0.062	0.056**	0.096*	-0.038**	-0.114***
Ownership						
Listed	0.093***	0.059	0.074**	0.125*	-0.032	-0.094***
Family or entre.	0.093***	0.059	0.043**	0.075*	-0.036**	-0.108***
Other firm or bus associates	0.096***	0.061	0.067**	0.114*	-0.027*	-0.077***
VC or BA	0.098***	0.063	0.056*	0.097*	-0.031	-0.091**
Sole trader	0.089***	0.057	0.032**	0.057*	-0.025**	-0.069***
Other	0.064**	0.040	0.051*	0.089*	-0.037*	-0.111***

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP. * p<0.10, ** p<0.05, *** p<0.01

We test the marginal effect by firm size and find that medium-sized firms are more likely to use both trade credit and other informal or company loans when constrained relative to both small- and micro-sized firms. The difference is marginal for trade credit finance, however, medium sized firms are 1.3 to 2 per cent more likely to use informal or other company loans when constrained depending on the constraint definition. The marginal effect for medium-sized firms constrained as per credit rationing ("cost too high") is 5.6 (9.6) per cent relative to 4.3 (7.5) per cent for small firms and 3.5 (6.3) per cent for micro-sized firms. Medium-sized firms also have a lower probability of

using grant finance relative to micro-sized firms. This is unsurprising as many state support facilities are targeted at micro-sized enterprises.

These findings provide some support for hypothesis H3, with trade credit usage clearly increasing for constrained firms as size increases. However, the expectation behind the hypothesis would indicate that informal loan usage should be higher for small- and micro-sized firms. This is the opposite of what we find. Given that we do not observe informal (for example family or friends loans) lending activity in isolation (i.e. other company/shareholders loans are included), this combination may explain our findings. Medium-sized firms may have access to additional shareholders' funds or may be more likely represent better candidates for cross-company lending than small-sized and micro-sized firms.

We finally test whether the effect of constraints on alternative finance usage differs by ownership. We find very little variation across ownership of the use of trade credit when bank constrained. The effect is slightly higher for Venture Capital (VC) or Business Angel (BA) ownership structures and lowest for sole traders and other ownership groups.

More variation is evident relating to the effects of constraints on informal loans or other company loans. Listed firms are the most likely to use informal or other company loans; the marginal effects are 7.4 and 12.5 per cent for credit rationing and "cost too high", respectively. Subsidiaries or firms owned by business associates have the second highest marginal effects, followed by venture capital or business angel firms. The lowest probability of firm usage of either informal or other company loans in the case of constrained firms is for family or entrepreneur owned firms and for sole traders. These results would suggest that firms which are owned by active investors and market participants seem more likely to use this type of financing when bank-constrained. Having such ownership structures may facilitate the opening up of other lending facilities such as additional loans from shareholders or intra company loans within a large multi-company group.

To draw some inferences from these marginal effects, we find evidence in support of research for H2 that older firms are more likely to use trade credit in response to a bank lending shock while younger firms are more likely to turn to informal or other company/shareholder loans.In relation to H3, however, while there would seem to be slightly more trade credit usage for larger constrained firms, we also find medium sized firms are more likely to use informal or other company/shareholder loans. In relation to H4, we find that firms with formal market-ownership structures seem to be more likely to use informal or other company/shareholder loans when constrained. Again, this is potentially due to the access to shareholder loans or market access for these types of firm.

3.2 Bank lending constraints and applications for alternative finance

Overall effects

The discussion in Section 3.1 focused on firm's usage of alternative financing in response to bank credit constraints. However, it could be the case that, while firms demand for alternatives increase following a shock to bank lending, an inability to access such creditwill mean that this latent demand will not be captured in the usage statistics. To identify this particular channel, we test whether bank-

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constrained firms are more likely to apply for all non-bank external financing. We then further sub-divide this into trade credit and all other external financing. Table 8 outlines the marginal effects for the panel probit with random effects. The effect of both credit-rationing and self-rationing ("cost too high") on applications for external finance are examined. Again, in all cases, the controls for firm quality, risk and general firm characteristics are included in each of the regressions. Time controls, time-varying county controls and sector dummies are also included.

Table 8: Effect of Financing Constraints on Alternative Finance Applications - Panel Probit Model With Random Effects – Marginal Effects

	Apply All		Apply TC		Apply Other	
	1 (a)	1 (b)	2 (a)	1 (a)	1 (b)	2 (a)
Credit-Rationed$_{t-1}$	0.088***		0.075***		0.022	
Cost Too High$_{t-1}$		0.177***		0.042		0.132**
Controls for Firm Risk and Quality						
Profit growth	0.045***	0.044***	0.039***	0.039***	0.018**	0.017**
Outlook	0.068***	0.068***	0.030**	0.030**	0.036***	0.036***
Past growth +20%	0.010	0.012	0.006	0.008	-0.004	-0.004
Future growth +20%	0.031	0.029	-0.009	-0.009	0.044***	0.042***
Turnover down past	0.043**	0.044**	0.041*	0.043*	-0.009	-0.009
Turnover down future	-0.040	-0.038	-0.010	-0.010	-0.026	-0.024
Production costs increase	0.006	0.007	-0.003	-0.002	0.008	0.008
Financial costs up	0.061***	0.065***	0.051***	0.054***	0.019**	0.019**
Increased debt to asset ratio	0.082***	0.085***	0.046***	0.048***	0.052***	0.053***
Capital position worsened	0.040**	0.039**	0.019	0.019	0.027**	0.025*
Credit history worsened	0.060***	0.064***	0.030*	0.034**	0.039**	0.040**
Additional Firm Controls						
Construction	-0.006	-0.006	-0.015	-0.016	0.003	0.003
Trade	-0.032*	-0.031*	-0.018	-0.019	-0.008	-0.007
Services	-0.058***	-0.057***	-0.071***	-0.071***	0.011	0.012
Family-owned	0.042*	0.042*	0.023	0.023	0.022	0.022
Other firms or business	0.042*	0.040	0.038**	0.036**	0.019	0.019
VC or BA	0.084	0.087	-0.005	-0.005	0.057	0.059
Sole trader	0.035	0.037	0.018	0.018	0.020	0.020
Other	-0.016	-0.016	-0.007	-0.008	-0.003	-0.002
5 to 9 years	-0.005	-0.002	-0.020	-0.018	0.011	0.012
2 to 4 years	0.022	0.027	0.010	0.013	0.017	0.018
Less than 2	0.039	0.034	-0.036	-0.036	0.059**	0.053**
Small	0.066***	0.066***	0.029**	0.029**	0.039***	0.038***
Medium	0.137***	0.138***	0.080***	0.080***	0.073***	0.073***
N	5,876	5,876	5,876	5,876	5,876	5,876

In columns 1(a) and 1(b) we test the effects of constraints on applications for all alternative financing. We find that credit-rationed firms are 8.8 per cent more likely to apply for alternative financing relative to non-rationed firms. The result is statistically significant at the 1 per cent level. For firms self-rationing in the "cost too high" category, we find that these firms are nearly 18 per cent more likely to apply for alternative finance with the result again significant at the 1 per cent level. These results support the central research hypothesis that bank credit constrained firms increase their demand for alternative financing types in response to the lack of bank funding. In the case of self-rationing firms, it would seem that such firms are encouraged enough by initial bank loan acceptance to be effectively steered towards lower cost alternatives. This response is almost 9 percentage points more likely than for those firms that are rejected outright.

Looking at the alternative forms of finance more specifically, columns 2(a) and 2(b) consider only applications for trade credit. Again, we find a positive and statistically significant effect of being credit-rationed on applications for trade credit. Credit-rationed firms are 7.5 per cent more likely to apply for trade credit. The result is significant at the 1 per cent level. However, we find no evidence that firms who reject the bank loan offer on cost grounds subsequently apply for trade credit when rationed. This finding is in line with the results in the previous section. Moving to applications for all other external finance, we again find that firms classified as constrained are more likely to apply for alternative financing, however, the effect is only evident for firms who reject the offer on cost grounds. These firms are 13 per cent more likely to apply for other alternative financing.

Across all three indicators of alternative finance applications, the results are conclusive and supportive of the findings in Section 3.1 and of H1: bank constrained firms' increase their demand for non-bank finance in response to the bank credit shock.

Across all the application categories, the controls variables suggest that service, wholesale and retail trade firms are less likely than manufacturing firms to apply for alternatives and the result is driven by applications for trade credit. More profitable firms and firms with a positive outlook are 4 per cent and 6 per cent more likely to apply for alternatives respectively. These results are significant at the 1 per cent level. Small-sized and medium-sized firms are 6 per cent and 13 per cent more likely to apply for alternatives than micro-sized firms with the results again significant. We do not find evidence of considerable variation by ownership or firm age. Again, we find that as financial pressures increase, either through heightened debt to asset ratios, increasing interest costs, deteriorations in capital position or a worsened credit history, firms are found to be more likely to apply for all types of alternative financing.

Marginal effects by age, size and ownership

Again, as in Section 3.1, we take the main model and estimate the marginal effects at different values of key firm characteristics. All marginal effects presented are statistically significant at the 5 per cent or 1 per cent level. In column 1(a) and 1(b) we test the effect of constraints on applications for all alternative financing by firm age, size and ownership for both credit-rationed firms and firms classified as "cost too high". The results do not indicate a considerable difference across firm age for applications for all alternative financing by constrained firms, however, firms in operation for more than 10 years are 1 per cent less likely to apply for alternative finance than firms in operation for less than two years. Moving to columns 2(a) and 2(b), the results indicate that the effect of constraints on applications for trade credit by age indicate that older constrained firms are more likely to apply for trade credit relative to start-ups and firms aged 5-9 years. However, firms aged 2 to 4 years are most likely to apply once constrained. This provides further evidence for H 2 which hypothesises that older firms are more likely to increase trade credit demand in response to a bank credit shock. In columns 3(a) and 3(b) the effects of constraints on other external financing applications are tested. The effects are only significant for firms constrained as "cost too high". The effect decreases with age which is in line with our expectations in H2.

Table 9: Marginal Probabilities of Constraints on Alternative Finance Applications for Values of Covariates - Random Effects Profit Model

| | Apply - AF | | Apply - TC | | Apply - Other | |
| | Credit-rationed | Cost too high | Credit-rationed | Cost too high | Credit-rationed | Cost too high |
	1(a)	1(b)	2(a)	2(b)	3(a)	3(b)
Age						
10 years or more	0.087***	0.175***	0.076***	0.043	0.021	0.128**
5 to 9 years	0.086***	0.174***	0.067***	0.038	0.023	0.140**
2 to 4 years	0.092***	0.185***	0.080***	0.046	0.025	0.146**
Less than 2	0.096***	0.187***	0.059**	0.033	0.032	0.175**
Size						
Micro	0.069***	0.146**	0.058***	0.032	0.013	0.089*
Small	0.089***	0.180***	0.073***	0.041	0.023	0.138**
Medium	0.104***	0.203***	0.093***	0.053	0.030	0.169**
Ownership						
Listed	0.077***	0.159***	0.065***	0.036	0.017	0.109*
Family or entre.	0.089***	0.178***	0.076***	0.043	0.022	0.134**
Other firm or bus associates	0.089***	0.177***	0.082***	0.046	0.022	0.131**
VC or BA	0.097***	0.193***	0.063***	0.035	0.029	0.167**
Sole trader	0.087***	0.176***	0.073***	0.041	0.022	0.132**
Other	0.072***	0.151**	0.062***	0.034	0.016	0.106*

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Focusing on the effects of constraints on applications by firm size, in columns 1(a) and 1(b), we see that, across both credit-rationed firms and firms classified as "Cost too high", the marginal effect increases with firm size. For credit-rationed firms ("Cost too high"), the effect is circa 7 (15) per cent for micro-sized firms and increases to 9 (18) per cent for small firms and 10 (20) per cent for medium-sized firms. This trend is mirrored across applications for both trade credit and other alternative external finance.

Next we consider the marginal effects by ownership across both credit-rationed firms and firms classified as "Cost too high". We find that, for all applications in columns 1(a) and 1(b), venture capital- and business angel-owned firms have the highest marginal effect with listed firms having the lowest. Focusing on trade credit in columns 2(a) and 2(b) subsidiaries and other business associate owned firms have the highest marginal effect with listed and venture capital firms facing the lowest. For other applications, the marginal effect is highest for venture capital firms.

3.3 Does the type of bank credit matter?

In Table 10, we decomposed credit rationing into firms who applied for investment loans and those that applied for working capital facilities (as outlined in Table 2). Given the very different usages and volumes potentially required for working capital or fixed investment, it is important to test whether firm's substitution patterns are different depending on which type of loan they have applied for. For example, given that working capital financing smooths firms productive process and inventory holdings, it could be expected that there is a larger substitution between working capital loans and trade credit. This seems reasonable given that the latter, in essence, captures delayed payments to suppliers. If a firm is undertaking a large fixed capital investment in machinery, land or buildings, it is less likely that this could be easily substituted with trade credit in a bank credit rejection scenario. The output in Table 10 only provides the marginal effects coefficients for the main credit rationing variables. However, all additional controls have been included in the regression (as in Table 9).

As expected, we only find a statistically significant effect of working capital constraints on trade credit usage. As discussed, bank working capital financing is used in many cases to smooth inventories and to purchase production inputs.It has a greater substitutability with trade credit compared to investment loans which require larger volumes and longer maturities. We do not find a relationship between working capital constraints and use of other loans (informal or other company). We do however identify a relationship between this financing type and investment loans. As these loans may be more similar in volume terms and maturities, they appear to have a greater substitutability with bank term loans.

As in Table 6, we do not find any statistically significant relationship between market financing and a firm being bank constrained. We do find however, that working capital constrained firms are nearly 5 per cent less likely to use grant financing. Given that the majority of government supports for SME finance are targeted at investment or longer term financing, this is unsurprising.

Table 10: Effect of Financing Constraints on Alternative Finance Usage - Panel Probit Model With Random Effects – Marginal Effects

	Trade Credit	Other loans - informal or company	Market financing	Grants
Credit-rationed (investment loans)	0.074	0.051**	0.019	-0.020
Credit-rationed (working capital)	0.092*	0.054	-0.000	-0.060***
N	5,840	5,841	5,876	5,841

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP. Controls for size, age, ownership, sector and business performance also included.

* p<0.10, ** p<0.05, *** p<0.01

We next examine credit rationing specifically in relation to firms that applied for investment loans and firms that applied for working capital facilities. We recalculate the marginal effects replacing each of these indicators in the main regression framework. The results are presented in Table 11.

Table 11: Effect of Financing Constraints on Alternative Finance Applications - Panel Probit Model With Random Effects – Marginal Effects

	Apply - AF	Apply –TC	Apply Other
Credit-rationed (investment loans)	0.080**	0.067***	0.042**
Credit-rationed (working capital)	0.076*	0.068*	-0.012
N	5,876	5,876	5,876

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP. Controls for size, age, ownership, sector and business performance also included.

* p<0.10, ** p<0.05, *** p<0.01

The effects for overall applications for alternative finance are similar across the two categories of credit-rationing, with the magnitude of the effects at 8 per cent for investment loans and 7.6 per cent for working capital loans. The results are significant at the 1 per cent level. In terms of applications for trade credit, the results again are similar with an effect of approximately 7 per cent. A priori, it is expected that working capital constrained firms may have a higher probability of applying for trade credit than investment constrained firms however this is not borne out by our empirical results. The final category is for all other applications for alternative financing. We find that credit-rationed firms who applied for investment purposes have a positive and significant probability of applying for other, non-trade credit, external financing. However there is no effect for working capital constrained firms.

It is interesting to note that our findings indicate that bank-constrained firms who applied for both investment and working capital financing instruments have a higher probability of applying for alternative financing and trade credit in particular. However, only constrained firms who applied for working capital financing had a higher probability of using trade credit facilities. This may reflect a

reluctance on the part of suppliers to provide investment financing arrangements on trade credit terms.

3.4 Exploring country-specific heterogeneity

One aspect of the recent financial crisis in Europe that presents particular challenges to policy makers trying to re-establish credit market functioning and financial stability is the very heterogeneous impacts of the crisis on individual member states. Table 12 draws on the work of Laeven and Valencia (2012) to illustrate the differential economic and fiscal costs of the current banking crises across our sample of countries. It can be seen that the effects are much larger in peripheral nations such as Ireland, Spain, Greece, and Portugal: output losses, which they measure on a cumulative basis against a derived trend real GDP, in Ireland, Spain and Greece, were estimated at 106, 39, and 43 per cent of GDP respectively. This has been reflected in the majority of these countries requiring official financing programmes. The effects are in stark contrast to countries such as Finland, where developments after the financial crisis have been relatively more benign as well as in Austria, Germany and Belgium.

Table 12: Overview of Differential Impact of Financial Crisis

	Output loss[1]	Fiscal costs[2]	Peak NPLs[3]	Public debt increase[4]
AT	14	4.9	2.8	14.8
BE	19	6	3.1	18.7
DE	11	1.8	3.7	17.8
ES	39	3.8	5.8	30.7
FI	-	-	-	-
FR	23	1.0	4.0	17.3
GR	43	27.3	14.7	44.5
IE	106	40.7	12.9	72.8
IT	32	0.3	11.0	8.6
NL	23	12.7	3.2	26.8
PT	37	0.0	7.3	33.6

Source: Laeven and Valencia (2012)

Notes: Variables defined as in Laeven and Valencia (2012). Definitions are:

1) In per cent of GDP. Output losses are computed as the cumulative sum of the differences between actual and trend real GDP over the period [T, T+3], expressed as a per centage of trend real GDP, with T the starting year of the crisis.

2) In per cent of GDP. Fiscal costs are defined as the component of gross fiscal outlays related to the restructuring of the financial sector. They include fiscal costs associated with bank recapitalizations but exclude asset purchases and direct liquidity assistance from the treasury.

3) In per cent of total loans. NPLs data come from IMF Staff reports and Financial Soundness Indicators.

4) In per cent of GDP. The increase in public debt is measured over [T-1, T+3], where T is the starting year of the crisis. For the 2007-2009 crises, it is computed as the difference between pre- and post-crisis debt projections.

Given this economic backdrop, and the heterogeneous effects on country's banking sectors, we may expect that the effect of financing constraints on the usage of, and applications for, alternative financing activity may reflect this heterogeneity. In Table 13, we present the marginal effects calculated for each specific country in terms of alternative finance usage.

Overall, we find evidence of country-specific heterogeneity in the effect of constraints on trade credit usage and grant finance usage. However, we do not find significant effects for market financing or informal or other company lending. We therefore focus our discussion on trade credit and grant finance. It also must be noted that the effects we identify must be over and above the country factors that we include. These factors control for the risk in the banking sectors using a median bank CDS spread, GDP growth and overall financial depth. Therefore it may not be surprising if crises countries do not have higher average constraint effects, controlling for these factors.

Additionally, it may not be the case that we find higher country-specific effects when we control for firm quality and risk. Financial providers may react to heightened firm-specific risk following the economy wide deterioration in growth by tightening supply. This is not necessarily credit rationing if the response is relative to the risk re-pricing and should be conducted in any system of normal market capital allocation.

Table 13. Effect of Financing Constraints on Alternative Finance Usage - Panel Probit Model With Random Effects – Marginal Effects

	Trade Credit		Other loans - informal or company		Market financing		Grants	
	Credit-Rationed	Cost too high	Credit-Rationed	Cost too high	Credit-Rationed	Cost too high	Credit-Rationed	Cost too high
	1(a)	1(b)	2(a)	2(b)	3(a)	3(b)	4(a)	4(b)
Austria	0.090***	0.057	0.055	0.094	0.005	0.016	-0.041*	-0.134***
Belgium	0.062*	0.038	0.074	0.122	0.007	0.022	-0.018	-0.050
Germany	0.049**	0.030	0.075	0.125	0.007	0.021	-0.023*	-0.067**
Spain	0.085	0.055	0.046	0.085	0.001	0.003	-0.062*	-0.246***
Finland	0.103**	0.066	0.069	0.114	0.006	0.018	-0.012	-0.033
France	0.036**	0.022	0.019	0.035	0.006	0.017	-0.016	-0.044
Greece	0.094***	0.061	0.050	0.087	0.001	0.004	-0.007	-0.017
Ireland	0.029	0.019	0.085	0.144	0.000	0.001	-0.048	-0.157
Italy	0.096**	0.062	0.024*	0.044	0.004	0.014	-0.027*	-0.080***
Netherlands	0.099**	0.065	0.079	0.132	0.002	0.007	-0.038	-0.120
Portugal	0.101**	0.065	0.038	0.068	0.001	0.004	-0.055*	-0.192**

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP.
* p<0.10, ** p<0.05, *** p<0.01

In column 1(a) and 1(b), we find that the effects of credit constraints on trade credit are highest in Finland and Portugal at 10 per cent for credit-rationed firms. France reports the lowest effects at just 3.6 per cent. This is unsurprising given that, as shown in Tables 3 and 4, typical usage of trade credit

is lower in the first place as are applications for this category of financing. The effects for firms in Austria, the Netherlands, Italy and Greece are between 9 and 10 percent and statistically significant.

Of particular interest is the fact that no statistically significant estimates are found for Ireland and Spain, the two countries which have suffered the most severe banking crises. Finland, by contrast, reports the highest probability of usage (albeit, only marginally greater than Portugal and the Netherlands), despite its relatively more sanguine experience. Our intuition behind this result lies with the fact that observing trade credit usage requires two aspects: demand for trade payables by borrower firms and supply of trade receivables by supplier firms. Our dependent variable captures the market outcome of the supply and demand effects. Therefore, when a firm is faced with a shock to bank credit availability, access to trade credit requires that suppliers are willing to extend credit. In countries such as Spain and Ireland, where the real economies have borne considerable contractions, borrower-specific default risk is much higher. Firms in these countries may increase their demand for alternative financing, but, absent willing suppliers, trade credit may also become less accessible. For SMEs in France, Germany and Belgium some substitution between bank lending and market financing does seem apparent. These differences may also reflect structural differences in inter-firm trust and country specific financing patterns.

In columns, 2 (a) and 2 (b) and 3 (a) and 3 (b), we do not find statistically significant differences between economies for the marginal effects of usage of informal or other company loans or market financing when firms are constrained. The effects of grants appear to be statistically significant for both constraint measures in Austria, Germany, Spain, Italy and Portugal.

We now turn to test whether the effect of constraints on applications for alternative finance differ by country. This will provide an accurate reflection on what happens to the demand for alternative financing by firms in specific countries when credit constrained. As noted, it is not clear that we would expect to find identical results in the case of usage as well as initial applications. As usage depends on accepted applications, borrower risk is already evaluated by the finance provider and the decision to allocate credit is subsequently taken. In the context, of financial crises where borrower risk from crisis countries is severely heightened, we may expect that bank- constrained firms would be more likely to apply for alternative forms of financing but that rejection rates would be higher. Usage, as noted, however depends on both parties being satisfied with current credit allocation given the potential project or use and the terms and conditions. With the marginal effects for usage above, we found that usage is not higher in crisis economies. However, it may be the case that applications are higher in crisis countries as firms have less internal funds available as well as the likelihood that bank lending constraints are generally higher. Table 14 presents the marginal effects by country.

Table 14. Effect of Credit Rationing on Alternative Finance Applications - Panel Probit Model With Random Effects – Marginal Effects

	Apply - AF		Apply - TC		Apply - Other	
	No-firm quality controls	Including firm-quality controls	No-firm quality controls	Including firm-quality controls	No-firm quality controls	Including firm-quality controls
	1(a)	1(b)	2(a)	2(b)	3(a)	3(b)
Austria	0.118 ***	0.082***	0.11***	0.083***	0.037 *	-

Belgium	-	-	-	-	-	-
Germany	0.082 *	0.053**	0.041**	0.030**		-
Spain	0.162 **	-	-	-	-	-
Finland	-	-	-	-	-	-
France	0.098 **	0.057**	0.036**	0.023***	0.046 *	-
Greece	0.146 *	0.084*	-	-		-
Ireland	0.167 ***	0.108**	0.181**	-		-
Italy	0.132 ***	0.083***	0.122***	0.081***	0.036***	-
Netherlands	0.132 *	0.096***	0.154***	0.115***	-	-
Portugal	0.149 ***	0.102***	0.159***	0.114***	-	-

Notes: Standard errors are robust to heteroscedasticity and clustered at the country-wave level. Country and year dummies are included in all regressions. Time varying country controls include median bank CDS, GDP growth and the volume of outstanding private sector credit to GDP.
* p<0.10, ** p<0.05, *** p<0.01

We find some evidence of heightened effects in crisis countries. The largest marginal effects for credit-rationed ("cost too high") firms are in Portugal and Ireland, both countries which have suffered considerable financial and sovereign debt crisis and have ended up entering official sovereign support programmes. The effects in Ireland are also interesting given it is a country which has suffered one of the most costly banking crises in history for an OECD country (Laeven and Valenica, 2012). The effects for firms in Austria, Greece, Italy and Netherlands are also elevated while France and Germany report much lower overall marginal effects. The effects are higher for firms in these countries classified as "Cost too high" relative to credit-rationed firms. In this case, Portugal has the highest estimated effect with Ireland and the Netherlands second and third respectively.

Focusing only on applications for trade credit, the highest levels are again found in Portugal and the Netherlands. For other applications, the country specific marginal effects are not widely significant and are only significant for firms constrained as per classification "cost too high". Observable patterns do not emerge to distinguish between crisis and non-crisis economies. Spain, however, has the highest rate at 22 per cent.

In conclusion, we find some evidence that the marginal effect of constraints on applications for alternative financing is higher in countries that suffered particularly severe banking crises. However, given that we control for both firm-specific as well as country-specific financial risk and demand conditions, it is not necessarily surprising that greater effects are not found for very severe crisis countries.

4. Conclusions

In this paper, our main hypothesis is to test whether bank lending constraints increase firms demand for alternative external finance, namely trade credit, informal or other company loans, market financing or government grants. We use firm-level data on SME access to finance from the ECB survey on access to finance for small-and medium-sized enterprises (SAFE) for the financial crisis

period between 2009 and 2011 across 11 euro area members. We make the following contributions. First, we determine whether bank lending constrained SMEs are more likely to 1) use trade credit, informal finance, other company loans, market financing, or government grants or 2) are more likely apply for trade credit or other external financing.

Our estimates of financial constraints distinguish between two types of constrained firms: a) credit-rationed firms (firms where loan applications are rejected outright) and b) self-rationing borrowers (firms that do not apply due to high lending costs). We also explore whether or not these effects differ by firm age, size, and ownership as well as testing whether country specific heterogeneity is present in the relationship. The sample used facilitates an evaluation of the relationship between bank constraints and non-bank finance on a broader heterogeneous sample than currently applied in the literature. This heterogeneity comes from the diversity of enterprise types and country groups in a period of financial crisis.

Our findings firstly look at the usage of alternative finance. They suggest that firms, when credit-rationed, are 9 per cent more likely to use trade credit than non-constrained firms. In the case of self-rationed borrowers, however, the effect is not statistically significant. This highlights the substitutability of trade credit for bank credit when constraints relate to volume based-credit rationing. It also highlights the supportive role that firms play as liquidity providers, particularly in times of financial crisis. In addition, the evidence suggests that, when controlling for firm risk, quality and other characteristics, the positive effect of bank constraints on trade credit usage still holds. Furthermore, the effect increases with firm sizeand we also find that more highly indebted firms and firms that have better outlooks are more likely to turn to trade credit having been rejected outright for additional bank-lending. The findings are statistically-significant and the positive relationship is robust to controlling for a variety of country-level variables and firm characteristics.

Looking at usage of other alternative financing types, we find that credit-rationed firms (self-rationed borrowers) are 4.5 (7.9) per cent more likely to use informal loans, other company or shareholder loans. The effect of bank lending constraints on the usage probability of this financing type increases with firm size and decreases with firm age. Similar to the results for trade credit, more indebted firms are found to have a greater propensity to turn to informal lending or to loans from other companies as do firms whose credit history has worsened. This is also true of firms that expect future growth prospects to ameliorate. We find no evidence that firms subject to bank-lending constraints respond by availing of market financing.

Our findings in relation to the usage of alternative lending highlight the lack of substitutability amid an already high dependence on traditional bank lending in the euro area (European Commission, 2014) and it partly reinforces the case for creating a more diverse financing environment. We also find that, contrary to expectations, there is a negative and significant link between credit rationing and grant usage. These findings are interesting and may suggest that the current suite of policies available for SME finance both at a national level and on a pan-European basis are inadequately targeted at firms facing actual constraints. It may also be the case that firms rejected for bank loans or firms that self-ration on the basis of costs may subsequently decide against pursuing grant aid.

However, a lack of data on the specific type of scheme's in our dataset limits the policy implications of this finding.

Second, we focus on applications for alternative finance. We find that, credit–rationed firms are 9 per cent more likely to submit applications for all non-bank, alternative financing types, while self-rationed firms are almost 18 per cent more likely to apply for these. Separating this effect into applications for trade credit and all other applications, we find that the effect is only significant for trade credit (7.5 per cent) in the case of credit-rationed firms. By contrast, for self-rationed firms the effect is only significant for non-trade credit alternatives, for which firms are 13 per cent more likely to apply. Dividing credit-rationed firms into those who applied for investment loans and those who applied for working capital facilities indicates that alternative forms of financing, aside from trade credit, are seen to be demanded by credit-rationed firms seeking investment finance only. This suggests that trade credit is the main bank credit substitute for working capital purposes. We also find that applications for all alternative financing by constrained firms increase with firm size.

Finally, given the very different impacts of the recent financial crisis on the real economies of different euro area members, we explore cross-country heterogeneity in the effect of credit rationing on the usage of, and applications for, alternative financing. Specifically, we are interested in exploring whether there are systematic differences in crises countries that remain when country-specific and firm-quality effects are controlled for. For example, while constraints may be higher in crisis countries, such bank rejections may reflect the accurate re-pricing of firm-specific risk by financial institutions as opposed to banking reductions in credit supply at the country level. Our results indicate that the estimated marginal effects of being credit-constrained on using alternative finance are not systematically higher in crises countries. In the case of those countries where the impacts of the crisis were most acute, however, we do find an increase in the effect of bank lending constraints on applications for alternative financing. However, these effects lessen when we control for firm-specific quality.

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Appendix – Additional summary statistics

Table A1: Breakdown of observations by country

Country	Freq.	Per cent	Cum.
AT	225	3.83	3.83
BE	224	3.81	7.64
DE	930	15.83	23.47
ES	1,053	17.92	41.39
FI	137	2.33	43.72
FR	1,240	21.1	64.82
GR	145	2.47	67.29
IE	256	4.36	71.65
IT	999	17	88.65
NL	316	5.38	94.03
PT	351	5.97	100
Total	**5,876**	**100**	

Source: Authors' calculations using ECB SAFE data

Table A2: Breakdown of firms by age

Firm age			
10 years or more	4,293	73.06	73.06
5 to 9 years	901	15.33	88.39

2 to 4 years		594	10.11	98.5
Less than 2		88	1.5	100
Firm size				
Micro		1,898	32.3	32.3
Small		2,062	35.09	67.39
Medium		1,916	32.61	100
Sector				
Industry		1,636	27.84	27.84
Construction		670	11.4	39.24
Trade		1,522	25.9	65.15
Services		2,048	34.85	100
Ownership				
Listed		226	3.85	3.85
Family or entrepreneur		3,212	54.66	58.51
Other firm or bus associates		837	14.24	72.75
VC or BA		80	1.36	74.12
Sole trader		1,415	24.08	98.2
Other		106	1.8	100
Total		5,876	100	

Source: Authors' calculations using ECB SAFE data

Table A3: Additional firm-level control variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Profit growth	5,876	0.382914	0.486139	0	1
Outlook	5,876	0.212049	0.408794	0	1
Past growth +20%	5,876	0.040674	0.197551	0	1
Future growth +20%	5,876	0.030123	0.170939	0	1
Turnover down past	5,876	0.082369	0.274949	0	1
Turnover down future	5,876	0.036419	0.187347	0	1
Production costs increase	5,876	0.743703	0.436625	0	1
Financial costs up	5,876	0.317733	0.465635	0	1
Increased debt to asset ratio	5,876	0.22175	0.415459	0	1
Capital position worsened	5,876	0.2032	0.402414	0	1
Credit history worsened	5,876	0.142614	0.349709	0	1

Source: Authors' calculations using ECB SAFE data

Table A4: Summary of Country-Level Variables

Country	Credit as % of GDP	Gov. 10 Year Bond Yield	Median Bank CDS
AT	643.738	3.4358	139.379
BE	463.702	3.86651	255.289

DE	516.916	2.95025	135.733
ES	921.019	4.50791	311.825
FI	396.005	3.1793	84.819
FR	518.522	3.34365	119.237
GR	554.558	11.1793	844.163
IE	905.105	8.14384	1030.22
IT	590.454	4.35643	171.391
NL	846.596	3.26405	119.424
PT	806.735	6.54527	470.829

Source: Datastream, Thomsons Reuters

Table A5: Summary statistics for credit rationing broken down by investment and working capital

	Credit-rationed (investment)	Credit-rationed (working capital)
AT	0.0%	1.3%
BE	1.3%	3.1%
DE	2.0%	1.9%
ES	6.5%	6.6%
FI	0.7%	0.0%
FR	3.3%	5.6%
GR	6.2%	4.1%
IE	5.9%	10.2%
IT	3.3%	6.0%
NL	2.5%	2.5%
PT	4.3%	3.7%

Source: Authors' calculations using
ECB SAFE data
Note: Combined totals for these indicators may not sum to the overall as 1) firms could be constrained by both measures and 2) we limit investment constraints to only firms who indicated some demand for external finance for fixed-asset investment.

Highlights

- We test the interaction between bank constraints and alternative external finance
- We distinguish between credit rationed firms and firms who self ration
- We find that constrained firms turn to trade credit and informal finance
- We find no link between bank constraints and formal market financing (debt/equity)
- Trade credit is found to substitute for bank working capital facilities