Access to External Financing and Firm Growth

Background Study

for the European Competitiveness Report 2014

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Table of Contents

List of Figures

List of Tables

Executive Summary

Europe's economic success depends to a large extent on the competitiveness and growth of European enterprises. Access to external financing is essential for enterprises to invest, innovate and grow. As a consequence of financial market imperfections, 'financing gaps' could limit enterprises' investment and growth options when viable projects could not be financed. Such 'financing gaps' are likely to be more binding for certain types of enterprises including start-ups, young, innovative, small scale, domestic enterprises and more technologically advanced industries. It has been widely documented that during recessions and financial crises, the presence and role of financial mechanisms such as collateral constraints and debt overhang increase financial constraints faced by enterprises. The overall functionality of the financial system and its efficiency in the allocation of capital varies considerably across countries and regions. Given this heterogeneity, the recent financial crisis has had uneven effects across enterprises, industries and countries.

Understanding the nature and extent of financing constraints faced by specific types of enterprises and industries and how they impact on their investment and growth is crucial to design effective enterprise and industry policies. This analysis is based on insights from the most recent relevant theoretical and empirical models and provides novel empirical evidence to inform policy measures and instruments to assist domestic SMEs in obtaining access to external financing and support enterprise growth.

This study focuses on key policy relevant issues related to access to external financing and its role in driving firm growth: What major financial market imperfections are likely to restrict access to external finance? What types of financial instruments are used by enterprises, in particular domestic SMEs? To what extent are European enterprises financially constrained and what are the determinants of such constraints? Is external finance dependence impacting firms' decisions including investment, employment, productivity and exporting? Has the effect of external finance dependence on firm growth changed since the onset of the financial crisis? What policy recommendations could be drawn from this analysis to assist domestic SMEs in obtaining access to external financing and support firm growth?

This analysis draws on a number of data sources including the ECB/EC Survey of Access to Finance for SMEs (SAFE), the EC EFIGE dataset, and the Amadeus dataset from Bureau Van Dijk. This provides a broad, wide ranging review of the nature and extent of financing constraints. The main findings of this analysis can be summarised as follows.

Financial market imperfections are more likely to affect particular firm groups

A 'financing gap' or financial market failure occurs when viable projects cannot be financed due to financial market imperfections. This perceived 'financing gap' is linked to a number of factors including information asymmetries, high uncertainty, intangible assets, the complexity of the financing life cycle, transaction costs and investor's risk aversion. Theory and empirical evidence suggest these market failures are more likely in the following situations:

- the higher the uncertainty of project success (economic and technical risks);
- the greater the information asymmetries between lenders and borrowers;
- the earlier stage of the project financing cycle;
- the lower the collateral of the firm;
- the lower the availability of internal funds; and
- the less likely that the firm has a track record.

European firms, in particular small, young firms, lack broad financial diversification and are very dependent on bank financing

There is clear evidence that more financial instruments become relevant to enterprises as they mature and expand. This indicates that firms early in their lifecycle and smaller firms are less financially diversified, and are much more likely to be exposed to shocks in the supply of their main funding

source. Policy measures to broaden and deepen the range of options available to these firms would be a positive development.

By far, European SMEs indicate that bank financing (both loan and working capital facilities) is the most relevant source of external funding. Formal market financing, which includes equity, debt or subordinated loans, is only relevant for a much smaller fraction of firms. Smaller and younger firms also face internal financing constraints and indicate that retained earnings are less relevant to their operation.

Financing constraints are higher for smaller firm, younger firms, firms with high leverage ratios and firms in industries with greater dependence on external finance

The investigation of the nature and extent of financing constraints in the European Union focuses on both actual and perceived constraints The evidence indicates that actual constraints are higher than perceived constraints both in the Eurozone and in the wider EU-28. Both actual and perceived constraints are higher for small and micro firms with actual constraints decreasing with firm age. These findings hold even when controlling for demand related factors such as turnover, profitability and indicators of firm financial health.

While credit rationing is important, borrower discouragement is widespread especially among small firms and young firms

Delving below aggregate actual constraints, this analysis find that credit rationed firms make up the largest group of these firms. This is followed closely by discouraged borrowers, with firms believing the cost to be too high a small proportion of the overall constrained category. These findings point to the fact that supply constraints in Europe are volume, not pricing based. More indebted firms are more likely to face actual financing constraints. If existing leverage ratios are elevated, this may deter financial institutions from providing additional finance and act as an impediment to firm credit access. Firms in industries which have a high dependence on external finance are more likely to be credit rationed.

Access to external financing has a strong impact on investment with financing constraints binding in the post crisis period for all enterprises.

Financing constraints are found to effect investment in tangible assets for European firms; however they are only binding since the onset of the financial crisis in 2008. Such constraints are larger for domestic SMEs, micro-sized firms, and firms in high-tech knowledge intensive service sectors. Long term debt financing also has a strong impact on investment suggesting that external finance dependence is important. The sensitivity of investment to long term credit flows is higher for young and micro-sized firms. In general the effect of external credit flows on investment is decreasing with firm age and size. The evidence indicates that short term debt financing facilities are linked to investment for young firms. Short term funding facilities are not necessarily the correct financial instrument with which to cover long-term investment programmes with payback periods outside the maturity of the credit facility. If young firms are unable to convince financial institutions to provide longer maturities, due to a lack of collateral, track record or increased risk, this may have consequences for their growth potential and chances of survival.

Employment levels are sensitive to external financing with trade credit playing an important role

This analysis finds significant effects of financial factors on employment over and above other determinants and control variables, including structural firm characteristics, output demand, as well as industry- and country-specific cyclical factors. Greater trade credit had a positive effect on labour demand for high-tech manufacturing, other services and other manufacturing in the pre- and post-financial crisis periods.

Since the crisis investment and employment have fallen more than can be explained by demand factors and financial variables

For both investment and employment, the evidence indicates a negative and significant effect of the crisis over and above demand and financial factors. Both factor demands are circa 4 percent lower than can be predicted by the models. General economic uncertainty and the inability to accurately evaluate investment opportunities in a period of heightened economic and financial instability could be contributing to this finding.

Financing constraints are found to affect total factor productivity with differences across firm groups and industries

TFP growth is positively related to a firm's internal cash flow in all firm types, sectors and country groups. This finding implies that productivity growth is responsive to shocks to a firm's internal cash flow. Ideally, this would not be the case in a well functioning financial market as financial intermediaries should provide firms with the necessary external funding to undertake projects with an expected positive impact on total factor productivity growth. This finding suggests that financial constraints are having a negative impact on productivity growth for European SMEs. The financial crisis exacerbated this effect for cash flow on productivity growth for young firms, firms in the construction sector and firms in the high-tech manufacturing sector.

The decision of firms to export is negatively affected by financing constraints

The propensity of firms to export is negatively correlated with the firm's financial constraints measure. One potential explanation is that less financially constrained firms are more capable of overcoming the sunk costs of entry in export markets. The effect is found to be stronger for small firms and younger firms. No differential effects of financial constraints on firms export intensity have been identified.

Policy implications and recommendations

The evidence provided in this study indicates that financial market imperfections amplified during the recent financial crisis have affected negatively the investment and growth of European SMEs over and above demand and cyclical factors. These effects have been uneven across enterprise, industry and country groups. This heterogeneity of financing challenges suggests that policy measures and instruments to assist enterprises to improve access to external financing and support enterprise growth should take into account the types of enterprises and life cycles stages that are *most affected by financial market imperfections* and should be targeted *where they have most impact*. The evidence in this study also suggests that policy measures should be targeted to address specific *supply-side* (credit rationing) and *demand-side* (discouraged borrowers) financial market imperfections. These policy measures need to be complementary.

In relation to *supply-side financial constraints*, there are many initiatives at the European level that are currently in place to deal with financial market imperfections including a wide range of loan facilities, guarantees, capital supports, direct investment funding including the COSME, JEREMIE and JASMINE programmes, and other initiatives. It is crucial that such policy measures ensure *financing additionality* and *are co-ordinated on an European basis* to reduce market fragmentation and support the development of a single financing market.

Specific policy measures should address the restricted access to external financing due to financial market imperfections related to general economic uncertainty associated with the financial crisis. However, these measures should be temporary to avoid crowding-out the private financing once the financial markets have picked-up. While the sensitivity of investment to access to external financing has increased following the recent financial crisis for all firms, *young and micro firms* appear to be the most affected by increased financing constraints due to financial market imperfections associated with information asymmetries. Policy measures to improve the liquidity of SMEs loans such as SMEs securitisations should be strengthened.

Policy measures to improve access to external financing should target particularly firms which are most affected by financial market imperfections, particularly domestic micro, small and young firms. The evidence provided by this analysis indicates that over and above demand factors, actual and perceived financing constraints are higher for small and micro firms. Actual financing constraints decrease with firm age.

Policy measures to assist SMEs to obtain access to external financing should focus on broadening the range of financing sources and instruments available particularly to small and young firms. The evidence provided by this analysis indicates that the number of financial instruments relevant to enterprises decreases with firm size and age. This evidence implies that firms in their early lifecycle and smaller firms have less diversified financing mix structures, and they are more likely to be exposed to shocks in the supply of their main funding source, usually bank loans. Specifically, measures that improve the access of small and young firms to equity and debt markets could strengthen their capital structure and enhance their financing capacity. The evidence in this chapter also highlights that access to trade credit facilities could serve as an alternative to formal market financing particularly for young firms.

Policy measures to improve access to external financing for firms with international activities should consider the firms' internationalisation strategies. The evidence suggests that financing constraints are perceived to be binding particularly for firms with more complex international production operations such as outward investment and international outsourcing.

With respect to differentials across industries and sectors, *firms in the high-tech knowledge-intensive services appear to face the greatest difficulties in accessing external financing*.

Given the variation of the severity of the financial crisis across countries, policy measures and instruments to improve SMEs' access to external financing should consider *country specific conditions*. This analysis highlights that SMEs' financing constraints have been highest in Ireland, Greece and Spain, the countries with the most severe banking and sovereign debt crises.

Policy measures to improve and diversify access to external financing are likely to generate employment and productivity growth of SMEs. The evidence indicates that while for young firms employment growth seems to be more responsive to the availability of internal funding, in mature firms employment growth is funded to a greater extend by access to trade credit. Access to trade credit appears to be important for employment growth particularly in manufacturing and services other than high-tech services. Furthermore, the evidence indicates The financial crisis has exacerbated the sensitivity of productivity growth to access to external financing particularly for *young firms* and firms in the *construction* and *high-tech manufacturing and services*. Furthermore, the evidence in this study suggests that cash hoarding linked to the lack of investment opportunities have impacted negatively on productivity growth in domestic SMEs. For young firms, financial pressure linked to indebtedness has led to productivity growth while the interest burden in the post-crisis period has impacted negatively productivity growth in high-tech knowledge-intensive services.

Financial constraints are negatively associated with the propensity to export, however the export sales intensity does not appear to be related to access to external financing. The sensitivity of export propensity to access to external financing appears to be most important for those firms which are young, domestic owned and firms in the traditional industries. Furthermore, the sensitivity of export propensity to financing constraints decreases with firm size.

In relation to *demand-side constrained enterprises* (discouraged borrowers), since these do not interface with a financial institution or with wider capital markets, traditional financing policy support mechanisms such as the current guarantees', risk-sharing initiatives, direct equity investment and direct loan facilities are not able to address this particular market failure. *Policy measures that facilitate the development of borrower financial capabilities and capacities*, such as *training* in the preparation of financial documentation for bank-lending applications, the improvement in understanding of SMEs relating to how different financing sources are relevant for their business, and

how to produce market ready business plans would be beneficial. *Up-skilling and improving the financial knowledge base* of European SMEs could greatly reduce negative perceptions of the degree to which credit is available. *Standardisation in documentation and improving information on creditworthiness* across the single market for financial products could reduce informational asymmetries. Better capacities for information gathering and sharing can enhance the ability of borrowers and lenders to understand risk. *Information provision to borrowers* regarding the availability of supports would be important to encourage active engagement with the market or with finance providers. These measures are of particular importance for *micro and small enterprises and firms in their early lifecycle.*

While financial market imperfections provide the rationale for policy intervention, such intervention should not distort competitive market mechanisms for the allocation of financial resources. Policy intervention should not eliminate the creative destruction process which allows the reallocation of resources from low productivity to high productivity enterprises and industries. Public intervention should ensure *financing additionality* and foster self-sustainable private financing in the long run. Furthermore, new policy measures and instruments to assist enterprises to obtain access to external financing motivated by the effects of the financial crisis should be temporary to avoid crowding-out the private financing once the financial markets have picked-up.

In the context of limited financial resources, *current policies should be evaluated for effectiveness* by assessing both benefits and costs of public intervention.

Chapter 1. Financing Constraints faced by Enterprises and Industries in the European Union

1.1 Introduction

Key Questions

- What major financial market imperfections and regulatory failures are likely to restrict the access of (domestic) enterprises to external finance? How could these imperfections/failures be measured/proxied?
- Measures of financial constraints
- What are the underlying causes/determinants of financial constraints faced by enterprises and to what extent could the financial constraints be linked to financial market imperfections? What is the role of the financing mix? What is the additional effect of the recent financial crisis on financial constraints over and above the effect of financial market imperfections and regulatory failures?
- Which types of enterprises and which types of industries were/are more likely to be financially constrained?

Key Findings

Financial Market Imperfections

- It is widely accepted in the relevant literature on access to finance that a 'financing gap' or financial market failure occurs when viable projects could not be financed due to financial market imperfections. This perceived 'financing gap' is linked to a number of factors including *information asymmetries*, *high uncertainty*, *intangible assets*, the *complexity of the financing life cycle*, *transaction costs* and *investors' risk aversion.*
- Theory and empirical evidence suggest that financial market failures are more likely in the following situations:
    - the higher the uncertainty in relation to the success of the project (the higher the risk linked to economic and technical considerations)
    - the greater the information asymmetries between lenders and borrowers
    - the earlier stage of the project financing cycle
    - the lower the collateral of the firm
    - the lower the availability of internal funds
    - the less likely is that the firm has a track record

Relevance/Use of Financing Sources - Evidence based on the SAFE Data Set

- By far, European SMEs indicate that bank financing (both loan and working capital facilities) is the most relevant source of funding. Over 80 per cent of firms indicate bank loans are relevant and over 77 per cent indicate bank working capital is relevant. Leasing/Factoring/Hire purchase is also indicated as very relevant at 77 per cent.
- Formal market financing, which includes equity, debt or subordinated loans, is only relevant for less than 30 per cent, 15 per cent and 16 per cent of firms respectively.
- Retained earnings are relevant for 50 per cent of firms while trade credit is also important at 64 per cent of firms.
- There is clear evidence that more financial instruments become relevant to enterprises as they mature and grow. As this indicates that firms early in their lifecycle and smaller firms are less financially diversified, these firms are much more likely to be exposed to shocks in the supply of their main funding source. Policy measures to broaden and deepen the range of options available to these firms would be a positive development.
- Relative to firms in the construction sector, the analysis suggests industrial firms, traded firms (wholesale and retail) and service firms are less diversified. Such differences may reflect the variance in financial market complexity that is required given different combinations of factor inputs and production technologies.
- Firstly, in relation to retained earnings, they are less relevant for service firms but there is no variation in usage by sector.
- There is some evidence that retained earnings are less relevant for very young firms but, if relevant they are more likely to be used as firms get younger. The intuition behind this finding is potentially that some very young firms struggle to build up cash stocks, but if these are available they are more likely to use them. The latter effect may be some indicator of financing constraints, a topic we return to in the next section.
- When the quality and risk of an enterprise is controlled for, there does not appear to be an effect of age on the relevance of equity financing. If equity is relevant, its usage actually increases for younger firms. For micro-sized firms, equity is less relevant.
- We find that bank loans are less relevant for young firms and bank working capital facilities are less relevant for very young firms. The relevance and usage of bank loans falls with firm size but the relationship is not as clear for bank working capital.

Determinants of Financing Constraints - Evidence based on the SAFE Data Set

- Our investigation of the nature and extent of financing constraints in the European Union focuses on both actual and perceived constraints. Actual financial constraints are made up of credit rationed firms (rejected borrowers), discouraged borrowers (did not apply due to possible rejection) and firms that rejected the offer as the cost was too high. Perceived constraints relate to firm's view on access to finance being their biggest obstacle to growth and development.
- We find that actual constraints are higher than perceived constraints both in the Eurozone and in the wider EU-28. Both actual and perceived constraints are higher for small and micro firms with actual constraints decreasing with firm age. These findings hold even when we control for demand-related factors such as turnover, profitability and indicators of firm financial health.

- There is evidence that firms conducting organisational innovation have been facing higher actual financing constraints, however, this result must not be interpreted as causal.
- Focusing on actual constraints, we find variation by industry. Firms in the construction sector are the most constrained with trade and service firms facing lower constraints.
- Delving below aggregate actual constraints, we find credit rationed firms make up the largest group of these firms. This is followed closely by discouraged borrowers, with firms believing the cost to be too high being a small proportion of the constrained category. These findings point to the fact that supply constraints in Europe are volume, not price-based.
- We find that industry, trade and service firms are less credit rationed that firms in the construction sector, however only traded firms are less discouraged than firms in construction. This suggests that borrower discouragement is more widespread.
- There is very little variation across firm ownership when demand factors are controlled for. There is some evidence that VC or BA owned firms are more credit rationed. This may however reflect borrower-specific risk.
- For firms that are credit rationed and discouraged, constraints decrease considerably with age, with the exception of firms aged less than two years which are less likely to be discouraged.
- For credit-rationed firms, there are no apparent differences between medium, small and micro firms. It is only for discouraged borrowers that a size effect exists.
- There is evidence that firms engage in organisational innovation face higher credit rationing, discouragement and higher costs. Process innovators also seem to be more discouraged.
- Focusing on financing by source, we consider constraints for bank loans, bank working capital facilities, trade credit and other external financing separately.
- For bank loans and bank working capital facilities, we find that constraints decrease with firm age. However, there is no evidence of credit rationing or borrower discouragement for bank loan constraints for the youngest firms, aged two years or less. This effect is evident for credit rationed firms applying for bank working capital applications.
- For discouraged borrowers, applying for bank loans and bank working capital facilities, constraints decrease with age and size. However, there is no credit rationing differences between medium, small and micro firms in relation to bank constraints (both loans and working capital).
- Organisational innovators are associated with higher constraints on bank working capital facilities.
- In relation to trade credit facilities, rationing is actually lower for micro firms while discouragement increases as firm size declines. There is no general effect of firm age, however, firms aged 2-5 are more likely to be rationed and discouraged. In the Eurozone sample, all ownership groups are more constrained for trade credit applications than publicly listed firms.
- In relation to other external financing constraints, credit rationing is actually lower for micro and small firms, while discouragement is higher for these firm groups.

- Small firms (between 10 and 49 employees) perceived themselves to be more constrained than large firms. Product innovators and firms in industries which have a high dependence on external finance also perceived themselves to be financially constrained.
- Importers were associated with lower perceived financial constraints while firms with foreign direct investment abroad and active international outsourcers were more likely to perceive financial constraints to be binding.
- Exporters were less likely face actual financing constraints.
- Firms exporting to more destinations were less likely to be credit rationed. Furthermore, firms exporting to the EU and beyond were less likely to be credit rationed than those who exported to the EU only.
- In terms of the enterprises' financial characteristics, more indebted firms are more likely to face actual financing constraints. If existing leverage ratios are elevated, this may deter financial institutions from providing additional finance and be an impediment to firm credit access, while firms which had higher liquidity ratios were less likely to be credit constrained.
- Firms in industries which have a high dependence on external finance were more likely to be credit rationed.

1.2 Financial Market Imperfections: Theoretical and Empirical Background

Introduction

Access to financing has long been an area of considerable focus for policymakers and academia. Research on the role of credit in the economic growth process highlights the fact that access to finance impacts firm behaviour (investment, production and exporting decisions) and growth (output, innovation, employment, productivity, exporting) through various channels. Levine (2005) states that these channels include the production of information on investments, the allocation of capital, monitoring and evaluation of allocated funds, the exertion of corporate governance after providing finance, the management of risks, and the mobilisation and intermediation of savings.

However, the overall functionality of the financial system and its efficiency in the transmission of funds varies considerably across countries and regions. Varying degrees of financial market development and structure gives rise to differential funding environments for firms (Cecuk *et al.*, 2013) and thus impacts their relative firm performance and competitiveness. In many financial systems, market failures exist that limit the effectiveness with which the allocation of capital is undertaken, and lead to sub-optimal outcomes.

Since the onset of the financial crisis, concerns relating to the degree of market failures have heightened given the scale of the difficulties in the financial sector globally. In evaluating the effect of access to external finance on firm growth in the European Union, this section presents a review of the underlying definitions and theoretical causes of imperfections in capital markets. In particular, the following questions are addressed:

- What are the theoretical causes for financial market imperfections?
- What types of firms are more likely to suffer from financial market imperfections?
- What major financial market imperfections and regulatory failures are likely to restrict the access of (domestic) firms to external finance?

The following section provides a theoretical background and conceptual framework in regard to financial market imperfections.

Financial Market Imperfections: Theoretical and Empirical Background

Under perfect financial markets, access to internal and external finance would be perfect substitutes (Modigliani and Miller, 1958). This fact implies that the availability of internal funds should not influence investment options and investment decisions.

It is widely accepted in the relevant literature on access to finance that a 'financing gap' or financial market failure occurs when viable projects could not be financed due to financial market imperfections (O'Sullivan, 2005; Oxera, 2005; BIS, 2012). OECD (2006) research into financing SMEs defines credit constraints or a "financing gap" as a situation where a significant number of SMEs have the ability to use funds productively but cannot get access to such credit from the formal financial system. This perceived 'financing gap' is linked to a number of factors including *information asymmetries*, *high uncertainty*, *intangible assets*, the *complexity of the financing life cycle*, *transaction costs* and *investor's risk aversion* (Oxera, 2005; Hall and Lerner, 2010). Theory and empirical evidence suggest that the financial market failures are more likely in the following situations:[1]

[1] See for example O'Sullivan (2005)

- the higher the uncertainty in relation to the success of the project (the higher the risk linked to economic and technical considerations)
- the greater the information asymmetries between lenders and borrowers
- the earlier stage of the project financing cycle
- the lower the collateral of the firm
- the lower the availability of internal funds
- the less likely it is that the firm has a track record

However, the access to external financing may be also linked to other *system-related factors* such as institutional factors, financial market regulations, the tax regime, the lack of an equity market culture (Oxera, 2005, BIS, 2012). In addition, *demand-related factors* may be linked to a shortage of viable projects BIS (2012).

Sound evidence based on theory, surveys and empirical analysis[2] (Gertler and Gilchrist, 1993; Hall and Lerner, 2010) has established that financing gaps, as defined, are likely to be more binding for certain types of enterprises including start-ups, young, innovative, small scale, domestic enterprises and more technologically advanced industries.

Financial market imperfections exist mainly because of *informational asymmetries* between lenders and borrowers. These informational asymmetries arise in the following situations[3]:

(i) information about investment profitability can be obtained at a cost following a state verification;
(ii) unobserved misbehaviour of borrowers (moral hazard);
(iii) unobserved borrowers' risk types (adverse selection).

The above-mentioned informational asymmetries imply that the cost of external funds is higher than the price of internal funds. As a result, due to restricted access of some potentially viable enterprises, there will be underinvestment, a suboptimal allocation of capital and missed enterprise growth opportunities.

On the lenders' side, the lack of information about investment profitability increases costs related to evaluating collateral and monitoring. It is difficult for lenders to distinguish between high- and low-risk entrepreneurs without incurring significant transaction costs. As a consequence, lenders base their decisions on collateral and track record, rather than the economic viability of enterprises (BIS, 2012). Furthermore, the higher the debt relative to net worth, the higher the risk of bankruptcy and the higher the lending costs (Nickell and Nicolitsas, 1999).

On the borrowers' side, the lack of information/knowledge about external funding sources and investment opportunities limits the demand for external funding and expansion possibilities of firms, in particular for small firms who do not have the skills/capacity to assess investment opportunities. Furthermore, a number of firms do not apply for external finance due to fear of rejection (BIS, 2012).

Information asymmetries do not affect all types of enterprises and industries in the same way. Sound evidence based on theory surveys and empirical analysis[4] indicates that financial constraints are likely to be more binding for start-ups, young, innovative, small and domestic enterprises. High-tech industries are more likely to be financially constrained.

Additional financial market imperfections that restrict access to external finance include positive *externalities*, and *moral hazard*.

[2] See for example, reviews by Gertler and Gilchrist (1993) and Hall and Lerner (2010).
[3] IMF (2013) reviews the relevant recent literature.
[4] See for example, reviews by Gertler and Gilchrist (1993) and Hall and Lerner (2010).

Externalities restrict access to external finance of good quality projects by viable enterprises particularly in the case of investment in R&D by innovative enterprises. This market failure is linked to the non-rival nature of knowledge and it has been established theoretically by Nelson (1959) and Arrow (1962). As a consequence, the returns to investment in R&D cannot be fully appropriated by firms leading to underinvestment in R&D. Empirical evidence shows that indeed social returns to R&D investment are higher than private returns (Griliches, 1992; Hall, 1996; Hall *et al.*, 2010).

R&D investment is more difficult to fund relative to other types of investment due to a number of distinct characteristics (Hall and Lerner, 2010). First, the outcome of R&D investments is knowledge embedded in employees' human capital which is an intangible asset and cannot be used as collateral. Second, the uncertainty associated with the output of R&D investments makes them riskier than other projects. As a consequence, the required rate of return to R&D may be higher than that of conventional investment.

Moral hazard results from the separation of ownership and management. Conflicting goals between owners and managers lead to a principal-agency problem which could result in investment strategies that do not maximise the share value (Hall and Lerner, 2010). Two types of agency costs may emerge. The first type relates to the tendency of mangers to finance certain projects that benefit themselves. The second type relates to reluctance of risk-averse managers to invest in uncertain R&D projects. Evidence on such R&D investment-related agency costs has been provided by Johnson and Rao (1997), Francis and Smith (1995) and Eng and Shackell (2001).

In recessions or in periods of financial crisis, these financial market imperfections may increase financial constraints enterprises face. The presence and role of financial mechanisms that amplify financial constraints during recessions have been confirmed by empirical evidence for past recessions as well as the current recession following the global economic and financial crisis.[5] These financial mechanisms include:

- *Collateral constraints* – a decline in asset prices (following depressed stock or bond markets) leads to a lower value of collateral and thus a lower value of the loan that can be obtained with that collateral; exporters are affected by collateral constraints and banking sector distress (Kalemli-Ozcan *et al.*, 2010); evidence for the UK shows that more SMEs have been asked for collateral over the period 2007-2009 in comparison to the pre-crisis period (Fraser, 2012);
- *Debt overhang* – banks' exposure to non-performing loans affects new lending (Gan, 2007); banks' capital ratio and liquidity ratio impact the provision of loans to firms (Jiménez *et al.*, 2012);
- *Banking relationships* – the quantity of firm-level credit is influenced by firm-bank relationships (Petersen and Rajan, 1994); in Eastern Europe, firms with relationships with Western banks were more negatively affected (Ongena *et al.*, 2013).

[5] For a review of this evidence see IMF (2013).

1.3 Explaining the Composition of Finance across Enterprises and Industries in Europe

Introduction

In determining the degree to which firms face difficulties accessing external finance in the European Union, it is informative to firstly provide a brief review of what types of finance are commonly used by enterprises and what types of finance firms view as relevant for their operations. This is particularly salient given the considerable reliance of European firms on bank lending for external funding and the disruption to bank-lending channels since the financial crises.

There has long been a research interest into the determinants of corporate financial structure and the financial growth cycle of firms. Much of this research has been motivated by the seminal work of Modigliani and Miller (1958) and the work of Myers (1984) in highlighting the preferences of firms towards specific financing types and the implications for firm activity. In many countries, there are structural, institutional and cultural factors that influence the way firms have chosen to structure their capital liabilities. Given that this structure of liabilities can affect enterprise performance, it is useful to explore such patterns in the context of determining finance as a growth constraint for business. This section attempts to answer the following research questions:

1. What types of finance are relevant for, and what composition is used by, firms in Europe?
2. How does the usage and relevance of financing types differ across enterprises and industries?

In providing empirical evidence to answer these questions, our goal is not to focus on what is the preferable capital structure for an individual firm, but rather to review, with a view to formally testing for financing constraints in the next section, whether or not particular types of enterprises or industries are more reliant on certain types of financing. This in turn should provide evidence to identify if public policy can play a role to develop or maintain alternative funding options for particular firms who can then incorporate a wider range of sources in their optimal financing mix.

Data and Summary Statistics

To consider the composition of finance across firms and industries in the European Union, we draw on the ECB Survey of Access to Finance for SMEs (SAFE). This survey is primarily aimed at capturing information on the financing conditions for Eurozone firms on a continuous six monthly basis. However, every two years the survey is run on a wider basis to cover all 28 EU member states. The survey includes firms across all size classes: micro (less than 9 employees), small (10 to 49 employees), medium (50 to 249 employees) and large (250 or more employees). It also covers the following broad sectoral groups: mining, construction, manufacturing, wholesale and retail, transport and real estate. Firms in agriculture, public administration and financial services are not surveyed.

In the context of this evaluation, the SAFE survey questions firms on the types of financing that they use in their ongoing operations and whether or not different types of financing is relevant for the operation of their enterprise. Specifically, they ask firms whether or not they a) used a particular source in the past six months, b) did not use the source in the last six months but have experience with it or c) did not use it as the instrument is not relevant for their firm.

The following types of finance are included:

- Retained earnings or sale of assets;
- Grants or subsidised bank loans (public support);
- Bank overdrafts, credit lines or credit card overdrafts (bank working capital facilities);
- Bank loans;
- Trade credit (accounts payable);
- Other loans (non-trade credit, other related business loans and/or family and friends);
- Leasing/hire purchase or factoring;
- Issued debt securities;
- Subordinated loans, participating loans, preferred stocks or similar financing instruments; and
- Equity.

The type of financing that firms used matters for immediate growth and longer term competitiveness as an adequate supply of market-priced capital will ensure their ability to undertake viable investment projects, maintain and support employment, innovation and boost productivity and break into new markets. Which product they use matters due to the potentially different volumes available, the instrument-specific costs, the transactions costs, the implications for corporate governance and information flows and the maturities available.

Specifically, while formal market financing such as issuing debt securities and accepting equity financing are costly for many SMEs, they can provide corporate governance and other informational benefits that help firms in their development.

It is also important from a policy perspective to have an empirically driven understanding of firms' funding structures given the EC Green Paper on Long Term Financing commitments explore mechanisms to wider and deepen the number of financing sources available.

There are also concerns relating to financing supply in periods of financial instability. If firms use fewer financing sources or alternatives are unavailable or unfamiliar to their enterprise, this leaves them more exposed and can post a greater risk to their operations if a particular severe supply shock occurs in their main source. The current banking crisis is a good example of such a scenario.

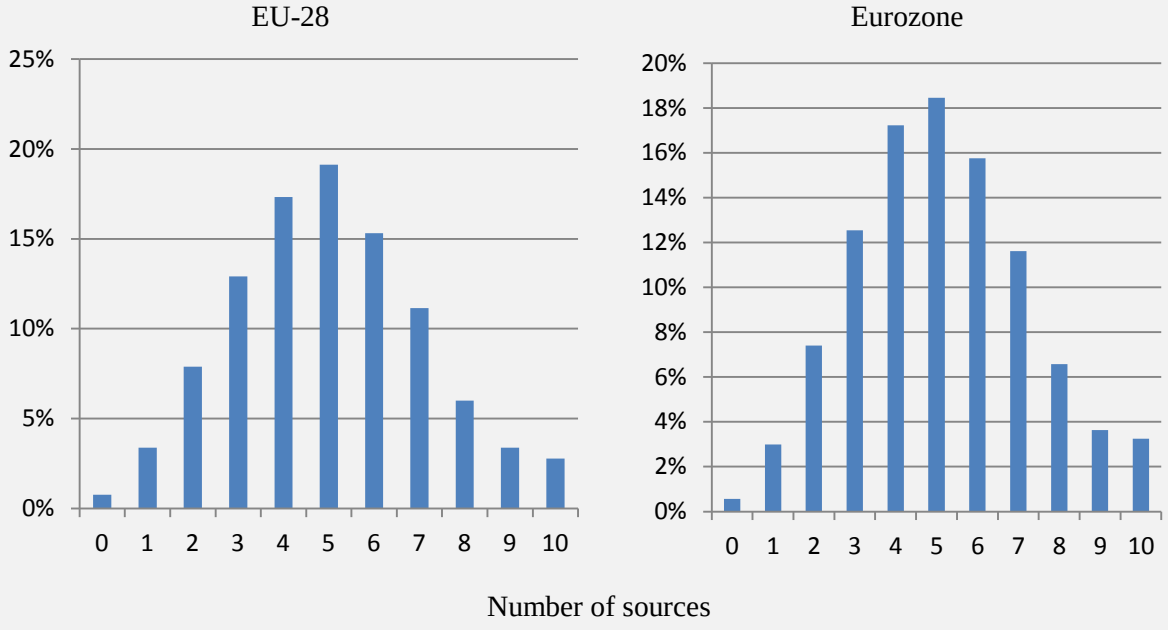
To evaluate the relevance of and usage of the different financing types to European SMEs, two indicators are used. Using the data from SAFE, we firstly measure relevance as whether or not firms answered c) in the above question (did not use it as the instrument is not relevant for their firm). Our binary relevance indicator is 0 if firms indicated that the source is not relevant and 1 if they indicated a) or b), that they used the source or they have experience with it. To measure usage within the past six months, we define an indicator = 1 if they used the source and 0 if they didn't use the source but it is relevant.

Summary Statistics

Firstly, to understand the patterns of importance for different financing sources for European firms, in particular in the context of building a more diversified funding mix, it is important to understand the types of financing used and the number of different instruments that enterprises in Europe use.

Figure 1-1 presents the distribution of the number of sources that enterprises in the SAFE data indicate are relevant to their operations. Data for both the EU-28 and the Eurozone are presented and the time period is April to September 2011. The majority of firms use between 3 and 7 types of financing with 5 instruments being the most common amongst enterprises.

Figure 1-1 - Number Of Sources Relevant For Firms – EU-28 (% of firms)

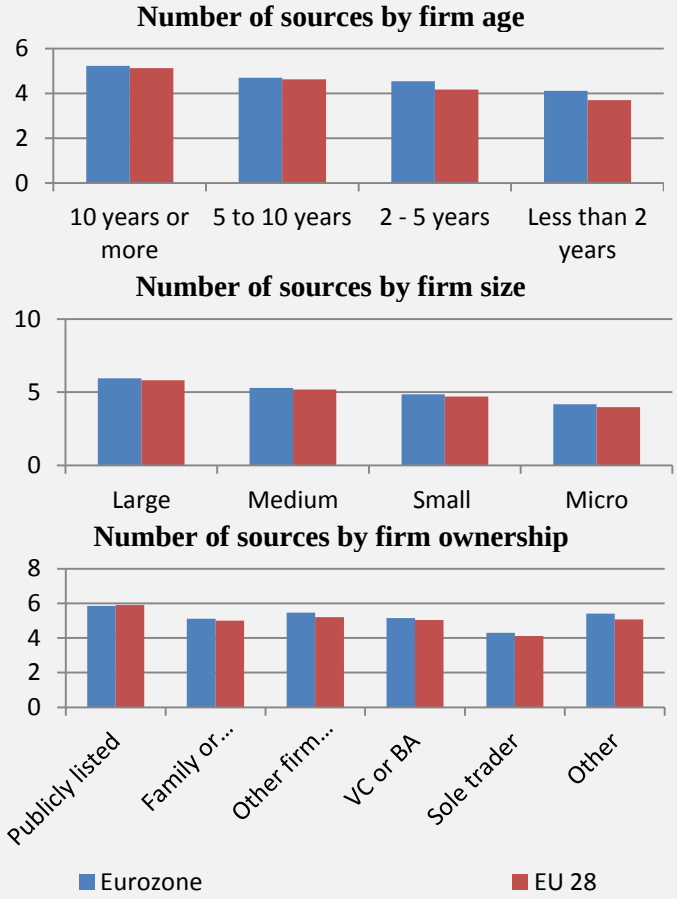


Source: Author's estimates using ECB SAFE data.

To capture the heterogeneity in usage by different types of firms, we consider differences by firm age, size and ownership. Exploiting the information in SAFE we use the following categories for age: age 10 +, age 5 to 10 years, age 2-5 years, and age less than 2. For size we use large, medium, small and micro breakdowns as noted above. For ownership we use: publicly listed, firms owned by family or other entrepreneurs, firms owned by other firms or business associates, venture capital or business angel owned firms, sole traders and other firms.

For age and size groups, a common pattern emerges. The number of relevant instruments increases as firms get older and larger. In terms of ownership, family-owned firms and sole traders appear to use the least amount of instruments while publicly listed firms have the most diversified set of relevant financial instruments. From the perspective of building a financial system with a broader range of financing types, this suggests that younger, smaller firms are the group which would require specifically targeted financial products.

Figure 1-2 - Average Number Of Sources By Firm Characteristics - Eu-28/Eurozone



Source: Author's estimates using ECB SAFE data.

Having considered the overall number of types, we now explore the usage of specific instruments. Figure 1-3 presents mean values for our summary statistics for the relevance and usage indicators across the different financial instruments. The data is taken from H1 2011 and covers all 28 EU member states. Charts 1.3.A and 1.3.B show the importance of bank loans and bank working capital facilities. Traditionally, bank intermediation of finance has dominated the corporate financing structures of enterprises in Europe. The data indicate that 80% of enterprises view bank loans as relevant and 77% view bank working capital facilities as relevant. In terms of usage, 66% of firms who viewed bank loans as relevant used bank finance in the past six months and 80% of firms who viewed bank working capital as relevant used this source.

While bank financing is popular and widely used, formal market financing (issued debt, receiving equity and taking subordinated market loans) is much less relevant. Only 28% of firms indicated equity is relevant, 32% indicated subordinated loans are relevant, and just 15% indicated that issuing debt securities is relevant. Of those that did indicate relevance, only 32 % used equity financing or subordinated debt financing, and 27 % issued formal debt. More widespread amongst European SMEs is the use of trade credit, which in this context is the receipt of goods on accounts payable. There is an extensive academic literature which highlights the importance of this particular channel, in particular during periods of recession (Love et al., 2007; Ferrando and Mulier, 2013; Casey and O'Toole, 2013). Of the

SMEs in the SAFE sample, 64 percent indicated trade credit is relevant and 78 percent of those indicated they used this source.

Another well established group of financing types are factoring/leasing/hire purchase. While these are quite distinct financing groups individually, unfortunately, data is only available for the aggregate grouping. For this group, 77 percent of firms indicated that the source is relevant and 68 of these firms indicated they used these types in the past six months.

The final three categories are public grants, retained earnings and other loan facilities. Circa 50 percent of firms indicated public grants are relevant with 45 percent of these firms stating that they used public grants. Surprisingly only 56 percent of firms indicated that that retained earnings are relevant, with 62 percent of those indicating they used retained earnings in the last six months. As internal financing is the lowest cost and the most flexible for firms, it would be expected that a majority of firms use this type. However, given the phrasing of the question, it could be the case that these firms just do not have corporate savings but do use cash flow to fund activities. In relation to other loan facilities, 43 percent of firms indicated they were relevant with 55 percent of these firms stating that they used the facilities.

Having reviewed the overall usage and relevance of financing sources, it is of particular policy relevance to understand whether there are differences across firms within Europe. The comparisons are presented in Figure 1-4 (relevance) and Figure 1-5 (usage). Each group is benchmarked against a base case. For the firm age groups, the base case is firms aged 10 +. For firm size, the base case is large firms. For ownership, the base case is publicly listed firms.

In relation to firm age, it appears that the number of relevant sources increases considerably as age increases. This suggests that older firms have access to a wider range of financial products. Of interest is that bank financing is much less relevant for very young firms relative to older firms with start-up enterprises in particular indicating that this source is not relevant. Retained earnings are also much less relevant for younger firms. As these enterprises are in the very early stages of their lifecycle, where revenues are only growing, risk levels are high, survival probabilities low, and investment high, it is unsurprising that these firms do not have the capacity to build up stocks of retained earnings. However, given that many of these firms have considerable potential to create jobs and grow, policy should investigate whether a greater targeting of measures to this group is required.

In relation to firm size, the relevance of all financial instruments seems to decrease as size decreases, pointing to a lack of financial diversification amongst European small firms. Interestingly the difference in relevance of bank financing between young and old firms and large and smaller firms is much narrower. This suggests that the lifecycle funding through banking has more variation by age than size. Retained earnings are much less relevant for smaller firms.

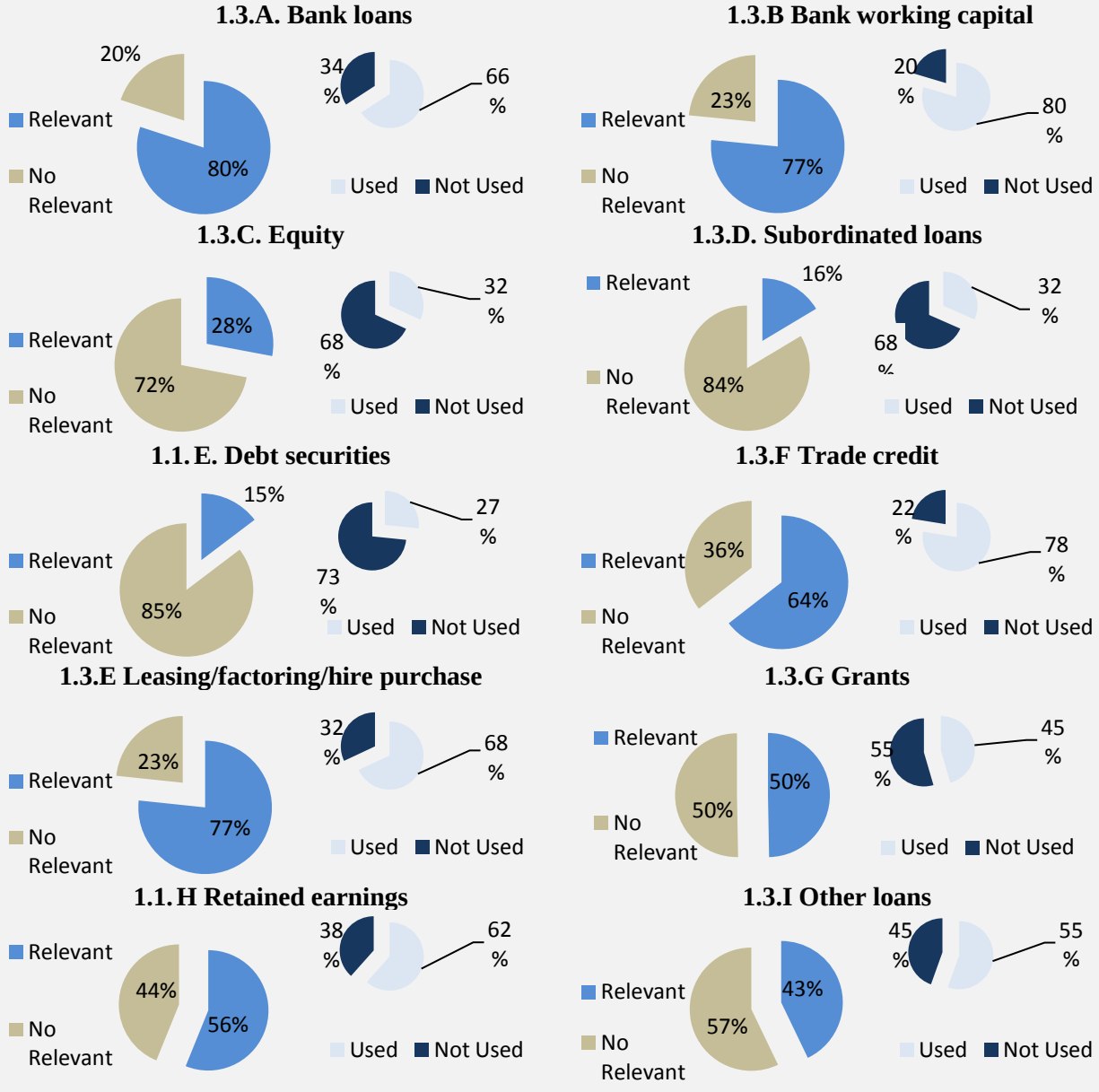
In terms of differences across ownership, it appears that family/entrepreneur-owned firms are more likely to find bank financing instruments more relevant than other firm groupings with venture capital or business angel financed firms the least likely to use such financing products. Relative to publicly listed firms, all ownership groups indicate that equity financing is less relevant. This is unsurprising given that the base category have stock market equity listings. Debt issuance relevance follows the same pattern.

Moving from the relevance of a source, to those firms that actually used a particular instrument if relevant, a number of interesting trends emerge. Younger firms appear to be much more likely to use non-bank financing once they view it as relevant. This is particularly the case for equity financing and trade credit. In relation to firm size, in general large firms

are more likely to use all types of financing. The exception is for equity financing which the usage is higher for smaller firms

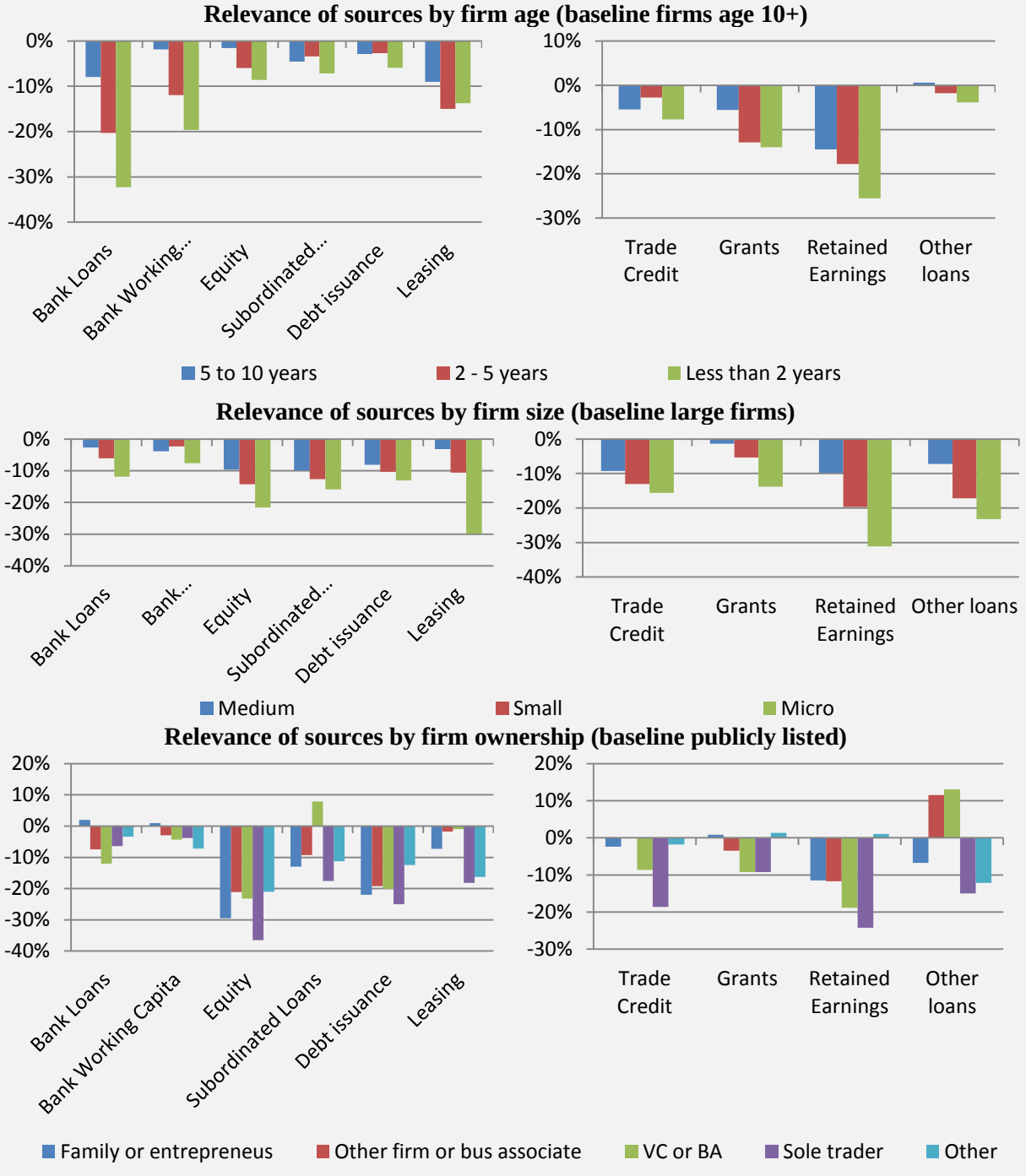
While these charts provide cross correlations, in the next section we provide a formal econometric evaluation of the findings to test the relationships' strength and robustness.

Figure 1-3 - Relevance And Usage Of Finance Types For Enterprises – EU-28



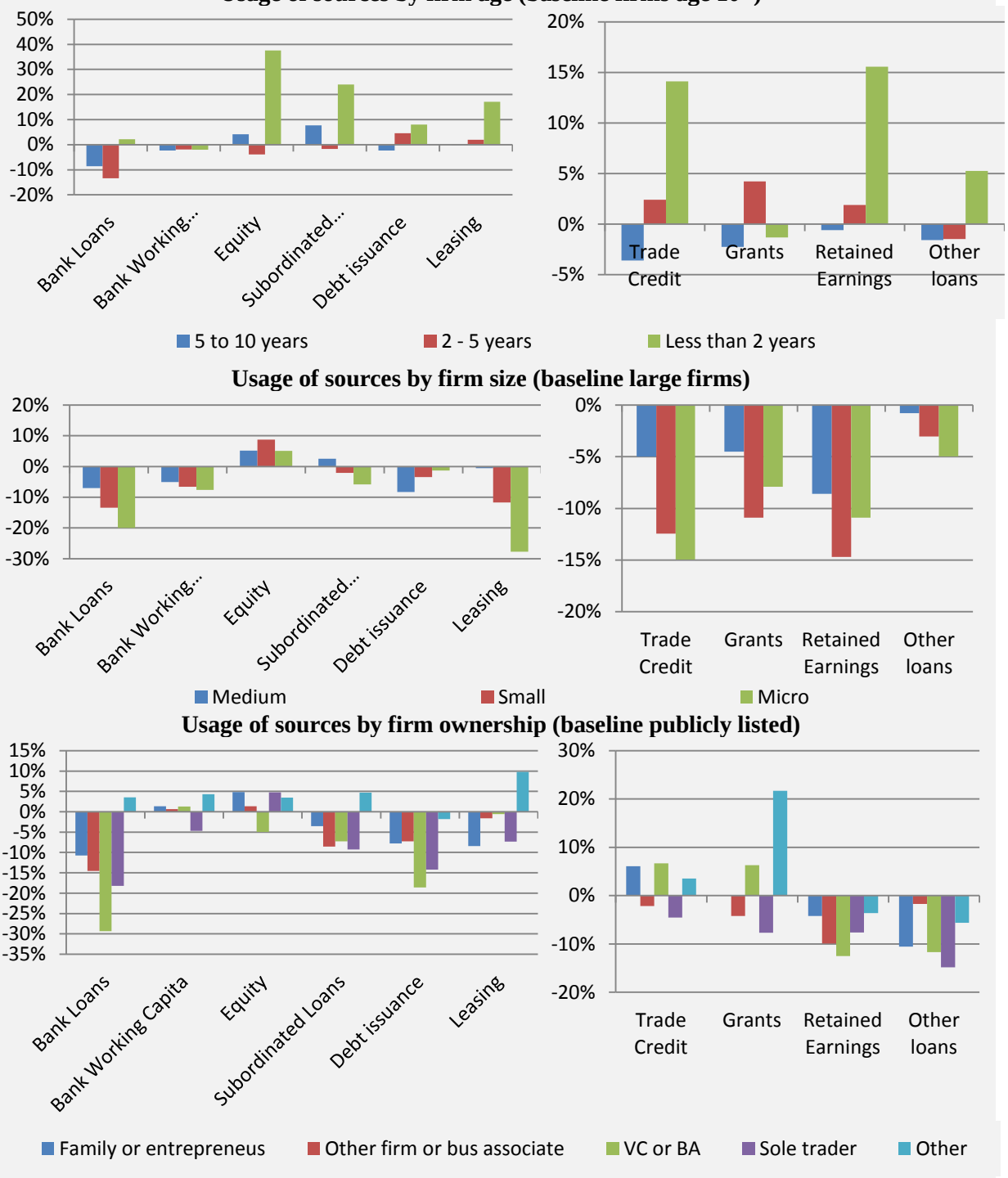
Source: Authors' calculations using ECB/EC SAFE Data

Figure 1-4 - Relevance of financing sources - comparison to baseline groups – EU-28



Source: Authors' estimates using ECB SAFE data.

Figure 1-5 - Usage of financing sources - comparison to baseline groups– EU-28



Source: Authors' estimates using ECB SAFE data.

Econometric Strategy

There are two main goals of this particular section. Firstly to test the determinants of the number of sources of finance used by firms and secondly to test the determinants of the relevance, and usage, of particular financing instruments by SMEs in Europe.

To econometrically model the number of sources requires a methodology that takes into account the categorical nature of the dependent variable (1,2,…for number of sources). We therefore apply an ordered-outcome model on the categories of sources. This model can be described as follows:

$$S_{ij}^{*} = \alpha + \boldsymbol{\beta}\mathbf{X_{ij}} + \varepsilon_{ij}$$

where the m alterative outcomes are defined as $S_{ij} = j$ if $\alpha_{j-1} < E_i^{*} \leq \alpha_j, j = 1, \dots, m$. X_{ijt} is a vector of firm-specific variables that determine the number of sources used. The probability that S_i is equal to a specific outcome j is:

$$\Pr(S_{ij} = j) = \Pr(\alpha_{j-1} < S_{ij}^{*} \leq \alpha_j)$$

Assuming the distribution of the error term is normal, the parameter vector, β can be estimated using an ordered probit. To provide a robustness check on our main estimations, we also estimate the model using a standard OLS model with robust standard errors.

The second objective is to test the determinants of the relevance and usage of financing sources. In these models, the dependent variables are binary. We use a probit approach assuming a normal distribution for the functional form. Our model for firm i, in country j is:

$$\Pr(\text{Relevance/Usage}_{ij}) = \Phi(\boldsymbol{\beta}\mathbf{X_{ij}} + \kappa_j + c_i)$$

where X_{ij} is a vector of firm-level controls. We also include country and firm fixed specific effects. The firm-specific controls included in $\mathbf{X_{ij}}$ are selected based on the literature covering firm financing choices (ECB, 2013; Ferrando and Mulier, 2013; Love, 2003; Beck, 2006; O'Toole, 2012). We include the indictor variables for age, size and ownership as discussed above. In addition we include dummy variables for the firms sector of operation: industry, services and trade with construction firms omitted as the base category. We include an indicator for whether or not the firm is a subsidiary.

We also include a number of variables to control for firm-specific risk and quality. We include indicator variables for whether the firms' turnover and profit increased, or remained unchanged (with decreased as the omitted category). We also control for whether the firms' capital position and credit history improved or remained unchanged over the previous six months. For the regressions on relevance and usage we include indicators of whether or not the firm undertook process, product, organisational or sales innovation.

In all regressions, we include country-time interactions to remove country-specific effects and cyclical factors.

Empirical Estimates

The empirical estimates of the two econometric models are presented in tables below. Table 1-1 outlines the determinants of the number of relevant financing sources. Having controlled for firm quality and risk, of particular interest are the coefficients on the firm groups for age, size, ownership and sectoral indicators.

Relative to firms in the construction sector, industrial firms indicate more financing sources are relevant while services firms indicate less sources are relevant. Such sectoral differences can reflect the variance in financial product complexity that comes with different production technologies and combinations of factor inputs.

In relation to ownership, sole traders indicate that significantly less sources are relevant to their operations relative to publicly listed firms. Such a finding is unsurprising but interestingly no other ownership indicators are significant. This suggests that observed differences are due to firm-specific variation in profitability, quality, size and age.

Focusing specifically on age and size, there is clear evidence that the number of sources relevant decreases with age and size. Firms in the early stages of the lifecycle are less financially diversified than are smaller firms.

Subsidiary firms indicate that fewer sources are relevant. They are potentially financing through parent companies and have less need to obtain external financing.

Table 1-1 - Number Of Financing Sources Relevant And Firm Characteristics

	EU - 28	
Y = No. of Sources (0-10)	**Ordered Probit**	**FGLS**
Industry	0.068*	0.128*
Trade	-0.076	-0.141
Services	-0.136***	-0.248***
Family owned	-0.118	-0.246
Other firm	-0.127	-0.260
Venture capital or bus angel	-0.072	-0.147
Sole trader	-0.310***	-0.584***
Other owner	-0.177*	-0.349*
Age: 5 to 10	-0.046	-0.088
Age: 2 to 5	-0.233***	-0.403**
Age: less 2 years	-0.353***	-0.584***
Small	-0.215***	-0.401***
Micro	-0.507***	-0.927***
Subsidiary	-0.111**	-0.171*
Turnover - unchanged	-0.068**	-0.121**
Turnover - positive	0.066	0.115
Profit - unchanged	-0.020	-0.040
Profit - positive	-0.021	-0.028
Credit history - unchanged	-0.149***	-0.267***
Credit history - improved	0.060	0.105
Firm capital position - unchanged	-0.071*	-0.127
Firm capital position - increased	0.004	0.013
n	9,625	9,625

Source: Authors' estimates using ECB SAFE data

Table 1-2 and Table 1-3 contain the results for the relevance and usage of the specific instruments. A number of findings emerge from the analysis.

Firstly, in relation to retained earnings, they are less relevant for service firms but there is no variation in usage by sector. There is some evidence that they are less relevant for very young firms but, if relevant they are more likely to be used as firms get younger. The intuition behind this finding is potentially that some very young firms struggle to build up cash stocks, but if these are available, they are more likely to use them. The latter effect may be some indicator of financing constraints, a topic we return to in the next section. The relevance and usage of retained earnings is decreasing with size. There is some evidence that innovative firms (in product space) indicate retained earnings are more relevant.

Focusing on other loans (which are from friends or family or other businesses), we find they are more relevant for younger firms, and are more relevant as firm size decreases. We also find they are more relevant for innovators.

For bank loans and working capital facilities, controlling for all firm factors, we find that bank loans are less relevant for young firms and bank working capital facilities are less relevant for very young firms. Bank loans are more relevant for industry, services and trade sectors relative to construction. Subsidiaries are less reliant on bank lending facilities and more on other loans. The relevance and usage of bank loans falls with firm size.

Equity financing is more relevant for construction firms than firms in industry, trade and services. However, if relevant, there is no variation in usage evident. We find equity financing is less relevant for family-owned firms, sole traders and enterprise-owned firms. However, if the source is relevant, sole traders and other business-owned firms are more likely to use equity. Interestingly, when firm factors are controlled for there is no effect of age on the relevance of equity financing. If relevant, its usage actually increases for younger firms. This finding suggests that it is not specifically age that matters for the relevance of equity but the fundamentals of the firm. For micro-sized firms, equity is less relevant.

In relation to subordinated loans, the product is more relevant for venture capital and business angel firms but less relevant for sole traders. There is no difference by age but some evidence that micro-sized firms are less likely to find this source relevant. In terms of usage if relevant, all ownership groups are more likely to use the source than publicly listed firms.

For trade credit facilities, a number of findings emerge. There is no clear evidence across ownership groups or firm age. However, both the relevance and usage declines with firm size. In relation to market debt issuances, relevance decreases with size and its usage is lower for all sectors relative to construction.

For leasing, factoring and hire purchase facilities, both the usage and relevance falls with firm size. If relevant, the likelihood of usage actually decreases with age. For grant finance, interestingly we actually find that this decreases with size.

Table 1-2- Determinants Of Whether Or Not Different Financing Sources Are Relevant Or Used By To Enterprises.

Y =1 if source is relevant	Retained Earnings		Other loans		Bank loans		Bank working capital		Equity	
	Relevance	**Usage**	**Relevance**	**Usage**	**Relevance**	**Usage**	**Relevance**	**Usage**	**Relevance**	**Usage**
Industry	-0.027	-0.024	0.006	-0.024	0.053**	-0.059	0.006	-0.003	-0.061***	-0.038
Trade	-0.041	-0.026	0.008	-0.056	0.054**	-0.004	0.003	0.013	-0.054***	-0.005
Services	-0.078***	-0.039	-0.013	-0.066*	0.042**	-0.052	0.004	-0.029	-0.046***	-0.050
Family owned	0.012	-0.003	-0.03	0.013	0.024	0.043	0.004	0.035	-0.109***	0.081
Other firm	-0.045	0.0022	0.026	0.059	-0.022	0.021	-0.032	0.021	-0.127***	0.125**
Venture capital or bus angel	-0.006	0.157*	0.011	-0.006	-0.101	-0.275***	-0.063	0.015	-0.091	0.032
Sole trader	-0.023	0.052	-0.09	-0.043	-0.001	0.041	-0.027	0.004	-0.140***	0.093*
Other owner	-0.061	-0.059	-0.005	-0.076	0.045	0.108	-0.065	-0.009	-0.036	0.102
Age: 5 to 10	-0.029	0.057*	0.049**	0.001	-0.013	-0.025	0.019	0.001	0.032	0.083**
Age: 2 to 5	-0.057*	0.169***	0.067**	0.118***	-0.139***	-0.100***	-0.042	0.034	0.008	0.081*
Age: less 2 years	-0.098	0.136	0.078	0.127	-0.214**	0.063	-0.133**	0.000	-0.024	0.381***
Small	-0.094***	-0.044*	-0.074***	-0.063**	-0.045***	-0.072**	-0.018	-0.016	-0.017	0.006
Micro	-0.153***	-0.045*	-0.104***	-0.042	-0.089***	-0.088***	-0.058***	-0.023	-0.076***	0.009
Innovation (Product)	0.050***	0.006	0.039***	0.046*	0.001	0.012	0.029*	-0.010	0.035*	0.035
Innovation (Process)	0.003	0.006	-0.007	0.046*	0.035***	0.012	-0.019	-0.010	0.007	0.035
Innovation (Organisation)	-0.007	-0.022	0.023*	0.049	-0.013	0.011	0.035**	0.045**	0.029	0.063**
Innovation (Sales)	-0.028	0.018	0.037*	-0.028	0.004	0.035**	-0.022	0.035*	-0.010	-0.016
Subsidiary	-0.016	-0.083	0.068**	0.090**	-0.105***	-0.044	-0.098***	-0.045*	0.014	0.015
Turnover - unchanged	-0.014	-0.082***	-0.014	-0.013	0.02	0.060*	-0.019	-0.005	0.013	-0.081*
Turnover - positive	0.024	-0.091***	-0.004	0.027	0.052*	0.061**	0.048***	0.012	0.050**	-0.059*
Profit - unchanged	0.021	-0.003	0.001	-0.036	-0.033	-0.049	-0.047**	-0.034*	-0.005	0.001
Profit - positive	-0.01	-0.091***	0.036	0.027	-0.042*	0.061**	-0.035	0.012	-0.009	-0.059*
Credit history - unchanged	0.004	-0.003	-0.069***	-0.036	-0.077***	-0.049	-0.048**	-0.034*	-0.004	0.001
Credit history - improved	0.044	0.0269	-0.029	-0.058	-0.042	0.009	-0.015	-0.014	0.037	0.020
Firm capital position - unchanged	-0.051*	-0.031	-0.032*	-0.077*	0.003	0.040	-0.026	0.022	0.000	-0.112**
Firm capital position - increased	0.025	0.049	-0.014	-0.033	0.027	0.062*	-0.079***	-0.048**	-0.012	-0.008
n	4,722	2,390	4,742	1,991	4,752	3,710	4,757	3,540	4,708	1,158

Source: Authors' analysis using SAFE

Table 1-3- Determinants Of Whether Or Not Different Financing Sources Are Relevant Or Used By To Enterprises.

Y =1 if source is relevant	Subordinated loans		Trade credit		Debt financing		Leasing		Grants	
	Relevance	Usage	Relevance	Usage	Relevance	Usage	Relevance	Usage	Relevance	Usage
Industry	-0.0191	0.0212	0.0124	0.001	-0.0099	-0.1257**	-0.0013	-0.0301	0.1139***	-0.0679*
Trade	-0.0265	-0.0893	0.0203	0.0373**	-0.0175	-0.1837***	-0.0627***	-0.0303	-0.0416	-0.0355
Services	-0.02	-0.0488	-0.1005***	-0.0457***	-0.0208	-0.1385***	-0.0326*	-0.0017	0.0204	-0.0286
Family owned	-0.0495	0.1173**	0.0142	0.0191	-0.0483	0.0944	-0.0283	-0.0806	0.0558	0.0546
Other firm	-0.0384	0.2344***	0.0003	0.0418	-0.0673**	0.1634***	-0.0202	-0.1227**	0.0291	0.1072
Venture capital or bus angel	0.1260**	0.1253*	-0.0438	0.1345**	-0.0219	0.1109	0.1162*	0.0013	-0.0666	0.1062
Sole trader	-0.0656*	0.1831**	-0.0338	-0.0084	-0.0412	0.1285*	-0.0393	-0.0414	0.0504	0.0536
Other owner	-0.0022	0.0529	-0.0619	-0.035	-0.0334	0.1158	-0.2236***	-0.0695	0.1805**	0.1724**
Age: 5 to 10	0.0165	0.0572	-0.0253	0.0303	-0.0126	-0.1113**	-0.0123	0.0365	-0.0092	-0.0431
Age: 2 to 5	0.0402	0.0816	0.0559*	-0.0303	0.0268	0.033	-0.0399	0.0674*	-0.0543	-0.0186
Age: less 2 years	-0.0142	-0.038	-0.0364	0.0066	-0.0041	0.156	-0.1077	0.1644**	-0.0014	0.1127
Small	-0.0208	-0.0568	-0.0386**	-0.0278*	-0.0263*	0.0511	-0.0698***	-0.1170***	-0.0460*	-0.0535*
Micro	-0.0371*	-0.0823	-0.0798***	-0.0645***	-0.0525***	-0.0004	-0.1761***	-0.2661***	-0.1080***	-0.0914**
Innovation (Product)	0.0111	0.0551	0.0499**	0.0149	0.0035	-0.0554	-0.0298	0.0272	0.0524**	0.0279
Innovation (Process)	0.0167	0.0551	-0.0204	0.0149	0.0197*	-0.0554	0.0229	0.0272	-0.0057	0.0279
Innovation (Organisation)	0.0198*	0.0138	-0.0353*	-0.0356**	0.0161*	0.0032	-0.0059	0.0352	0.0057	0.0497*
Innovation (Sales)	0.0083	0.0549	0.0234	0.0117	0.0007	-0.0946**	0.0131	-0.0059	0.0538***	-0.0373
Subsidiary	-0.0071	-0.1183***	-0.0091	-0.0385	0.0218	-0.0499	-0.0391	0.052	-0.0153	-0.0312
Turnover - unchanged	-0.0049	-0.0715	0.0004	-0.0082	0.0033	-0.0805*	0.0144	0.0274	0.0059	-0.0343
Turnover - positive	0.0067	0.0067	0.0058	0.0177	0.004	0.0603*	0.0499***	0.0303	0.0343	0.0166
Profit - unchanged	-0.0029	0.0089	-0.0018	-0.0052	-0.013	0.0324	-0.0094	-0.0114	0.02	-0.0401
Profit - positive	-0.0126	0.0067	-0.0151	0.0177	0.006	0.0603*	0.0127	0.0303	-0.0017	0.0166
Credit history - unchanged	-0.0305	0.0089	0.035	-0.0052	-0.0175	0.0324	-0.0156	-0.0114	-0.0249	-0.0401
Credit history - improved	-0.0227	-0.0668	0.0513*	0.002	-0.0084	-0.1439*	0.0508	0.0231	0.023	-0.049
Firm capital position - unchanged	-0.0084	0.0273	-0.0621***	0.0225	0.0091	0.0063	0.0019	0.0302	-0.0409	0.0665*
Firm capital position - increased	0.0230*	0.0365	-0.0106	0.0197	-0.0027	0.0227	-0.0341	0.0194	0.0132	0.1075***
n	4,679	571	4,740	3,054	4550	563	4750	3461	4722	2187

Source: Authors' analysis using SAFE

Conclusions and Policy Implications

The financial crisis has brought to the fore concerns relating to the funding landscape for European firms. Their traditional reliance on bank financing increases the risk of banking sector instability impacting on real decisions. Within this context, there has been a commitment towards exploring potential policy initiatives which can broaden and widen the scope of financial instruments available, in particular for SMEs.

Before an evaluation of financing constraints and their effect on firms is conducted, it is important to understand the type of products that SMEs use and develop an understanding of how they compose their capital structures. Relating to financial diversification, this section considers the number of sources used by SMEs and relates this to firm-specific characteristics. Secondly, the section estimates the determinants of which financial instruments are relevant and used by particular types of firms and industries.

A number of findings emerge from the analysis:

- By far, European SMEs indicate that bank financing (both loan and working capital facilities) is the most relevant source of funding. Over 80 per cent of firms indicate bank loans are relevant and over 77 per cent indicate bank working capital is relevant. Leasing/Factoring/Hire purchase is also indicated as very relevant at 77 per cent.
- Formal market financing, which includes equity, debt or subordinated loans, is only relevant for less than 30 per cent, 15 per cent and 16 per cent of firms respectively.
- Retained earnings are relevant for 50 per cent of firms while trade credit is also important at 64 per cent of firms.
- There is clear evidence that the number of financial instruments relevant to enterprises decreases with firm size and age. As this indicates that firms early in their lifecycle and smaller firms are less financially diversified, these firms are much more likely to be exposed to shocks in the supply of their main funding source. Policy measures to broaden and deepen the range of options available to these firms would be a positive development.
- Relative to firms in the construction sector, the analysis suggests industrial firms, traded firms (wholesale and retail) and service firms are less diversified. Such differences may reflect the variance in financial market complexity that is required given different combinations of factor inputs and production technologies.
- Firstly, in relation to retained earnings, they are less relevant for service firms but there is no variation in usage by sector.
- There is some evidence that they are less relevant for very young firms but, if relevant they are more likely to be used as firms get younger. The intuition behind this finding is potentially that very young firms struggle to build up cash stocks, but if these are available they are more likely to use them. The latter effect may be some indicator of financing constraints, a topic we return to in the next section.
- When the quality and risk of an enterprise is controlled for, there does not appear to be an effect of age on the relevance of equity financing. If equity is relevant, its usage actually increases for younger firms. For micro-sized firms, equity is less relevant.
- We find that bank loans are less relevant for young firms and bank working capital facilities are less relevant for very young firms. The relevance and usage of bank loans falls with firm size but the relationship is not as clear for bank working capital.

1.4 Financing Constraints across Enterprises and Industries in the European Union

Introduction

Since the onset of the financial crisis, there has been considerable policy focus on the supply of financing across EU member states. In this section, we present a methodology for measuring the degree to which European firms face access to finance constraints and look at the determinants of these constraints. We focus on groups of firms, industries and countries in our analysis.

In the literature, there are four main methodologies that have been used to empirically measure the degree to which firms face financing constraints. Firstly, numerous studies estimate the relationship between measures of internal funds and firm outcomes and test the degree to which reliance on internal finance affects firm performance as measured by investment, exporting, inventory management or firm growth (for example Fazzari et al., 1988; Hubbard, 1998; Love, 2003; Bond and Soderbom, 2013. For reviews of this literature see Chirinko (1993) or Guariglia (2008)).

The second method uses information on firm financial factors (net worth, liquidity management, interest coverage) to proxy the firms' financial health in a structural model of outcomes such as Euler equation approaches (Whited, 1992; Bond and Meghir, 1994; Bond et al., 2003; and Whited and Wu, 2006). Thirdly, researchers have exploited the differential cost of capital between external financing sources and linked this to firm growth (Kashyap et al, 1993; Huang, 2003; Bougheas et al., 2006; Guariglia and Mateut, 2010; O'Toole and Newman, 2012, O'Toole et al., 2014).

Finally, as recently detailed firm surveys have become available, researchers have drawn on questions relating to enterprises perceptions of access to finance as an obstacle to growth and expansion (*perceived financing constraints*) (Beck et al. 2006; Clarke et al, 2006), detailed questions on credit applications and rejections (*actual financing constraints*) (Brown et al., 2012; Popov and Udell, 2012; Byiers et al., 2010; Gerlach-Kristen et al, 2013).

The rest of this section is structured as follows: firstly, we outline the data and measurement of the selected financing constraints indicators, secondly, we outline our methodological approach and the determinants of constraints, thirdly we present summary statistics for the main measures, fourthly we present the econometric estimates and finally conclude.

Data and Measuring Financing Constraints

We mainly draw from the fourth of the methods for measuring constraints discussed in the literature, however in sections 2 and 3 we use a mix of the aforementioned methodologies. Our empirical analysis mainly uses two specific datasets: the ECB Survey on Access to Finance for SMEs (SAFE) and the FP7 funded research dataset on European Firms in a Global Economy (EFIGE).[6] Using these datasets, we begin by defining indicator variables for whether or not firms face financing constraints or view finance as an obstacle to growth and development. Given our recourse to different datasets, the exact definition of our financing constraint indicators is specific to the available questions in each survey.

In the ECB/EC SAFE dataset, firms are asked to indicate what is the main problem that they face from a list of business issues. These include finding customers, competition, access to finance, cost of production or labour, availability of skilled staff or managers, regulation and

[6] A detailed overview of these datasets is presented in Appendix 1: Data.

other issues. Our first indicator of access to finance uses this data to capture "perceived financing constraints". This indicator takes the value of one if the firm indicates that access to finance is the most pressing problem that it faces and is 0 otherwise. The definition of this indicator is in line with Ferrando and Greisshaber (2011) and Ferrando and Mulier (2013). As firms must select "access to finance" as the most pressing issue, this indicator is more likely to pick up the firms for which credit market conditions are the most strained than surveys which allow firms to select multiple issues as equally pressing. However, as noted in Ferrando and Mulier (2013), the data may miss firms for which credit is a problem but is not the most pressing problem and thus underestimate the degree of access to capital markets for European enterprises.

As many authors have expressed concerns over relying on perception based measures of financing constraints, we mainly focus on measures of actual financing constraints faced by firms. These measures are based on applications for financing and the outcome of those applications.

In the ECB SAFE data, financial applications data are available for the following categories: bank loans, bank working capital, trade credit and other external financing. Other external financing is a composite grouping which includes loans from other lenders, equity or debt issuance, leasing or factoring but excludes bank loans, overdrafts, and trade credit.[7] While bank financing is critically important to European SMEs, our definition of constraints will also take into account the trade credit and other external finance applications. We include these groups so as to provide a broad review of access to finance as opposed to a narrower focus on bank-based credit provision only.

Using the aforementioned data, we follow Popov and Udell (2012) and define financial constraints as containing three categories of firms: 1) ***credit rationed*** where we define a firm as constrained if it applied for finance in any one of the categories of financing and were rejected outright, applied and got most of it (between 75-99 percent), applied and got a limited part (between 1 and 74 percent) 2) ***discouraged borrowers*** where the firm did not apply due to possible rejection and 3) refused the offer as the ***costs associated were too high***.[8]

An important consideration in measuring financing constraints relates to the comparison group of unconstrained firms. In this context, our baseline grouping is firms that applied and were successful in their application. We limit the sample to these firms and those that are constrained by each of the above measures for our overall evaluation. This is important as firms that do not apply for reasons other than discouragement do not have a demand for finance and it is salient to ensure our comparison group are active participants in the credit market. Our overall indicator of "actual financing constraints" takes the value of 1 if firms are credit rationed, discouraged or the costs of the offer were too high and 0 if the firm had a successful application.

One concern that arises when using this data is that for credit rationed firms, and firms who reject the offer due to cost, we do not have any information on the reason for the rejection. To correctly identify a firm as credit constrained, the reason for the rejection must relate to supply side rationing by the bank e.g. the bank does not lend to specific sectors, the bank does not lend to specific firm types. In other words, the firm has the ability to use funds productively at the market cost of capital and can demonstrate this but the bank refuses to provide the volume of credit. The rejection must not be on the basis of poor borrower

[7] See www.ecb.int for more information on SAFE dataset and the definition of questions. Q7a of the survey October 2012 to March 2013 is used for this analysis.

[8] There is no information in the ECB questionnaire on whether or not the cost indicated relates to interest rates or loan conditions or a combination of both.

fundamentals or must not relate to the borrower-specific risk. In relation to the cost of the loan, to be constrained, the cost of the offer must be prohibitive due to the bank offering a cost package that is above the market or competitive rate. In this case, although the bank is offering the credit volume to the borrower but the cost associated is equivalent to volume rationing through price setting.

To control for these influences, we include variables which relate to the underlying performance of the firm and its credit status.

Table 1-4 Overview Of SME Financing Constraint Indicators

Indicator	SAFE	EFIGE
Perceived financing constraint	Indicator = 1 if firm viewed finance as the greatest obstacle to their growth and expansion, 0 otherwise.	Indicator = 1 if firm believed financial constraints hampered growth and 0 otherwise.
Actual financing constraint	Indicator = 1 if firm is ***Credit Rationed***, ***Cost of Offer is Too High*** or is a ***Discouraged Borrower,*** *0 if firm is unconstrained.*	
Credit rationing	Indicator = 1 if firm has applied for finance and been rejected, *0 if firm is unconstrained.*	Indicator = 1 if firm was unsuccessful in application for more bank credit in 2009 and zero otherwise.
Cost of offer too high	Indicator = 1 if firm has applied but rejected the offer due to cost, *0 if firm is unconstrained.*	n/a
Discouraged borrowers	Indicator = 1 if firm did not apply due to possible rejection, *0 if firm is unconstrained.*	Indicator = 1 if firm was willing to increase its borrowing at the same interest rate as its current credit line but did not apply for more credit.

Methodological Approach

As we are focusing on both firm's perceptions of financing constraints as well as actual financing constraints, we propose to follow a joint estimation strategy as in Ferrando and Greisshaber (2011) and Ferrando and Mulier (2013) and estimate both actual and perceived constraints simultaneously in a bivariate probit model. Drawing on the ECB SAFE data and the EFIGE dataset, our data are either cross-sectional or repeated cross-sections. In this context, the following bi-variate framework is used in the estimation of our models. Perceived financing constraints (PC) and actual financing constraints (AC) can be described by underlying unobserved latent models:

$$PC^*_{icj} = \boldsymbol{X}'_{\mathbf{1}:ijc}\boldsymbol{\beta} + \varepsilon_{\mathbf{1}:icj}$$

$$AC^*_{icj} = \boldsymbol{X}'_{\mathbf{2}:ijc}\boldsymbol{\beta} + \varepsilon_{\mathbf{2}:icj}$$

Where the error terms, representing firm i, in sector j, and country c, are joint normally distributed with mean zero and variance of unity and also have the following correlation condition:

$$Cov(\varepsilon_1, \varepsilon_2) = \rho \neq 0$$

The binary outcomes that we observe in our data are:

$$PC_{icj} = \begin{cases} 1 & if\ PC^*_{icj} > 0 \\ 0 & if\ PC^*_{icj} \leq 0 \end{cases}$$

and

$$AC_{icj} = \begin{cases} 1 & if\ AC^*_{icj} > 0 \\ 0 & if\ AC^*_{icj} \leq 0 \end{cases}$$

As noted in Ferrando and Greisshaber (2011), Poirer (1980) shows that the estimated standard errors in this framework are more efficient than single equation estimation when the correlation coefficient $\rho \neq 0$. This model is estimated using maximum likelihood techniques with heteroskedasticity-robust standard errors.

To model the determinants of financing constraints, the vector $\boldsymbol{X}_{it}$ contains the general firm-level characteristics and in the case of EFIGE firm-bank financial characteristics. In the SAFE dataset, we include the following controls: categorical variables for firm age (10 years or more, 5 – 10 years, 2-5 years, and less than 2 years), firm size categories (micro (less than 9 employee's), small (10 to 49 employee's), medium sized (50 to 249 employee's) and large firms (greater than 250 employee's)).

As discussed in Section 1.2, there are many market and regulatory failures that determine the degree of financing constraints affecting enterprises, in particular SMEs. In particular if a considerable degree of asymmetric information exists in capital markets between lenders and borrowers, then access to finance will be heterogeneous across the distribution of firms in the economy. In this section, we draw on the international research in the area to identify the main firm characteristics that are associated with facing financing constraints (Ferrando & Greisshaber, 2012; Beck et al. ,2006; 2008a; 2008b; Casey and O'Toole, 2013; Canton et al., 2012).

Many studies identify firm *size* as a major indicator of access to finance (Beck at al., 2005; Beck and Demirguc-Kunt, 2006. Beck et al (2008) state that small firms find it more difficult to access financial services due to greater information and transaction costs. Additionally, as large firms internalise many of the functions of capital market allocation, as well as potentially having recourse to additional internal resources, small firms are likely more dependent on external financing. We therefore include firm size (measured by the number of employee's) as an explanatory variable for financing constraints.

A second important characteristic is firm *age*. Younger firms can face considerable difficulties in accessing external financing due to information asymmetries between borrowers and lenders. Younger firms do not have a track record of financial information, can have underdeveloped business and management practises and can appear very opaque to financial institutions. This leads to difficulties evaluating borrower risk and can increase financing constraints. To test the effects of firm age on financing constraints, we include the indicator categories for firm age.

We include a control for whether or not the firm is a subsidiary[9], and whether or not the firm undertook product, process, organisational or sales innovation. We also include country controls in all regressions.

[9] As using Question d2 from the ECB SAFE data.

As noted above, it is important to control for borrower-specific profitability and firm performance in isolating the determinants of financing constraints. While there is no data available in SAFE on the level of output or the level of profitability, we include controls for whether or not the firm's turnover has increased, remained constant or decreased in the previous six months and a binary variable for whether or not the firm posted a profit, made a loss or broke even in the previous six months. We also include controls for whether or not the firm's credit history has improved, remained constant or deteriorated as well as whether the capital position of the firm has improved, remained constraint or deteriorated (self reported).

These factors help capture the productive capacity of the firm, the scale of its operation, its risk profile and the profitability of its operations and investment opportunities. These variables will also help strip out much of the firm-level heterogeneity which we are unable to explicitly deal with due to the cross-sectional nature of the data.[10]

One of the main advantages of conducting separate analysis using the EIFGE dataset is that it contains information on internationalisation characteristics of firms which can be related to the perceived and actual financial constraints faced by the firm. The EIFGE dataset contains information on foreign ownership as well as information on firm activity relating to exporting (i.e. regional breakdown and number of destinations), importing, FDI, Outsourcing. A growing literature suggests such characteristics are expected to matter for financial constraints.

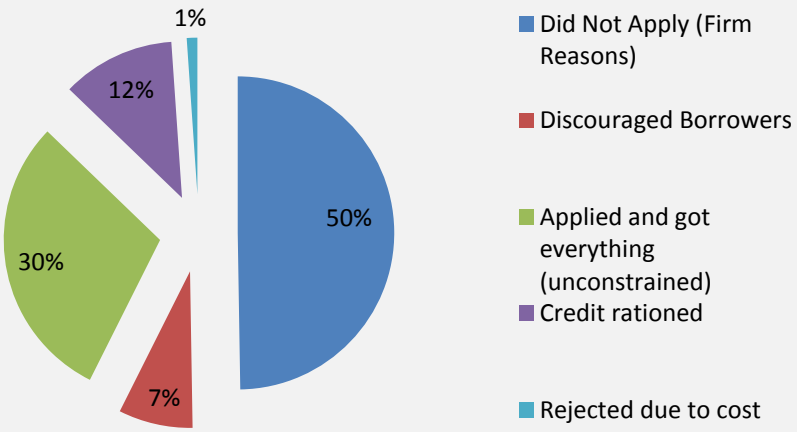
Summary Statistics

Statistics from ECB SAFE Dataset

Figure 1-6 illustrates the breakdown of SME financing constraints in the European Union for all types of financing including bank loans, trade credit and other external financing. The pie chart shows the average applications and constraints between 2011 and 2013 while the table below illustrates the change in applications and constraints since the first SAFE survey wave. The largest portion of firms in the sample did not apply for finance. The combination of those who applied and were successful and those who applied and were rejected gives an average application rate of 42%. We calculate that 12% of all firms were credit rationed over the period. The largest changes between the first SAFE wave and the latest are in the percentage of firms applying for credit and those firms classified as unconstrained. Firms applying for finance have increased by 3% while unconstrained firms have increased by 4%.

[10] Where panel data are available in the ECB SAFE data, we have conducted an analysis and the results are included as a robustness check.

Figure 1-6 - Overview Of SME Financing Constraints – Applications And Constraints – All Finance Sources – EU-28

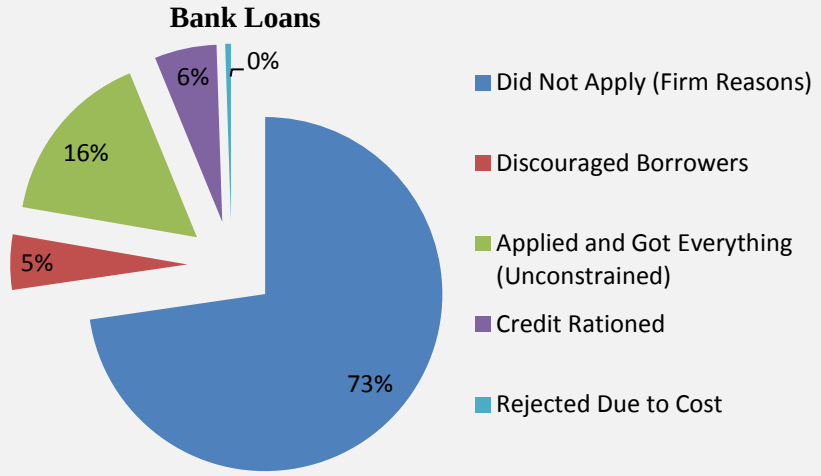


	Did not apply	Applied	Unconstrained	Credit rationed	Discouraged	Rejected due to cost
2011 H1	51%	41%	28%	12%	8%	1%
2013 H1	49%	44%	32%	13%	8%	1%
% Change	-2%	3%	4%	1%	0%	0%

Source: ECB SAFE Data

Figure 1-7 provides a similar breakdown as Figure 1-6 but solely for applications and constraints in relation to bank loans. On average, 78% of firms did not apply for bank loans over the period for either firm reasons or due to discouragement. The vast majority of non-applications are for firm reasons with only 5% due to the firms being discouraged. Of the 22% who did apply, on average 16% were entirely successful and 6% were credit rationed. The largest changes between the first survey wave and the latest are in the number firms applying for bank loans. There was a 2% increase in firm applications and a similar 2% increase in successful applications.

Figure 1-7 - Overview Of SME Financing Constraints – Applications And Constraints – All Finance Sources – EU-28 – Bank Loans

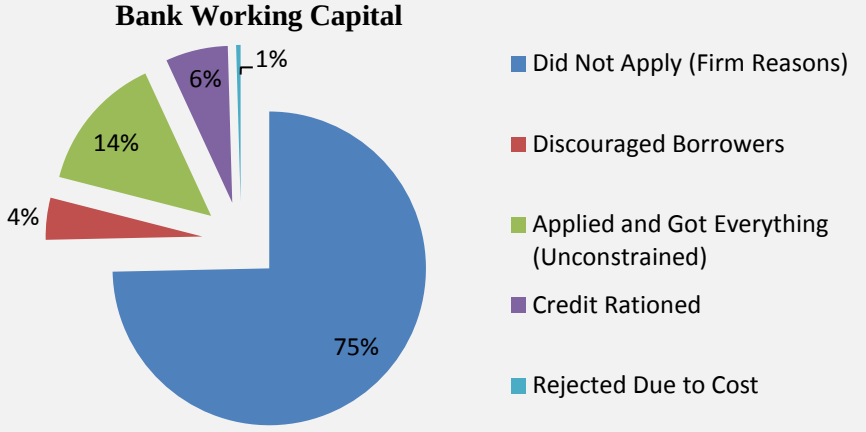


	Did not apply	Applied	Unconstrained	Credit rationed	Discouraged	Rejected due to cost
2011 H1	73%	22%	15%	5%	5%	1%
2013 H1	71%	24%	17%	6%	5%	0%
% Change	-2%	2%	2%	1%	0%	0%

Source: ECB SAFE Data

Figure 1-8 provides a breakdown of applications and constraints for applications for working capital loans from banks. Similarly to figure Figure 1-7, 79% of firms did not apply for working capital funding from banks. Of the 20% of firms which did apply for working capital financing, on average, 14% were successful and 6% were rationed. There has been very little change in the application rates and constraints for bank working capital finance between the first wave and the latest wave.

Figure 1-8 - Overview of SME Financing Constraints – Applications And Constraints – All Finance Sources – EU-28 – Bank Working Capital

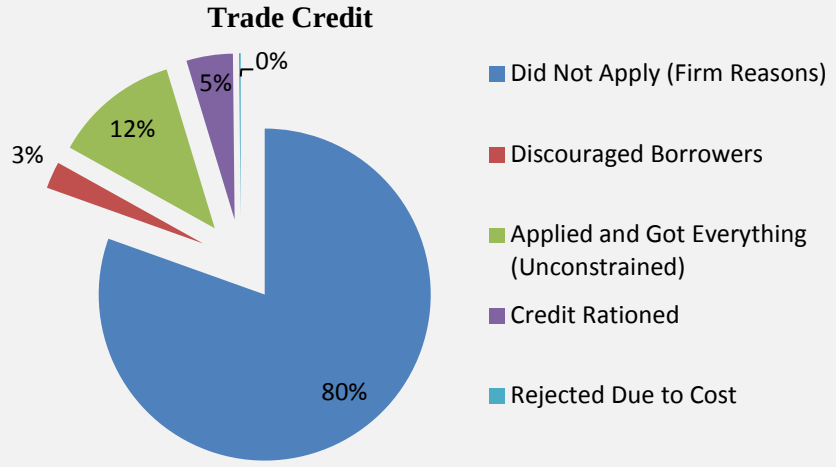


	Did not apply	Applied	Unconstrained	Credit rationed	Discouraged	Rejected due to cost
2011 H1	74%	22%	14%	6%	4%	1%
2013 H1	74%	22%	14%	7%	4%	0%
% Change	0%	0%	0%	0%	0%	0%

Source: ECB SAFE Data

Figure 1-9 provides a breakdown of trade credit applications and constraints from the ECB SAFE survey. 83% of firms have not applied for any form of trade credit financing. Of the 17% that have applied, 12% were successful and 5% were classified as constrained. Again, there has been very little change between the earliest and latest waves of the survey. These has been a slight increase in applications and credit rationing and a slight decrease in discouraged firms.

Figure 1-9 - Overview of SME Financing Constraints – Applications And Constraints – All Finance Sources – EU-28 – Trade Credit

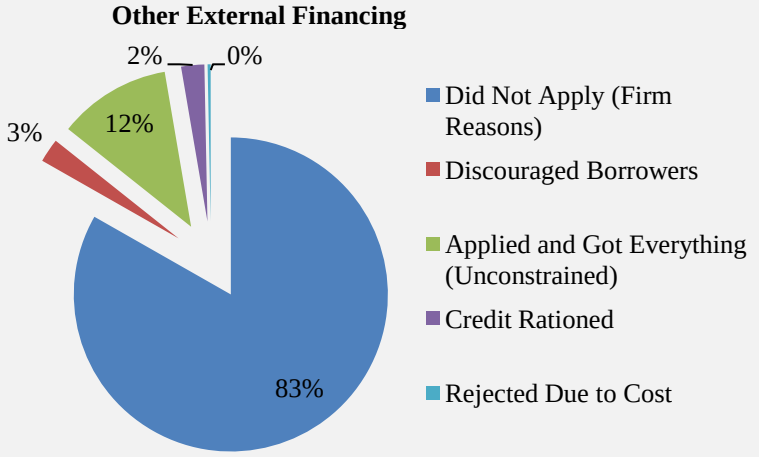


	Did not apply	Applied	Unconstrained	Credit rationed	Discouraged	Rejected due to cost
2011 H1	80%	17%	12%	4%	3%	0%
2013 H1	80%	18%	12%	5%	2%	0%
% Change	0%	1%	0%	1%	-1%	0%

Source: ECB SAFE Data

Figure 1-10 outlines the trends in applications and constraints for other forms of external financing. Other external financing is composed of any non-bank or non-trade credit financing options. 86% of firms on average have not applied for any form of other external financing. Of the 14% who did apply, 12% were successful with only 2% classified as rationed. The number of firms applying for other external financing has increased since the earliest SAFE survey wave while the number of firms who are successful in their applications has also increased by 5%.

Figure 1-10 - Overview Of SME Financing Constraints – Applications And Constraints – All Finance Sources – Eu-28 – Other External Financing

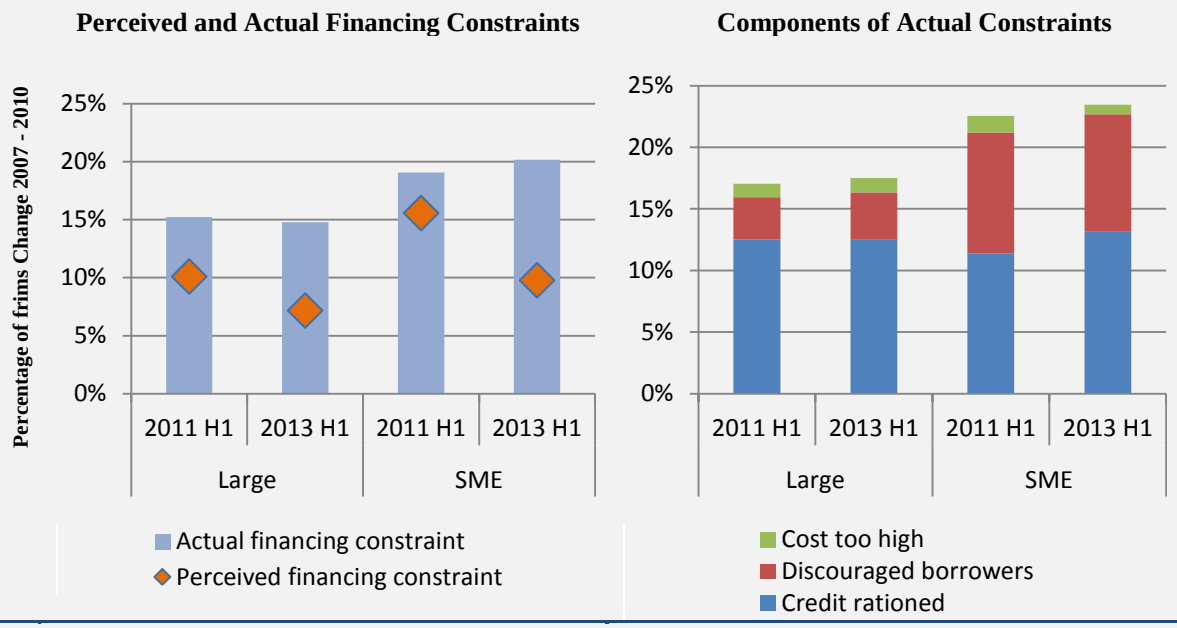


	Did not apply	Applied	Unconstrained	Credit rationed	Discouraged	Rejected due to cost
2011 H1	84%	13%	9%	3%	3%	0%
2013 H1	81%	17%	14%	2%	2%	0%
% Change	-3%	4%	5%	-1%	-1%	0%

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-11 illustrates the breakdown of perceived and actual constraints for the European Union across the earliest and latest waves of the ECB SAFE survey. The definitions of perceived and actual constraints were discussed previously in Table 1-4. Firms who are classed as having perceived constraints list access to finance as the greatest problem their firm faces while the metric for actual constraints takes into account whether or not a firm is credit rationed or discouraged from borrowing during the survey period. For large firms, we observe that actual and perceived constraints have fallen between the survey waves. For SMEs, actual constraints have increased slightly while perceived constraints have declined substantially. The right hand side panel provides a breakdown of the component parts of actual financing constraints faced by firms. The make-up of the actual constraints seem to be stable across the survey waves for both large firms and SMEs. The actual constraints across both large firms and SMEs are primarily made up of credit rationed and discouraged borrowers with those firms rejecting financing due to prohibitive costs being in a small minority across all sectors. Discouragement appears to be a smaller component of overall constraints for large firms than it is for SMEs. For SMEs credit rationed and discouraged borrowers are almost equal in their share of actual constraints.

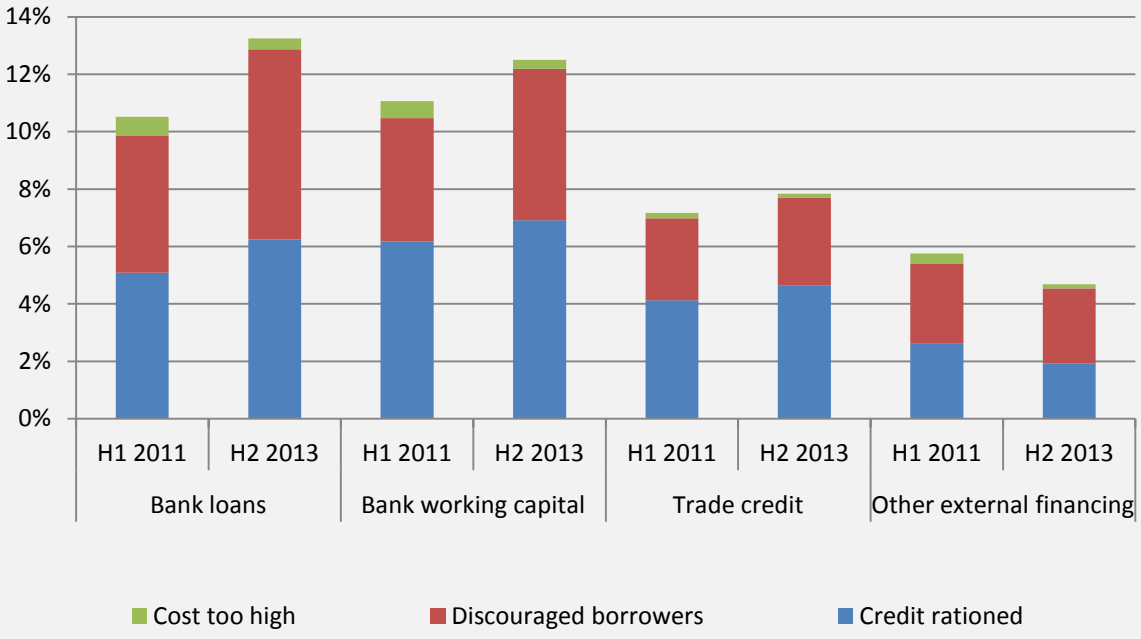
Figure 1-11 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013)



*Note:*Only a subset of European Union members conducted the Access to Finance survey.*

Source: ESRI analysis of Eurostat *Access to Finance data.*

Figure 1-12 Actual Financing Constraints for SMEs by Type of Financing

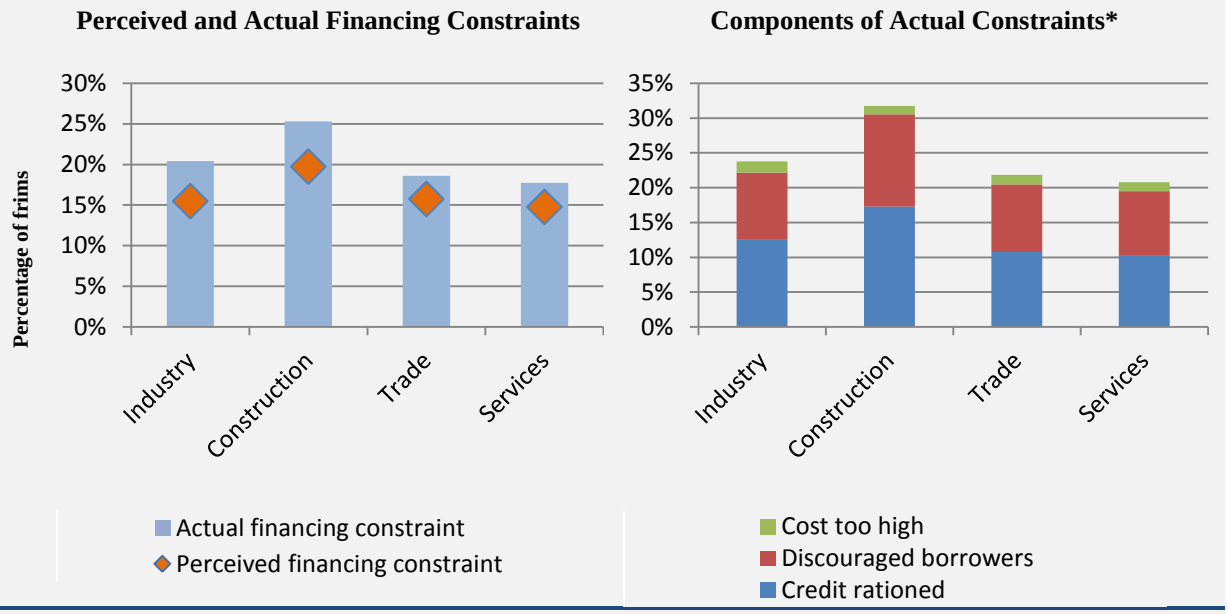


*Note:*Only a subset of European Union members conducted the Access to Finance survey.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-12 provides a breakdown of makeup of the actual financing constraints faced by SMEs and the change in this makeup between 2011 and 2013, by financing type. The constraints associated with bank loans, application for bank working capital and trade credit have all increased between H1 2011 and H2 2013. Constraints on application for other forms of external financing have eased over the same time period.

Figure 1-13 Perceived and Actual Financing Constraints for EU 28 SMEs (H1 2011 & H1 2013) by Sector

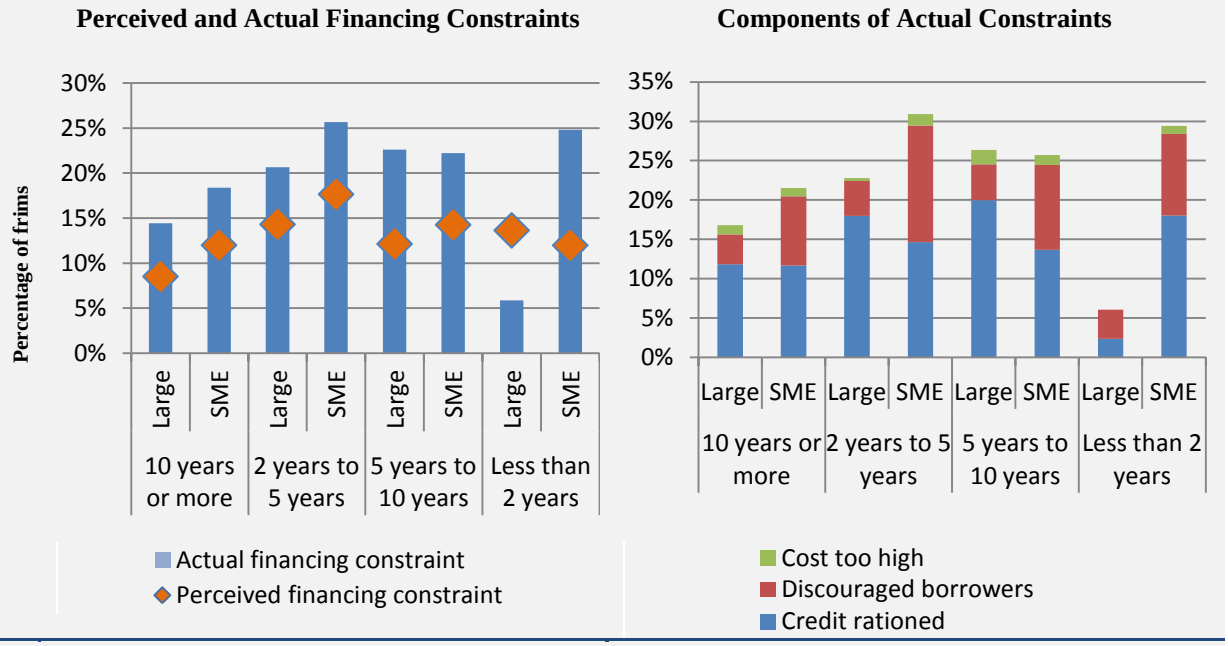


*Note:*Components of Actual financing constraints can sum to greater than the total as firms may be counted in each category depending on their answers relating to differing financing types.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-13 provides a breakdown of perceived and actual financing constraints for SMEs across different sectors, on average, between 2011 and 2013. SMEs in the construction industry display both the highest level of perceived and actual constraints. SMEs in the services sector appear to be the most unconstrained in terms of both actual and perceived constraints. The actual constraints across all sectors are primarily made up of credit rationed and discouraged borrowers with those firms rejecting financing due to prohibitive costs being in a small minority across all sectors.

Figure 1-14 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Firm Age

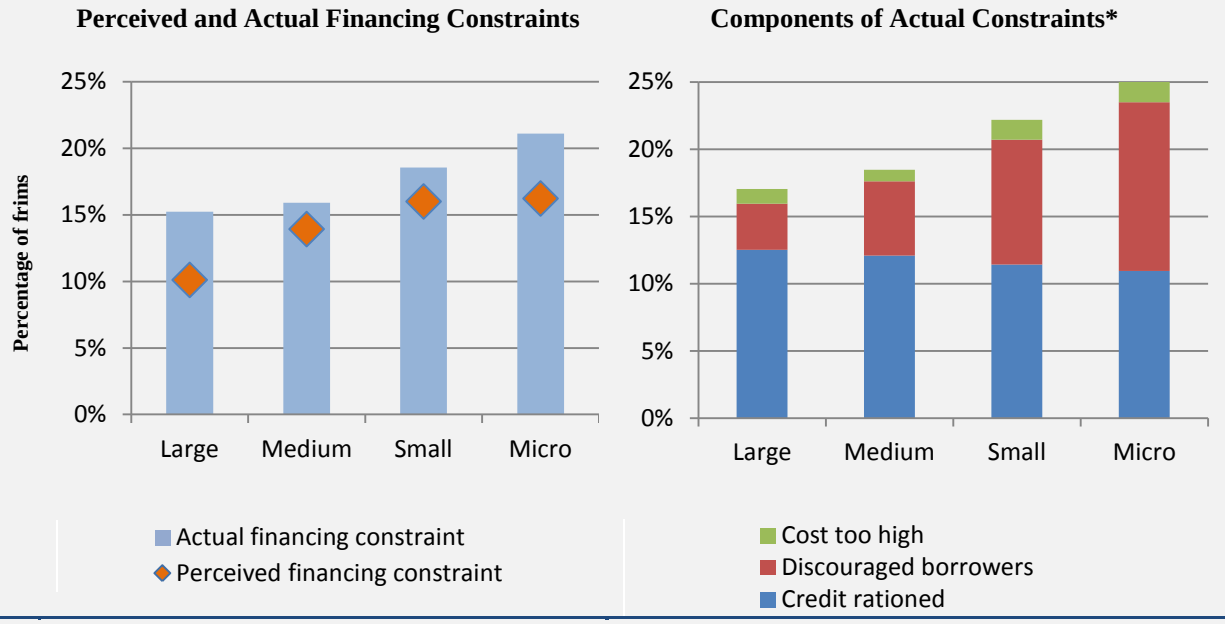


*Note:*Only a subset of European Union members conducted the Access to Finance survey.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-14 provides a breakdown of perceived and actual financing constraints for different age categories and different firm sizes, on average, between 2011 and 2013. Large firms in almost all age categories face lower perceived and actual constraints. The only exception being for firms aged between 5 and 10 years where large firms face slightly higher actual constraints. The most constrained SMEs appear to be those aged between 2 and 5 years while the most constrained large firms appear to be those aged between 5 and 10 years. The anomalous finding that young large firms are less constrained than older large firms is due to a sampling issue. There are very few firms with more than 250 employees who are also less than 2 years old. We can again observe that discouraged borrowers make up a smaller proportion of actual constraints for large firms than SMEs across all age brackets.

Figure 1-15 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Firm Size

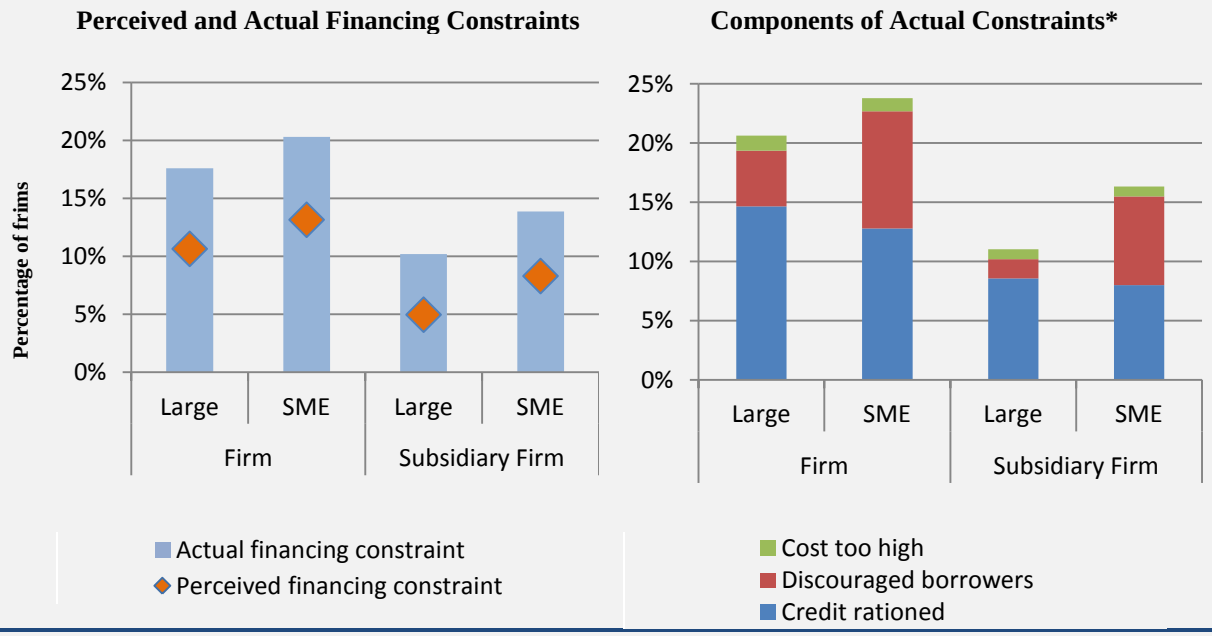


*Note:*Components of Actual financing constraints can sum to greater than the total as firms may be counted in each category depending on their answers relating to differing financing types.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-15 provides a breakdown of perceived and actual financing constraints for SMEs by firm size, on average, between 2011 and 2013. Actual constraints decrease as firm size increases. We observe a similar trend for perceived constraints, although small and micro firms display very similar levels of perceived constraints. We can also observe that discouraged borrowers make up a larger portion of actual constraints for smaller firms than larger firms.

Figure 1-16 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Subsidiary

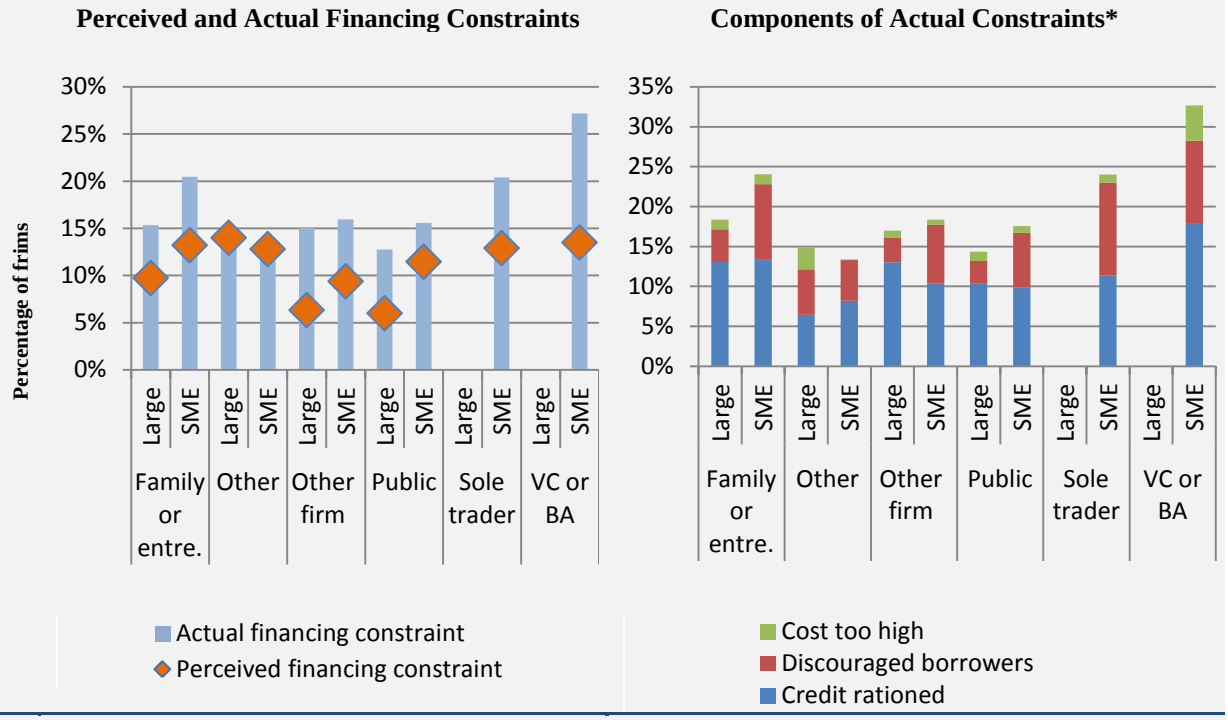


*Note:*Components of Actual financing constraints can sum to greater than the total as firms may be counted in each category depending on their answers relating to differing financing types.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-16 illustrates the different levels of perceived and actual constraints depending on whether the firm is a subsidiary or not and across firm size. Subsidiary firms appear less constrained in terms of both perceived and actual constraints. This is the case for both large firms and for SMEs. Subsidiary firms also appear to have a lower number of discouraged borrowers in their actual constraints makeup.

Figure 1-17 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Ownership

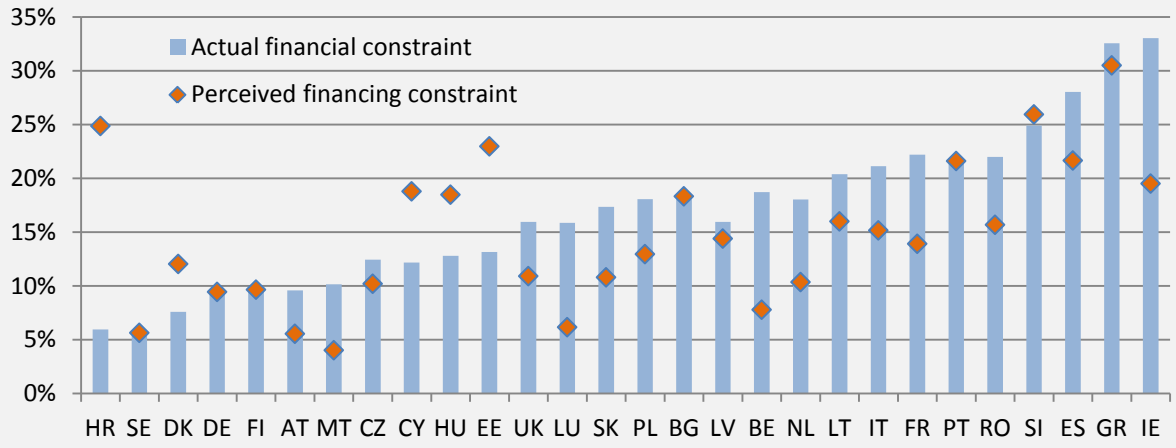


*Note:*Components of Actual financing constraints can sum to greater than the total as firms may be counted in each category depending on their answers relating to differing financing types.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-17 gives a breakdown of perceived and actual financing constraints by firm size and ownership. The firms with the highest levels of actual constraints appear to be those SMEs which operate as sole traders, are family or entrepreneur owned or are owned by venture capital or business angel investment. These firms also display high levels of perceived constraints too. Large firms, across all ownership structures, display lower perceived and actual constraints. Discouraged borrowers appear most numerous in the makeup of actual constraints for sole traders, family owned and venture capital owned SMEs.

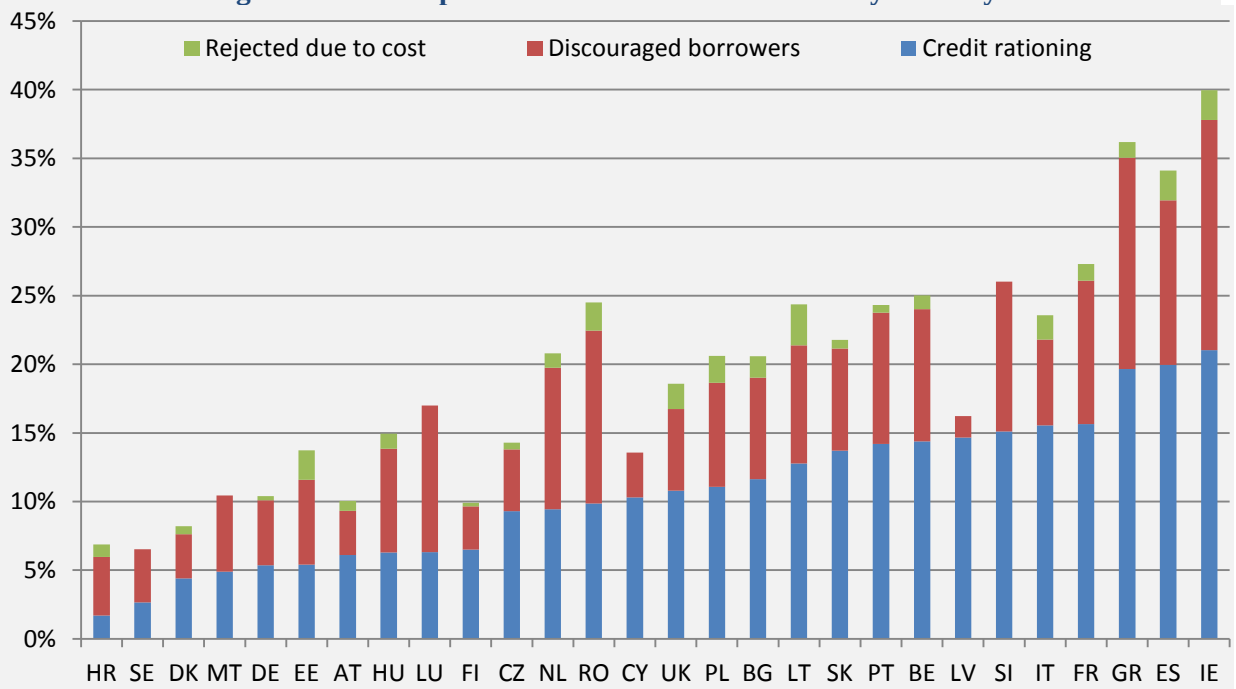
Figure 1-18 - Overview of SME Financing Constraint Indicators – By Country



Source: ECB SAFE Data

Figure 1-18 illustrates the different levels of perceived and actual constraints across the 28 member states of the European Union. Ireland, Greece and Spain display the highest levels of actual constraints. Greece also has the highest levels of perceived constraints. Croatia, Cyprus, Hungary and Estonia display some of the highest levels of perceived constraints despite having substantially lower levels of actual constraints. The least constrained countries in terms of actual constraints include Croatia, Sweden, Denmark and Germany. In terms of perceived constraints, the least constrained countries are Austria, Malta and Sweden.

Figure 1-19 - Components Of Actual Constraints – By Country

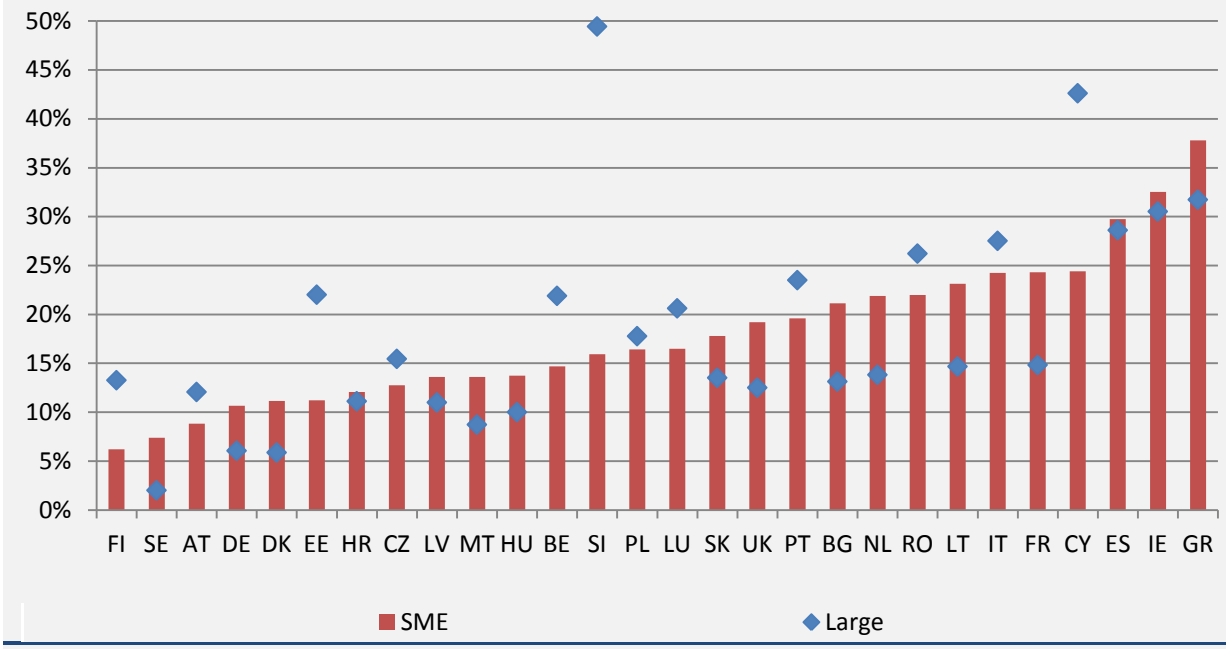


Source: ECB SAFE Data

Figure 1-19 provides a breakdown of the component parts of actual constraints across the member states of the European Union. The highest levels of credit rationing are prevalent in

Ireland, Spain and Greece. These countries also display the highest levels of discouraged borrowers.

Figure 1-20 Actual Financing Constraints for Firms by Country



Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-20 gives a breakdown of the different levels of actual financing constraints faced by SMEs and large firms across the member states of the European Union. For the majority of countries, large firms appear to suffer lower actual credit constraints than SMEs, although this is not the case for several countries, including Austria, Finland and Italy.

Figure 1-21 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Country

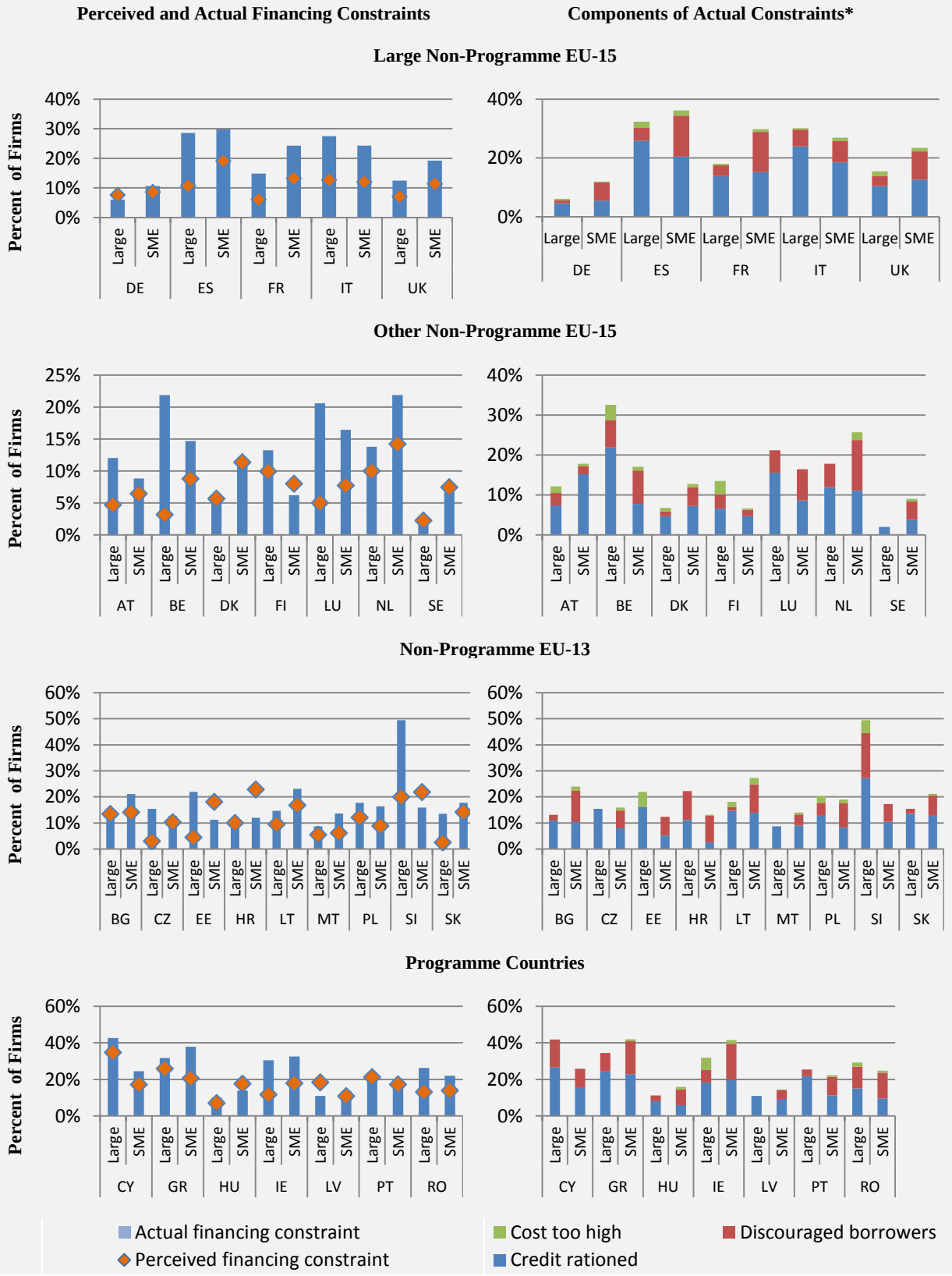
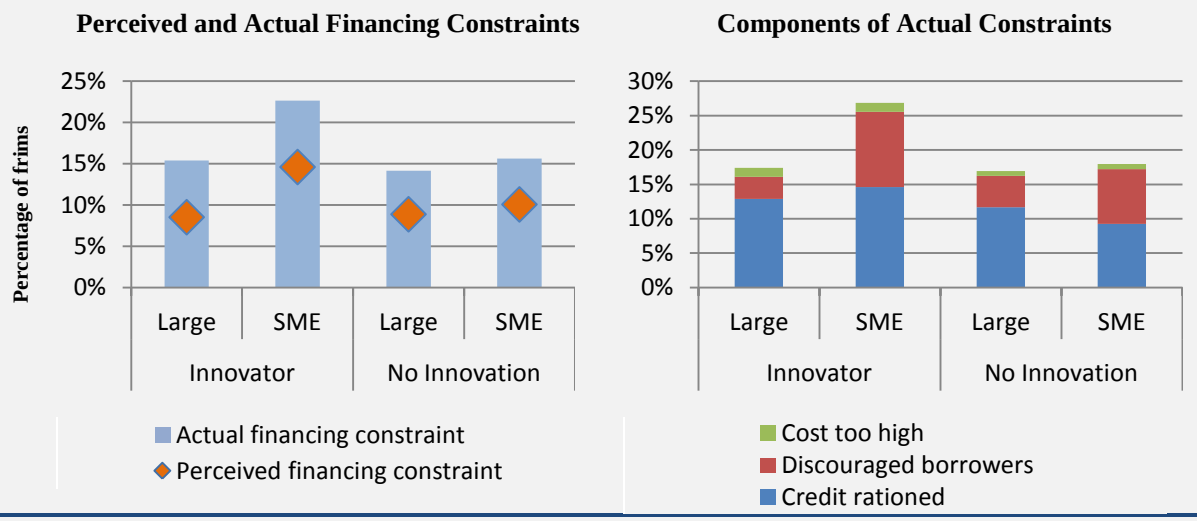


Figure 1-21 provides an illustration of the actual and perceived financing constraints faced by large firms and SMEs across the member states of the European Union and between the first wave of the ECB SAFE Survey in H1 2011 and H2 2013. The right hand side of Figure 1-21 also provides an illustration of the makeup of actual constraints and how they have changed between the survey waves.

Figure 1-22 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Innovating Firms*

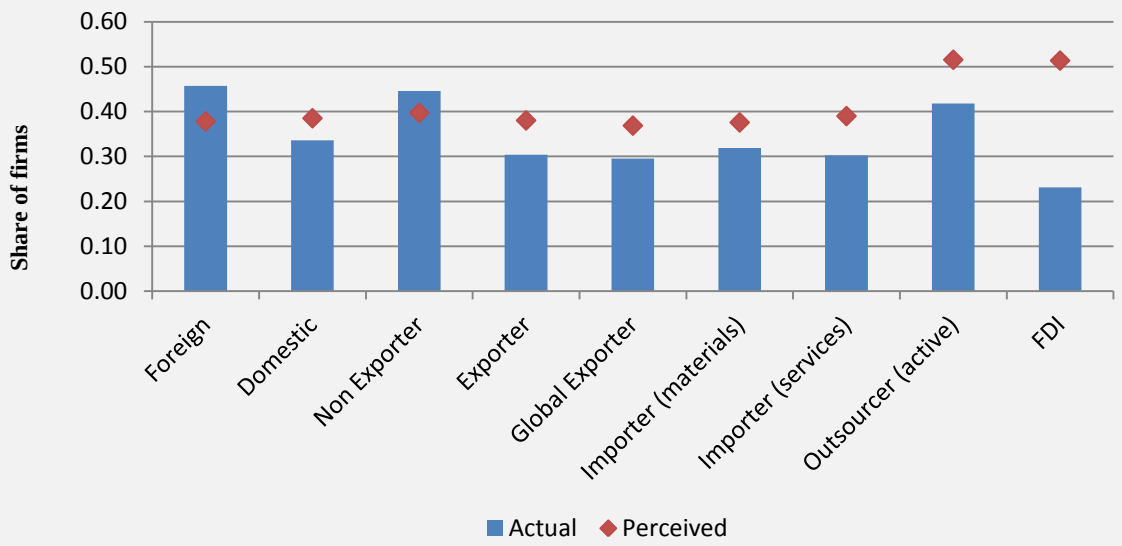


*Note:*Innovation refers to product, process, organisational and sales innovation.*

Source: ESRI analysis of Eurostat Access to Finance data.

Figure 1-22 provides a breakdown of perceived and actual financing constraints across different firm sizes and whether or not the firm is engaged in innovation. For both large firms and SMEs actual constraints are higher for innovating firms. Perceived constraints are more or less the same for large firms whether they are innovating or not while innovating SMEs also face higher perceived constraints.

Figure 1-23 Perceived And Actual Financing Constraints By Internationalisation Activity



Note: Based on sample used in empirical analysis

Source: ESRI analysis of EFIGE dataset

Figure 1-23 shows the level of perceived and actual financing constraints across the different levels of internationalisation activity undertaken by firms. We observe that firms engaged in foreign direct investment display the lowest level of actual constraints while also reporting the joint highest level of perceived constraints. Outsourcing firms, non-exporting firms and foreign owned firms experience the highest levels of actual constraints.

Econometric Estimates

Table 1-5 outlines the coefficients for our models of the determinants of financing constraints across the full EU-28 sample. The first model contains only commonly cited indicators of asymmetric information; size, age, ownership status and sector. This first model examines the extent to which these indicators of asymmetric information are driving financing constraints. The broader model controls for indicators of firm specific risk and firm quality. These indicators include turnover, profitability and credit history. This broader model examines whether the financial market imperfections driven by asymmetric information between the firm and the financial intermediaries persist even when controlling for firm specific risk and quality indicators.

The first model finds that constraints are decreasing with firm size and firm age. There also appears to be increased constraints associated with firms engaged in innovation. These findings hold for the second model in which we control for firm specific risk and quality indicators. These findings imply that financial market imperfections persist for younger and smaller firms even when controlling for the fundamental quality and risk profile of these firms.

As expected, we also find that constraints are decreasing with turnover and profitability. Improvements in a firm's credit history and capital positions also lead to lower financing constraints. We also find that firms classified as operating in the trade sector[11] are less likely to be financially constrained (relative to the base case of the construction sector), controlling for measures of firm performance. Interestingly, we find very little difference in financing constraints across different firm ownership structures in either the narrow or broader models.

[11] Trade includes wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods.

Table 1-5– Determinants Of Financing Constraints - EU-28

	Model with AI Indicators		Broader Model	
Y = 1 if constrained, 0 otherwise	**Perceived Financing Constraints**	**Actual Financing Constraints**	**Perceived Financing Constraints**	**Actual Financing Constraints**
Industry	0.001	-0.042*	0.007	-0.018
Trade	-0.023	-0.098***	-0.018	-0.073***
Services	-0.013	-0.065***	-0.000	-0.037*
Family owned	-0.012	-0.025	-0.014	-0.006
Other firm	-0.039	-0.048	-0.045	-0.025
Venture capital or bus angel	-0.002	0.095	-0.009	0.092
Sole trader	-0.001	0.031	-0.009	0.042
Other owner	-0.014	-0.052	-0.014	-0.057
Age: 5 to 10	0.020	0.032*	0.025	0.041**
Age: 2 to 5	0.052**	0.106***	0.047**	0.117***
Age: less 2 years	-0.035	0.102**	-0.022	0.163***
Small	0.032***	0.056***	0.032***	0.056***
Micro	0.058***	0.156***	0.052***	0.108***
Innovation (Product)	-0.008	0.002	-0.008	0.010
Innovation (Process)	0.012	0.008	0.011	0.017
Innovation (Organisation)	0.043***	0.069***	0.039***	0.064***
Innovation (Sales)	0.040***	0.032**	0.039***	0.025
Subsidiary	-0.074***	-0.021	-0.037*	0.009
Turnover – unchanged			0.012	-0.049**
Turnover – positive			0.047***	-0.063***
Profit – unchanged			0.005	0.004
Profit – positive			-0.024	-0.065***
Credit history - unchanged			-0.102***	-0.170***
Credit history – improved			-0.090***	-0.173***
Firm capital position - unchanged			-0.004	-0.099***
Firm capital position - increased			-0.035*	-0.106***
n	9691	9691	9123	9123
Error correlations (ρ) – p-value	0.000	0.000	0.000	0.000

Notes: reference category for age is firms greater than 20 years of age, for sectors is construction and for size is for medium sized firms.

Source: Author's estimates using ECB SAFE data

Table 1-6 outlines our findings for the determinants of actual financing constraints by constraint type. Controlling for indicators of firm performance and risk, we find that credit rationing is decreasing in firm age and size, is higher for firms engaged in organisational innovation and is decreasing as turnover and profitability rise. The likelihood of being credit rationed also decreases as the firm's credit history and capital position improve. We also find that firms in the trade sector are more likely to be credit rationed. Similarly, firms are less likely to be discouraged borrowers if they are in the trade sector. There is also some evidence that younger firms are more likely to be discouraged borrowers, although this is less evident than for credit rationing. Smaller firms are more likely to be discouraged, as are firms engaged in process or organisational innovation. The likelihood of being credit rationed falls if they firm displays an increase in turnover, the firm's credit history improves or its capital position increases.

Table 1-6 – Determinants Of Actual Financing Constraints By Constraint Type - EU-28

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower	Cost Too High
Industry	-0.018	-0.044*	0.015	0.010
Trade	-0.073***	-0.073***	-0.041**	0.003
Services	-0.037*	-0.059**	0.008	0.002
Family owned	-0.006	-0.015	-0.000	-0.005
Other firm	-0.025	-0.018	-0.007	-0.024
Venture capital or bus angel	0.092	0.103	-0.007	0.074
Sole trader	0.042	0.027	0.033	-0.006
Other owner	-0.057	-0.013	-0.034	-0.032
Age: 5 to 10	0.041**	0.047**	0.019	0.002
Age: 2 to 5	0.117***	0.076***	0.085***	0.016
Age: less 2 years	0.163***	0.185***	-0.003	-0.012
Small	0.056***	-0.012	0.073***	0.013***
Micro	0.108***	-0.008	0.177***	0.030***
Innovation (Product)	0.010	0.013	-0.024*	0.011*
Innovation (Process)	0.017	0.002	0.032**	0.002
Innovation (Organisation)	0.064***	0.057***	0.043***	0.012*
Innovation (Sales)	0.025	0.030*	0.006	-0.011**
Subsidiary	0.009	-0.024	0.028	0.003
Turnover - unchanged	-0.049**	-0.034*	-0.033*	0.003
Turnover - positive	-0.063***	-0.050**	-0.049***	0.009
Profit - unchanged	0.004	0.009	-0.010	0.000
Profit - positive	-0.065***	-0.055***	-0.026	-0.009
Credit history - unchanged	-0.170***	-0.151***	-0.081***	-0.009
Credit history - improved	-0.173***	-0.141***	-0.100***	-0.008
Firm capital position - unchanged	-0.099***	-0.085***	-0.071***	-0.006
Firm capital position - increased	-0.106***	-0.062**	-0.104***	-0.012
n	9123	7060	6970	5183
Error correlations (ρ) – p-value	0.000	0.000	0.000	0.000

Source: Author's estimates using ECB SAFE data

Table 1-7 outlines the results for the models estimating the determinants of financing constraint type for those firms applying for a bank loan. For both perceived and actual

financing constraints when applying for a bank loan, we find the likelihood of being constrained decreases with firm age and firm size and falls as firms' turnover, profitability, credit history and capital position improve. Firms engaged in sales and organisational innovation are also more likely to be subject to perceived and actual financing constraints when applying for bank loans.

Similarly, credit rationing is less likely for older firms, firms with improved credit histories and firms who have experienced an improvement in their capital positions. We also find that family owned firms are less likely to experience credit rationing when applying for a bank loan. We find that firms in the trade sector are more likely to be discouraged when applying for a bank loan. Discouragement is also more likely for younger firms and smaller firms. Firms engaged in organisational innovation are also more likely to be discouraged. Similarly to credit rationing, firms are less likely to be discouraged if the firm's credit history, turnover or capital position has improved.

Table 1-7 - – Determinants Of Actual Financing Constraints By Constraint Type - Bank Loans – EU- 28

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.049	-0.049*	-0.015
Trade	-0.089***	-0.061**	-0.054***
Services	-0.046	-0.040	-0.013
Family owned	-0.050*	-0.081***	-0.017
Other firm	-0.073**	-0.080***	-0.023
Venture capital or bus angel	-0.048	-0.053	-0.008
Sole trader	-0.011	-0.052*	0.012
Other owner	-0.093**	-0.104**	-0.023
Age: 5 to 10	0.031*	0.026*	0.042***
Age: 2 to 5	0.107***	0.051**	0.095***
Age: less 2 years	0.052	0.044	-0.011
Small	0.043***	-0.003	0.058***
Micro	0.088***	-0.007	0.118***
Innovation (Product)	0.017	0.010	-0.007
Innovation (Process)	0.021*	0.006	0.026*
Innovation (Organisation)	0.040**	0.024	0.028***
Innovation (Sales)	0.031***	0.041***	0.002
Subsidiary	-0.003	-0.041***	0.046**
Turnover - unchanged	-0.036**	-0.014	-0.026**
Turnover - positive	-0.033**	-0.010	-0.039***
Profit - unchanged	0.010	0.021	-0.012
Profit - positive	-0.041***	-0.021	-0.015
Credit history - unchanged	-0.127***	-0.103***	-0.050**
Credit history - improved	-0.119***	-0.082***	-0.063***
Firm capital position - unchanged	-0.075***	-0.061***	-0.055***
Firm capital position - increased	-0.085***	-0.049***	-0.089***
n	9808	7445	7017

Source: Author's estimates using ECB SAFE data

Table 1-8 outlines our results for the determinants of financing constraints for firms applying for working capital funding from a bank. We find that both perceived and actual financing constraints when applying for bank working capital financing are more likely for firms in the trade sector, younger firms and smaller firms. Perceived and actual constraints are less likely for those firms which have seen improving turnover, credit history or capital positions. Firms engaged in organisational or sales innovation are also more likely to perceive financial constraints or suffer actual financing constraints when applying for bank working capital financing.

We find that firms are less likely to suffer credit rationing when applying for bank working capital finance in the industry sector, the trade sector and the services sector, all relative to the omitted category of the construction sector.

Table 1-8 - – Determinants Of Financing Constraints By Constraint Type - Bank Working Capital – EU - 28

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.013	-0.045**	0.028**
Trade	-0.051***	-0.050***	-0.024**
Services	-0.013	-0.037**	0.024**
Family owned	0.007	-0.011	0.005
Other firm	-0.010	-0.013	-0.013
Venture capital or bus angel	0.045	0.050	-0.028
Sole trader	0.020	-0.008	0.028
Other owner	-0.058	-0.045	-0.034
Age: 5 to 10	0.002	0.018	0.002
Age: 2 to 5	0.088***	0.064***	0.056**
Age: less 2 years	0.104*	0.114*	-0.000
Small	0.037**	0.007	0.038***
Micro	0.099***	0.016	0.120***
Innovation (Product)	-0.004	0.004	-0.022*
Innovation (Process)	0.001	-0.005	0.017
Innovation (Organisation)	0.051***	0.041**	0.028**
Innovation (Sales)	0.029***	0.036***	0.004
Subsidiary	0.014	-0.006	0.021
Turnover - unchanged	-0.045**	-0.024	-0.023
Turnover - positive	-0.046***	-0.025*	-0.035**
Profit - unchanged	-0.016	0.007	-0.024
Profit - positive	-0.029*	-0.021	-0.024
Credit history - unchanged	-0.144***	-0.113***	-0.057***
Credit history - improved	-0.151***	-0.103***	-0.076***
Firm capital position - unchanged	-0.058**	-0.064**	-0.030*
Firm capital position - increased	-0.080***	-0.058**	-0.059***
n	9801	7413	7027

Source: Author's estimates using ECB SAFE data

Table 1-9 outlines our results for the determinants of financing constraints for firms that apply for trade credit. We find that credit rationing and both perceived and actual financing constraints are more likely when applying for trade credit for firms aged between 2 and 5, family owned firms, sole traders, firms owned by venture capital and business angels and firms undertaking organisation innovation. Perceived and actual constraints are less likely for those firms that have seen turnover, credit history or capital positions remain the same or improve. Discouragement from applying for trade credit is more likely for micro and small firms and for firms engaged in organisational, process, or sales innovation. It is less likely for those firms which have positive profit or improved credit history in the last period.

Table 1-9 - Trade credit – Determinants Of Financing Constraints By Constraint Type – EU 28

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.016	-0.010	0.010
Trade	-0.024	-0.022*	0.002
Services	-0.006	0.004	-0.001
Family owned	0.033**	0.009	0.018
Other firm	0.021	0.001	0.018
Venture capital or bus angel	0.098**	0.121***	-0.007
Sole trader	0.041**	0.008	0.030
Other owner	0.025	0.009	0.017
Age: 5 to 10	0.010	0.012	0.012
Age: 2 to 5	0.043**	0.037***	0.024
Age: less 2 years	-0.002	0.019	-0.026
Small	0.002	-0.025**	0.028***
Micro	0.028	-0.038***	0.073***
Innovation (Product)	0.011	0.012	-0.016**
Innovation (Process)	0.023	-0.003	0.033***
Innovation (Organisation)	0.035**	0.026*	0.015**
Innovation (Sales)	0.010	0.009	0.014*
Subsidiary	0.027**	-0.007	0.030**
Turnover - unchanged	-0.031***	-0.026**	0.000
Turnover - positive	-0.027***	-0.022**	-0.007
Profit - unchanged	-0.019	-0.013	-0.011
Profit - positive	-0.047***	-0.035***	-0.018*
Credit history - unchanged	-0.064***	-0.043***	-0.028
Credit history - improved	-0.089***	-0.041***	-0.056***
Firm capital position - unchanged	-0.023**	-0.023*	-0.014
Firm capital position - increased	-0.033**	-0.016	-0.026*
n	9768	7405	6941

Source: Author's estimates using ECB SAFE data

Table 1-10 outlines our results for the determinants of financing constraints for firms that apply for other types of external financing. Both perceived and actual financing constraints in relation to accessing other external financing sources are more likely for micro firms, firms aged between 2 and 5, sole traders, and firms engaged in organisational, process, or sales innovation.

Perceived and actual constraints are less likely for those firms that have seen positive turnover growth, stable or improved credit history or improved financial capital position. We find that discouragement amongst potential borrowers of other types of external financing is more likely for small and micro firms and for firms engaged in organisational or process innovation. The effect is particularly strong for micro firms. It is less likely for those firms that had positive profit, stable or improved credit history, or an improved financial capital position.

Table 1-10 – Determinants Of Actual Financing Constraints By Constraint Type - Other External Financing – EU 28

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	0.007	0.015*	-0.003
Trade	-0.007	-0.003	-0.004
Services	-0.006	0.004	-0.001
Family owned	0.030	0.005	0.020
Other firm	0.009	-0.009	0.013
Venture capital or bus angel	0.059	0.030	0.022
Sole trader	0.032*	0.005	0.028
Other owner	0.002	-0.012	0.019
Age: 5 to 10	0.006	0.022***	-0.001
Age: 2 to 5	0.041***	0.016	0.030**
Age: less 2 years	0.022	0.028	-0.021
Small	0.012	0.000	0.016**
Micro	0.027**	-0.017**	0.053***
Innovation (Product)	-0.006	0.001	-0.016**
Innovation (Process)	0.023**	0.011	0.030***
Innovation (Organisation)	0.031**	0.014*	0.013*
Innovation (Sales)	0.025*	0.014	0.015
Subsidiary	0.025*	0.014	0.015
Turnover - unchanged	-0.015	0.005	-0.011
Turnover - positive	-0.025***	0.001	-0.022***
Profit - unchanged	0.007	0.009	-0.009
Profit - positive	-0.008	-0.002	-0.016
Credit history - unchanged	-0.059***	-0.036***	-0.027*
Credit history - improved	-0.067***	-0.032***	-0.054***
Firm capital position - unchanged	-0.042***	-0.017	-0.021**
Firm capital position - increased	-0.043***	-0.014	-0.019*
n	9750	7363	6864

Source: Author's estimates using ECB SAFE data

Econometric Estimates – EFIGE Sample

The econometric estimates of the determinants of constraints using the EFIGE sample are presented in Table 1-11. A number of important findings emerge.

Small firms (between 10 and 49 employees) perceived themselves to be more constrained than large firms. Product innovators and firms in industries which have a high dependence on external finance also perceived themselves to be financially constrained.

The trading status of the enterprises seems to have a considerable effect on actual and perceived constraints. Given the differential capital requirements for firms in traded and non-traded sectors, this is expected. Specifically, we find that importers were associated with lower perceived financial constraints while firms with foreign direct investment abroad and active international outsourcers were more likely to perceive financial constraints to be binding. Exporters were less likely face actual financing constraints. Firms which exported to more destinations were less likely to be credit rationed. Furthermore, firms which exported to the EU and beyond were less likely to be credit rationed than those who exported to the EU only.

In terms of the enterprises' financial characteristics, more indebted firms are more likely to face actual financing constraints. If existing leverage ratios are elevated, this may deter financial institutions from providing additional finance and be an impediment to firm credit access while firms which had higher liquidity ratios were less likely to be credit constrained. Firms in industries which have a high dependence on external finance were more likely to be credit rationed.

Table 1-11 Determinants of Financing Constraints – Probit Analysis- EFIGE sample

	Perceived constraints			Actual constraints		
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic owned	0.028	0.026	0.028	-0.093	-0.148	-0.087
	(0.046)	(0.048)	(0.047)	(0.088)	(0.091)	(0.087)
Size (10-49 employees)	0.084**	0.072*	0.090**	-0.031	-0.032	-0.041
	(0.038)	(0.041)	(0.038)	(0.054)	(0.057)	(0.056)
Age (0-6 years)	-0.024	-0.030	-0.032	-0.052	-0.042	-0.053
	(0.027)	(0.029)	(0.028)	(0.037)	(0.039)	(0.037)
Family managed	-0.030	-0.030	-0.030	-0.039	-0.020	-0.030
	(0.029)	(0.030)	(0.029)	(0.039)	(0.042)	(0.040)
Industry external financing dependence	0.051*	0.059**	0.056**	0.062*	0.065*	0.054
	(0.027)	(0.029)	(0.028)	(0.033)	(0.035)	(0.034)
Product innovator	0.054**	0.047*	0.048*	-0.039	-0.033	-0.033
	(0.026)	(0.028)	(0.027)	(0.033)	(0.036)	(0.034)
Process innovator	0.004	0.009	0.011	-0.057*	-0.053	-0.058*
	(0.025)	(0.026)	(0.025)	(0.033)	(0.035)	(0.034)
Sales growth	0.008	-0.006	-0.003	-0.067	-0.068	-0.063
	(0.054)	(0.055)	(0.054)	(0.064)	(0.065)	(0.064)
Tangible assets	-0.014	-0.009	-0.011	0.000	0.004	-0.001
	(0.010)	(0.011)	(0.011)	(0.014)	(0.015)	(0.014)
Leverage ratio	0.145	0.207*	0.149	0.314**	0.245*	0.282**
	(0.101)	(0.107)	(0.103)	(0.122)	(0.136)	(0.123)
Profitability	-0.286	-0.318	-0.189	0.030	0.125	0.027
	(0.360)	(0.386)	(0.363)	(0.518)	(0.587)	(0.527)
Liquidity ratio	-0.061	-0.040	-0.056	-0.115**	-0.115*	-0.104*
	(0.038)	(0.041)	(0.039)	(0.055)	(0.060)	(0.056)
Cash flow/total assets	-0.105	-0.109	-0.137	-0.144	-0.175	-0.164
	(0.149)	(0.156)	(0.151)	(0.191)	(0.209)	(0.193)
Bank relationship (7-19 years)	-0.040	-0.047	-0.035	-0.039	-0.029	-0.043
	(0.031)	(0.033)	(0.032)	(0.039)	(0.041)	(0.040)
Bank relationship (20 years +)	-0.030	-0.025	-0.021	-0.066	-0.053	-0.072
	(0.034)	(0.036)	(0.034)	(0.046)	(0.049)	(0.047)
Foreign bank	-0.031	-0.027	-0.031	0.094	0.111*	0.097
	(0.036)	(0.038)	(0.036)	(0.058)	(0.060)	(0.059)
Number of banks	0.011**	0.010*	0.010*	-0.009	-0.002	-0.010
	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Shane bank debt at main bank	-0.000	-0.000	-0.000	-0.001	-0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Benefited from financial incentives	0.036	0.048	0.044	-0.065*	-0.062	-0.059
	(0.031)	(0.034)	(0.032)	(0.039)	(0.042)	(0.040)
Benefited from tax incentives	0.016	0.013	0.018	-0.123***	-0.128***	-0.123***
	(0.029)	(0.031)	(0.030)	(0.036)	(0.038)	(0.037)
Importer	-0.052*	-0.055*	-0.050*	0.047	0.079**	0.064*
	(0.027)	(0.029)	(0.027)	(0.035)	(0.038)	(0.036)
FDI	0.137**	0.115*	0.132**	-0.070	-0.087	-0.074
	(0.063)	(0.064)	(0.064)	(0.076)	(0.076)	(0.076)
Active international outsourcer	0.131**	0.143**	0.146**	-0.045	-0.042	-0.036
	(0.058)	(0.060)	(0.058)	(0.090)	(0.097)	(0.100)
Exporter	0.005			-0.063*		
	(0.029)			(0.037)		
Exported to one destination		0.066			0.014	
		(0.055)			(0.074)	
Exported to more than one destination		0.001			-0.133***	
		(0.033)			(0.043)	
Exported to EU countries only			-0.019			-0.055
			(0.040)			(0.051)
Exported to EU and non EU countries			0.015			-0.072*
			(0.030)			(0.040)
N	1639	1477	1593	768	691	739
Pseudo R2	0.08	0.0797	0.1198	0.1269	0.1293	0.1276

Source: Authors' analysis of EFIGE data

Conclusions and Policy Implications

Our investigation of the nature and extent of financing constraints in the European Union focuses on both actual and perceived constraints. Actual financial constraints are made up of credit rationed firms (rejected borrowers), discouraged borrowers (did not apply due to possible rejection) and firms that rejected the offer as the cost was too high. A number of findings emerge from our analysis:

- We find that actual constraints are higher than perceived constraints both in the Eurozone and in the wider EU-28. Both actual and perceived constraints are higher for small and micro firms with actual constraints decreasing with firm age. These findings hold ever when we control for demand related factors such as turnover, and profitability and indicators of firm financial health.
- There is evidence that firms conducting organisational innovation facing higher actual financing constraints, however, this result must not be interpreted as causal.
- Focusing on actual constraints, we find variation by industry. Firms in the construction sector are the most constrained with trade and service firms facing lower constraints. We also find that firms in industries dependent on external financing are more likely to face financing constraints.
- Delving below aggregate actual constraints, we find credit rationed firms make up the largest group of these firms. This is followed closely by discouraged borrowers with firms believing the cost to be too high a small proportion of the constrained category. These findings point to the fact that supply constraints in Europe are volume, not pricing based.
- We find that industry, trade and service firms are less credit rationed that firms in the construction sector, however only traded firms are less discouraged than firms in construction. This suggests that borrower discouragement is more widespread.
- There is very little variation across firm ownership when demand factors are controlled for. There is some evidence that VC or BA owned firms are more credit rationed. This may however reflect borrower specific risk.
- For firms that are credit rationed and discouraged, constraints decrease considerably with age, with the exception of firms aged less than 2 which are less likely to be discouraged.
- For credit rationed firms, there are no apparent differences between medium, small and micro firms. It is only for discouraged borrowers that a size effect exists.
- There is evidence that firms engage in organisational innovation face higher credit rationing, discouragement and higher costs. Process innovators also seem to be more discouraged.
- Focusing on financing by source, we consider constraints for bank loans, bank working capital facilities, trade credit and other external financing separately.
- For bank loans and bank working capital facilities, we find that constraints decrease with firm age. However, there is no evidence of credit rationing or borrower discouragement for bank loan constraints for the youngest firms, aged 2 or less. This effect is evident for credit rationed firms applying for bank working capital applications.
- For discouraged borrowers, applying for bank loans and bank working capital facilities, constraints decrease with age and size. However, there is no credit rationing differences between medium, small and micro firms in relation to bank constraints (both loans and working capital)..
- Organisational innovators are associated with higher constraints on bank working capital facilities.

- In relation to trade credit facilities, rationing is actually lower for micro firms while discouragement increases as firm size declines. There is no general effect of firm age, however, firms age 2-5 are more likely to be rationed and discouraged. In the Eurozone sample, all ownership groups are more constrained for trade credit applications than publicly listed firms.
- In relation to other external financing constraints, credit rationing is actually lower for micro and small firms, while discouragement is higher for these firm groups.

Chapter 2. Access to External Financing and Firm Growth

This chapter outlines the results of our analysis of the affect of financing constraints on firm investment decisions, employment levels and productivity growth. Section 2.1 outlines the results for the models analysing firm investment decisions, section 2.2 contains the results for the analysis of financing constraints and employment while section 2.3 discusses the impact of financial constraints and productivity growth for European firms.

Key Questions

For each section, the key questions the analysis seeks to address are:

- How do financing constraints affect firm outcomes (investment decisions / employment levels / productivity growth)?
- Are there differential effects of financing constraints on firm outcomes for different groups of firms?
- Are there differential effects of financing constraints on firm outcomes for different groups of industries?
- Has the financial crisis had an effect on the impact of financing constraints on firm outcomes?

Key Findings

Investment

Financing constraints are found to effect investment in tangible assets for European firms; however they are only binding since the onset of the financial crisis in 2008. Such constraints are larger for domestic SMEs, micro-sized firms, and firms in high-tech knowledge intensive service sectors. Long term debt financing also has a strong impact on investment suggesting that external finance dependence is important. The sensitivity of investment to long term credit flows is higher for young and micro-sized firms. In general the effect of external credit flows on investment is decreasing with firm age and size. We find evidence that short term debt financing facilities are linked to investment for young firms. Short term funding facilities are not necessarily the correct financial instrument with which to cover long-term investment programmes with payback periods outside the maturity of the credit facility. If young firms are unable to convince financial institutions to provide longer maturities, due to a lack of collateral, track record or increased risk, this may have consequences for their growth potential and chances of survival.

Employment

We find significant effects of financial factors on employment over and above other determinants and control variables, including structural firm characteristics, output demand, as well as industry- and country- specific cyclical factors. Greater trade credit had a positive effect on labour demand for high-tech manufacturing, other services and other manufacturing in the pre- and post-financial crisis periods.

Productivity

We find that productivity growth is positively related to a firm's internal cash flow in all firm types, sectors and country groups. This finding implies that productivity growth is responsive to shocks to a firm's internal cash flow. Ideally, this would not be the case in a well functioning financial market as financial intermediaries should provide firms with the

necessary external funding to undertake projects with an expected positive impact on total factor productivity growth. This finding suggests that financial constraints are having a negative impact on productivity growth for European SMEs. The financial crisis exacerbated this effect for cash flow on productivity growth for young firms, firms in the construction sector and firms in the high-tech manufacturing sector.

2.1 Financing Constraints and Investment

Key Questions

- How do financial constraints impact on investment decisions?
- Are there differential effects of financing constraints on investment decisions for different groups of firms or industries?
- Has the financial crisis altered the effect of access to finance on investment?

Key Findings

- We find that the fundamental variables such as investment profitability and return on capital are statistically significant and positively related to investment.
- We also find a negative and significant effect of the crisis dummy over and above controlling for demand factors and financial factors. The coefficient value indicates that investment is 4 per cent lower than can be predicted by the model. General economic uncertainty and the inability to accurately evaluate investment opportunities in a period of heightened economic and financial instability could be contributing to this finding.
- We find investment is sensitive to cash flow. However, this sensitivity is only significant in the post crisis period suggesting firms currently face financing constraints that were not present before the onset of the crisis. These results suggest that capital market imperfections exist currently for European firms and such imperfections have heightened considerably since the crisis.
- Our analysis indicates that net external credit flows, in particular those of long term maturity, are very important drivers of investment activity. For the overall sample, a one percent increase in long net external credit flows increases investment by 0.14 per cent. The sensitivity is much higher for young firms (0.4 per cent) and micro-sized firms (0.18 per cent). This suggests that external finance dependence is a factor in driving investment for all firms and that young and micro-sized firms are very sensitive to the availability of such credit flows. In general the effect of external credit flows on investment is decreasing with firm age and size.
- We find very little evidence that trade credit flows affect tangible investment in either the pre- or post-crisis periods. This suggests that European firms do not use trade credit facilities to finance long-term capital investment activities. This is unsurprising given the maturity mismatch inherent between long-term capital spending and mainly short-term accounts payable and receivable management.
- The analysis also indicates that short-term credit flows are important for funding investment, in particular for young firms before the crisis. Short-term funding facilities are not necessarily the correct financial instrument with which to cover long-term investment programmes with payback periods outside the maturity of the credit facility. If young firms are unable to convince financial institutions to provide longer maturities, due to a lack of collateral, track record or increased risk, this may have consequences for their growth potential and chances of survival.
- Regarding the sectoral distribution of effects, we find a positive and significant effect of cash flow on investment for all sectors except high-tech manufacturing. The coefficient is largest for the high-tech knowledge-intensive services firms. This indicates that these firms are most reliant on internal finance, and potentially have greater difficulties in accessing external credit. In this case, policy measures that provide risk management support or guarantees for such firms could potentially reduce the financing constraints they face.

- In relation to external credit flows, for the overall sample, long-term financing has an impact on investment for firms in all sectors except other services. However, since the crisis, the average effect of long-term credit flows is positive and significant for high-tech firms (both services and manufacturing) and other service firms.

Introduction

Fixed capital expenditure by firms is one of the single most important drivers of economic growth. Investment in productivity-enhancing inputs facilitates efficiency gains and directly enhances the productive capacity of the economy. In Europe, fixed investment (including investment in machinery and equipment, construction and buildings, and other physical capital) accounts for approximately one fifth of total GDP (EIB, 2013).

Since the initial financial crisis in Europe in 2008/2009, there has been a considerable fall in investment levels across the European Union. Following the crisis, the peak-to-trough fall in business investment ranged from 59% in Greece to 2% in Poland, with the decline more pronounced in countries suffering from banking, currency crises, or sovereign debt crises. In many member states, investment levels have rebounded somewhat but remain at levels much below pre-crises trends.

Diagnosing the factors that have driven these dynamics is important for the medium-term prospects of the European economy. A critical element in such analysis is disentangling investment demand factors from supply-side constraints such as access to finance, labour quality and regulatory burdens. In countries which experienced housing or credit booms prior to the onset of the crises, some of the investment declines are most likely due to the required realignment of industrial structures away from construction and the reallocation of capital across the economy. However, general uncertainty about macroeconomic developments, sovereign risk and the buoyancy of domestic and international markets has weighted heavily on firm's investment plans (EIB, 2013). In addition, given the large increase in corporate indebtedness prior to the crises, the overhang effect could limit the ability of firms to undertake new investment. Recent research by the ECB highlights that firms with higher levels of debt reduce investment more than lower debt firms, which represents a challenge to medium-term investment prospects (ECB, 2013).

Within this context, and focusing on supply-side considerations, the nature and scale of the banking crises in Europe, and the ensuing sovereign debt crises in specific EU member states, has led to a renewed focus on access to finance for firms and the functioning of the financial sector. In intermediating finance between savers and borrowers, the financial sector plays a critical role in allocating investment across enterprises and industries in the economy. In this context, researchers and policymakers have long focused on the financing of such investments and the degree to which capital markets may contain imperfections that prevent firms from undertaking profitable investments. Such imperfections can be structural in many cases and exist across the economic cycle. However, the recent crisis has led to considerable reductions in the supply of traditionally-intermediated bank credit, the main source of external finance for European enterprises. This crisis-specific effect may have exacerbated existing capital market imperfections and increased the overall level of investment financing constraints. Coupled with the regulatory changes to asset risk weights for firm debt under the Basel III framework, the supply of finance for non-financial corporates, and SMEs in particular, has tightened considerably.

In this context, how firms finance capital investments and how they manage their dependence on external finance will be important factors in how aggregate investment trends develop. In this section, we aim to test how capital market imperfections affect investment decisions

across firms in the EU and how these dynamics have changed since the onset of the financial crisis.

Specifically, we ask: How are firm's investment decisions affected by external financial dependence and access to finance? To what degree are these effects structural? How have they changed since the onset of the financial crisis? How does the effect of financing constraints on investment differ across types of firms and industries? How does the external finance dependence effect investment across firm sources of external financing?

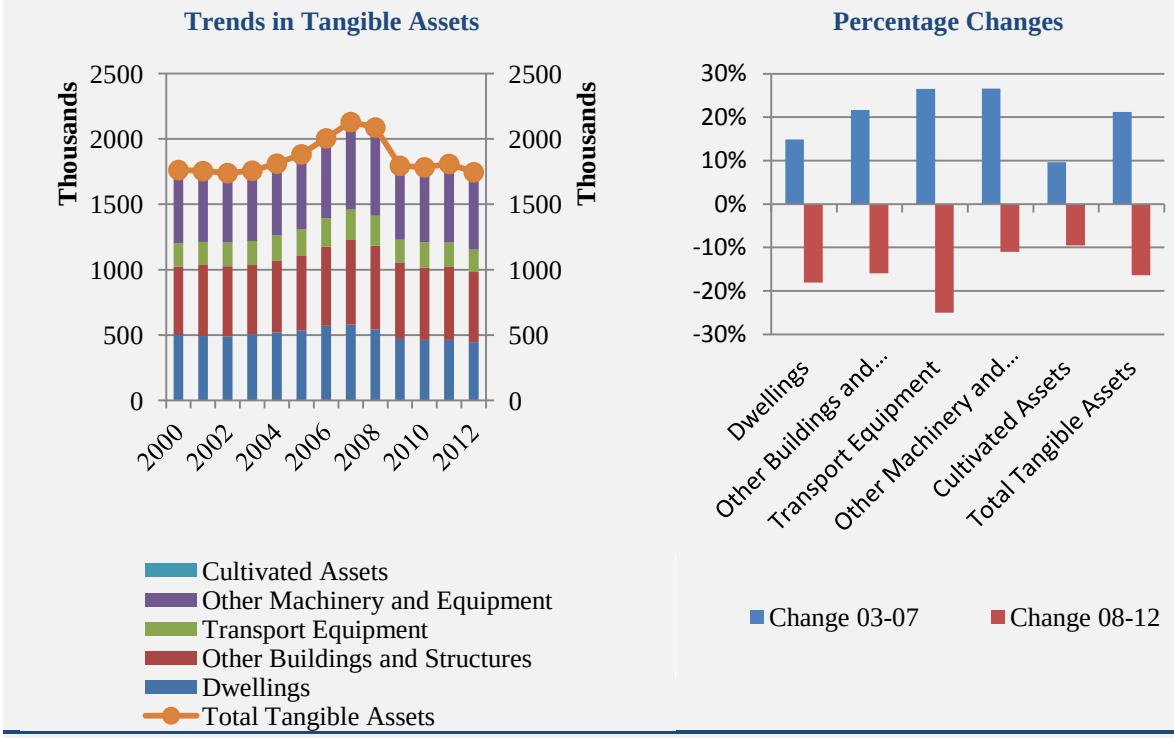
The rest of this section is structured as follows: section 2.2.2 outlines the theoretical and empirical literature on capital market imperfections and investment. Section 2.2.3 presents our empirical methodology. Section 2.2.4 provides an overview of the data and presents some summary statistics. Section 2.2.5

Motivation and Summary Data

Background and Motivation

Before discussing the specific dataset which we use to test our research hypotheses, it is informative to review developments in capital formation in Europe using aggregate data. Eurostat data on investment by asset type is presented in Figure 2-1 below. Tangible investment includes spending on new capital inputs such as machinery and equipment, buildings and structures, transport equipment, other machinery and equipment, and cultivated assets.Total investment in tangible assets increased by 21 per cent in the period 2003 to 2007 but has fallen back by 16 per cent since the onset of the crisis. In fact, a considerable drop in investment across all asset types is evidence following the financial crisis. The effect is particularly large in transport equipment and dwellings investment which have fallen by 25 and 18 per cent respectively.

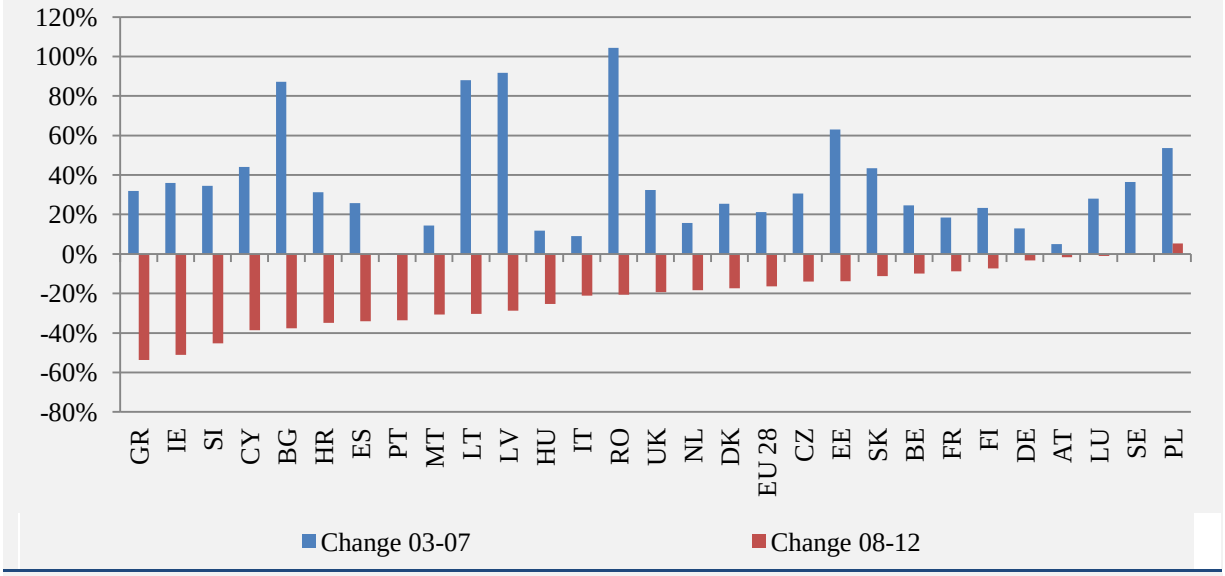
Figure 2-1 Overview of Trends in Tangible Assets – EU 28 2000-2012



Source: ESRI analysis of Eurostat data.

There are large falls across investment asset types. However, given the elevated pre-crisis investment levels, some retrenchment in capital spending was inevitable. As considerable capacity and infrastructures were put in place, firms do not require additional capital inputs to increase production. As the severity of the financial crisis, as well as the strength of the pre-crisis boom phase differed considerably across member states, it is pertinent to consider the changes by country. These are presented in Figure 2-2. It can be seen that in countries which have been particularly hard hit by banking and sovereign debt crises, such as Greece, Ireland, and Cyprus, there have been very large falls in investment levels. From the perspective of disentangling the role of financial markets in driving the investment falls, our interest lies in testing to what extend such dramatic declines have been due to economic realignment and a poor macroeconomic outlook or whether a portion is due to a lack of available financing.

Figure 2-2 Changes in Tangible Investment – EU 28 2003-2012



Source: ESRI analysis of Eurostat data.
Notes: From the data used in Eurostat, Latvia and Croatia did not have reported values for intangible assets so it was not possible to remove this from total fixed assets. For Bulgaria and Romania, missing data for intangible investment for 2011 and 2012 was approximated using a four year average value then removed from total fixed assets to provide values for tangible fixed assets.

There is an extensive international literature that highlights the effect of financial market imperfections on firm investment (see Chirinko (1993); Hubbard (1998) and Guariglia (2008) for reviews). In a standard neoclassical model with no financial frictions, firms increase their capital stock up to the point at which the marginal benefit of an extra unit of capital is equal to its marginal cost. In this framework, the seminal work of Mogiliani-Miller suggests that without such frictions, firms should be ambivalent as to which sources they use to develop their capital structure.

However, when firms are faced with imperfections in capital markets, or if transactions costs are considerable, this drives a wedge between the internal and external cost of financing and thus raises the level to which new projects must be profitable before they can be undertaken. In extreme cases, such as the well known Stiglitz and Weiss (1981) model, external financing providers may completely ration credit and the firm can only invest until internal funds are depleted. It is this rationale that provides the basis for the extensive empirical literature that attempts to test the relationship between investment and external funds.

While the issue of financing constraints and investment is a long standing one in the academic literature, the recent financial crisis has refocused the debate on investment financing and brought access to finance concerns back onto the mainstream policy debate, as noted by Kashyap and Zingales (2010). New research has focused on testing the effect of the financial crisis on corporate investment financing. Campello, Graham, and Harvey (2010) use survey data from 1,050 Chief Financial Officers in the U.S., Europe, and Asia to directly assess the effect of credit constraints during the financial crisis. They find that constrained firms planned deeper cuts in tech spending, employment and capital spending while also burning more quickly through cash stocks. Moreover, they find that an inability to borrow caused US firms to bypass attractive investment opportunities.

Duchin, Ozbas and Sensoy (2010) test the effect of the recent financial crisis on investment by corporates. Their methodological approach controls for firm-level characteristics and time-varying shocks. They find that the fall was greatest for firms that have low cash reserves

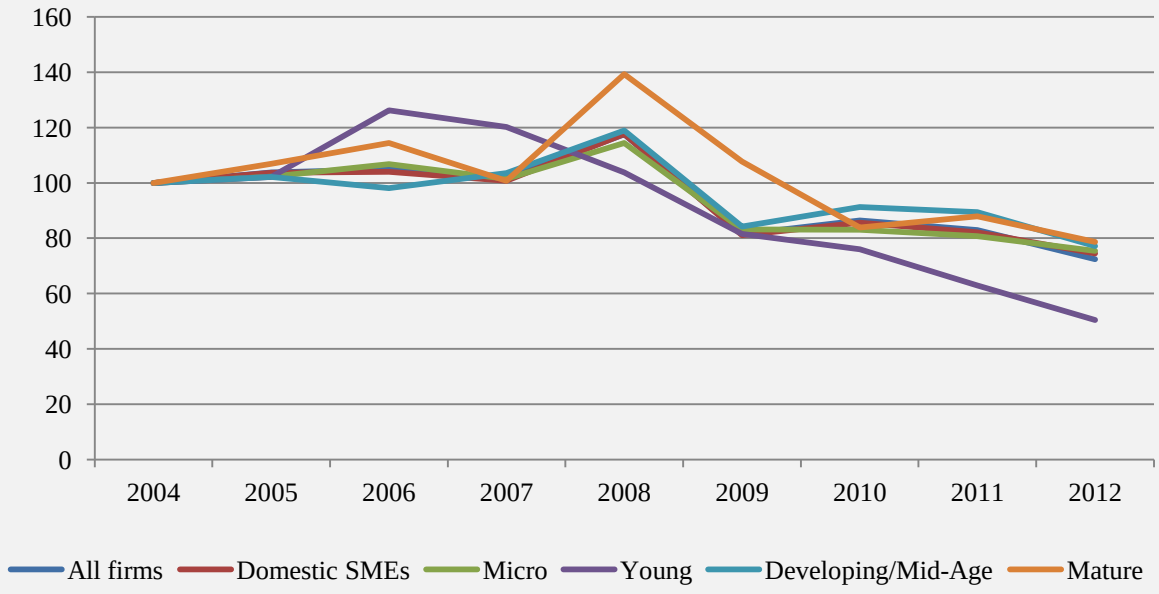
or high net short-term debt, are financially constrained or operate in industries that are very dependent on external financing. In an Irish context, O'Toole, Newman and Hennessy (2014) research how internal finance dependence and access to credit effected investment by farm enterprises and find a considerable increase in financing constraints following the financial crisis.

Data and Summary Statistics

To conduct our firm-level analysis, we draw on data from the Bureau Van Dijk Amadeus dataset which provides information on firms between the years 2003 and 2012. Our data covers firms of all enterprise sizes and NACE sectors, however, due to missing data, the final sample is not necessarily representative at the country level. We use weighting techniques to address this particular issue. With missing data our sample includes 22,555 firms across the following European countries: Belgium (622), Bulgaria (104), Czech Republic (95), Germany (221), Spain (2,296), Finland (478), France (7,211), Italy (8,372), Portugal (2,842), Sweden (125) and the UK (174).

Figure 2-3 outlines the trends in tangible investment in our sample for different groups of firms. We present data for all firms, domestic SMEs, domestic micro enterprises, young firms aged 0 to 6, firms aged 6 to 20 and older firms aged 20 plus. For tangible investment expenditure, it can be seen that for the majority of firm groups, investment levels fell considerably following the onset of the financial crisis; the fall seems particularly steep for young firms.

Figure 2-3 Trends in Tangible Asset Investment by Firm Size

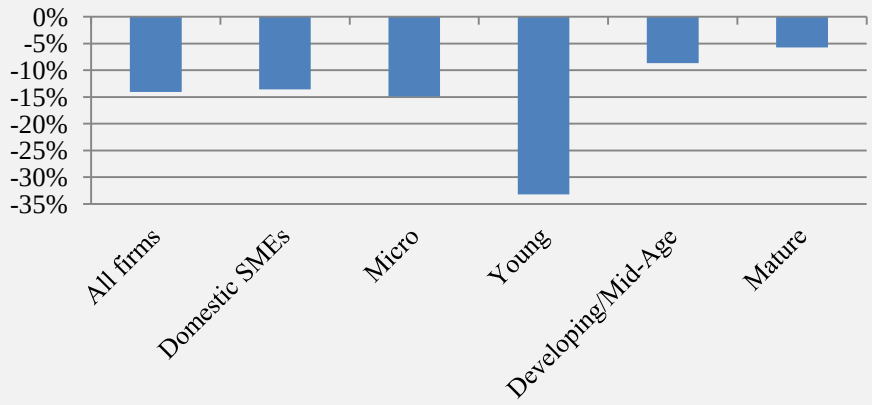


Source: ESRI analysis of Amadeus data.

Focusing on the changes pre- and post- crisis, Figure 2-4 below presents the mean values of the total asset to investment in tangible assets ratio for each of the firm groups as well as the difference in the ratio pre and post the crisis.

Figure 2-4 Trends in Average Value of Tangible Investment to Total Assets

	All firms	Domestic SMEs	Micro	Young	Developing/Mid-Age	Mature
Average 04-07	6.5%	6.5%	6.2%	8.0%	6.1%	5.7%
Average 08-12	5.6%	5.6%	5.3%	5.3%	5.6%	5.3%



Source: ESRI analysis of Amadeus data.

While the differences in the ratio indicate that investment levels have fallen across all groups, it can be seen that young firms and micro firms post the largest falls in investment. Given that these firm groups are particularly prone to financial market imperfections, it is important to evaluate the role financial factors has played in these declines.

Trends in the main financial variables included in our analysis by firm group, as well as mean comparisons pre- and post-crisis, are presented in Figure 2-5and Figure 2-6 below. It can be that that financial pressures have increased for European enterprises across a number of measures. Beginning with cash flows (scaled by total assets), there has been a general fall across all firm groupings as profitability has declined; cash flow to total assets fell on average by circa 12 per cent since the onset of the crisis. The decline in cash flows is particularly acute for young firms at 17 per cent. Given the well recognised challenges faced by young firms in access external financing, coupled with the fact that cash flows constraints can be limiting for young, fast-growing firms, these figures highlight the very strained operating environment for firms under six years of age in Europe.

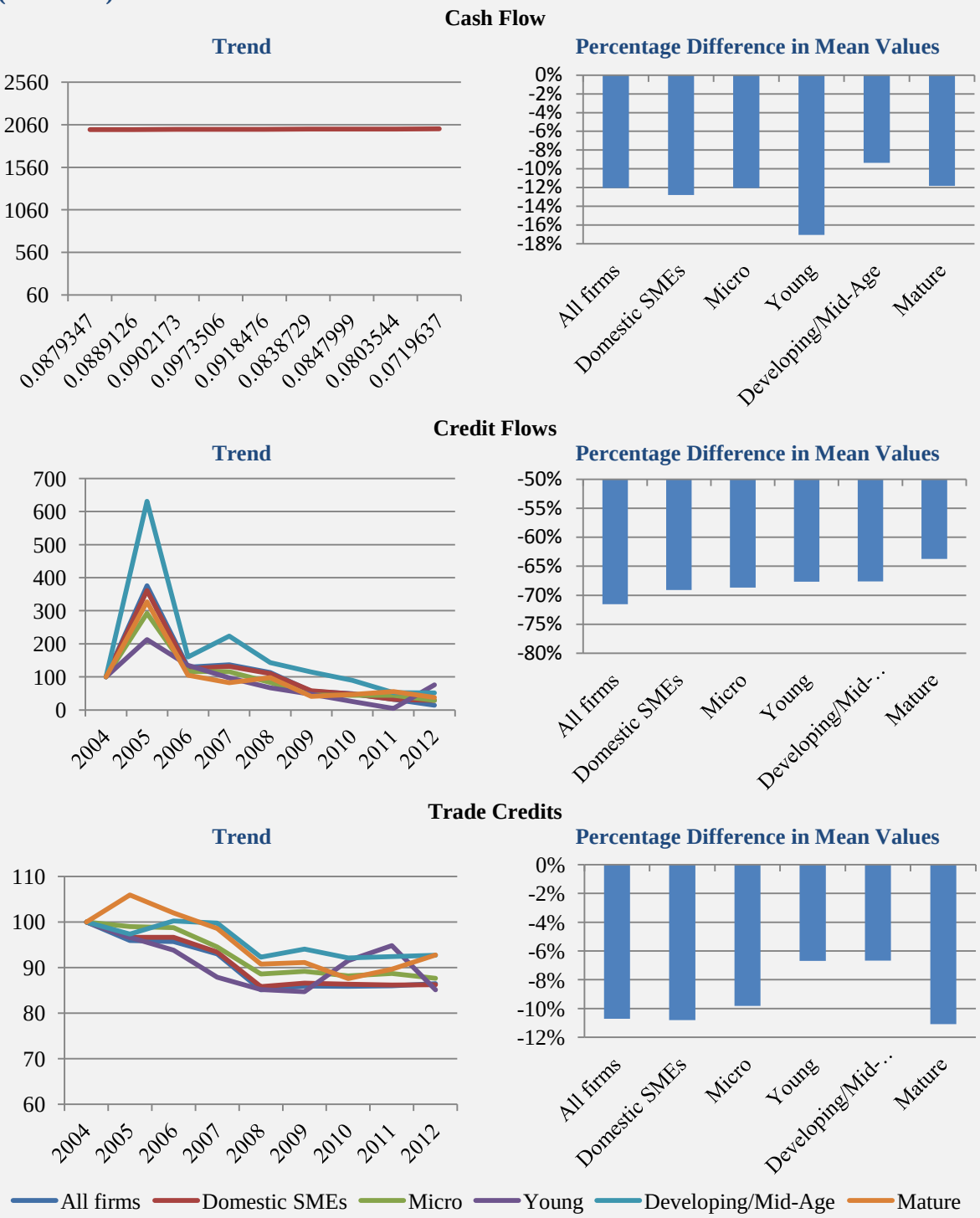
Focusing on external net credit flows (both long-term and short-term), we see that volumes have fallen across all types of firms. While the elevated pre-crisis credit flow volumes were unsustainable from a financial stability and growth perspective, and part of the declines in net credit flows are due to debt repayments and firms working through unsustainable balances, the considerable declines in net credit inflows can have an adverse impact on firms if investment opportunities are foregone. The data suggest that older firms (mature) have experienced less of a reduction in net credit flows relative to younger firms.

Figure Figure 2-5 also presents the trends in total trade credits to total assets. The role of trade credit in financing firms is a topic of particular interest during periods of financial crises. Ferramdo and Mulier (2013) find that more financially-constrained firms use trade credit to manage growth while Casey and O'Toole (2013) show that bank-constrained firms are more likely to apply for, and use, trade credit since the financial crisis in Europe. This

would suggest that trade credit and banks credit are substitutes. However, there is contradictory evidence as Love et al (2010) find that trade credit can substitute for bank credit in times of crisis, instead propagating liquidity shocks. In our data, we observe declines in trade credit volumes following the onest of the crisis. This holds across all firm types however, mature firms seem to have experienced the largest fall in trade credit volumes.

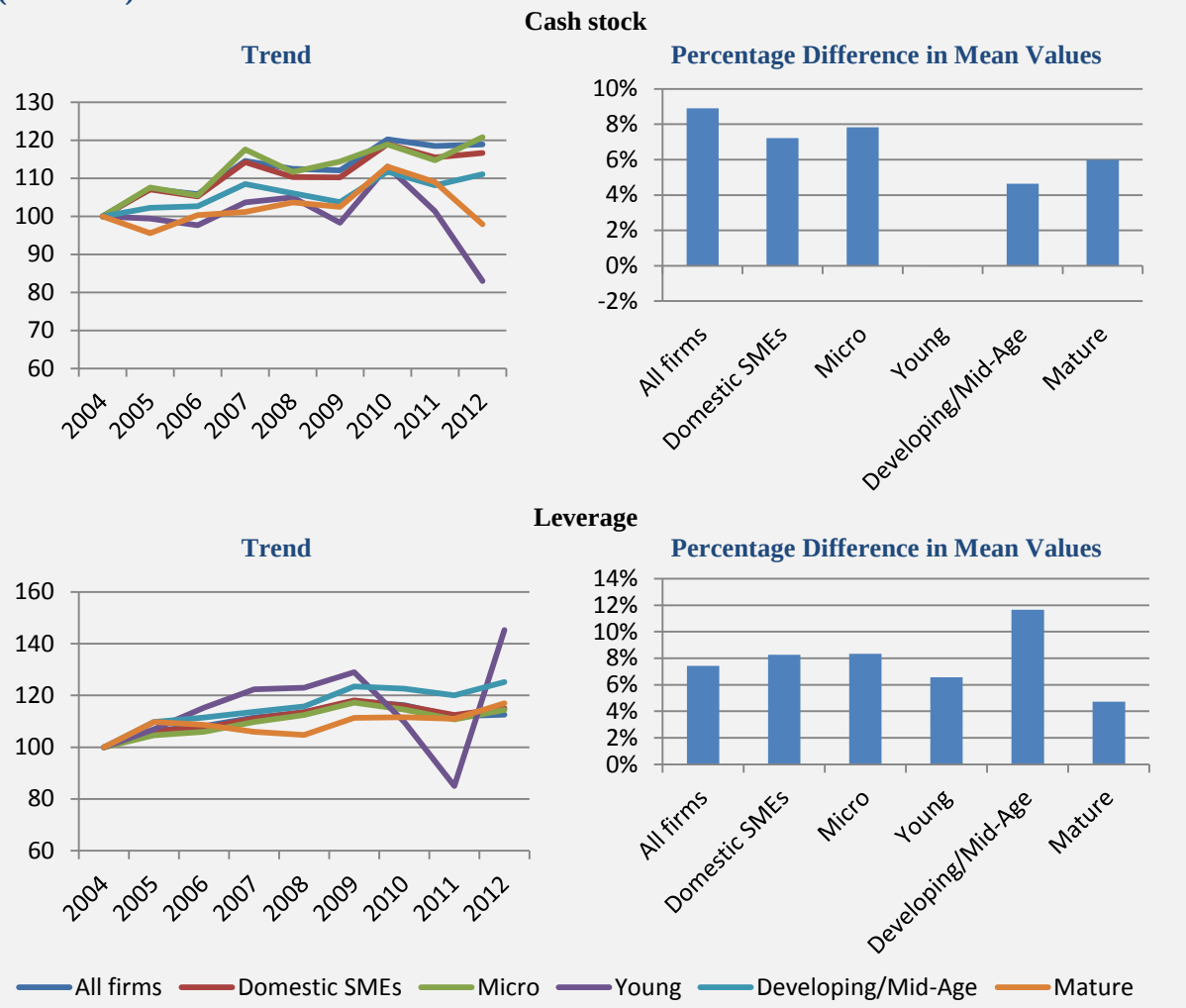
Figure 2-6 presents trends in cash stocks and leverage. Interestingly, we see some slight increases in cash stocks following the onset of the crisis. If firms are holding off on investment due to general uncertainty around the economic environment, corporate savings rates can increase. The data provide tentative evidence of this. Additionally, we find slight increases in leverage following the onset of the crisis, however at a much slower pace than in the pre-crisis period.

Figure 2-5 Overview of Flows in External Finance by Firm Types – Indices of Main Trends (2004=100).



Source: ESRI analysis of Amadeus data.

Figure 2-6 Overview of Flows in External Finance by Firm Types – Indices of Main Trends (2004=100).



Source: ESRI analysis of Amadeus data.

Empirical Methodology

The empirical methodology that we draw upon to estimate the effect of financing constraints and external finance dependence on firm investment activity draws on the extensive literature available in this regard (Bond and Meghir, 1994; Erikson and Whited, 2000; Bond and Soderbom, 2013). We apply a structural Q model of finance which links investment decisions to potential returns. A write-up of the theoretical model is presented in Box A and its derivation is presented in O'Toole et al. (2014).

Box A: Modelling Investment

Our methodological approach draws on the Q model of finance which provides a basis for assessing the relative effects of demand and access to credit on firm investment (Tobin,1969; Bond and Soderbom, 2013). While an overview is provided here for intuition, a complete outline of the Q model and its derivation is presented in O'Toole et al. (2014). The Q model is based on the neoclassical firm profit maximisation process. It assumes no imperfections in capital markets and complete access to external financing. In this framework, firms maximise the present value of discounted profits, V_{it}, as:

$$V_{it} = E_{it}\left[\sum_{s=1}^{\infty} \beta_{t+s-1}^{t}(\Pi_{it+s-1})|\Omega_t\right]$$

Subject to the following constraints:

$$K_{it} = (1-\delta)K_{it-1} + I_{it}$$

$$\Pi_{it} = R[K_{it}, L_{it}] - A[K_{it}, L_{it}] - r_{it}I_{it}$$

The first constraint is the standard capital accumulation equation where the capital stock (K_{it}) evolves relative to previous period values minus depreciation plus current investment I_{it}. The second condition is the firm profit in period t is equal to net revenues $R[K_{it}, L_{it}]$ minus total cost and adjustment costs (in relation to any investment that is undertaken). Adjustment costs,$A[K_{it}, L_{it}]$, are a function of the current capital and labour stocks. Substituting the constraints into the model, setting up the Lagrangian factor, and taking the first order derivative with respect to investment provides the following condition:

$$\frac{\partial f(.)}{\partial I} = Q - A'[K_{it}, L_{it}] - r_{it} = 0$$

Where Q is the Lagrangian shadow factor on the investment constraint. Re-arranging gives:

$$Q = A'[K_{it}, L_{it}] + r_{it}$$

This is the well known Q formula where Q represents the marginal benefit of an additional unit of capital to the firm. The firm should invest up to this condition whereby the marginal benefit is equal to the marginal cost of investment, which is made up of the adjustment cost and the cost of capital r_{it}.

From the firm's perspective, if no capital market imperfections exist, then investment decisions should be made only on the basis of the expected returns. In this case, if we include a measure of Q in an empirical equation driving investment, then no other factors should affect investment other than Q, the marginal return per unit. However, there is an added

difficulty for the econometrician in developing a suitable proxy for the unobservable Q statistic. Hayashi (1982) outlines the conditions under which average Q is a suitable proxy for marginal Q and this allows the estimation of the statistic from observable information. The most well known measure of Q is the ratio of the market value of equity and bonds to the book value of the firm (Erikson and Whited, 2006). In the context of our research this metric is not applicable as our interest is in SMEs, the majority of whom do not have financial market listings. We therefore use an alternative methodology outlined by Gilchrist and Himmelberg (1995) and used empirically by Ryan et al. (2014), O'Toole et al. (2014), Chaddad et al. (2005), Bierlen and Featherstone (1998) and Benjamin and Phimister (2002). This method uses a vector auto regression (VAR) on firm performance indicators to estimate a "fundamental Q" which can be used as a proxy for the Q statistic for firms without bond or market listings. The VAR is as follows:

$$\boldsymbol{X_{it}} = \boldsymbol{AX_{it-1}} + c_i + \theta_j \ + \mu_c \ + \tau_t + \epsilon_{it}$$

$$Q_{it} = (c'[I - \xi A])X_{it}$$

Where the vector $\boldsymbol{X_{it}}$ contains proxies for the marginal product value of capital. The proxied value for Q is then inserted into an empirical equation and treated econometrically for measurement error.

Our empirical framework for the Q model of finance provides the following reduced form estimation equation:

$$\left(\frac{I}{K}\right)_{itcj} = \alpha_0 + \beta_1 \left(\frac{I}{K}\right)_{it-1cj} + \beta_2 Q_{it-1cj} + \varepsilon_{itcj}$$

The Q statistic, in essence, captures investment demand and is a proxy for the benefit of an additional unit of capital to firm profitability. The variable captures the return to the firm of investment in their capital stock. In such a model, investment in fixed tangible capital should be related directly to how much extra return a firm earns from the investment. We investment should rise as returns, and subsequently Q, rise, we expect a positive and significant sign on the coefficient β_2. We include a lagged dependent variable to capture dependency in the investment relationship. In the model, ε_{itcj} is a composite error term including:

$$\varepsilon_{itcj} = c_i + \theta_j \ + \mu_c \ + \tau_t + \epsilon_{it}$$

where c_i captures firm-specific, time-invariant effects, θ_j are sector specific effects, μ_c are country fixed effects and τ_t are time effects.

Measuring and Testing for Financial Market Imperfections

Testing the effect of financial factors on investment is an extensively studied area in the international literature (Chiriniko, 1993; Hubbard, 1998; and Guariglia, 2008). As this research is focused on providing evidence for policy, we test how the investment sensitivity to a number of different financing sources, namely internal funds, external credit flows, trade credit as well as financial health indicators of leverage and the interest burden ratio.

We firstly consider internal financing sources. Among the main methodologies for testing the extent of financing constraints on investment is to test the sensitivity of investment to internal cash flows and cash stocks, with higher sensitivities indicating greater financing constraints (Fazzari et al, 1988; Love, 2003; Harrison, Love and McMillan, 2003). While this

methodology has been criticised (Kaplan and Zingales, 1997), more recent research has underpinned its theoretical appropriateness (Bond and Soderbom, 2013).

The intuition behind this methodology is that firms who face constraints in accessing external finance must rely on internal funds. If such firms receive a boost to internal cash flows and investment volumes react in line with this, then the firm must have had some pent up investment demand which they could not finance. The methodology relies on testing the sensitivity of investment to cash flow across different industries, firm types and timeframes and using the estimated sensitivities to conclude whether certain groups of firms are more or less reliant on internal finance i.e. face higher financing constraints. These relationships are generally used to identify whether firms face financial market imperfections. An over-reliance on internal funds for investment can indicate that a wedge exists between the firms internal and external cost of capital. If such an effect is present, we would expect a positive and significant effect on the coefficients relating to these variables. We therefore include cash flow and cash stock in all regressions to capture these effects.

From a policy perspective, it is also important to explore the effect on investment of different sources of external finance and financial pressures. Testing the sensitivity of investment to broad indicators of financing sources and indicators of financial health should provide evidence on the financial dependency of European firms to external funding.

To test directly for the sensitivity of investment to external credit access, we include the total net credit flows in the period in our analysis. Including a variable relating to credit flows is an important predictor of direct flows of external credit impact on the investment rate. With this variable, we expect a positive and significant effect i.e. as flows of external credit increase (decrease), investment rises (falls). As investment in fixed tangible capital is long-term in nature (purchasing machinery, buildings and equipment with a longer use horizon), the particular financial instrument with which such activity is financed can be an important determinant of the impact of such investment on the firms profitability. Financing longer-term investments should therefore require longer-term funding facilities. We therefore split external credit flows into long-term and short-term. An over-reliance on short-term funding for investment activity could be detrimental to the firm both from a cost of capital and a transactions cost perspective.

To capture the role played by trade credit (accounts receivable and payable) we include the ratio of total trade credit (receivables to payables) to total assets. Ferrando and Mulier (2013) find that this indicator has a positive and significant effect on firm growth.

The final indicators of financial health that we include are total firm leverage, and the interest burden. A priori, it is expected that leverage or debt overhang acts as a drag on investment by reducing the borrowing capacity of the firm and indicating heavy financial pressures. For the interest burden, we expect a negative and significant coefficient. The greater the share of cash flows that are used up to cover interest payments, the lower the firms' ability to invest. An overview of the variables and the expectations is included in the table below.

Table 2-1 A-Priori Expectations for Financial Variables		
Indicator	**A priori expectation**	**Intuition**
Cash stock	+	An increase in internal cash balances should have a larger impact on investment for constrained firms
Cash flow	+	An exogenous shock to cash flow should have a larger impact on investment for constrained firms
Long term credit flows	+	An increase in external capital flows should positively increase investment. This sensitivity should be greater for more constrained firms
Short term credit flows	?	An increase in external capital flows should positively increase investment. This sensitivity should be greater for more constrained firms
Interest burden	-	Higher interest rates should decrease investment
Leverage	-	Higher levels of leverage potentially act as a drag on firm investment due to reduced collateral and borrowing capacity
Trade credit	+	More trade credit availability should be supportive of increased investment

Our empirical estimation equation, including the financial factors becomes:

$$\left(\frac{I}{K}\right)_{itcj} = \alpha_0 + \beta_1 \left(\frac{I}{K}\right)_{it-1cj} + \beta_2 Q_{it-1cj} + \boldsymbol{\gamma F(1)_{it}} + \boldsymbol{\delta F(2)_{it-1}} + \boldsymbol{\pi Z_{it}} + \varepsilon_{it}$$

where $\varepsilon_{it}$is a composite error containing firm-specific, time-invariant heterogeneity, sector-time and country-time factors to control for any sector-specific and country-specific cyclical factors and macroeconomic developments. X is a vector that contains firm demand controls and fundamental variables that are model specific. To capture a range of financial channels available to the firm, we include the two sets of financial variables in the vectors ***F(1)*** and ***F(2).*** The a priori expected relationship between these variables and the specific outcome variable are discussed in the subsections below. The vector Z contains standard controls for firm size, age and stock market listing status.

To identify the effects of the financial crisis on the relationship between investment and financing constraints, we interact the financial factors with a binary indicator for the period 2008-2012 to pick up any crisis-specific effects:

$$\left(\frac{I}{K}\right)_{itcj} = \alpha_0 + \beta_1 \left(\frac{I}{K}\right)_{it-1cj} + \beta_2 Q_{it-1cj} + \boldsymbol{\gamma_1 F(1)_{it}} + \boldsymbol{\delta_1 F(2)_{it-1}} + \boldsymbol{\gamma_2 F(1)_{it}} \times FC + \boldsymbol{\delta_2 F(2)_{it-1}} \times FC + \boldsymbol{\pi Z_{it}} + \varepsilon_{it}$$

The coefficients on the interaction terms will provide insight into whether or not there is a differential effect following the financial crisis.

Estimating empirical investment models presents a number of challenges from an econometric perspective. These are discussed in Appendix 4.3. To estimate these models we use system GMM techniques which address the concerns outlined. In all cases, tests for serial correlation in the error structure and the validity of the instruments are presented in the regression output.

Testing for Heterogeneous Effects Across Firms and Industries

Of particular interest from a policy perspective is how the effects of access to external finance affect investment differently across firms in the economy. To explore the heterogeneity of the relationship between investment and access to finance, we interact the internal finance variables and the external credit flows with indicators for different groups of firms. The groups are as follows:

1. Firm age
    a. Young firms (0 to 5 years of age);
    b. Developing mid-age firms (6 to 20 years); and
    c. Mature firms (20 + years).
2. Firm size
    a. Micro firms (< 10 employees);
    b. Small firms (Between 10 and 49 employees);
    c. Medium-sized firms (Between 50 and 249 employees); and
    d. Large firms (250 + employees).
3. Domestic firms
4. Industrial sector
    a. High-tech knowledge intensive services (HTKIS);
    b. High-tech manufacturing (HTM);
    c. Other services (OS);
    d. Other manufacturing (OM); and
    e. Construction firms (C).[12]

Exploring how the effects differ across these categories of firms provides us with insight into whether the effect of financial market access on investment differs across firms within the European economy.

Empirical Results

In this section, we present the main results of our tests of the effect of financial factors on investment. All models are estimated using system GMM techniques, an outline of which is presented in Annex A. In all cases, the Hansen test of instrument validity and the second order autocorrelation tests are included in the main regression output. The data are time-sector and country-time demeaned prior to estimation to control for any country-specific and sector specific factors that are both cyclical and time-invariant. Controls for firm size, age and whether or not the firm is listed on the stock market are also included. Standard errors are robust to heteroskedasticity.

In our analysis we present results in two main formats. Firstly, in the initial tables, we present GMM regressions of the effect of the main financial variables on investment for the full sample period. This provides our test of the effect of financial factors on investment. Secondly, we interact the financial variables with binary indicators for the crisis period (2008-2012) to test whether there exists a differential effect of access to finance on investment since the crisis. This is completed for the main sample and each of the sub-samples analysed. Table 2-2 presents the results for our overall sample and for sub-samples based on firm groups. Table 2-4 presents the results by industrial sector. In total 134,128 observations are used in the analysis covering 22,540 firms. The number of firms and observations across the different sub-samples are included in the regression output.

[12] These sectoral categories are in line with EC categorisations at:

Having evaluated the full sample and the differential effect since the crisis, we then estimate the overall effect for each of the pre and post crisis periods. These results are presented in tables Table 2-3 and Table 2-5.

Focusing on the full sample and differential effects in Table 2-2, we find that the fundamental variables are statistically significant and positively related to investment i.e. as sales grow or profitability improves, firms increase investment. This finding holds across the majority of sub-samples. We also find a negative and significant effect of the crisis dummy over and above controlling for demand factors and financial factors. The coefficient value indicates that investment is 4 per cent lower than can be explained and indicates that investment declined to a greater degree than the model predicts during the crisis period and could be related to general economic uncertainty and the inability to accurately evaluate investment opportunities in a period of heightened economic and financial instability.

Turning to the financial factors, in column (1), the results are presented for the overall sample. Firstly, we find a positive and significant effect of cash flow on investment: a one per cent increase in cash flows leads to a 0.35 per cent increase in investment. The result is statistically significant at the 1 per cent level.

Secondly, we find a strong positive effect of long term external credit inflows on investment which is suggestive of a strong positive effect of access to external finance on business capital investment. A one per cent increase in external credit flows leads to an increase in investment of approximately 0.14 per cent. We do not find a statistically significant effect of short term credit flows. This finding is in line with the interpretation that firms use longer term funding structures to manage and undertake large capital investment projects.

We also find a positive and significant effect of overall leverage on investment. This finding is somewhat surprising in that the debt overhang literature suggests that leverage is negatively related to investment. However, in our model, the leverage variable is most likely picking up the factor that higher leverage is used to fund investment expenditures. In this case, the financing incurred as leverage increases is directly used in investment. To test the robustness of this finding, we included leverage squared to test for non-linearities in the relationship. This variable was insignificant. However, when we exclude the credit flows variables, leverage becomes insignificant which suggests that the same dynamics are driving both variables. This finding is also unsurprising given that, in general, the firms in our sample have low levels of leverage and thus have borrowing capacity. The coefficient size on leverage is large: a one per cent increase in the leverage ratio increases the investment rate by circa 0.94 per cent.

We do not, on average, find an effect of cash stock, the interest burden, or trade credit on investment. On the trade credit channel, while there may be no evidence of an effect on investment, it is likely that trade credit can impact firms' real activities through other mechanisms such as the impact on employment, working capital or inventory management. We test its impact on employment and productivity in subsequent sections.

In column (2) we test for the effect of the financial crisis by interacting all financial factors with dummy variables for the post-crisis period. The key finding of this analysis is that the cash flow variable becomes insignificant in the pre-crisis period but the differential following the crisis becomes positive and significant. This suggests that firms did not face financing constraints in the pre-crisis period but that constraints are binding since the onset of the crisis.

Interestingly, we find that cash stocks are negative and significant following the onset of the crisis. While this is a surprising finding, it could be the case that firms are hoarding cash given the economic uncertainty.

Having tested the impact on the full sample, we now address the results across the different sub samples. In column (3) and (4), we present the model for domestic SMEs only. In general, our main findings hold that cash flow has a positive and significant effect on investment. Long term credit flow and leverage are also positively and significant as before. Interestingly, we now find an effect of the interest burden that is negative and statistically significant as well as a weak effect of short term credit flows. This evidence suggests that the investment of domestic SMEs is more sensitive to financial factors than for all firms in general.

Focusing on the differentials pre- and post-crisis, we again find that cash flow interacted with the crisis dummy is positive and significant. This is further evidence of financing constraints binding in the post-crisis period. We also again find that cash stock is negative and significant in the post-crisis period, potentially indicating cash hording by corporates.

One particular group of firms that receives considerable policy attention are micro-sized enterprises. Such firms typically can suffer from financing constraints to a greater degree than large firms due to a lack of collateral, poor financial capacities, and an opaque appearance to financial institutions. In columns, (4) and (5) we specifically analyses the effects of financial factors on micro firms.

The results suggest that cash flow and external credit flows are the two most important sources of credit for micro enterprises. In fact, the sensitivity of investment to long-term credit flows is higher for micro-sized firms that all firms and domestic SMEs: a one per cent increase in long term credit flows leads to a 0.18 per cent increase in investment for micro firms relative to a 0.15 per cent increase for all firms. Focusing on the effects pre- and post-crisis, a number of findings emerge. Again, cash flow is positive and significant in the post-crisis period while leverage becomes positive and significant in the pre-crisis period and negative and significant in the post-crisis period. We also find that short-term credit flows become positive and significant in the pre-crisis period and are negative and significant in the post-crisis period.

We now address the impacts by firm age. Firstly, considering young firms in columns (7) and (8), we find a positive and significant effect of cash flows on investment. We also find that young firms are very sensitive to external credit flows: a one per cent increase in net long term credit flows increases investment by 0.41 per cent relative to 0.15 for all firms. There is also a weak effect of short-term credit flows. This suggests a very high level of external financial dependence for young firms. Young firms are also affected by the interest burden which is negative and significant. Focusing on the effects pre- and post-crisis, we find no increase in the cash flow sensitivity between the periods; we find that young firms are more reliant on cash stocks post-crisis. We also find that the effect of long term credit flows is very strong following the crisis; nearly double the size of the effect in the overall sample. We also find that in the pre-crisis period young firms used short term financing for investment but this fell considerably following the crisis.

For firms between 6 and 20 years of age (developing/mid-age), we find an effect of long term, and short-term external credit flows and a positive cash flow effect. For firms aged 20 years or more, we do not find an effect overall of credit flows but we do find a cash flow effect. More mature firms may prefer internal financing sources and have adequate internal resources. Interestingly for these firms, the crisis dummy is positive and significant suggesting that these firms actually had higher investment during this period than the model predicts. This does not mean that overall investment rose for these firms. The coefficient indicates that the model would have predicted an even lower level, given fundamentals and

financial factors. We do find a positive and significant impact of the interaction of cash flow and the crisis indicating that constraints increased for this firm group.

While the above effects provide the differential impacts (i.e. how the effect of a financial factor differs between the pre- and post-crisis period), we also calculate the average effects overall and in each sub-period. These are presented in **Table 2-3**.

A number of key findings emerge across all firm groups. Overall investment is sensitive to cash flow; however, this sensitivity is only significant in the post-crisis period. This finding suggests that firms now face financing constraints in accessing adequate volumes of external investment financing and these financing constraints were not present before the onset of the crisis. This sensitivity is significant and positive across all sub samples since the financial crisis period. These results suggest that capital market imperfections exist currently for European firms and such imperfections have heightened considerably since the crisis.

Our analysis indicates that net external credit flows, in particular those of long term maturity, are very important drivers of investment activity. For the overall sample, a one per cent increase in long net external credit flows increases investment by 0.14 per cent. The sensitivity is much higher for young firms at 0.4 per cent and it is also elevated for micro-sized firms at 0.18 per cent. This suggests that external finance dependence is a factor in driving investment for all firms, that young and micro-sized firms are very sensitive to the availability of such credit flows. Overall this sensitivity declines with firm age. In fact, focusing on both the pre- and post-crisis periods, this sensitivity only emerges in post-crisis when funding availability is tighter. These data are backed up by our findings in relation to leverage which indicate a positive and significant effect which falls in magnitude following the crisis.

The analysis also indicates that short term credit flows are important for funding investment, in particular for young firms before the crisis. Short term funding facilities are not necessarily the correct financial instrument with which to cover long-term investment programmes with payback periods outside the maturity of the credit facility. If young firms are unable to convince financial institutions to provide longer maturities, due to a lack of collateral, track record or increased risk, this may have consequences for their growth potential and chances of survival.

There is evidence that European enterprises have been hoarding cash stocks since the crisis and that corporate returns have been used for savings not investment. The economic and financial uncertainty surrounding the banking and sovereign debt crises surely play an important factor in this.

We find very little evidence that trade credit flows effect tangible investment in either the pre or post crisis periods. This suggests that European firms do not use trade credit facilities to finance long term capital investment activities. This is unsurprising given the maturity mismatch inherent between long term capital spending and mainly short term accounts payable and receivable management.

We find that interest burdens are not significant determinants of firm investment across the board. However, there is evidence that young enterprises are significantly affected by interest costs. As young firms are potentially in growth and expansion phases, cash flow generation might be limited or only slowly developing. If interest payments consume a considerable amount of resources for these firms, there are potentially less able to manage such burdens relative to more mature firms.

Table 2-2The Effect of Financial Factors and The Financial Crisis on Tangible Investment – Enterprise Types

Dep Var: I/K_t	All Firms		Domestic SMEs		Micro Enterprises		Young Enterprises		Developing/Mid Age		Mature	
	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
I/K_{t-1}	0.063	0.069	0.052	0.053	0.133**	0.099*	0.069	0.033	0.122*	0.094	-0.107**	-0.128***
	(0.052)	(0.054)	(0.048)	(0.047)	(0.067)	(0.058)	(0.044)	(0.046)	(0.063)	(0.068)	(0.044)	(0.043)
Q_{t-1}	0.002**	0.002**	0.002**	0.002*	0.001*	0.002**	0.003	0.003**	0.002*	0.001	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Crisis	-0.041*	-0.064**	-0.040*	-0.065**	-0.051**	-0.088***	-0.103	-0.080	-0.061**	-0.093***	0.148***	0.115**
	(0.022)	(0.027)	(0.022)	(0.026)	(0.026)	(0.030)	(0.072)	(0.134)	(0.026)	(0.032)	(0.052)	(0.055)
CF/K_t	0.351***	0.103	0.339***	0.121	0.285***	0.081	0.260***	0.016	0.395***	0.156	0.265***	0.106
	(0.043)	(0.088)	(0.045)	(0.087)	(0.045)	(0.095)	(0.069)	(0.253)	(0.053)	(0.122)	(0.077)	(0.069)
CS_K_{t-1}	-0.024	0.018	-0.032*	0.013	-0.024	0.018	-0.043	-0.086***	0.007	0.025	-0.057***	-0.016
	(0.020)	(0.020)	(0.018)	(0.020)	(0.019)	(0.025)	(0.030)	(0.025)	(0.033)	(0.030)	(0.017)	(0.019)
TC/TA_{t-1}	-0.085	0.184	0.007	0.148	0.121	-0.091	-0.324	1.334	-0.024	-0.066	0.152	0.751**
	(0.208)	(0.166)	(0.243)	(0.169)	(0.197)	(0.181)	(0.283)	(1.115)	(0.317)	(0.270)	(0.298)	(0.303)
Interest $burden_{t-1}$	-0.140	-0.081	-0.185*	-0.187	-0.113	-0.097	-0.598***	-2.068***	0.006	-0.509	-0.139	-0.326*
	(0.098)	(0.204)	(0.108)	(0.221)	(0.132)	(0.227)	(0.142)	(0.494)	(0.101)	(0.448)	(0.122)	(0.168)
$Leverage_{t-1}$	0.944**	1.426*	0.967**	1.542*	0.219	1.987**	0.567	1.889	0.103	1.878*	0.853	1.085*
	(0.393)	(0.817)	(0.392)	(0.794)	(0.354)	(0.891)	(0.518)	(2.114)	(0.288)	(1.054)	(0.521)	(0.594)
Credit flows (long)	0.147***	0.097	0.149***	0.145	0.181***	0.143	0.415***	-0.317	0.142***	0.344*	0.080	0.021
	(0.044)	(0.140)	(0.044)	(0.147)	(0.053)	(0.129)	(0.051)	(0.289)	(0.045)	(0.191)	(0.062)	(0.122)
Credit flows (short)	0.057	0.226	0.079*	0.261*	0.038	0.232**	0.146*	0.488***	0.072*	0.291**	0.045	-0.028
	(0.037)	(0.141)	(0.042)	(0.143)	(0.027)	(0.114)	(0.078)	(0.172)	(0.042)	(0.139)	(0.033)	(0.083)
CF/K t x Crisis		0.195**		0.177*		0.208**		0.107		0.206		0.206***
		(0.823)		(0.094)		(0.104)		(0.257)		(0.143)		(0.079)
CS_K t-1 x Crisis		-0.045**		-0.041**		-0.051**		0.147***		-0.048*		-0.030
		(0.823)		(0.018)		(0.022)		(0.035)		(0.029)		(0.019)
TC/TA t-1 x Crisis		-0.134		-0.070		0.137		-1.150		0.201		-0.623**
		(0.823)		(0.160)		(0.162)		(1.101)		(0.245)		(0.299)
Interest $burden_{t-1}$ x Crisis		0.089		0.172		0.091		1.809***		0.518		0.127
		(0.823)		(0.221)		(0.217)		(0.511)		(0.441)		(0.176)
Leverage t-1 x Crisis		-1.141		-1.198		-1.678*		-0.979		-1.475		-0.383
		(0.823)		(0.799)		(0.875)		(2.192)		(1.036)		(0.610)
Credit flows (long) x Crisis		0.024		-0.032		-0.012		0.708**		-0.224		0.055
		(0.149)		(0.155)		(0.141)		(0.294)		(0.201)		(0.133)
Credit flows (short) x Crisis		-0.197		-0.219		-0.216*		-0.368**		-0.261*		0.063
		(0.144)		(0.147)		(0.117)		(0.185)		(0.145)		(0.091)
Observations	134,128	134,128	130,103	130,103	33,628	33,628	5,524	5,524	64,482	64,482	60,097	60,097
Firms	22,540	22,540	21,887	21,887	7,530	7,530	2,453	2,453	13,858	13,858	11,747	11,747
Autocorrelation Test (AR2) (pvalue)	0.272	0.127	0.351	0.197	0.035	0.061	0.079	0.099	0.135	0.184	0.071	0.023
Hansens test of instrument validity (pvalue)	0.388	0.134	0.448	0.135	0.717	0.819	0.606	0.731	0.482	0.648	0.752	0.606

Source: Authors' analysis of Amadeus data.

Table 2-3 The Effect of Financial Factors and The Financial Crisis on Tangible Investment – Enterprise Types

Dep Var: I/K_t	All Firms	Domestic SMEs	Micro Enterprises	Young Enterprises	Developing/Mid Age	Mature
	(1)	(2)	(3)	(4)	(5)	(6)
Cash Flow	0.351***	0.339***	0.285***	0.260***	0.395***	0.265***
Pre-crisis	*0.103*	*0.121*	*0.081*	*0.016*	*0.156*	*0.106*
Post-crisis	*0.298****	*0.298****	*0.289****	*0.122***	*0.362****	*0.311****
Cash stock	-0.024	-0.032*	-0.024	-0.043	0.007	-0.057***
Pre-crisis	*0.018*	*0.013*	*0.018*	*-0.086****	*0.025*	*-0.016*
Post-crisis	*-0.027***	*-0.027****	*-0.033****	*0.061***	*-0.022**	*-0.046****
Trade credit	-0.085	0.007	0.121	-0.324	-0.024	0.152
Pre-crisis	*0.184*	*0.148*	*-0.091*	*1.334*	*-0.066*	*0.751***
Post-crisis	*0.050*	*0.077*	*0.0451*	*0.183*	*0.135*	*0.1277*
Interest burden	-0.140	-0.185*	-0.113	-0.598***	0.006	-0.139
Pre-crisis	*-0.081*	*-0.187*	*-0.097*	*-2.068****	*-0.509*	*-0.326**
Post-crisis	*0.086*	*-0.015*	*-0.006*	*-0.259***	*0.009*	*-0.198**
Leverage	0.944**	0.967**	0.219	0.567	0.103	0.853
Pre-crisis	*1.426**	*1.542**	*1.987***	*1.889*	*1.878**	*1.085**
Post-crisis	*0.2849**	*0.344***	*0.309*	*0.909*	*0.402**	*0.702****
Credit flows (long)	0.147***	0.149***	0.181***	0.415***	0.142***	0.080
Pre-crisis	*0.097*	*0.145*	*0.143*	*-0.317*	*0.344**	*0.021*
Post-crisis	*0.1216**	*0.112****	*0.132****	*0.391****	*0.119****	*0.075*
Credit flows (short)	0.057	0.079*	0.038	0.146*	0.072*	0.045
Pre-crisis	*0.226*	*0.261**	*0.232***	*0.488****	*0.291***	*-0.028*
Post-crisis	*0.029*	*0.042*	*0.016*	*0.120****	*0.029*	*0.035*

Source: Authors' analysis of Amadeus data.
Estimates developed using a structural Q model of investment estimated using system GMM. Lags of all variables are included as instruments dated t-3, t-4 and t-5. Models pass standard tests for instrument validity. Detailed estimates are provided in the background study. Demand controls include Tobin's Q, lagged investment, firm size, age and an indicator for non-listed firms.

In addition to testing the effects of financial factors on investment for different groups of firms, we also test the relationships across different groups of industries. These are presented in Table 2-4 and Table 2-5. To recap, the sectors included are high-tech knowledge-intensive services (HTKIS), high-tech manufacturing (HTM), other service sectors, other manufacturing sectors and construction.

We find a positive and significant effect of cash flow on investment overall for all sectors except high-tech manufacturing. The coefficient is largest for the high-tech knowledge-intensive services firms. This suggests that these firms faced the highest financing constraints, relying on internal finance for investment. If high-tech knowledge-intensive firms have different business structures or a lack of collateral, their business case might be difficult for banks to evaluate. In this case, policy measures that provide risk management support or guarantees for such firms could potentially reduce the financing constraints they face.

In relation to external credit flows, for the overall sample, long-term financing has an impact on investment for firms in all sectors except the other services sector. However, since the crisis, the average effect of long term credit flows is positive and significant for high-tech firms and other service firms.

Table 2-4 The Effect of Financial Factors and The Financial Crisis on Tangible Investment – Industrial Sectors

Dep Var: I/K $_t$	**HTKIS**		**HTM**		**Other Services**		**Other Manufacturing**		**Construction**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects
I/K $_{t-1}$	0.106	0.096	-0.000	0.007	0.108	0.104	0.012	0.004	-0.107**	-0.108**
	(0.075)	(0.086)	(0.023)	(0.028)	(0.085)	(0.073)	(0.048)	(0.043)	(0.046)	(0.047)
Q_{t-1}	0.008**	0.008***	0.010***	0.009**	0.005***	0.004**	0.001	0.000	0.001*	0.002***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Crisis	0.107	0.216	-0.012	0.057	-0.062*	-0.114***	-0.012	-0.042	-0.035	0.088
	(0.118)	(0.167)	(0.149)	(0.154)	(0.033)	(0.043)	(0.029)	(0.031)	(0.050)	(0.073)
Cash Flow $_t$	0.701***	0.564***	0.123	0.374***	0.314***	0.358***	0.291***	0.104	0.293***	0.089
	(0.175)	(0.094)	(0.262)	(0.136)	(0.103)	(0.125)	(0.049)	(0.119)	(0.055)	(0.128)
Cash Stock$_{t-1}$	-0.050	-0.097*	0.297*	-0.234**	-0.058*	-0.094**	-0.012	0.022	-0.033***	0.017
	(0.043)	(0.054)	(0.179)	(0.102)	(0.034)	(0.045)	(0.023)	(0.028)	(0.009)	(0.045)
Trade Credit $_{t-1}$	-0.286	-0.603	-0.276	-0.717	-0.364	0.341	-0.052	-0.032	0.279	-0.217
	(0.312)	(0.430)	(0.598)	(1.043)	(0.350)	(0.287)	(0.165)	(0.200)	(0.254)	(0.251)
Interest burden $_{t-1}$	-0.048	-0.797	0.135	0.220	-0.141	-0.226	-0.081	0.337	0.031	0.635*
	(0.083)	(0.527)	(0.104)	(0.244)	(0.096)	(0.282)	(0.105)	(0.302)	(0.117)	(0.383)
Leverage $_{t-1}$	1.602**	0.612	2.141**	1.715	0.693	2.374	0.307	0.262	-0.420	0.025
	(0.746)	(0.960)	(0.904)	(1.144)	(0.533)	(1.457)	(0.318)	(0.693)	(0.599)	(1.009)
Credit flows (long)	0.247*	0.158	0.112*	0.279	0.139	0.107	0.138***	0.279	0.163**	0.083
	(0.129)	(0.103)	(0.061)	(0.269)	(0.089)	(0.200)	(0.045)	(0.187)	(0.064)	(0.052)
Credit flows (short)	0.168**	0.065	0.064	-0.072	0.070	-0.097	0.059	0.308**	-0.007	-0.187
	(0.070)	(0.163)	(0.047)	(0.072)	(0.046)	(0.152)	(0.044)	(0.121)	(0.034)	(0.155)
Cash Flow t x Crisis		0.134		-0.211		-0.054		0.154		0.161
		(0.218)		(0.205)		(0.142)		(0.133)		(0.133)
Cash Stock t-1 x Crisis		0.044		0.510***		0.055		-0.028		-0.046
		(0.060)		(0.186)		(0.049)		(0.025)		(0.048)
Trade Credit t-1 x Crisis		0.215		0.072		-0.424*		0.178		0.458*
		(0.444)		(1.138)		(0.247)		(0.193)		(0.240)
Interest burden$_{t-1}$ x Crisis		0.738		-0.105		0.136		-0.330		-0.639*
		(0.524)		(0.297)		(0.291)		(0.283)		(0.388)
Leverage t-1 x Crisis		1.004		-0.676		-2.060		0.113		0.088
		(0.994)		(1.120)		(1.512)		(0.703)		(1.077)
Credit flows (long) x Crisis		0.160		-0.166		-0.020		-0.163		0.155
		(0.163)		(0.276)		(0.214)		(0.191)		(0.140)
Credit flows (short) x Crisis		0.106		0.165		0.143		-0.260**		0.210
		(0.213)		(0.109)		(0.158)		(0.128)		(0.160)
Observations	2,511	2,511	1,360	1,360	44,647	44,647	65,525	65,525	16,060	16,060
Firms	431	431	219	219	7,410	7,410	11103	11103	2724	2724
Autocorrelation Test (AR2) (pvalue)	0.760	0.617	0.891	0.669	0.316	0.542	0.800	0.853	0.347	0.175
Hansens test of instrument validity (pvalue)	0.383	0.591	0.866	0.975	0.070	0.064	0.509	0.210	0.334	0.361

Source: Authors' analysis of Amadeus data.

Table 2-5 The Effect of Financial Factors and The Financial Crisis on Tangible Investment – Industrial Sectors

Dep Var: I/K_t	HTKIS	HTM	Other Services	Other Manufacturing	Construction
Cash Flow	0.701***	0.123	0.314***	0.291***	0.293***
Pre-crisis	*0.564****	*0.374****	*0.358****	*0.104*	*0.089*
Post-crisis	*0.698****	*0.162*	*0.258****	*0.303****	*0.249****
Cash stock	-0.05	0.297*	-0.058*	-0.012	-0.033***
Pre-crisis	*-0.097**	*-0.234***	*-0.094***	*0.022*	*0.017*
Post-crisis	*-0.053*	*0.275**	*-0.006*	*-0.039**	*-0.028****
Trade credit	-0.286	-0.276	-0.364	-0.052	0.279
Pre-crisis	*-0.603*	*-0.717*	*0.341*	*-0.032*	*-0.217*
Post-crisis	*-0.387*	*-0.644*	*0.146**	*-0.083*	*0.241*
Interest burden	-0.048	0.135	-0.141	-0.081	0.031
Pre-crisis	*-0.797*	*0.220*	*-0.226*	*0.337*	*0.635**
Post-crisis	*-0.058*	*0.114*	*0.006*	*-0.089*	*-0.003*
Leverage	1.602**	2.141**	0.693	0.307	-0.42
Pre-crisis	*0.612*	*1.715*	*2.374*	*0.262*	*0.025*
Post-crisis	*1.616***	*1.038*	*0.375***	*0.314*	*0.113*
Credit flows (long)	0.247*	0.112*	0.139	0.138***	0.163**
Pre-crisis	*0.158*	*0.279*	*0.107*	*0.279*	*0.083*
Post-crisis	*0.318***	*0.113**	*0.115****	*0.087*	*0.237*
Credit flows (short)	0.168**	0.064	0.07	0.059	-0.007
Pre-crisis	*0.065*	*-0.072*	*-0.097*	*0.308***	*-0.187*
Post-crisis	*0.170***	*0.092*	*0.048*	*0.046*	*0.023*

Source: Authors' analysis of Amadeus data.
Estimates developed using a structural Q model of investment estimated using system GMM. Lags of all variables are included as instruments dated t-3, t-4 and t-5. Models pass standard tests for instrument validity. Detailed estimates are provided in the background study. Demand controls include Tobin's Q, lagged investment, firm size, age and an indicator for non-listed firms.

Conclusions and Policy Implications

This section presents an evaluation of the effects of financial dependence and access to external finance on tangible investment activity by enterprises. Evaluating such dependency and correctly identifying whether firms face imperfections in capital markets is an important policy area for the development of enterprises competitiveness in Europe. In the evaluation, the extent to which the financial crisis has altered the relationship between financial factors and investment is also examined. The analysis covers different groups of firms, industrial sectors and simple country typologies.

A number of key findings emerge. Firstly, we find the fundamental factors to be positive and significantly significant. In relation to the financial factors, we find investment is sensitive to cash flow; a 1 per cent increase in cash flow leads to a 0.30 per cent increase in investment. However, this sensitivity is only significant in the post crisis period suggesting firms currently face financing constraints that were not present before the onset of the crisis. These results suggest that capital market imperfections currently exist for European firms and such imperfections have heightened considerably since the crisis.

Our analysis indicates that net external credit flows, in particular those of long-term maturity, are very important drivers of investment activity. For the overall sample, a one per cent increase in long net external credit flows increases investment by 0.14 per cent. The sensitivity is much higher for young firms (0.4 per cent) and micro-sized firms (0.18 per cent). This suggests that which external finance dependence is factor in driving investment for all firms, that young and micro-sized firms are very sensitive to the availability of such credit flows. In general, the effect of external credit flows on investment is decreasing with firm age and size.

The analysis also indicates that short-term credit flows are important for funding investment in particular for young firms before the crisis. If this is indeed the case, it may indicate financial market imperfections that are preventing young firms from obtaining credit at maturities close to investment payback periods. If young firms are unable to convince financial institutions to provide longer maturities, due to a lack of collateral, track record or increased risk, this may have consequences for their growth potential and chances of survival.

We find very little evidence that trade credit flows effect tangible investment in either the pre- or post-crisis periods. This is unsurprising given capital investment funding requires maturities that are potentially outside normal trade credit terms.

We find that interest burdens are not significant determinants of firm investment across the board. However, there is evidence that young enterprises are significantly affected by interest costs.

Regarding the sectoral distribution of effects, we find a positive and significant effect of cash flow on investment overall for all sectors except high-tech manufacturing. The coefficient is largest for the high-tech knowledge-intensive services firms. This indicates that these firms are most reliant on internal finance, and potentially have greater difficulties in accessing external credit. In this case, policy measures that provide risk management support or guarantees for such firms could potentially reduce the financing constraints they face.

In relation to external credit flows, for the overall sample, long-term financing has an impact on investment for firms in all sectors except other services. However, since the crisis, the

average effect of long-term credit flows is positive and significant for high-tech firms (both services and manufacturing) and other service firms.

2.2 Financing Constraints and Firm Employment

Research Questions

- How do financing constraints impact on employment?
- Are there differential effects of financing constraints on employment for different groups of firms?
- Are there differential effects of financing constraints on employment for different groups of industries?

Key Findings

- On average, employment demand appears to be driven by lagged employment levels, capital stock and wage growth as well as growth in firm output.
- We find significant effects of financial factors on employment over and above other determinants and control variables, including structural firm characteristics, output demand, as well as industry- and country- specific cyclical factors.
- We find heterogeneous effects of financial factors on employment demand across groups of firms. In young firms aged less than 6 years, labour demand appears more responsive to the availability of cash stock. For firms older than 21 years, trade credit had a positive impact on labour demand. Greater access to trade credit and long term credit flows lead to an increase in employment for domestic SMEs, Micro and firms aged between 6-20 years.
- Comparing the effects of financial dependence on firm labour demand between the pre- and post- crisis period we find that the sensitivity of labour demand to trade credit remained stable for domestic SMEs, Micro and firms aged between 6-20 years were important in both periods. Additional long term credit is found to have had a positive effect on labour demand for SME, Micro firms and firms aged between 6 and 20 years in the post-crisis period.
- Greater trade credit had a positive effect on labour demand for high tech manufacturing, other services and other manufacturing in the pre- and post-crisis periods.

Introduction

To the extent that hiring of new employees is linked to investment choices, employment decisions will also be affected, Nickell and Nicolitsas, (1999). Further, credit rationing reduces working capital and thus may also lead to lower employment. Indeed, the theoretical and empirical literature has shown that increased financial pressure can have a negative effect on employment; Nickell and Nicolitsas, (1999) for UK firms, and Hernando and Martínez-Carrascal (2008) for Spanish firms. Furthermore, recent evidence suggests that the effects of financial pressure are heterogeneous across firms, Fort et al. (2013).

To understand how financial dependence and the financial crisis have affected employment, this section addresses the following three questions: (i) how does financing impact on employment? (ii) Are there differential effects of financing constraints on employment for different groups of firms? and (iii) Are there differential effects of financing constraints on employment for different groups of industries?

Theoretical and Empirical Background

Theoretical models predict that access to external finance influences investment decisions (Cabral and Mata, 2003). Furthermore, it has been shown that this link is particularly strong in the case of young firms (Evans and Jovanovic, 1989). More recent models have been developed to explain how financial market imperfections account for the simultaneous dependence of firm growth on size and age (Cooley and Quadrini, 2001; Hopenhayn, 2004; Clementi and Hopenhayn, 2006). Coluzzi et al. (2012) show that financial constraints hamper firm growth, in particular, in countries with larger shares of small and medium-sized enterprises.

Sharpe (1994) shows that more leveraged firms tend to hoard relatively less labour when financial markets are tight. Ogawa (2003) examined the impact of financial distress on employment in Japan during the 1990s.

Fort et al. (2013) analysed the responsiveness of employment to business cycles in the US using data for the period 1981-2010. They show that young small firms were associated with a large decline in net employment growth and job creation as well as a large increase in job destruction during the 2007-2009 financial crisis. While large firms have also experienced large declines in net employment growth, the relative decline was bigger for young, small firms than for large and mature firms. They suggest that one possible channel to explain the greater vulnerability of young, small firms to cyclical shocks is the financing of start-ups and young firms by home equity.

Empirical Methodology

To analyse the effects of financial variables on firm employment we estimate a labour demand equation augmented with financial variables as follows:

$$L_{ijct} = \alpha_i + \beta_1 X_{ijct-1} + \eta_{jt} + \lambda_{ct} + \mu_{ijct} \qquad \textbf{(1)}$$

The dependent variable is the natural logarithm of employees in firm *i*, industry *j*, country *c*, at time *t*. The explanatory variables are firm characteristics (lagged employment in *t-1* and *t-2*, capital stock as share of total assets, log growth and lagged level of average real wage, financial variables (cash flow, cash stock, leverage, and interest rate burden, trade credit, long

and short term credit as share of total assets), and to control for changes in demand we include log growth in firm turnover.

To investigate changes in the relationship between firm employment and the financial variables before and after the financial crisis we interact the financial variables with a financial crisis dummy. The financial crisis variable equals 1 if the year is greater than 2008 and zero otherwise.

$$L_{ijkt} = \alpha_i + \beta_1 X_{ijkt-1} * FC_{ijkt-1} + \eta_{jt} + \lambda_{kt} + \mu_{ijkt} \quad \textbf{(2)}$$

To control for sector time and country time specific effect we de-mean our variables by country-year and by industry-year.

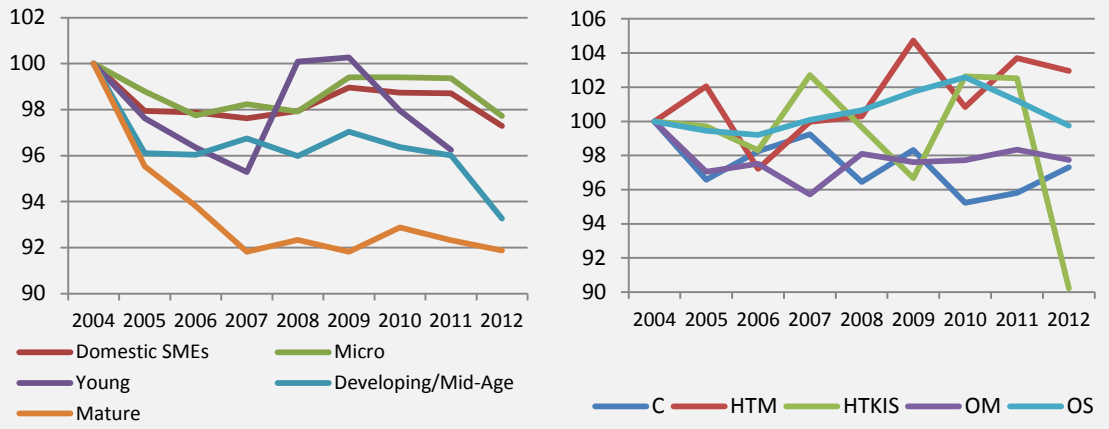
We first estimate our model specifications for the full sample of firms. Next, we estimate our model on different subsamples: firm size groups, firm age groups, sector and country regions. This approach allows us to investigate potential changes in the relationships between firm employment and financial dependence before and after the crisis for different types of firms.

We estimate our model specification using system GMM. This estimation approached is described in detail in the Appendix Section A4.2.

Descriptive Statistics

Figure 2-7 plots average employment by firm groups and sector over the period 2004 – 2012. We observe that average employment performance has varied across firm groups over the period. Since the 2008 employment is lower in all firm age and size categories presented, with young firms experiencing the sharpest decline. The employment patterns appear more volatile across sectors over the period. Focusing on period since the financial crisis, it is apparent that sector employment responses differed; employment in Other Manufacturing remained relatively stable over the period compared with Construction and High-Tech manufacturing which exhibited a decline in employment before recovering, High tech knowledge intensive services and other services show a rise in employment before experiencing a decline.

Figure 2-7 Average Employment By Firm Groups And Sectors, 2004 – 2012



Note: Average employment of each firm category is indexed with a base year value of 100 in 2004. Construction; Cons, High-tech Manufacturing; HTM, High-tech Knowledge Intensive Services; HTKIS, Other Manufacturing; OM, OS - Other Services; OS.

Source: Amadeus

Empirical Results

In this section, we present the estimates of our model specifications that identify the effects of financial dependence on firm labour demand.

We estimate two model specifications; the baseline model specification identifies the average effect of the dependence on various financial sources on the labour demand over the full period. The second specification which includes the interaction terms enables us to test whether the relationships between labour demand and the financial variables differ between the pre- and post-financial crisis periods. Both model specifications are estimated for the full sample and for sub-samples. Table 2-6 and Table 2-7 present the effects of the financial variables on labour demand for the full period and for the pre- and post-crisis. These effects are based estimation results contained in Table 2-8 to Table 2-7. The interaction term in the model captures the difference in the effect of the financial variables on labour demand in the post-crisis period compared with the pre-crisis period.

In Table 2-6 , we find, on average, trade credit and long term credit flows are important channels of financing and had a significant and positive impact on firm employment for the full sample of firms. Looking across the sub samples, the effect of trade credit and long term credit flows were important for domestic owned SMEs, firms older than 21 years and especially for Micro firms. For young firms aged 5 years or less, the share of cash stock was also found to be important for employment. Focusing on the sector regressions in Table 2-7, we find on average trade credit had a significant impact on labour demand for all sectors except high-tech knowledge intensive services sector.

When we compare the effects of financial dependence on firm labour demand between the pre- and post-crisis period in Table 2-6 we find that trade credit had a significant impact on employment for domestic, Micro and firms aged between 6-20 years in both periods. Access to more long term credit is found to have a positive effect on labour demand for SME, Micro

firms and firms aged between 6 and 20 years in the post-financial crisis period. In table 2-6, we find that greater trade credit was observed to have a positive effect on labour demand for high-tech manufacturing, other services and other manufacturing in both periods.

Table 2-6 The Effect Of Financial Factors And The Financial Crisis On Employment, Firm Groups

Dep Var: lnemp $_t$	All Firms	Domestic SMEs	Micro Enterprises	Young Enterprises	Developing/Mid Age	Mature
Cash Flow	0.041	0.110	0.127	-0.160	0.064	-0.270
Pre-crisis	-0.236	-0.167	-0.170	1.823*	-0.080	-0.270
Post-crisis	0.076	0.138	0.144	-0.486*	0.266*	0.028
Cash stock	0.109	0.090	0.185	0.357***	0.007	0.090
Pre-crisis	0.004	0.010	0.163	0.249	-0.060	0.040
Post-crisis	0.094*	0.055	0.118	0.322***	0.001	0.131**
Trade credit	0.069	0.060	0.138	-0.056	0.024	-0.076
Pre-crisis	0.169	0.197	0.385	-0.093	0.168	0.145
Post-crisis	0.002	0.008	0.053	-0.059	0.050	-0.044
Interest burden	-0.012	-0.028	-0.041	-0.022	-0.035	-0.039
Pre-crisis	-0.108	-0.104	-0.081	-0.057	-0.096	-0.128**
Post-crisis	-0.008	-0.023	-0.057	-0.016	-0.025	-0.003
Leverage	0.148**	0.111*	0.187***	0.067	0.028	0.131**
Pre-crisis	0.101***	0.086**	0.124**	0.319	0.107**	0.053
Post-crisis	0.080***	0.072***	0.116**	0.025	0.053	0.106***
Credit flows (long)	0.452**	0.531**	0.763**	-0.008	0.328*	0.137
Pre-crisis	1.239	1.257	1.229	-0.490	0.026	0.883
Post-crisis	0.302	0.405*	0.669**	0.034	0.343*	0.163
Credit flows (short)	0.175	0.287	0.290	-0.161	0.308	0.518
Pre-crisis	-0.298	-0.161	-0.312	-0.576	-0.336	0.713
Post-crisis	0.244	0.355	0.347	-0.163	0.490*	0.390
N	22540	22040	7979	3262	14810	12183

Source: Econometric analysis based on Amadeus.

Table 2-7 The Effect of Financial Factors and The Financial Crisis on Employment, Sectors

Dep Var: lnemp $_t$	HTKIS	HTM	Other Services	Other Manufacturing	Construction
Cash Flow	0.333*	-0.018	-0.042	0.337	0.293
Pre-crisis	1.719	-0.119	-0.192	-0.193	0.896
Post-crisis	0.242	-0.065	0.062	0.248	0.158
Cash stock	-0.143	0.148	0.257**	-0.055	0.484**
Pre-crisis	0.196	-0.018	0.084	-0.176	0.297
Post-crisis	-0.127	0.104	0.108	0.040	0.261*
Trade credit	-0.592***	-0.122	0.156	0.030	-0.103
Pre-crisis	0.573	-0.152	0.363	0.187	-0.217
Post-crisis	-0.650***	-0.061	0.102	-0.030	-0.248
Interest burden	-0.044	0.000	0.023	0.003	-0.090
Pre-crisis	0.050	-0.086*	-0.099	-0.103	-0.020
Post-crisis	-0.045	0.014	0.014	0.014	-0.091
Leverage	-0.023	0.146**	0.142**	0.122**	0.210**
Pre-crisis	0.179	-0.254*	0.104**	0.172***	0.289**
Post-crisis	-0.010	0.080*	0.073**	0.082***	0.130
Credit flows (long)	0.406*	0.096	0.231	0.145	0.397
Pre-crisis	0.631	0.871**	0.655	0.282	0.569
Post-crisis	0.356	0.104	0.217	0.092	0.289
Credit flows (short)	1.236**	0.238	0.190	-0.241*	0.591**
Pre-crisis	1.921***	-0.299	-0.356	-0.531	0.470
Post-crisis	0.948	0.190	0.292	-0.207	0.725***
N	7718	246	11362	445	2769

Source: Econometric analysis based on Amadeus

Table 2-8 The Effect of Financial Factors and The Financial Crisis on Employment, Firm Size Groups

	Full sample		SMEs		Micro enterprises	
	Baseline	Crisis	Baseline	Crisis	Baseline	Crisis
$Employment_{t-1}$	0.949***	0.956***	0.948***	0.952***	0.913***	0.921***
	(0.039)	(0.041)	(0.041)	(0.042)	(0.055)	(0.058)
$Employment_{t-2}$	-0.042	-0.047	-0.056	-0.060	-0.039	-0.051
	(0.045)	(0.046)	(0.047)	(0.047)	(0.056)	(0.058)
Fixed Tangible $Assets_t$	0.025***	0.024***	0.023***	0.024***	0.013	0.017*
	(0.007)	(0.007)	(0.008)	(0.007)	(0.010)	(0.009)
Change in $Wages_t$	-0.713***	-0.719***	-0.724***	-0.729***	-0.858***	-0.890***
	(0.080)	(0.083)	(0.078)	(0.080)	(0.164)	(0.160)
$Wages_{t-1}$	-0.000	0.001	0.026	0.023	0.034	0.025
	(0.031)	(0.027)	(0.040)	(0.036)	(0.049)	(0.044)
Change in $tunover_t$	0.236***	0.232***	0.220***	0.216***	0.259**	0.268***
	(0.066)	(0.062)	(0.063)	(0.060)	(0.109)	(0.103)
Cash $Flow_t$	0.041	-0.236	0.110	-0.167	0.127	-0.170
	(0.199)	(0.276)	(0.211)	(0.275)	(0.286)	(0.418)
Cash $Stock_{t-1}$	0.109	0.004	0.090	0.010	0.185	0.163
	(0.102)	(0.103)	(0.113)	(0.111)	(0.125)	(0.159)
$Leverage_{t-1}$	0.069	0.169	0.060	0.197	0.138	0.385
	(0.080)	(0.139)	(0.081)	(0.159)	(0.101)	(0.321)
Interest $burden_{t-1}$	-0.012	-0.108	-0.028	-0.104	-0.041	-0.081
	(0.024)	(0.079)	(0.027)	(0.075)	(0.035)	(0.098)
Trade $Credit_{t-1}$	0.148**	0.101***	0.111*	0.086**	0.187***	0.124**
	(0.059)	(0.037)	(0.066)	(0.039)	(0.058)	(0.052)
(Long) $Creditflows_t$	0.452**	1.239	0.531**	1.257	0.763**	1.229
	(0.205)	(0.835)	(0.218)	(0.845)	(0.303)	(1.081)
(Short) $Creditflows_t$	0.175	-0.298	0.287	-0.161	0.290	-0.312
	(0.299)	(0.657)	(0.287)	(0.699)	(0.257)	(0.754)
Crisis	-0.042***	-0.085***	-0.034***	-0.072***	-0.033***	-0.066**
	(0.007)	(0.025)	(0.008)	(0.027)	(0.011)	(0.033)
Cash $Flow_t$*Crisis		0.312		0.306		0.314
		(0.241)		(0.246)		(0.382)
Cash $Stock_{t-1}$*Crisis		0.090		0.045		-0.046
		(0.092)		(0.094)		(0.136)
$Leverage_{t-1}$*Crisis		-0.167		-0.188		-0.332
		(0.135)		(0.157)		(0.318)
Interest $burden_{t-1}$*Crisis		0.100		0.081		0.024
		(0.077)		(0.076)		(0.099)
Trade $Credit_{t-1}$*Crisis		-0.021		-0.014		-0.009
		(0.033)		(0.033)		(0.043)
(Long) $Creditflows_t$*Crisis		-0.937		-0.851		-0.560
		(0.795)		(0.827)		(1.097)
(Short) $Creditflows_t$*Crisis		0.542		0.516		0.659
		(0.581)		(0.622)		(0.741)
Observations	109735	109735	1.06E+05	1.06E+05	26229	26229
No of Firms	22535	22535	21882	21882	6979	6979
Autocorrelation test (2^{nd} order)	0.667	0.550	0.881	0.993	0.779	0.599
Hansen Test	0.147	0.240	0.136	0.250	0.228	0.298
Instruments	194	201	194	201	194	201

Source: Econometric analysis based on Amadeus

Table 2-9 The Effect of Financial Factors and The Financial Crisis on Employment, Firm Size Groups

	Small		Medium		Small or Medium	
	Baseline	**Crisis**	**Baseline**	**Crisis**	**Baseline**	**Crisis**
$Employment_{t-1}$	1.090***	1.083***	1.099***	1.074***	1.124***	1.111***
	(0.038)	(0.040)	(0.066)	(0.061)	(0.037)	(0.039)
$Employment_{t-2}$	-0.126***	-0.114***	-0.072	-0.036	-0.146***	-0.135***
	(0.037)	(0.037)	(0.070)	(0.060)	(0.035)	(0.036)
Fixed Tangible $Assets_t$	0.011*	0.013*	0.002	-0.005	0.010	0.012*
	(0.006)	(0.007)	(0.012)	(0.010)	(0.006)	(0.006)
Change in $Wages_t$	-0.677***	-0.662***	-0.660***	-0.655***	-0.673***	-0.666***
	(0.068)	(0.067)	(0.080)	(0.081)	(0.071)	(0.069)
$Wages_{t-1}$	0.012	0.010	0.018	0.012	0.003	-0.001
	(0.020)	(0.019)	(0.035)	(0.029)	(0.019)	(0.019)
Change in $tunover_t$	0.197***	0.194***	0.218*	0.202*	0.210***	0.207***
	(0.052)	(0.053)	(0.119)	(0.110)	(0.056)	(0.056)
Cash $Flow_t$	-0.033	-0.097	0.167	0.340	-0.040	-0.078
	(0.121)	(0.124)	(0.295)	(0.282)	(0.118)	(0.119)
Cash $Stock_{t-1}$	-0.103	0.024	0.075	-0.265**	-0.024	0.017
	(0.081)	(0.062)	(0.112)	(0.121)	(0.078)	(0.057)
$Leverage_{t-1}$	-0.035	0.004	-0.012	-0.069	-0.017	-0.008
	(0.053)	(0.076)	(0.138)	(0.089)	(0.055)	(0.065)
Interest $burden_{t-1}$	0.007	0.020	-0.024	0.104*	-0.005	0.023
	(0.017)	(0.023)	(0.019)	(0.056)	(0.018)	(0.022)
Trade $Credit_{t-1}$	0.016	0.024	0.060	-0.009	0.025	0.020
	(0.039)	(0.027)	(0.050)	(0.051)	(0.037)	(0.026)
(Long) $Creditflows_t$	0.116	0.813	0.187	0.056	0.109	0.815
	(0.159)	(0.568)	(0.228)	(0.453)	(0.148)	(0.504)
(Short) $Creditflows_t$	-0.202**	-0.005	-0.076	-0.325	-0.217**	-0.063
	(0.103)	(0.528)	(0.125)	(0.327)	(0.101)	(0.465)
Crisis	-0.038***	-0.043***	-0.048***	-0.063**	-0.039***	-0.044***
	(0.004)	(0.014)	(0.009)	(0.025)	(0.004)	(0.014)
Cash $Flow_t$*Crisis		0.211*		-0.219		0.169
		(0.112)		(0.198)		(0.105)
Cash $Stock_{t-1}$*Crisis		-0.040		0.294**		-0.009
		(0.052)		(0.119)		(0.050)
$Leverage_{t-1}$*Crisis		-0.025		0.089		-0.011
		(0.077)		(0.085)		(0.064)
Interest $burden_{t-1}$*Crisis		-0.007		-0.120**		-0.013
		(0.022)		(0.059)		(0.021)
Trade $Credit_{t-1}$*Crisis		-0.007		0.057		0.002
		(0.026)		(0.056)		(0.025)
(Long) $Creditflows_t$*Crisis		-0.763		0.075		-0.758
		(0.582)		(0.537)		(0.525)
(Short) $Creditflows_t$*Crisis		-0.226		0.354		-0.167
		(0.531)		(0.377)		(0.469)
Observations	70288	70288	9908	9908	80196	80196
No. of firms	15562	15562	2156	2156	17197	17197
AR 2 test	0.797	0.967	0.089	0.075	0.785	0.972
Hansen Test	0.000	0.000	0.039	0.024	0.000	0.000

Source: Econometric analysis based on Amadeus

Table 2-10 The Effect of Financial Factors and The Financial Crisis on Employment, By Firm Age

	Less than 6 years		6-20 years		21 years plus	
	Baseline	Crisis	Baseline	Crisis	Baseline	Crisis
$Employment_{t-1}$	0.888***	0.917***	0.948***	0.966***	0.937***	0.931***
	(0.066)	(0.067)	(0.052)	(0.051)	(0.054)	(0.057)
$Employment_{t-2}$	0.024	0.000	-0.055	-0.072	-0.037	-0.027
	(0.052)	(0.052)	(0.055)	(0.054)	(0.047)	(0.051)
Fixed Tangible $Assets_t$	0.034	0.032	0.008	0.011	0.042***	0.036***
	(0.022)	(0.022)	(0.010)	(0.009)	(0.011)	(0.010)
Change in $Wages_t$	-1.009***	-0.966***	-0.725***	-0.745***	-0.647***	-0.703***
	(0.116)	(0.121)	(0.080)	(0.080)	(0.078)	(0.084)
$Wages_{t-1}$	-0.077	-0.078	0.040	0.013	-0.053	-0.076
	(0.065)	(0.058)	(0.043)	(0.038)	(0.046)	(0.046)
Change in $tunover_t$	0.594***	0.600***	0.247***	0.230***	0.161*	0.178*
	(0.128)	(0.127)	(0.070)	(0.066)	(0.093)	(0.098)
Cash $Flow_t$	-0.160	1.823*	0.064	-0.080	-0.270	-0.270
	(0.274)	(1.092)	(0.224)	(0.308)	(0.218)	(0.421)
Cash $Stock_{t-1}$	0.357***	0.249	0.007	-0.060	0.090	0.040
	(0.111)	(0.437)	(0.122)	(0.118)	(0.109)	(0.104)
$Leverage_{t-1}$	-0.056	-0.093	0.024	0.168	-0.076	0.145
	(0.200)	(0.661)	(0.113)	(0.214)	(0.122)	(0.187)
Interest $burden_{t-1}$	-0.022	-0.057	-0.035	-0.096	-0.039	-0.128**
	(0.037)	(0.163)	(0.032)	(0.076)	(0.031)	(0.050)
Trade $Credit_{t-1}$	0.067	0.319	0.028	0.107**	0.131**	0.053
	(0.091)	(0.280)	(0.070)	(0.046)	(0.062)	(0.056)
(Long) $Creditflows_t$	-0.008	-0.490	0.328*	0.026	0.137	0.883
	(0.192)	(0.943)	(0.193)	(0.433)	(0.291)	(1.276)
(Short) $Creditflows_t$	-0.161	-0.576	0.308	-0.336	0.518	0.713
	(0.207)	(0.570)	(0.237)	(0.572)	(0.468)	(0.759)
Crisis	-0.064***	0.173	-0.035***	-0.089***	-0.047***	-0.080***
	(0.021)	(0.142)	(0.010)	(0.030)	(0.010)	(0.030)
Cash $Flow_t$*Crisis		-2.309**		0.346		0.298
		(1.117)		(0.288)		(0.346)
Cash $Stock_{t-1}$*Crisis		0.074		0.059		0.092
		(0.441)		(0.102)		(0.095)
$Leverage_{t-1}$*Crisis		0.034		-0.118		-0.189
		(0.660)		(0.214)		(0.182)
Interest $burden_{t-1}$*Crisis		0.041		0.071		0.125**
		(0.168)		(0.077)		(0.050)
Trade $Credit_{t-1}$*Crisis		-0.293		-0.054		0.053
		(0.276)		(0.038)		(0.055)
(Long) $Creditflows_t$*Crisis		0.523		0.318		-0.720
		(0.953)		(0.463)		(1.180)
(Short) $Creditflows_t$*Crisis		0.413		0.826		-0.323
		(0.592)		(0.621)		(0.483)
Observations	2950	2950	51968	51968	51507	51507
No of firms	1674	1674	13102	13102	11731	11731
AR(2) test	0.839	0.556	0.939	0.894	0.614	0.694
Hansen test	0.499	0.780	0.035	0.103	0.371	0.407

Source: Econometric analysis based on Amadeus

Table 2-11 The Effect of Financial Factors and The Financial Crisis on Employment, Sectors

	HTKIS		**HTM**		**Other Services**		**Other manufacturing**		**Construction**	
	Baseline	Crisis	Baseline	Crisis	Baseline	Crisis	Baseline	Crisis	Baseline	Crisis
$Employment_{t-1}$	0.907***	0.925***	0.983***	0.985***	0.929***	0.955***	0.972***	0.974***	0.910***	0.989***
	(0.078)	(0.085)	(0.044)	(0.045)	(0.051)	(0.051)	(0.046)	(0.047)	(0.085)	(0.095)
Fixed Tangible $Assets_t$	0.048**	0.038**	0.015	0.014	0.026***	0.024***	0.025***	0.024**	0.025	0.026
	(0.021)	(0.019)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.017)	(0.018)
Change in $Wages_t$	-0.705***	-0.750***	-0.771***	-0.766***	-0.508***	-0.512***	-0.728***	-0.715***	-1.026***	-1.068***
	(0.107)	(0.111)	(0.074)	(0.074)	(0.083)	(0.086)	(0.068)	(0.069)	(0.126)	(0.145)
$Wages_{t-1}$	-0.098**	-0.065	0.113***	0.123***	0.015	0.016	0.018	0.015	-0.064	-0.052
	(0.046)	(0.050)	(0.030)	(0.031)	(0.036)	(0.032)	(0.033)	(0.028)	(0.067)	(0.064)
Change in $tunover_t$	0.102	0.034	0.218***	0.237***	0.166**	0.171**	0.243***	0.254***	0.256***	0.280***
	(0.147)	(0.163)	(0.066)	(0.065)	(0.084)	(0.082)	(0.060)	(0.060)	(0.080)	(0.067)
Cash $Flow_t$	0.333*	1.719	-0.018	-0.119	-0.042	-0.192	0.337	-0.193	0.293	0.896
	(0.177)	(1.160)	(0.161)	(0.397)	(0.261)	(0.321)	(0.237)	(0.385)	(0.289)	(0.548)
Cash $Stock_{t-1}$	-0.143	0.196	0.148	-0.018	0.257**	0.084	-0.055	-0.176	0.484**	0.297
	(0.146)	(0.304)	(0.096)	(0.209)	(0.130)	(0.106)	(0.107)	(0.156)	(0.207)	(0.261)
$Leverage_{t-1}$	-0.592***	0.573	-0.122	-0.152	0.156	0.363	0.030	0.187	-0.103	-0.217
	(0.119)	(0.780)	(0.086)	(0.141)	(0.107)	(0.223)	(0.088)	(0.160)	(0.164)	(0.387)
Interest $burden_{t-1}$	-0.044	0.050	0.000	-0.086*	0.023	-0.099	0.003	-0.103	-0.090	-0.020
	(0.057)	(0.226)	(0.019)	(0.049)	(0.025)	(0.073)	(0.023)	(0.092)	(0.130)	(0.133)
Trade $Credit_{t-1}$	-0.023	0.179	0.146**	-0.254*	0.142**	0.104**	0.122**	0.172***	0.210**	0.289**
	(0.075)	(0.153)	(0.061)	(0.143)	(0.059)	(0.049)	(0.062)	(0.053)	(0.093)	(0.129)
(Long) $Creditflows_t$	0.406*	0.631	0.096	0.871**	0.231	0.655	0.145	0.282	0.397	0.569
	(0.229)	(0.921)	(0.191)	(0.434)	(0.171)	(0.596)	(0.163)	(0.430)	(0.526)	(1.047)
(Short) $Creditflows_t$	1.236**	1.921***	0.238	-0.299	0.190	-0.356	-0.241*	-0.531	0.591**	0.470
	(0.542)	(0.454)	(0.153)	(0.586)	(0.256)	(0.785)	(0.141)	(0.625)	(0.265)	(0.686)
Crisis	-0.033	0.172	-0.071***	-0.051	-0.037***	-0.077**	-0.044***	-0.116***	-0.008	0.061
	(0.034)	(0.176)	(0.021)	(0.043)	(0.010)	(0.033)	(0.009)	(0.041)	(0.021)	(0.079)
Cash $Flow_t$*Crisis		-1.477		0.054		0.253		0.441		-0.738
		(1.162)		(0.379)		(0.287)		(0.348)		(0.632)
Cash $Stock_{t-1}$*Crisis		-0.323		0.121		0.024		0.216		-0.036
		(0.352)		(0.207)		(0.080)		(0.162)		(0.269)
$Leverage_{t-1}$*Crisis		-1.223		0.091		-0.261		-0.217		-0.031
		(0.818)		(0.138)		(0.222)		(0.158)		(0.447)
Interest $burden_{t-1}$*Crisis		-0.095		0.100*		0.114		0.116		-0.070
		(0.263)		(0.052)		(0.074)		(0.092)		(0.128)
Trade $Credit_{t-1}$*Crisis		-0.189		0.334**		-0.031		-0.090*		-0.158
		(0.171)		(0.142)		(0.046)		(0.052)		(0.108)
(Long) $Creditflows_t$*Crisis		-0.275		-0.767		-0.438		-0.190		-0.280
		(0.919)		(0.497)		(0.610)		(0.459)		(1.050)
(Short) $Creditflows_t$*Crisis		-0.973		0.488		0.649		0.323		0.255
		(0.606)		(0.608)		(0.803)		(0.666)		(0.747)
Observations		2007 (431)		1120 (219)		53398 (11100)		36735 (7408)		13165 (2724)
AR(2) / Hansen test	0.240 / 0.450	0.497/ 0.144	0.263/0.348	0.090/0.259	0.849/0.009	0.728/0.013	0.4990.105	0.4840.076	0.094/0.357	0.097/0.118

Source: Econometric analysis based on Amadeus

Conclusion

In this section, we examined the effect of financial dependence on firm labour demand, using firm-level panel data for the period 2003-2012. We also analysed how the financial crisis has impacted on the sensitivity of firm labour demand to its dependence on different types of financing.

We find the responsiveness of employment demand to external financing varies for different types of firms. While on average, labour demand is sensitive to trade credit and to long-term credit flows, we observe that for micro firms labour demand appears more responsive to the availability of trade credit and to long-term credit flows.

We observe that the relationship between trade credit and employment demand has remained stable pre- and post-financial crisis for domestic SMEs, micro and firms aged between 6-20 years. We observe that access to more long-term credit was found to have a positive effect on labour demand for SMEs, micro firms and firms aged between 6 and 20 years in the post-financial crisis period. Trade credit was found to matter for labour demand in high-tech manufacturing, other services and other manufacturing during the pre- and post-crisis periods.

From a policy perspective our findings indicate that improving access to external financing, such as long term loans, will foster employment demand more in micro enterprises.

2.3 Financing Constraints and Firm Productivity

Key Questions

- How do financing constraints affect firm productivity growth?
- Are there differential effects of financing constraints on productivity growth for different groups of firms?
- Are there differential effects of financing constraints on productivity growth for different groups of industries?
- Has the financial crisis had an effect on the impact of financing constraints on firm productivity growth?

Key Findings

- Total Factor Productivity (TFP) growth is positively related to a firm's internal cash flow in all firm types, sectors and country groups. This finding implies that productivity growth is responsive to shocks to a firm's internal cash flow. Ideally, this would not be the case in a well functioning financial market as financial intermediaries should provide firms with the necessary external funding to undertake projects with an expected positive impact on total factor productivity growth. This finding suggests that financial constraints are having a negative impact on productivity growth for European SMEs.
- The financial crisis exacerbated the effect of cash flow on productivity growth in particular for young firms in the construction sector and the high-tech manufacturing sector. Firms in the high-tech, knowledge-intensive services sector appear to have been more constrained in the pre-crisis period, though their productivity growth remains constrained by access to finance issues in the post-crisis period too.
- Cash stock displays a negative relationship with productivity growth in the post-crisis period for domestic SMEs, micro firms, young firms, mature firms, construction firms, other manufacturing firms and other services firms. There is also an overall negative effect of cash stocks on TFP growth for high-tech manufacturing firms. The likely explanation for this finding is that firms are hoarding cash due to a lack of profitable investment and expansion opportunities in the post-crisis period and are thus experiencing stagnating productivity growth.
- Leverage is positively related to TFP growth for young firms over the whole sample period. This corresponds to the strand of the literature which finds that increased financial distress can lead to increased productivity growth in some cases.
- The interest burden has a negative and significant effect on productivity growth in high-tech knowledge-intensive services firms in the post-crisis

period. This finding implies that increased debt repayments in the post-crisis period are having a detrimental effect on productivity growth for these firms.

Theoretical and Empirical Background

It is widely accepted that in the long-term growth in output per capita is determined by productivity growth and that cross-country differentials in productivity growth are explained by total factor productivity (TFP) differences (Hall and Jones, 1999; Easterly and Levine, 2001).

The theoretical literature has established that financial frictions lead to lower firm productivity by hampering investment in high quality projects or newest vintages of capital (Moreno-Badi and Slootmaekers 2009). The main mechanism on which these long-term growth models are based is that liquid financial markets facilitate long-term productivity-enhancing investments (Levine, 1991; Bencivenga et al. 1995). Furthermore, efficient financial markets allocate savings to productivity-enhancing projects (King and Levine, 1993).

Existing empirical evidence at country and industry levels has shown that financial development and the efficiency of financial systems have a positive effect on aggregate productivity growth (King and Levine, 1993; Levine and Zervos, 1998; Beck et al. 2000).

Recent emerging empirical literature has analysed the effects of financial factors on productivity at firm-level. Two empirical approaches can be distinguished. The first approach estimates the effect of financial variables on firm productivity in a production function model (Nickell and Nicolitsas, 1999). The second group of empirical models relate measures of firm productivity to financial variables (Nucci et al. 2005; Nunes et al. 2007; Gatti and Love 2008; Musso and Schiavo, 2008; Moreno-Badia and Slootmaekers 2009; Chen and Guariglia, 2013)

Nickell and Nicolitsas (1999) analysed the effect of financial pressure on firm productivity based on a model derived from a production function augmented with financial variables such as the borrowing ratio (defined as interest payments divided by the sum of profits before tax, depreciation, and interest payments). Using firm-level data for the manufacturing firms in the UK over the period 1972-1986, they find that increases of financial pressure leads to a small but positive effect on firm productivity.

The results obtained with the second group of empirical models are mixed. Evidence of a positive relationship between financial pressure and total factor productivity is provided by Pusher (1995), Lang et al. (1996), and Smith et al. (2004). Nucci et al. (2005) use panel data for firms in Italy and find that firms with a higher leverage ratio had lower total factor productivity. Nunes et al. (2007) examined the relationship between firms' leverage and labour productivity by using a panel data for firms in Portugal over the period 1999-2003. They show that this relationship is nonlinear: while it was found to be positive for those firms with higher labour productivity, it was negative for those firms with lower labour productivity. They interpret the positive relationship between leverage and labour productivity as evidence for the argument put forward by Jensen (1986) that a high level of leverage increases the bankruptcy risk which in turn incentivises managers to improve productivity. The negative relationship between leverage and labour productivity may be explained by the negative link between investment in R&D which is productivity enhancing but negatively linked to collateral. This argument is in line with Jensen and Meckling (1976) and Myers (1977) who provide evidence on a negative relationship between leverage and R&D activities.

Gatti and Love (2008) used cross-section data of firms in Bulgaria and found that access to credit was positively linked to TFP.

Musso and Schiavo (2008) used data for manufacturing firms in France over the period 1996-2004 and construct a time-varying index of financial constraints. Their analysis found that financial constrained firms had a higher labour and total factor productivity growth. They interpret their evidence as support for the hypothesis that financial pressure helps to solve agency problems and foster firm performance.

Moreno - Badia and Slootmaekers (2009) construct a time-varying financial constraints score for firms in Estonia over the period 1997-2005. They find that financial constraints did not have an impact on productivity on most sectors with the exception of R&D and other business services where they were negatively associated with productivity.

Chen and Guariglia (2013) examined the link between financial constrains and total factor productivity using a panel data for firms in China over the period 2001-2007. They find that the availability of internal funds is strongly and positively related to total factor productivity. Furthermore, they found that foreign-owned exporters were less likely to be financially constrained however, this is not true for domestic exporters.

Empirical Methodology

We analyse the impact of financial constraints on firm productivity following a production function approach as in Nickell and Nicolitsas (1999). We analyse the impact of financial constraints on firm productivity growth by using this indirect empirical approach. We estimate the following dynamic empirical model for total factor productivity:

$$\ln TFP_{ijkt} = \delta_i + \gamma_1 \ln TFP_{ijkt-1} + \gamma_2 \ln AGE_{ijkt} + \gamma_3 \ln SIZE_{ijkt} + \gamma_4 DOM_{ijkt} + \gamma_5 \Delta SALES_{ijkt} + \gamma_6 MKTS_{ijkt} + \\ + \gamma_7 FIN_{ijkt-1} + \lambda_{jt} + \eta_{kt} + \mu_{ijkt}$$

The dependent variable TFP_{ijkt} is the difference in natural logarithm of total factor productivity in firm *i*, industry *j*, country *k* at time *t*. Total factor productivity is obtained using the Levinsohn-Petrin methodology (Levinsohn and Petrin, 2003) to correct for simultaneity and selection biases related to firms' decisions on factor inputs and unobserved productivity shocks.[13]

The explanatory variables include the lagged dependent variable, firm characteristics (age, size and ownership), sales growth (a proxy for demand shocks), market share, financial factors, as well as controls for industry-time and country-time specific effects. The financial variables included are the following:

- cash flow ratio
- cash stock ratio
- leverage ratio
- trade credit ratio
- long term credit growth rate

[13] The Levinsohn-Petrin estimation method for TFP uses intermediate inputs as a proxy for unobserved productivity shocks. An alternative TFP estimation method proposed by Olley and Pakes (1996) uses investment as a proxy for unobserved productivity shock. Our choice for the Levinsohn-Petrin method is based on the better data coverage for intermediate inputs than for investment.

- short term credit growth rate
- interest burden

We first estimate the model on the full sample of firms from the Amadeus database. Our first iterations of the model are run without any interactions with the financial crisis in order to extract an overall effect of financing constraints on productivity growth across the full sample period. Next, we run these same models across different sub-samples of firms to examine the impact of financing constraints on productivity growth in different firm groups. We run the model on subsamples of:

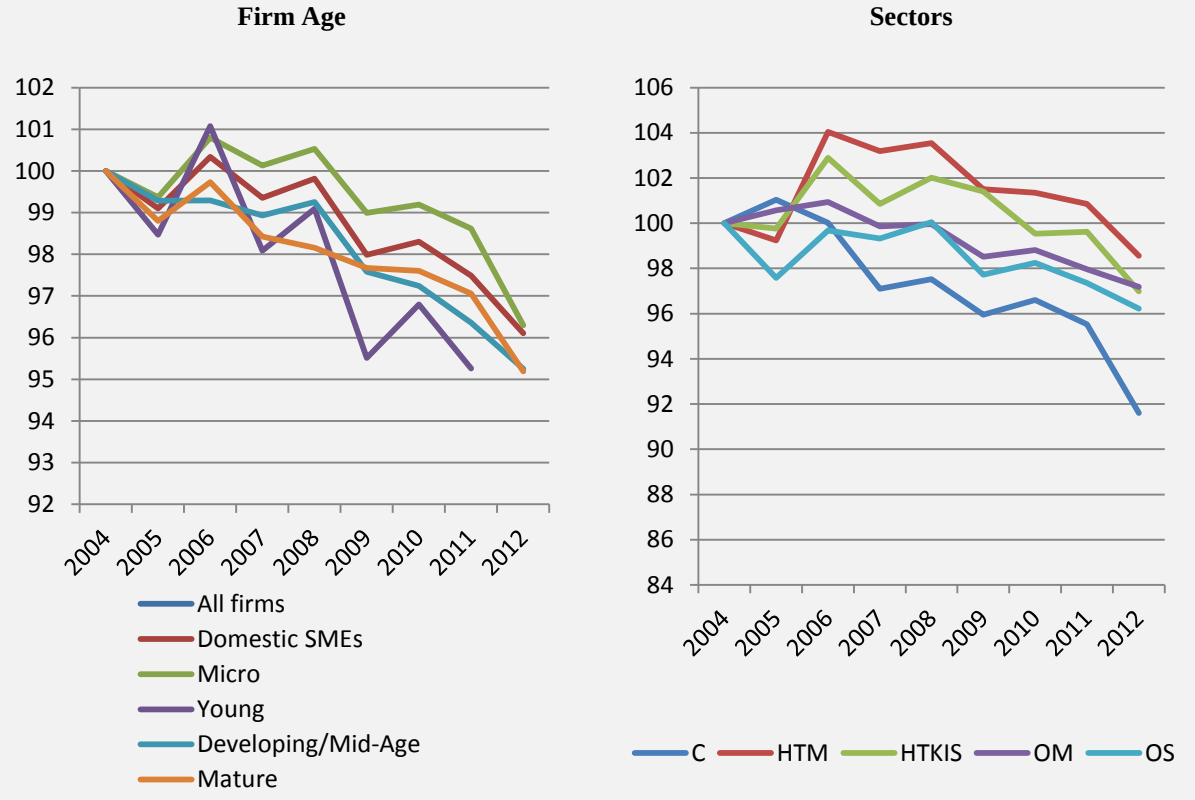
- All firms
- All domestic SMEs
- Young firms (firms between 0 and 5 years of age)
- Mid-age (Firms between 6 and 20 years of age)
- Mature (Firms greater than 20 years of age)
- Micro firms (Firms with less than 6 employees)
- Firms in different sectors:
    - Construction
    - High-tech manufacturing
    - High-tech knowledge-intensive services
    - Other manufacturing
    - Other services

Data and Summary Statistics

All data used in our analysis of financial constraints and firm productivity growth are either taken directly from, or derived using data from, the Amadeus database.

Figure 2-8 illustrates the trends in the level of TFP over the sample period and across the different subsamples of firms in our analysis. The graphs are indexed to 100 in 2004. The first panel demonstrates that productivity levels have displayed a downward trend since the crisis across the firm size classes. Examining productivity across sectors, the trend has also been a reduction in productivity levels since the crisis. Only young firms appear to have experienced productivity growth in the post crisis period in our sample.

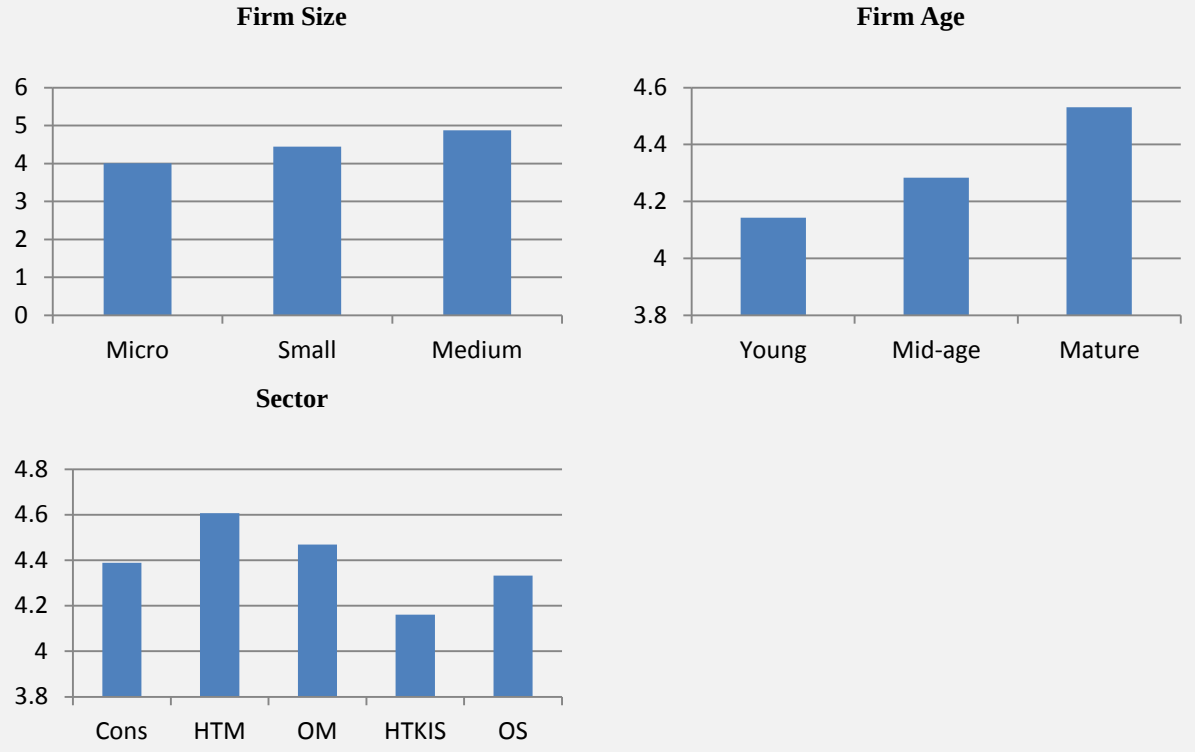
Figure 2-8 Trends in Total Factor Productivity – Indexed to 100 in 2004



Source: Authors' analysis of Amadeus data.

Figure 2-9 illustrates the average productivity levels of different firm groups over the sample period. We observe that larger firms have higher productivity levels. In light of this, it is unsurprising that older firms also display higher productivity levels. High-tech manufacturing firms exhibit the highest average productivity of the sectors considered.

Figure 2-9 Trends in Total Factor Productivity – Indexed to 100 in 2004

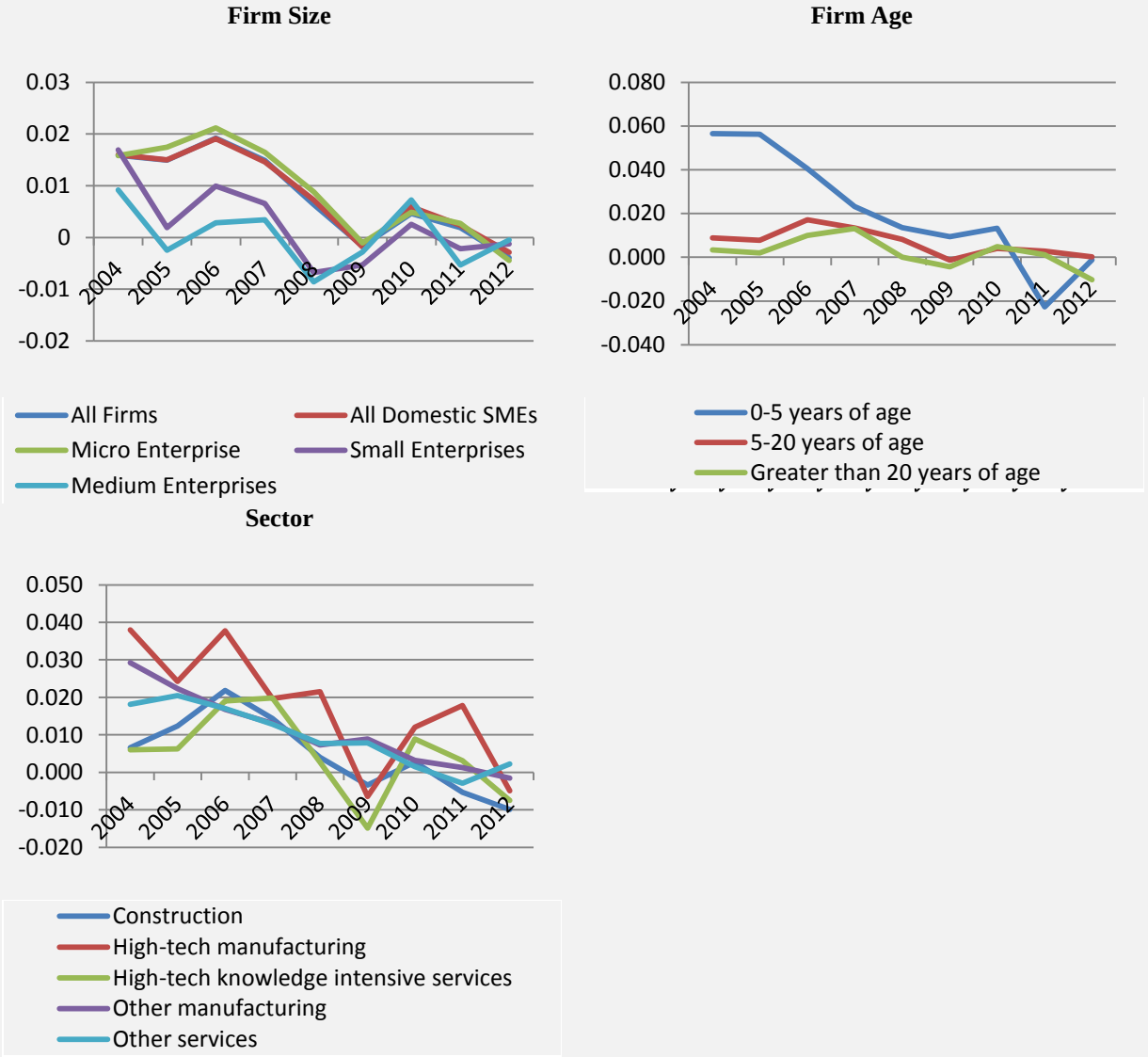


Source: Authors' analysis of Amadeus data.

While the level of TFP is interesting in and of itself and relevant in putting our findings in context, we expect to find the greatest impact of financial constraints by examining the growth rate of TFP. Figure 2-10 thus illustrates the trends in TFP growth rates over the sample period and across the sub-samples included in our analysis.

We observe in all the sub-samples a marked decline in TFP growth rates following the crisis with several subsamples seeing negative growth rates during one or more years. In terms of firm size, micro firms display the highest productivity growth rates in almost every period. Similarly, we observe that younger firms also display the highest growth rates, though they also have seen the largest fall in growth rates since the crisis. The sectors display the same trend as the overall sample, uniformly experiencing falling and negative growth rates in the post-crisis period.

Figure 2-10 Trends in Total Factor Productivity Growth



Source: Authors' analysis of Amadeus data.

Table 2-12 displays the means of the independent variables included in our analysis across the sample period.

Table 2-12 - Summary Statistics For Variables In Productivity Analysis - Annual Mean

	Sales Growth	Market Share	Cash Flow	Cash Stock	Trade Credit	Leverage	Long Term Credit Flows	Short Term Credit Flows	Interest Burden
2004	0.060	0.015	0.089	0.093	0.646	0.190	0.009	0.010	0.350
2005	0.044	0.017	0.089	0.100	0.619	0.202	0.031	0.038	0.351
2006	0.074	0.014	0.094	0.099	0.618	0.206	0.007	0.016	0.323
2007	0.064	0.008	0.098	0.107	0.600	0.212	0.006	0.019	0.354
2008	0.021	0.008	0.091	0.105	0.549	0.216	0.012	0.009	0.363
2009	-0.051	0.006	0.082	0.105	0.555	0.224	0.010	0.000	0.305
2010	0.018	0.008	0.083	0.112	0.554	0.221	0.005	0.004	0.237
2011	0.004	0.008	0.079	0.111	0.555	0.213	0.001	0.005	0.312
2012	-0.032	0.010	0.072	0.111	0.558	0.214	-0.005	0.007	0.355

Empirical Results

Given the existing literature on productivity and financial factors, we expect to find some evidence that financial constraints negatively impact on TFP growth. However, as discussed previously, there is a strand of the literature which finds a positive relationship between financial distress and TFP growth, thus finding a positive impact of financial constraints on productivity in some instances would not be entirely surprising. The detailed results of our analysis are outlined in tables below.

Our analysis controls for firm specific factors (size, age, market share, sales) however we only report the results for the financial variables included in our analysis in our tables. Our overall results are presented in Table 2-13 and Table 2-14. These tables contain the findings, for each financial variable, of the overall effect of financial constraints across the full sample period as well as the effects before and after the crisis Table 2-15 and Table 2-16 contain the detailed coefficients from the model run with and without interactions for each sub-sample. The columns titled “Finance” give the results for the models run without interacting each of the financial variables with a financial crisis dummy. The columns titled “Crisis effects” contain the coefficients for the models run including the financial variables interacted with a financial crisis dummy. The results in the un-interacted models provide an overall effect of the financial variables on productivity growth over the whole sample period. The results for the interacted models give the effects of financial constraints on productivity growth in the pre-crisis period and the difference between this pre-crisis coefficient and the post-crisis coefficient. As these results are somewhat hard to interpret from the regression output tables, we provide a simplified breakdown in Table 2-13 and Table 2-14.

Broadly speaking, we find that financial constraints do have an effect on productivity growth in European SMEs. This effect is evident in the positive and significant coefficient for the cash flow variable in almost all iterations of the model without financial crisis interactions. The positive and significant coefficient indicates that TFP growth is sensitive to shocks to cash flow. This finding implies that firms which receive a positive cash flow shock would immediately see positive TFP growth, suggesting that their TFP growth is constrained by

their internal cash flow. For example, for young firms our findings suggest that a 1% increase in cash flow would result in a corresponding .66% increase in the growth rate of TFP. This finding implies a binding financial constraint on the firm's TFP growth. Ideally, an unconstrained firm's TFP growth would not be overly dependent on internal cash flow. A well functioning financial market should provide external funding for projects and investments which bring about increased productivity growth, on the assumption that increasing productivity will provide a positive return in the medium to long term. The only sub-sample for which we do not find this overall positive and significant effect of cash flow is for young firms, however, we do find that young firms' productivity growth has become more cash flow sensitive since the crisis, implying that financial constraints have impacted negatively on productivity growth for these firms since 2008.

Table 2-13 The Effect of Financial Factors and The Financial Crisis on TFP Growth – Enterprise Types

Dep Var: $dlnTFP_t$	All Firms	Domestic SMEs	Micro Enterprises	Young Enterprises	Developing/Mid-Age	Mature
Cash Flow	0.465***	0.498***	0.667***	0.175	0.606***	0.622***
Pre-crisis	-0.030	-0.046	0.085	0.319	-0.047	-0.023
Post-crisis	-0.000	0.007	0.130*	0.339***	-0.016	0.237***
Cash stock	0.006	0.007	0.004	-0.685	-0.061	-0.069
Pre-crisis	-0.059	-0.074*	-0.123*	0.099	-0.075	-0.028
Post-crisis	-.041**	-0.044***	-0.065***	-0.176***	-0.037*	-0.052***
Trade credit	0.010	0.006	0.019	-0.096	0.019	0.021
Pre-crisis	-0.010	-0.01	-0.017	-0.036	-0.037	-0.028
Post-crisis	-0.003	-0.002	-0.003	0.034	-0.008	-0.002
Interest burden	-0.001	0.001	0.016	-0.12	-0.018	0.004
Pre-crisis	-0.013	-0.031	-0.028	-0.095	-0.032	-0.042
Post-crisis	0.004	0.006	0.015	0.005	0.002	0.004
Leverage	-0.065	-0.057	-0.132	0.648**	0.005	-0.016
Pre-crisis	-0.057	-0.064	-0.149	-0.191	-0.173	-0.073
Post-crisis	-0.011	-0.015	-0.047*	-0.068	0.002	-0.065***
Credit flows (long)	-0.002	-0.001	-0.005	0.083	-0.001	0.001
Pre-crisis	0.004	0.016	0.03	-0.062*	0.032	0.026
Post-crisis	-0.002	-0.003	-0.002	-0.012***	0.011	-0.010
Credit flows (short)	0.001	0.000	-0.002	-0.042	-0.001	0.011**
Pre-crisis	0.011	0.009	-0.005	-0.042	0.002	-0.006
Post-crisis	0.012*	0.011	0.004	-0.000	0.004	0.005

Source: Authors' analysis of Amadeus data.

For several of the other sub-samples we also find different effects of financing constraints on productivity before and after the crisis. For mature firms, those firms that have been in existence for more than 20 years, we find that cash flow has had a positive and significant impact only in the post-crisis period. This suggests that financial constraints have only become an issue for the productivity growth of these older firms in the wake of the crisis. The coefficients in Table 2-14 indicate that the main driver of the positive and significant impact

of cash flow on total factor productivity over the full period for the construction and the high-tech manufacturing sectors are in the post-crisis period. This finding again suggests that financial constraints have tightened for these firms since the financial crisis. Conversely, the larger coefficient for the high-tech services sector firms is for the pre-crisis period, suggesting that these firms' productivity growth was relatively more constrained before the crisis. We are unable to identify a significant difference between the pre- and post-crisis effects for those subsamples which display a positive and significant overall coefficient for cash flow but with no significance in either of the sub-periods.

Table 2-14 The Effect of Financial Factors and The Financial Crisis on TFP Growth – Sectors Types & Country Groups

Dep Var: $dlnTFP_t$	**Construction**	**High-tech manu.**	**High-tech services**	**Other manu.**	**Other services**
Cash Flow	0.301***	0.422***	0.206**	0.567***	0.372***
Pre-crisis	0.437*	-0.227	1.140***	0.291	-0.087
Post-crisis	0.193***	0.357***	0.274***	0.082	0.098
Cash stock	-0.113	-0.170**	-0.136	-0.034	-0.018
Pre-crisis	-0.039	-0.142	-0.049	-0.034	-0.097*
Post-crisis	-0.089***	-0.134	-0.053	-0.060**	-0.046**
Trade credit	0.000	-0.057*	-0.014	-0.043	-0.024
Pre-crisis	0.041	0.145	-0.029	-0.002	-0.031
Post-crisis	-0.017	-0.033	0.0147	0.005	-0.002
Interest burden	0.014	0.006	-0.002	0.013	-0.008
Pre-crisis	0.057	0.082	-0.022	-0.011	-0.011
Post-crisis	0.019	0.011	-0.019**	0.003	0.013
Leverage	-0.049	0.048	0.015	0.036	-0.054
Pre-crisis	-0.041	-0.1	0.049	-0.035	-0.167
Post-crisis	-0.049	0.030	0.087*	-0.010	-0.014
Credit flows (long)	0.008	0.000	0.002	0.014	-0.01
Pre-crisis	0.005	-0.091*	0.039	-0.024	0.025
Post-crisis	0.006	-0.000	0.005	0.004	-0.003
Credit flows (short)	0.006	0.000	-0.007	0.009**	-0.007*
Pre-crisis	-0.006	0.021	0.027	0.004	0.008
Post-crisis	0.003	-0.001	-0.006	0.009	-0.001

Source: Authors' analysis of Amadeus data.

For the cash stock variable, our only significant finding for the full sample period is a negative coefficient for the high-tech manufacturing firms. A negative coefficient suggests that the larger a firm's cash stock, the lower their productivity growth. When examining the effects in the pre- and post-crisis periods we find negative and significant coefficients for the post-crisis period for domestic SMEs, micro firms, young firms, mature firms, firms in the construction sector, firms in the other manufacturing sector and firms in the other services sector. This negative relationship may be explained by cash hoarding in the post-crisis period. If firms are hoarding cash due to a lack of profitable investment opportunities in the post-crisis period then a negative relationship between cash stocks and productivity growth may emerge.

We find no significant results for the trade credit variable across any of the sub-samples for the full period, the pre-crisis period or the post-crisis period. This suggests that trade credit has had no material impact on productivity growth for the firms in our sample. We obtain similar results for the interest burden, apart from a negative and significant coefficient in the post-crisis period for high-tech services firms. This finding suggests that as the cost of servicing their debt went up for these firms in the post-crisis period, their TFP growth slowed.

We find a positive overall effect of leverage on productivity growth for young enterprises. This result conforms to the strand of the literature which finds that increased financial pressure can lead to increased productivity in some cases as the increased bankruptcy risk forces managers to strive for additional productivity gains (Jensen, 1986). However, we also find negative and significant effects of leverage in the post-crisis period for mature firms, though the coefficient is much smaller than that for young firms.

Our finding that the growth rate of TFP amongst European SMEs is constrained by access to finance lends empirical support to those policy interventions aimed at easing access to finance for these SMEs. The sensitivity of productivity growth to internal cash flow exhibited by our sample suggests that many enterprises have the potential to increase their productivity levels but are constrained by financial market imperfections. Our finding that some firms exhibit a negative relationship between cash stock and productivity in the post-crisis period will likely be alleviated as the European economy continues to recover and profitable investment opportunities arise for those firms with large internal cash stocks.

Table 2-15 – The Effects Of Financing Constraints On Productivity Growth – Firm Size And Age												
Dep Var: dlnTFP $_t$	**All Firms**		**Domestic SMEs**		**Micro Enterprises**		**Young Enterprises**		**Developing/MidAge**		**Mature**	
	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects	Finance	Crisis Effects
L.dlntfp	-0.361***	-0.230***	-0.326***	-0.232***	-0.394***	-0.315***	-0.605	-0.422***	-0.109	-0.042	-0.544***	-0.412***
	(0.109)	(0.086)	(0.108)	(0.087)	(0.122)	(0.090)	(1.180)	(0.131)	(0.112)	(0.085)	(0.138)	(0.130)
CF/TA_t	0.465***	-0.030	0.498***	-0.046	0.667***	0.085	0.175	0.319	0.606***	-0.047	0.622***	-0.023
	(0.105)	(0.153)	(0.109)	(0.150)	(0.128)	(0.184)	(0.773)	(0.412)	(0.139)	(0.204)	(0.179)	(0.240)
CS/TA_{t-1}	0.006	-0.059	0.007	-0.074*	0.004	-0.123*	-0.685	0.099	-0.061	-0.075	-0.069	-0.028
	(0.073)	(0.037)	(0.074)	(0.040)	(0.100)	(0.064)	(0.894)	(0.281)	(0.081)	(0.065)	(0.076)	(0.041)
$Leverage_{t-1}$	-0.065	-0.057	-0.057	-0.064	-0.132	-0.149	0.648**	-0.191	0.005	-0.173	-0.016	-0.073
	(0.059)	(0.066)	(0.060)	(0.068)	(0.081)	(0.114)	(0.291)	(0.214)	(0.071)	(0.112)	(0.054)	(0.115)
Interest $Burden_{t-1}$	-0.001	-0.013	0.001	-0.017	0.016	0.005	-0.120	-0.002	-0.018	-0.017	0.004	-0.011
	(0.011)	(0.036)	(0.011)	(0.031)	(0.012)	(0.028)	(0.094)	(0.095)	(0.012)	(0.032)	(0.012)	(0.042)
TC_TA_{t-1}	0.010	-0.010	0.006	-0.010	0.019	-0.017	-0.096	-0.036	0.019	-0.037	0.021	-0.028
	(0.023)	(0.021)	(0.024)	(0.021)	(0.025)	(0.024)	(0.178)	(0.062)	(0.028)	(0.027)	(0.039)	(0.039)
Credit Flows (long)	-0.002	0.004	-0.001	0.016	-0.005	0.030	0.083	-0.062*	-0.001	0.032	0.001	0.026
	(0.007)	(0.038)	(0.007)	(0.033)	(0.008)	(0.032)	(0.164)	(0.033)	(0.009)	(0.035)	(0.005)	(0.028)
Credit Flows (short)	0.001	0.011	0.000	0.009	-0.002	-0.005	-0.042	-0.042	-0.001	0.002	0.011**	-0.006
	(0.004)	(0.016)	(0.004)	(0.016)	(0.003)	(0.018)	(0.053)	(0.064)	(0.003)	(0.018)	(0.005)	(0.026)
Crisis	0.006**	-0.003	0.007**	-0.006	0.008***	-0.007	0.030	0.040	0.008**	-0.001	0.001	-0.017
	(0.003)	(0.016)	(0.003)	(0.015)	(0.003)	(0.017)	(0.060)	(0.042)	(0.004)	(0.020)	(0.004)	(0.018)
CF/TA_t x Crisis		0.030		0.054		0.046		0.020		0.030		0.261
		(0.134)		(0.133)		(0.167)		(0.388)		(0.187)		(0.234)
CS_TA_{t-1} x Crisis		0.018		0.030		0.057		-0.276		0.037		-0.024
		(0.033)		(0.037)		(0.060)		(0.279)		(0.064)		(0.039)
Leverage $_{t-1}$ x Crisis		0.045		0.049		0.101		0.122		0.176		0.008
		(0.063)		(0.066)		(0.111)		(0.227)		(0.111)		(0.104)
Interest Burden $_{t-1}$ x Crisis		0.017		0.023		0.010		0.008		0.019		0.016
		(0.034)		(0.029)		(0.026)		(0.098)		(0.030)		(0.044)
TC_TA_{t-1} x Crisis		0.007		0.008		0.013		0.070		0.028		0.025
		(0.020)		(0.021)		(0.023)		(0.066)		(0.027)		(0.034)
Credit flows (long) x Crisis		-0.006		-0.020		-0.032		0.050		-0.020		-0.037
		(0.039)		(0.034)		(0.033)		(0.034)		(0.035)		(0.030)
Credit flows (short) x Crisis		0.001		0.002		0.009		0.042		0.003		0.011
		(0.016)		(0.016)		(0.017)		(0.065)		(0.018)		(0.027)
N	1.32e+05	1.32e+05	1.28e+05	1.28e+05	33504.000	33504.000	5473.000	5473.000	63747.000	63747.000	59251.000	59251.000
Autocorrelation test	0.027	0.381	0.052	0.414	0.067	0.175	0.366	0.251	0.862	0.707	0.019	0.106
Hansen's J	0.052	0.472	0.112	0.493	0.148	0.324	0.890	0.549	0.263	0.887	0.252	0.221
Source: Authors' analysis of Amadeus data.												

Table 2-16 - The Effects Of Financing Constraints On Productivity Growth – Industry Sector And Country Group										
Dep Var: dlnTFP $_t$	**Construction**		**High-tech manu.**		**High-tech services**		**Other manu.**		**Other services**	
	Finance	FC Effects	Finance	FC Effects	Finance	FC Effects	Finance	FC Effects	Finance	FC Effects
L.dlntfp	-0.288**	-0.452***	-0.559***	-0.367***	-0.520***	-0.197*	-0.422**	-0.235**	-0.306***	-0.260***
	(0.124)	(0.110)	(0.153)	(0.113)	(0.178)	(0.104)	(0.185)	(0.114)	(0.098)	(0.093)
CF/TAt	0.301***	0.437*	0.422***	-0.227	0.206**	1.140***	0.567***	0.291	0.372***	-0.087
	(0.115)	(0.258)	(0.109)	(0.498)	(0.083)	(0.405)	(0.139)	(0.249)	(0.110)	(0.161)
CS/TAt-1	-0.113	-0.039	-0.170**	-0.142	-0.136	-0.049	-0.034	-0.034	-0.018	-0.097*
	(0.075)	(0.094)	(0.079)	(0.185)	(0.089)	(0.194)	(0.106)	(0.064)	(0.083)	(0.057)
Leveraget-1	-0.049	-0.041	0.048	-0.100	0.015	0.049	0.036	-0.035	-0.054	-0.167
	(0.074)	(0.140)	(0.063)	(0.174)	(0.065)	(0.265)	(0.084)	(0.107)	(0.064)	(0.124)
Interest Burdent-1	0.014	0.057	0.006	0.082	-0.002	-0.022	0.013	-0.011	-0.008	-0.011
	(0.014)	(0.042)	(0.012)	(0.115)	(0.009)	(0.071)	(0.009)	(0.041)	(0.020)	(0.031)
TC_TA t-1	0.000	0.041	-0.057*	0.145	-0.014	-0.029	-0.043	-0.002	-0.024	-0.031
	(0.026)	(0.028)	(0.031)	(0.093)	(0.031)	(0.048)	(0.055)	(0.039)	(0.023)	(0.023)
Credit Flows (long)	0.008	0.005	-0.000	-0.091*	0.002	0.039	0.014	-0.024	-0.010	0.025
	(0.011)	(0.024)	(0.005)	(0.048)	(0.007)	(0.031)	(0.009)	(0.035)	(0.009)	(0.028)
Credit Flows (short)	0.006	-0.006	-0.000	0.021	-0.007	0.027	0.009**	0.004	-0.007*	0.008
	(0.006)	(0.010)	(0.005)	(0.021)	(0.005)	(0.018)	(0.004)	(0.028)	(0.003)	(0.012)
Crisis	0.007	0.036	0.007	-0.084	0.019**	0.097*	0.010***	0.024	0.003	-0.022
	(0.007)	(0.023)	(0.007)	(0.051)	(0.009)	(0.051)	(0.004)	(0.022)	(0.004)	(0.017)
CF/TA t x Crisis		-0.244		0.584		-0.865**		-0.208		0.186
		(0.263)		(0.489)		(0.408)		(0.221)		(0.146)
CS_TA t-1 x Crisis		-0.051		0.007		-0.005		-0.026		0.051
		(0.096)		(0.177)		(0.191)		(0.061)		(0.055)
Leverage t-1 x Crisis		-0.009		0.131		0.039		0.024		0.152
		(0.136)		(0.168)		(0.253)		(0.099)		(0.126)
Interest Burden t-1 x Crisis		-0.037		-0.071		0.003		0.015		0.024
		(0.042)		(0.118)		(0.070)		(0.039)		(0.031)
TC_TA t-1 x Crisis		-0.059**		-0.178*		0.044		0.007		0.028
		(0.029)		(0.100)		(0.046)		(0.035)		(0.021)
Credit flows (long) x Crisis		0.002		0.090*		-0.033		0.029		-0.028
		(0.024)		(0.048)		(0.032)		(0.034)		(0.029)
Credit flows (long) x Crisis		0.010		-0.023		-0.033*		0.006		-0.010
		(0.012)		(0.021)		(0.018)		(0.027)		(0.012)
N	15885.000	15885.000	1335.000	1335.000	2456.000	2456.000	44028.000	44028.000	64767.000	64767.000
Autocorrelation test	0.739	0.068	0.346	0.328	0.131	0.169	0.022	0.314	0.056	0.274
Hansen's J	0.082	0.209	0.352	0.169	0.143	0.487	0.356	0.138	0.185	0.288
Source: Authors' analysis of Amadeus data.										

2.4 Financing Constraints and Export Performance

Key Questions

- How do financing constraints affect the decision of firms to export?
- How do financing constraints affect how much firms decide to export?
- Are there differential effects of financing constraints on export performance for different groups of firms?

Key Findings

- In line with the related literature on exporting and firm performance we find that more productive, larger, older, product innovating, foreign owned firms, were more likely to be exporters.
- We also find that firms with ICT systems used to manage E-commerce and supply networks, and had at least one manager with experience working abroad, were more likely to be exporters.
- The propensity of firms to export is negatively correlated with the firm's financial constraints measure. This is in line with the argument that less financially constrained firms are more capable of overcoming the sunk costs of entry in export markets. Interestingly, the results also indicated that, on average, financial constraints did not affect the export intensity of the firm.
- The effect of financial constraints on the exporting propensity varies depending on firm characteristics. The financial constraint index was associated with a lower export propensity for firms younger than 20 years, domestically owned firms, and firms in the traditional industries. Further, we find that the financial constraint index was associated with a lower export propensity for small firms, but the relationship weakened as firm size increased and became insignificant for firms above the median percentile. We observe no differential effects of financial constraints on firms export intensity.

Introduction

In this section, we analyse the relationship between firm export performance and financial constraints. Exports are recognised as a key driver of growth in the EU and even more so now as member states continue their economic recovery in the aftermath of the Great Recession. From a research perspective, the theoretical and empirical literature has highlighted the importance of the role of individual firms for international trade. Therefore, In order to identify appropriate policies that can be implemented to best promote export activity in Europe, it is clearly important to develop an understanding of the reasons underlying firm export behaviour, both in terms of their decision to export and how much they choose to export.

Theoretical and Empirical Background

Export behaviour and export performance vary greatly within industries across firms. The theoretical and empirical literature on international trade with heterogeneous firms has established that exporters differ systematically from firms serving only domestic markets and that these differences exist before firms engage in exporting (Bernard and Jensen 1995, 1999; Melitz, 2003; Bernard et al., 2007). Thus, it has been established empirically and theoretically that exporters are larger, have higher productivity, higher capital intensity and higher skills intensity than non-exporters.[14]

Exporting involves high sunk costs which can be overcome only by firms with a productivity above certain thresholds. Financial constraints have been considered as an additional source of firm heterogeneity that contributes to explain the different export behaviour and export performance within industries across firms (Chaney, 2005; Manova, 2006; Berman and Héricourt, 2010; Bellone et al., 2010). Specifically, under imperfect financial markets, increased access to external financing increases the effect of productivity on selection of firms into export.

Under imperfect financial markets, exporting firms may be less financially constrained than non-exporting firms (Bellone, et al., 2010; Bricongne et al., 2012). Four channels underlying this hypothesis are documented by the theoretical and empirical literature. *First*, given the substantial sunk costs related to export participation (extensive margin), only less financially constrained firms engage in exporting (Chaney 2005 – theoretical model). *Second*, exporting could improve access to external financing through more stable cash flows derived from the international diversification of sales and thus lower exposure to demand-side shocks (Campa and Shaver 2002; Bridges and Guariglia 2008). *Third*, exporting could be perceived by investors as a signal of external competitiveness and would thus reduce informational asymmetries which underline financial market imperfections (Ganesh-Kumar, 2001). *Finally*, exporting could facilitate the access to external funds in international financial markets (Bellone et al., 2010).

The bulk of existing evidence relates to the relationship between financial constraints and export participation while the link between financial constraints and export intensity has been less analysed. Greenaway et al. (2007) find evidence for a positive link between export participation and financial health for firms in the UK over the period 1993-2003. Further, they uncover that this positive link was driven by continuous exporters while export starters had poorer financial health (low liquidity and high leverage ratios). Their evidence also indicates that export participation improved *ex-post* the financial health of firms. In contrast,

[14] Recent reviews of micro-econometric evidence include Helpman (2006), Bernard et al. (2007), Greenaway and Kneller (2007) and Wagner (2007).

Bellone at al. (2010) found that over the period 1993-2005, less financially constrained firms (with access to external financing) self-selected into exporting in France. Their evidence highlighted that export starters had a better financial health than non-exporters. Furthermore, they found no evidence of a positive relationship between financial health and the share of exports in total sales. Silva (2011) found that new exporters in Portugal over the period 1993-2006 improved *ex-post* their financial health. This positive link was found to be especially important for small firms and it was independent of export intensity.

Berman and Héricourt (2010) used data for nine developing countries over the period 1998-2004 and found that financial health of firms increased the probability to start exporting. However, it appears that financial health played no significant role in maintaining the export participation or on the size of exports. Further, they find that productivity and access to external finance were positively linked and that productivity matters for export entry only above a certain threshold of access to finance. If access to credit were very limited, productivity and export status are not correlated. Furthermore, they found that financial development at country level affects positively the selection of firms into exporting and the number of exporters. Thus, in countries more developed financially, exporting firms are more productive and export larger quantities.

Minetti and Zhu (2011) found that credit rationing reduced the exporting probability and the export sales of firms in Italy in 2000. While credit rationing had also a negative effect on domestic sales, its impact on export sales was significantly stronger. Furthermore they find that financial constraints were a hampering factor for exports especially in high-tech industries and in industries highly dependent on external finance.

Bricongne et al. (2012) found that the collapse of trade over the period 2008-2009 in France was mainly due to the large demand shock and product composition of exports. While the financial crisis worsened the export performance of financially constrained firms, it had only a limited impact on export performance. While large firms adjusted by reducing their portfolio of products offered for export and consequently their export sales, small firms reduced the range of export destinations or stopped exporting.

Cagesse and Cuñat (2013) show theoretically and empirically (using data for manufacturing firms in Italy over the period 1995-2003) that financial constraints distort the selection of firms into exporting. As a consequence, when a substantial number of firms face financial constraints, the impact of productivity in determining export participation decisions decreases. The implication of their evidence is that limited access to credit reduces the aggregate productivity gains induced by trade liberalisation.

Empirical Methodology

The effect of financial constraints on export participation – the extensive margin

We estimate the probability to export as a function of firm characteristics (size, age, ownership, productivity, innovation, human capital, capital/labour ratio, IT capacities, international managerial experience), a financial constraint index and control variables for industry, industry group (i.e Pavitt classification) and country specific effects. In addition, to control for demand shocks, we include in the estimated models variables that measure the sales' growth at firm and industry levels.

The probability of firm *i* in country *c* industry *k* during year *t* is estimated as follows:

$$Prob(X_{ickt}) = 1 \; if \; \alpha + \beta Z_{ickt-1} + \gamma F_{ickt-1} + \varepsilon_{ickt-1} > 0$$

$$= 0 \text{ otherwise}$$

Labour productivity, exporting and financial constraints could be determined simultaneously by unobserved firm characteristics. To account for this potential endogeneity, we instrument these variables with their lagged values.

We compute an index of financial constraints for each firm i and time t (WW_{it}) based on Whited and Wu (2006). The index of financial constraints is defined using the estimates from a structural investment model[15] as follows:

$$WW_{it} = -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it}$$

The variables included above are defined as follows: CF is the ratio of cash flow to total assets; DIVPOS is a binary variable which is equal to one if the firm pays cash dividends and zero otherwise; TLTD is the ratio of the long-term debt to total assets; LNTA is the natural logarithm of total assets; ISG is the firm's two digit industry sales growth; SG is the firm's sales growth.

The EFIGE linked data set for the period 2001-2007 is used to compute the financial constraints index. Since data on dividends payments is available for only a limited number of firms, we proxy the DIVPOS variable following Mancusi and Vezzulli (2010). We construct a dummy variable equal to one if the firm's net assets in 2008 were less than the sum of firm's net assets in 2007 plus the firm's profits (or losses) computed before tax. Following Altomonte et al (2013), we subtract from each firm's value of the WW_{it} index the country sample median. This variant of the index (WWd_{it}) provides improved comparability of the measure of financial constraints across countries.

The effect of financial constraints on export participation – the intensive margin

$$ln(X_{ickt}) = \theta + \rho Z_{ickt-1} + \sigma F_{ickt-1} + \mu_{ickt-1} \quad if \quad X_{ickt} > 0$$

We only observe the export sales for exporting firms. To account for this selection issue we estimate the export intensity conditional on the propensity of firms to export by using a Heckman selection model. The Heckman specification consists of two equations:

The selection equation explains the export propensity as a function of firm characteristics, financial variables and controls for unobserved industry and country specific effects.

The quantitative equation explains the export intensity as a function of determinants of exporting. For identification purposes we exclude from the quantitative equation firm level employment used a proxy for size[16].

It is important to note that although our empirical estimations may be indicative of a causal relationship they cannot be interpreted as such. In order to accurately estimate the effect of each variable in our model, we would need to observe all variables that affect firms' export participation. As there are unobserved variables which we are unable to control for, this gives rise to an endogeneity problem. Therefore, our estimates should only be interpreted as correlations.

[15] The estimates are obtained using quarterly data from the 2002 COMPUSTAT data set.
[16] While size is a determinant of the exporting propensity, existing empirical evidence suggests that export sales do not grow proportionally with size.

Data and Summary Statistics

To conduct our analysis we used the EFIGE linked dataset. We applied a number of criteria to clean the data used in our analysis. Firms with zero values for sales and fixed assets in 2008 and 2007 were excluded. For the following variables, the financial constraint index (WWd_{it}), labour productivity, capital labour ratio, employees, earnings per employee, we dropped a few outliers where the observation's modified z-score based on the median absolute deviation exceeded a value of 4 in 2007. We followed Altomonte et al. (2013) and excluded data for Austria, UK and Hungary from our sample due to the limited number of observations available. We also excluded a number of financially distressed firms which had negative cash flow in 2008.

Table 2-17 presents information on the composition of the sample used in the analysis by country ownership, size group, age and industry group. Italian and Spanish firms make up 73 per cent of the sample. The majority of firms in the sample are domestically owned, while the decomposition of the sample by size groups indicates that 87 percent of firms have less than 50 employees. Over half of the firms in the sample are more than 20 years of age. Our industry grouping of firms, based on the Pavitt industry classification, shows that 53 percent of firms are in traditional industries. Firms in high-tech industries represent 4 percent of the sample.

Table 2-17 - Decomposition Of Sample By Country Ownership, Size Group, Age And Industry Group

		Number of observations	Share
Country	France	961	0.24
	Germany	131	0.03
	Italy	1543	0.39
	Spain	1358	0.34
Ownership	Foreign	332	0.08
	Domestic	3661	0.92
Size group	less than 50	3483	0.87
	50 to 249	478	0.12
	More than 250	32	0.01
Age	0-5 years	193	0.05
	6-20 years	1514	0.38
	more than 20 years	2286	0.57
Industry group	Economies of Scale Industries	877	0.23
	Traditional Industries	2062	0.54
	Specialized Industries	721	0.19
	High-tech Industries	168	0.04

Source: EFIGE dataset

Table 2-18 provides summary statistics on the main variables used in our empirical analysis for the full sample and also by exporter and non exporters. Our summary statistics suggest that firms which exported in 2008 had on average, a higher proportion of foreign owners, higher sales, and employed a higher number of workers compared with non exporting firms. Consistent with findings in the related literature on exporting and firm performance, the summary statistics also indicate that exporters had higher labour productivity and capital intensity and performed more product and process innovation on average. Further, exporters appear more likely to have employed managers with experience working abroad and to have invested in ICT systems which manage E-commerce or supply networks. Finally, our constructed Whited and Wu Financial Constraint Index, 2007, indicates that non exporters were more constrained than exporters.

Table 2-18 - Decomposition of Sample By Country Ownership, Size Group, Age And Industry Group

	All firms		**Exporters**		**Non exporters**	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic owned	0.93	0.25	0.91	0.29	0.97	0.17
Sales, 2007	5456	9046	6454	10260	4010	6662
Labour productivity, 2007	4.99	0.63	5.12	0.57	4.80	0.65
Wage per employee, 2007	3.47	0.33	3.51	0.33	3.41	0.33
Employees, 2007	29.17	31.5	32.05	36.37	25.00	22.02
Capital Labour ratio	36.22	51.74	38.07	52.91	33.52	49.89
Age (0-5)	0.05	0.22	0.04	0.21	0.06	0.24
Age (6-20)	0.38	0.49	0.34	0.47	0.44	0.50
Age (over 20)	0.57	0.5	0.62	0.49	0.50	0.50
Sales growth, 2007	0.12	0.31	0.12	0.32	0.13	0.29
Industry sales growth, 2007	0.09	0.07	0.09	0.07	0.09	0.07
Share of firms which product innovate	0.47	0.5	0.57	0.49	0.33	0.47
Share of firms which process innovate	0.44	0.5	0.47	0.50	0.41	0.49
Share of firms with ecommerce or stock management ICT systems	0.49	0.5	0.52	0.50	0.45	0.50
Share of firm with internationally experienced managers	0.14	0.35	0.18	0.39	0.08	0.27
Constructed Whited and Wu Financial Constraint Index, 2007 (WWd)	0.01	0.05	-0.001	0.048	0.020	0.052

Note: Labour productivity, Wage per employee are expressed in natural lags

Source: EFIGE dataset

Table 2-19 shows the sample averages of the constructed Whited and Wu Financial Constraint Index for exporters and non-exporters by size class, age group, and ownership. Focusing on the financial constraints index, we observe that the financial constraint index is higher for younger firms and domestically owned firms compared with older firms and foreign firms respectively. The summary statistics suggests that larger firms were less financially constrained than smaller firms on average. In terms of the main relationship of interest in our analysis, we observe that non-exporters were more financially constrained than exporters for each group.

In Figure 2-11 we plot the share of exporters against the mean financial constraint index for each industry in each country. The figure indicates a negative relationship between the two variables. Figure 2.12 plots the relationship for these two variables by firm size, ownership

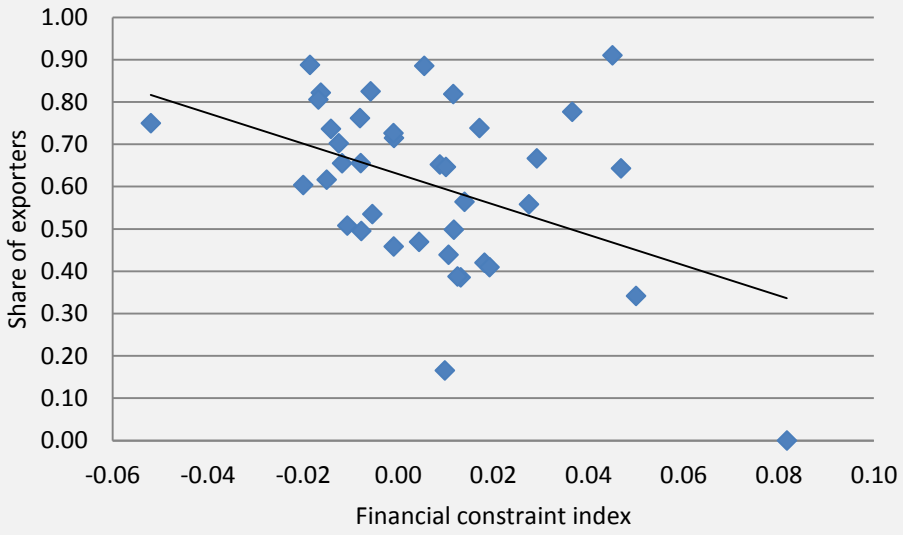
and age and we find that average industry export participation is lower in industries with higher average financial constraint index. Turning our attention to the export intensive margin, Figure 2-13 suggests there is a negative relationship between the average share of firm exports in total sales and the mean financial constraint index across industries. The information in Figure 2-14 indicates that this relationship generally holds for subsamples of firms grouped by size, ownership and age classes.

Table 2-19 - Sample Averages Cash Ratio, Leverage Ratio And Financial Constraint Index For Exporters And Non-Exporters By Size Class

		Financial constraint index	
		Non Exporter	**Exporter**
Size	Employ 10-49	0.02	0.01
	Employ 50-249	-0.03	-0.04
	Employ 250	-0.08	-0.09
Age	Age (0-5 years)	0.06	0.03
	Age (6 -20 years)	0.03	0.00
	Age (21 years plus)	0.01	-0.01
Ownership	Foreign	-0.001	-0.03
	Domestic	0.02	0.00

Source: EFIGE dataset

Figure 2-11 –Scatterplot Of The Share Of Exporters And Mean Financial Constraint Index In An Industry, Full Sample

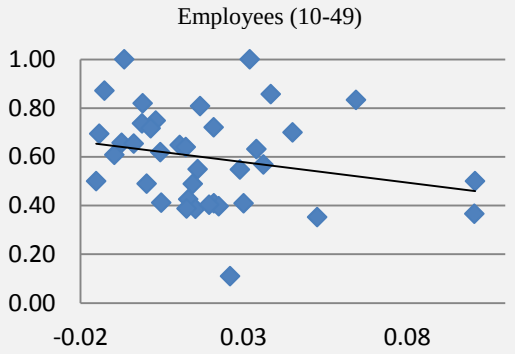


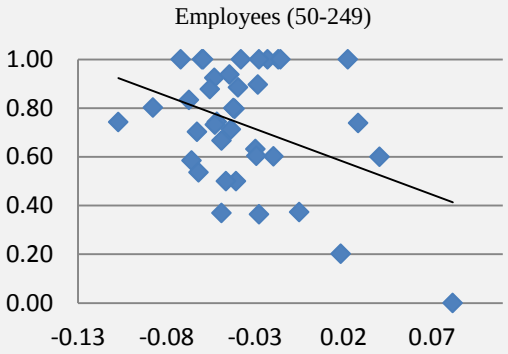
Notes: x-axis: mean country-industry financial constraint index, y-axis: country-industry share of exporters

Source: EFIGE dataset

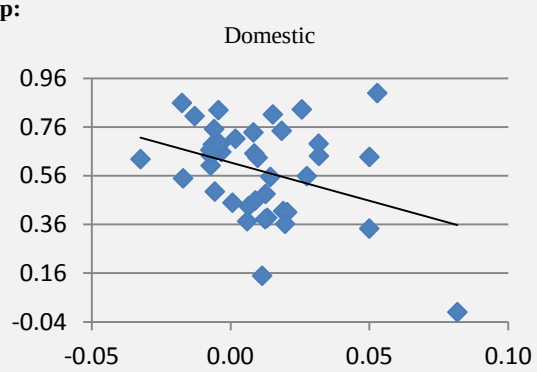
Figure 2-12 - Scatterplot Of The Share Of Exporters And Mean Financial Constraint Index In An Industry, By Firm Characteristic

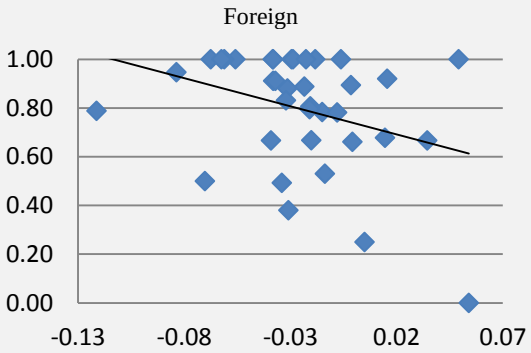
Size:



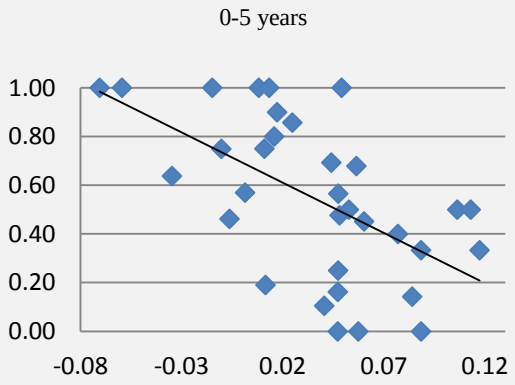


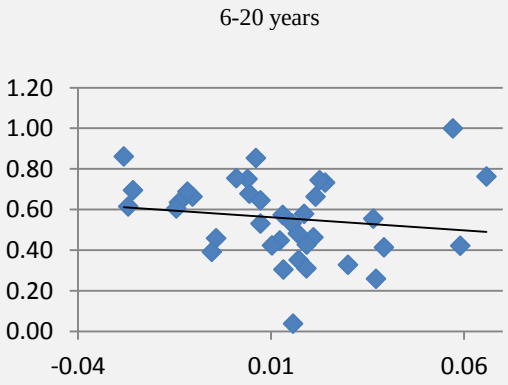
Ownership:

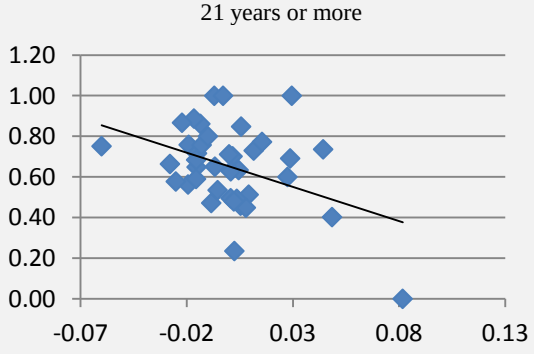




Age:



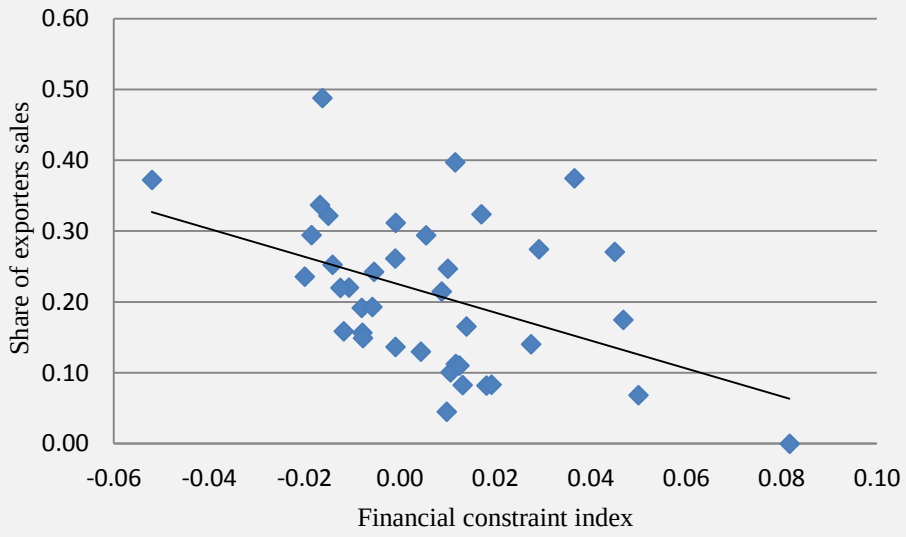




Notes: x-axis: mean country-industry financial constraint index, y-axis: country-industry share of exporters

Source: EFIGE datset

Figure 2-13 –Scatterplot Of The Mean Share Of Firm Export Sales In Total Sales And Mean Financial Constraint Index In An Industry, Full Sample

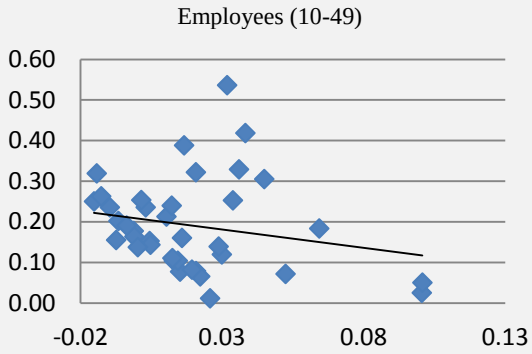


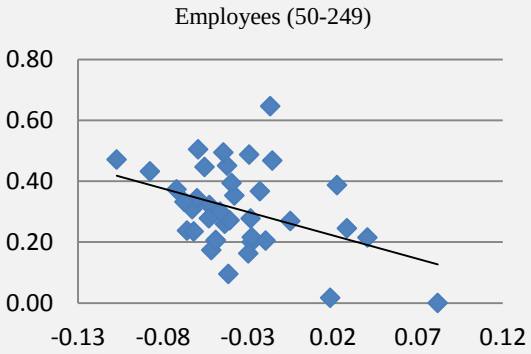
Notes: x-axis: mean country-industry financial constraint index, y-axis: mean country-industry share of export intensity

Source: EFIGE dataset

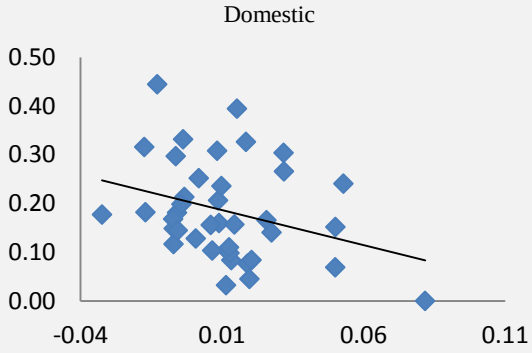
Figure 2-14 - Scatterplot Of The Mean Share Of Firm Export Sales In Total Sales And Mean Financial Constraint Index In An Industry By Firm Characteristic

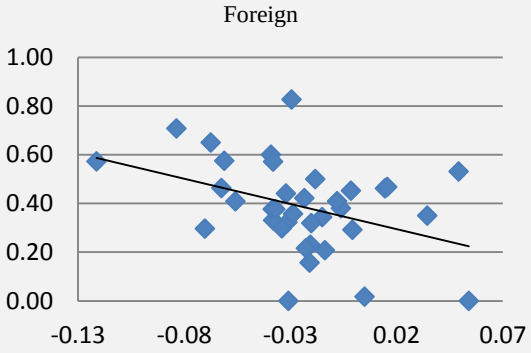
Size:



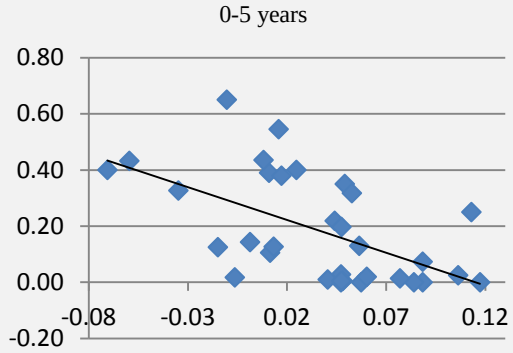


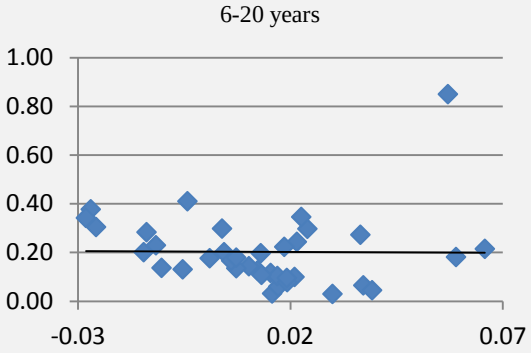
Ownership:

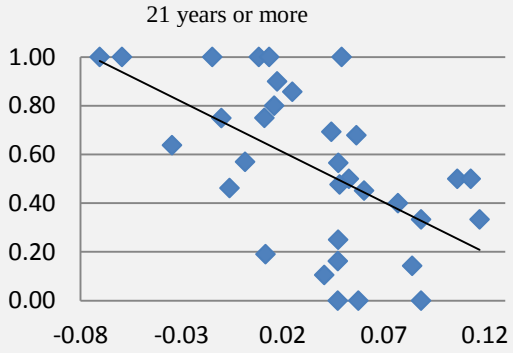




Age:







Notes: x-axis: mean country-industry financial constraint index, y-axis: mean country-industry share of export intensity

Source: EFIGE

Empirical Results

In this section, we first present the estimates of our model specification on the firm's propensity to export. Table 2-20 shows the estimates of the single equation probit model described earlier. The figures shown are the marginal effects and robust standard errors are reported in parentheses. All specifications include country, sector and Pavitt-industry group dummies to control for possible cross-firm heterogeneity arising from country and industry and industry group effects. Our initial estimates indicate that firms which were more productive, larger, older, product innovating, foreign owned, used ICT systems to manage E-commerce and supply networks, and had at least one manager with experience working abroad, were more likely to export. We also find that, on average, less financially constrained firms in 2007 had a higher propensity to export in 2008. This is in line with findings in Altomonte et al. (2013).

Table 2-1 presents the estimates of the instrumental variable probit model where we instrument labour productivity and the financial constraints index with their lagged values in 2006, 2005 and 2004. We continue to find export propensity was higher amongst firms which were older, product innovating, foreign owned, used ICT systems to manage E-commerce and supply networks, and employed a manager with at least one year of work experience abroad. Also, we continue to find that less financially constrained firms in 2007 were associated with a higher propensity of exporting in 2008. The labour productivity coefficient becomes marginally insignificant at the 10 percent level. The F-test from the first stage equations and the Amemiya-Lee-Newey test statistic suggests the instruments are valid.

We proceed with our analysis and investigate whether the strength of the negative relationship between financing constraints on export propensity differed amongst various groups of firms.

Table 2-20 - Export Extensive Margin, Probit Estimates

	(1)	(2)	(3)
WW Financial Constraint Index, 2007			-0.503**
			(0.256)
Domestic owned, 2008	-0.177***	-0.141***	-0.139***
	(0.033)	(0.034)	(0.035)
Age (> 20 years)	0.080***	0.080***	0.076***
	(0.016)	(0.015)	(0.016)
Labour productivity, 2007	0.158***	0.148***	0.134***
	(0.016)	(0.017)	(0.019)
Capital labour ratio, 2007	-0.012*	-0.010	-0.013*
	(0.007)	(0.007)	(0.008)
Wage per employee, 2007	-0.017	-0.004	-0.010
	(0.031)	(0.031)	(0.032)
Employees, 2007	0.092***	0.073***	0.050***
	(0.014)	(0.014)	(0.018)
Sales growth, 2007	-0.037	-0.037	-0.016
	(0.027)	(0.028)	(0.029)
Industry sales growth,2007	-0.220	-0.180	-0.165
	(0.175)	(0.182)	(0.185)
Product innovator, 2008		0.153***	0.152***
		(0.016)	(0.017)
Process innovator, 2008		0.020	0.019
		(0.016)	(0.016)
IT E-commerce/stock systems		0.040***	0.042***
		(0.015)	(0.016)
Int. experienced managers		0.142***	0.142***
		(0.022)	(0.023)
Observations	3993	3810	3720
Country dummies	yes	yes	yes
Sector dummies	yes	yes	yes
Adjusted R^2	yes	yes	yes

Notes The dependent variable is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Variables, Labour productivity, Capital Labour Ratio, and Employees, are expressed in natural logs. Country and sector dummies are included.

Source: EFIGE

Table 2-21 - Export Extensive Margin, Instrumental Variable Probit Estimates

	First Stage	First Stage	Second Stage
	Labour Productivity, 2007	WW Financial Constraint Index, 2007	
	(1)	(2)	(3)
WW Financial Constraint Index, 2007			-1.172*
			(0.663)
Domestic owned, 2008	-0.016***	-0.003	-0.153***
	(0.013)	(0.002)	(0.044)
Age (> 20 years)	0.018**	-0.001	0.064***
	(0.007)	(0.001)	(0.021)
Labour productivity, 2007			0.057
			(0.037)
Capital labour ratio, 2007	0.004	-0.003***	-0.008
	(0.003)	(0.001)	(0.011)
Wage per employee, 2007	0.174***	-0.010***	0.062
	(0.014)	(0.003)	(0.043)
Employees, 2007	-0.028***	-0.022***	0.030
	(0.008)	(0.001)	(0.034)
Sales growth, 2007	0.600***	0.001	-0.058
	(0.017)	(0.003)	(0.054)
Industry sales growth,2007	0.041	0.078***	-0.206
	(0.087)	(0.016)	(0.264)
Product innovator, 2008	-0.007	0.001	0.128***
	(0.007)	(0.001)	(0.020)
Process innovator, 2008	-0.01	0.001	0.029
	(0.007)	(0.001)	(0.020)
IT E-commerce/stock systems	0.011	0.000	0.055***
	(0.007)	(0.001)	(0.020)
Int. experienced managers	-0.004	0.000	0.136***
	(0.01)	(0.002)	(0.029)
Labour productivity, 2006	0.758***	-0.030***	
	(0.014)	(0.003)	
Labour productivity, 2005	0.015	0.011***	
	(0.016)	(0.003)	
Labour productivity, 2004	0.099***	-0.001	
	(0.014)	(0.003)	
WW Financial Constraint Index, 2006	-0.195**	0.251***	
	(0.096)	(0.017)	
WW Financial Constraint Index, 2005	-0.324***	0.228***	
	(0.1)	(0.018)	
WW Financial Constraint Index, 2004	0.002	0.000	
	(0.002)	(0.000)	
Observations	2099	2099	2099
Wald test of exogeneity:			χ^2 (2) = 1.98, Prob > $\chi^2$2 = 0.3724
Amemiya-Lee-Newey minimum χ^2 statistic			χ^2 (4) = 4.189, P-value = 0.3810
F tests	F(32, 2066) = 933.55, Prob > F = 0.0000	F(32, 2066) = 157.07, Prob > F = 0.0000	
Adjusted R^2	0.9343	0.7042	

Notes: The dependent variable is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Variables, Labour productivity, Capital Labour Ratio, and Employees, are expressed in natural logs .Labour productivity and financial constraint measure are instrumented with their lagged values in 2006, 2005, and 2004. Country and sector dummies are included in both models.

Source: EFIGE

We next examine the potentially heterogeneous relationship between firms' financial constraint index and its propensity to export by interacting the firms' financial constraint index with (i) firm ownership, (ii) age, (iii) size and (iv) Pavitt industry grouping. Table 2-22 presents the average marginal effects based on the model specifications which include the interaction of the financial variables with domestic ownership dummy in column (1), age (>20 years) dummy in column (2), with size in column (3) and with the Pavitt industry group in column (4). The computed average marginal effects take into account the interaction terms. The results in Table 2-22 are consistent with our initial findings. The average marginal

effects of the firms' financial constraint index on exporting propensity for differ firm groups are calculated in the bottom section of the Table. We observe the financial constraint index was associated with a lower export propensity for firms younger than 20 years, domestically owned firms, and firms in the traditional industries. Interestingly we find that for small the financial constraint index was associated with a lower export propensity for firms, however, this relationship weakens as firms increase in size and becomes insignificant for firms above the median percentile.

Table 2-22 - Extensive export margin, heterogeneous effects of financial constraints index

	Ownership	Age	Size	Sectors
	(1)	(2)	(3)	(4)
WW Financial Constraint Index, 2007	-0.506**	-0.520**	-0.516**	-0.527**
	(0.256)	(0.256)	(0.256)	(0.257)
Domestic owned, 2008	-0.140***	-0.134***	-0.141***	-0.140***
	(0.035)	(0.032)	(0.032)	(0.032)
Age (> 20 years)	0.077***	0.076***	0.076***	0.076***
	(0.016)	(0.016)	(0.016)	(0.016)
Labour productivity, 2007	0.134***	0.132***	0.134***	0.134***
	(0.019)	(0.019)	(0.019)	(0.019)
Capital labour ratio, 2007	-0.013*	-0.014*	-0.013*	-0.013*
	(0.008)	(0.008)	(0.008)	(0.008)
Wage per employee, 2007	-0.010	-0.012	-0.010	-0.013
	(0.032)	(0.032)	(0.032)	(0.032)
Employees, 2007	0.050***	0.051***	0.057***	0.052***
	(0.018)	(0.018)	(0.018)	(0.018)
Sales growth, 2007	-0.016	-0.007	-0.014	-0.017
	(0.029)	(0.030)	(0.029)	(0.029)
Industry sales growth,2007	-0.166	-0.172	-0.182	-0.164
	(0.185)	(0.184)	(0.184)	(0.185)
Product innovator, 2008	0.152***	0.153***	0.152***	0.154***
	(0.017)	(0.017)	(0.017)	(0.017)
Process innovator, 2008	0.019	0.020	0.019	0.020
	(0.016)	(0.016)	(0.016)	(0.016)
IT trading systems	0.043***	0.042***	0.042***	0.041***
	(0.016)	(0.015)	(0.015)	(0.015)
Int. Experience	0.143***	0.144***	0.144***	0.142***
	(0.023)	(0.023)	(0.023)	(0.023)
Traditional				0.141***
				(0.028)
Specialised				0.055
				(0.054)
High-tech				0.028
				(0.046)
Observations	3720	3720	3720	3720
Pseudo R^2	0.1564	0.1575	0.1570	0.1582
Country dummies	yes	yes	yes	yes
Sector Dummies	yes	yes	yes	yes
Pavitt Industry group dummies	yes	yes	yes	yes
Heterogeneous effects of financial constraints index - Average marginal effect of Financial Constraints for;				
Foreign owned firms	-0.289			
	0.536			
Domestic owned firms	-0.523**			
	(0.262)			
Firms 20 year old or less		-0.935***		
		(0.311)		
Firms older than 20 years		-0.201		
		(0.294)		
Employment (25th percentile)			-0.698**	
			(0.275)	
Employment (50th percentile)			-0.531**	
			(0.258)	
Employment (75th percentile)			-0.364	
			(0.268)	
Economies of Scale				0.125
				0.353
Traditional Industries				-0.831***
				0.283
Specialised Industries				-0.175
				0.442
High Tech industries				-0.820
				0.719

Note: The dependent variable equals to one if firm exported in 2008 and zero otherwise. Variables, labour productivity, capital labour ratio and employees are expressed in natural logs. The financial constraint variable is interacted with the firm characteristic denoted at top of the column. The average marginal effects account for the interaction terms.
Source: EFIGE dataset

Table 2-23 presents the estimates for the intensity of exporting conditional on choosing to export. We find firms that were larger, more productive, foreign owned, product-innovating and had internationally experienced managers were more likely to export and also exported a higher share of their total sales. We observe that while older firms and firms with ICT systems used for the management of supply networks and E-commerce were more likely to export, we find no significant relationship for export intensity.

Table 2-24 reports the average marginal effects taking into account the interaction terms and we find our estimates are consistent with our initial findings. Focusing on the average marginal effects of the financial constraint index, we again find it to be negatively related to the firm's export entry decision. Our estimates suggest that the relationship between the firms' financial constraint index and its export intensity is insignificant. Furthermore, the average marginal effects of the firms' financial constraint index for different firm groups, which are calculated in the bottom section of the Table, are also insignificant.

Table 2- reports the marginal effects of the financial constraint index on the propensity to export and on the intensity of exporting for different firm groups. We observe the financial constraint index was associated with a lower export propensity for domestically owned firms, and firms younger than 20 years. We also continue to find that the financial constraint index was associated with a lower export propensity for small firms and that the relationship becomes insignificant for firms with more than the median number of employees. We observe no significant relationships between the financial constraint index and export intensity.

Table 2-23 – Intensive Export Margin, Heckman Model

	Intensity	Selection
	(1)	(2)
WW Financial Constraint Index, 2007	-0.691	-0.407*
	(0.824)	(0.233)
Domestic owned, 2008	-0.505***	-0.122***
	(0.097)	(0.034)
Age (> 20 years)	0.042	0.074***
	(0.061)	(0.016)
Labour productivity, 2007	0.225***	0.136***
	(0.081)	(0.020)
Capital labour ratio, 2007	-0.012	-0.013*
	(0.026)	(0.007)
Wage per employee, 2007	-0.142	-0.025
	(0.112)	(0.031)
Employees, 2007	0.150***	0.058***
	(0.036)	(0.015)
Sales growth, 2007	0.004	-0.021
	(0.081)	(0.027)
Industry sales growth,2007	-0.624	-0.245
	(0.701)	(0.192)
Product innovator, 2008	0.212**	0.124***
	(0.089)	(0.018)
Process innovator, 2008	-0.095*	0.028*
	(0.054)	(0.016)
IT systems	-0.037	0.038**
	(0.053)	(0.015)
Int. experienced managers	0.261***	0.119***
	(0.082)	(0.024)
Observations	3617	3617
Wald test of independent equation (rho = 0)	χ^2 (1) = 25.68, Prob > χ^2 = 0.000	
Log pseudolikelihood	-5350	
Country dummies	yes	yes
Sector dummies	yes	yes
Pavitt industry group	yes	yes

Note: The dependent variable in the intensity equation is the natural log of export sales per total sales. The dependent variable in the selection equation is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Variables, labour productivity, capital labour ratio and employees are expressed in natural logs. For model identification, the employee variable is excluded from intensity equation; the average marginal effect reported captures the indirect effect of employment on export intensity.

Source: EFIGE dataset

Table 2-24 - Export Intensive Margins, Heckman Model Interactions

	Ownership		Age		Size		Sectors	
	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WW Financial Constraint Index, 2007	-0.701	-0.407*	-0.708	-0.434*	-0.594	-0.451*	-0.679	-0.434*
	(0.842)	(0.235)	(0.853)	(0.235)	(0.890)	(0.238)	(0.832)	(0.234)
Domestic owned, 2008	-0.511***	-0.126***	-0.486***	-0.119***	-0.479***	-0.126***	-0.479***	-0.126***
	(0.106)	(0.034)	(0.094)	(0.032)	(0.095)	(0.032)	(0.090)	(0.031)
Age (> 20 years)	0.043	0.075***	0.046	0.075***	0.043	0.075***	0.040	0.075***
	(0.061)	(0.016)	(0.063)	(0.016)	(0.061)	(0.016)	(0.059)	(0.016)
Labour productivity, 2007	0.225***	0.136***	0.227***	0.133***	0.230***	0.134***	0.229***	0.134***
	(0.082)	(0.020)	(0.081)	(0.020)	(0.082)	(0.020)	(0.077)	(0.019)
Capital labour ratio, 2007	-0.012	-0.013*	-0.012	-0.014*	-0.012	-0.013*	-0.015	-0.014*
	(0.026)	(0.007)	(0.026)	(0.007)	(0.026)	(0.007)	(0.026)	(0.007)
Wage per employee, 2007	-0.145	-0.025	-0.140	-0.027	-0.138	-0.025	-0.153	-0.030
	(0.112)	(0.032)	(0.113)	(0.032)	(0.114)	(0.031)	(0.111)	(0.031)
Employees, 2007	0.150***	0.058***	0.149***	0.058***	0.160***	0.063***	0.156***	0.060***
	(0.035)	(0.015)	(0.036)	(0.016)	(0.037)	(0.016)	(0.035)	(0.015)
Sales growth, 2007	0.005	-0.021	0.002	-0.011	-0.000	-0.017	-0.013	-0.022
	(0.081)	(0.028)	(0.087)	(0.028)	(0.084)	(0.028)	(0.076)	(0.027)
Industry sales growth,2007	-0.611	-0.245	-0.621	-0.246	-0.598	-0.260	-0.546	-0.234
	(0.703)	(0.192)	(0.704)	(0.192)	(0.704)	(0.192)	(0.687)	(0.191)
Product innovator, 2008	0.211**	0.127***	0.214**	0.127***	0.213**	0.126***	0.204**	0.127***
	(0.089)	(0.019)	(0.091)	(0.020)	(0.090)	(0.019)	(0.079)	(0.018)
Process innovator, 2008	-0.096*	0.027*	-0.095*	0.028*	-0.097*	0.028*	-0.093*	0.029*
	(0.054)	(0.016)	(0.054)	(0.016)	(0.054)	(0.016)	(0.053)	(0.016)
IT systems	-0.037	0.039**	-0.039	0.038**	-0.038	0.038**	-0.040	0.036**
	(0.053)	(0.015)	(0.053)	(0.015)	(0.053)	(0.015)	(0.053)	(0.015)
Int. experienced managers	0.245***	0.118***	0.250***	0.120***	0.245***	0.120***	0.240***	0.118***
	(0.082)	(0.023)	(0.082)	(0.023)	(0.082)	(0.023)	(0.075)	(0.022)
Traditional Industries dummy	0.495***	0.126***	0.497***	0.126***	0.498***	0.126***	0.466***	0.123***
	(0.141)	(0.031)	(0.140)	(0.031)	(0.139)	(0.031)	(0.132)	(0.030)
Specialised Industries dummy	0.110	0.084*	0.107	0.082	0.106	0.082	0.077	0.077
	(0.147)	(0.051)	(0.147)	(0.051)	(0.147)	(0.051)	(0.146)	(0.050)
High Tech Industries dummy	-0.034	0.052	-0.029	0.051	-0.032	0.051	-0.032	0.037
	(0.125)	(0.043)	(0.125)	(0.043)	(0.124)	(0.042)	(0.123)	(0.042)
Observations	3617	3617	3617	3617	3617	3617	3617	3617
Wald test of independent equation (rho = 0)	χ^2 (1) = 25.66, Prob > χ^2 = 0.000		χ^2 (1) = 24.19 Prob > χ^2 = 0.000		χ^2 (1) = 24.47 Prob > χ^2 = 0.000		χ^2 (1) = 41.0 Prob > chi2 = 0.0000	
Log pseudolikelihood	-5349.727		-5347.578		-5348.10		-5340.689	
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
Sector Dummies	yes	yes	yes	yes	yes	yes	yes	yes

The dependent variable in the primary equation is the natural log of export sales per total sales. The dependent variable in the selection equation is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Variables, labour productivity, capital labour ratio and employees are expressed in natural logs. The financial constraint variable is interacted with the firm characteristic denoted at top of the column. The computed average marginal effects take into account the interaction terms. For model identification, the employee variable is excluded from intensity equation; the average marginal effect reported captures the indirect effect of employment on export intensity.

Source: EFIGE dataset

Table 2-25 - Heterogeneous Effects Of Financial Constraints Index On Export Intensive Margins, Heckman Model Interactions; Average Marginal Effect Of Financial Constraints By Firm Characteristic

	Ownership		Age		Size		Sectors	
	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign owned firms	0.292	-0.092						
	(1.396)	(0.504)						
Domestic owned firms	-0.766	-0.429*						
	(0.871)	(0.242)						
Firms 20 year old or less			-0.623	-0.810***				
			(1.281)	(0.301)				
Firms older than 20 years			-0.734	-0.149				
			(0.862)	(0.268)				
Employment (25th percentile)					-0.560	-0.638**		
					(1.109)	(0.270)		
Employment (50th percentile)					-0.535	-0.468*		
					(0.909)	(0.240)		
Employment (75th percentile)					-0.532	-0.297		
					(0.794)	(0.244)		
Economies of Scale							-0.034	0.230
							(1.169)	(0.332)
Traditional Industries							-0.842	-0.894***
							(1.081)	(0.276)
Specialised Industries							-0.171	0.444
							(1.139)	(0.416)
High Tech industries							-0.227	-0.842
							(1.826)	(0.621)

Note: The marginal effects of the financial constraint index on the intensity of exporting (propensity to export) for different firm groups are reported in the odd (even) numbered columns. For model identification, the employee variable is excluded from intensity equation; the average marginal effect reported captures the indirect effect of employment on export intensity.

Source: EFIGE dataset

Chapter 3. Conclusions and Policy Recommendations

The evidence provided in this study indicates that financial market imperfections amplified during the recent financial crisis have affected negatively the investment and growth of European SMEs over and above demand and cyclical factors. These effects have been uneven across enterprise, industry and country groups. This heterogeneity of financing challenges suggests that policy measures and instruments to assist enterprises to improve access to external financing and support enterprise growth should take into account the types of enterprises and life cycles stages that are *most affected by financial market imperfections* and should be targeted *where they have most impact*. The evidence in this study also suggests that policy measures should be targeted to address specific *supply-side* (credit rationing) and *demand-side* (discouraged borrowers) financial market imperfections. These policy measures need to be complementary.

In relation to *supply-side financial constraints*, there are many initiatives at the European level that are currently in place to deal with financial market imperfections including a wide range of loan facilities, guarantees, capital supports, direct investment funding and other initiatives. It is crucial that such policy measures ensure *financing additionality* and *are co-ordinated on an European basis* to reduce market fragmentation and support the development of a single financing market.

Of particular importance are the products provided by the European Investment Bank (EIB) Group both covered by its own mandate and on behalf of the EC through the European Investment Fund (EIF). The EIB group provides a range of lending facilities and risk-sharing arrangements targeting specific areas where financial market failures are likely to occur. Their Loans for SMEs scheme (L4SME) provides intermediated loans and loan guarantees for mid-caps and SMEs. Such facilities are provided for both long term investment loans as well as working capital financing. Longer term loan facilities cover both tangible and intangible investment spending and has been recently widened to include patents and licences. The development of wide-ranging supports and lending for working capital purposes is important given the working capital needs that have arising since the onset of the crisis (Bain, 2013).

New products have been established to deal with specific, crisis-related issues. Specifically, trade finance initiatives have been provided in member states where banking sector fragilities are causing trade finance challenges for SMEs. This is an important direct intervention in financial markets that targets the impact of financial market imperfections on firm performance trough internationalisation possibilities. Direct loans for micro-enterprises through micro-finance products have been established.

Complementing the direct loan and intermediation facilities of the EIB, EIF has a complementary suite of financial assistance for European SMEs. EIF provides three main product groups to SMEs: equity risk capital, guarantees and securitizations and microfinance. By acting as a cornerstone investor in venture capital markets, they provide specific risk capital facilities directly through fund managers. Work on developing business angel

networks to provide additional direct equity funding is also undertaken by the EIF. EIF equity supports are available across the firms' lifecycle and are targeted at innovative, high-growth enterprises.

In terms of debt financing products, EIF provides a range of guarantees and securitisation products across loans and leases. For financial institutions to be eligible, new risk categories must be covered and financing additionality demonstrated.

EU Commission direct access to finance supports are covered under the Competitiveness and Enterprises and Small and Medium-sized Enterprises (COSME) programme which recently replaced the Competitiveness and Innovation Programme (CIP). These main access to finance policies are a) guarantees and counter-guarantees for financial intermediaries on SME loan facilities and leases and b) risk capital offering venture capital and mezzanine financing. Micro-finance products are provided by the EIF through its management of the EU Progress Microfinance Facility and Joint European Resources for Micro to Medium Enterprises (JEREMIE) and Joint Action to Support Microfinance Institutions (JASMINE). Both financial supports and technical assistance covered by these schemes.

Policy measures to assist SMEs to obtain access to external financing should focus on broadening the range of financing sources and instruments available particularly to small and young firms. The evidence provided by this analysis indicates that the number of financial instruments relevant to enterprises decreases with firm size and age. This evidence implies that firms in their early lifecycle and smaller firms have less diversified financing mix structures, and they are more likely to be exposed to shocks in the supply of their main funding source, usually bank loans. Specifically, measures that improve the access of small and young firms to equity and debt markets could strengthen their capital structure and enhance their financing capacity. The evidence in this chapter also highlights that access to trade credit facilities could serve as an alternative to formal market financing, particularly for young firms.

The broadening of the range of financing instruments should also account for *differentials across industries and sectors*. It appears that relative to the firms in the construction sector, firms in industry, trade, and services sectors have less diversified financial mix structures.

Given the variation of the severity of the financial crisis across countries, policy measures and instruments to improve SMEs' access to external financing should consider *country specific conditions*. This analysis highlights that SMEs' financing constraints have been highest in Ireland, Greece and Spain, the countries with the most severe banking and sovereign debt crises.

Policy measures to improve access to external financing should target particularly firms which are most affected by financial market imperfections, particularly domestic micro, small, young and innovative firms. The evidence provided by this analysis indicates that over and above demand factors, actual and perceived financing constraints are higher for small, micro and innovative firms. Actual financing constraints decrease with firm age.

Measures to improve access to external financing for firms with international activities should consider the firms' internationalisation strategies. The evidence suggests that financing constraints are perceived to be binding particularly for firms with more complex international production operations such as outward investment and international outsourcing.

Particular policy measures should address the restricted access to external financing due to financial market imperfections related to general economic uncertainty associated with the financial crisis. The evidence provided in this study indicates that over and above demand factors, the financial crisis has exacerbated financial market imperfections and has led to restricted access to external finance overall. However, these measures should be temporary and avoid crowding-out the private financing once the financial markets have picked-up. While the sensitivity of investment to access to external financing has increased following the recent financial crisis for all firms, *young and micro firms* appear to be the most affected by increased financing constraints due to financial market imperfections associated with information asymmetries, uncertainty and investors' risk aversion. General measures to improve the liquidity of SME loans at financial institutions such as SME securitisations (Kramer-Eis et al, 2013) should facilitate an easing of supply constraints on the part of banks and should be strengthened. Moves by the EIB to introduce financial interventions on providing liquidity to asset backed securities markets (ABS) for SME loans are important in the post-crisis setting.

With respect to differentials across industries and sectors, *firms in the high-tech knowledge-intensive services appear to face the greatest difficulties in accessing external financing*.

Policy measures to improve and diversify access to external financing are likely to generate employment growth of SMEs. The evidence indicates that over and above demand and industry and country specific cyclical factors, financial factors impact on employment growth. However, the sensitivity of employment growth to financial factors varies across firm and industry groups. While for young firms employment growth seems to be more responsive to the availability of internal funding, in mature firms employment growth is funded to a greater extend by access to trade credit. Access to trade credit appears to be important for employment growth particularly in manufacturing and services other than high-tech services.

Policy measures to improve and diversify access to external financing are likely to generate productivity growth of SMEs. The evidence in this study suggests that financing constraints restrict the productivity growth in domestic SMEs. The financial crisis has exacerbated the sensitivity of productivity growth to access to external financing particularly for *young firms* and firms in the *construction* and *high-tech manufacturing and services*. Furthermore, the evidence in this study suggests that cash hoarding linked to the lack of investment opportunities have impacted negatively on productivity growth in domestic SMEs. For young firms, financial pressure linked to indebtedness has led to productivity growth while the interest burden in the post-crisis period has impacted negatively productivity growth in high-tech knowledge-intensive services.

Financial constraints are negatively associated with the propensity to export, however the export sales intensity does not appear to be related to access to external financing. The sensitivity of export propensity to access to external financing appears to be most important for those firms which are young, domestic owned and firms in the traditional industries. Furthermore, the sensitivity of export propensity to financing constraints decreases with firm size.

In relation to *demand-side constrained enterprises* (discouraged borrowers), since these do not interface with a financial institution or with wider capital markets, traditional financing policy support mechanisms such as the current guarantees', risk-sharing initiatives, direct equity investment and direct loan facilities are not able to address this particular market failure. While in many cases, not all firms within this category would be successful in obtaining finance on market terms, even if they could be encouraged to apply, this group does represent a considerable latent demand for finance which could lead to productivity enhancements and output growth if such a demand was satiated. *Policy measures that facilitate the development of borrower financial capabilities and capacities*, such as *training* in the preparation of financial documentation for bank-lending applications, the improvement in understanding of SMEs relating to how different financing sources are relevant for their business, and how to produce market ready business plans would be beneficial. *Up-skilling and improving the financial knowledge base* of European SMEs could greatly reduce negative perceptions of the degree to which credit is available. *Standardisation in documentation and improving information on creditworthiness* across the single market for financial products could reduce informational asymmetries. Better capacities for information gathering and sharing can enhance the ability of borrowers and lenders to understand risk. *Information provision to borrowers* regarding the availability of supports would be important to encourage active engagement with the market or with finance providers. These measures are of particular importance for *micro and small enterprises and firms in their early lifecycle.*

While financial market imperfections provide the rationale for policy intervention, such intervention should not distort competitive market mechanisms for the allocation of financial resources. Policy intervention should not eliminate the creative destruction process which allows the reallocation of resources from low productivity to high productivity enterprises and industries. Rather, public intervention should ensure *financing additionality* and foster self-sustainable private financing in the long run. Furthermore, new policy measures and instrumnets to assist SMEs enterprises to obtain access to external financing motivated by the effects of the financial crisis should be temporary and avoid crowding-out the private financing once the financial markets have picked-up.

In the context of limited financial resources, *current policies should be evaluated for effectiveness* by assessing both benefits and costs of public intervention.

Building a Wider, Deeper Financial System for European SMEs

The recent EC Green Paper on "Long-Term Financing of the European Economy" calls for the development of a more diversified and robust financial sector that can adequately

transmit savings to productive borrowers without compromising financial stability. It also discusses whether "Europe's historically heavy dependence on bank intermediation will give way to a more diversified system with significantly higher share of direct capital market financing, institutional investor involvement and alternative financing sources". Such concerns are also shared in the recent EIB Group (2013) publication on "Investment and Investment Financing in Europe" who note a more diversified financial structure reduces the likelihood of borrowing constraints in the corporate sector.

The evidence provided by this analysis highlights such developments. The empirical results indicate that bank financing is the most relevant source of financing for both long term and working capital financing for European SMEs. Furthermore, this analysis finds that younger and smaller firms use less types of financing, leaving them exposed to constraints during periods of tightened supply.

To build a more robust financial sector that provides adequate capital for the real economy to grow and prosper, European firms need *wider, deeper capital market options* that can combine both bank funding with formal market debt, equity financing and alternative financing sources. Policy measures that target the development of such broader liquid financing types for SMEs, such as the proposed Project Bond market should be strengthened as should the EIFs role in developing a liquid European venture capital and business angel platforms. *Widening the funding mix* available to all European SMEs will ensure they have the financial platform on which to grow and expand.

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A. APPENDIX

A1 - Description of datasets

SAFE

The *Survey of Access to Finance for SMEs in the Euro Area (SAFE)*, conducted by the ECB and the European Commission, provides a rich source of information on SMEs financing in the Euro area countries. The survey covers micro, small, medium-sized and large firms and provides evidence on the financing conditions faced by SMEs compared with those of large firms during the past six months. Information is collated on the use of a range of financing sources including internal resources, bank credit, trade credit, market financing and informal credit. The survey also collates forward looking indicators of credit demand and firms' assessment of the challenges they face in their operating climate. It also contains information on employment activity, turnover, ownership and age, variables critical to linking access to finance to firm growth. In addition to a breakdown into firm size classes, it provides evidence across branches of economic activity, euro area countries, firm age, financial autonomy of the firms, and ownership of the firms. The first wave of the survey was held in June-July 2009. Part of the survey is run by the ECB every six months to assess the latest developments of the financing conditions of firms in the euro area. The more comprehensive survey, which includes the first wave of the survey, is run every two years, in cooperation with the European Commission. The analysis using the SAFE data set will cover the period 2009-2013.

AMADEUS

Amadeus (Bureau van Dijk) is a database of comparable financial and business information. It contains comprehensive information on around 14 million companies across Europe, combined from 35 sources. *Amadeus* includes standardised annual accounts (consolidated and unconsolidated), financial ratios, sectoral activities and ownership data. It compiles information on company balance sheets and profit and loss accounts and combines this with information from analyst evaluations and ownership information. This includes all information on capital stocks, cash flow, debt, trade credit, internal finance, employment, sales and profitability. By providing comparable continuous information on firm financials, it provides a unique dataset to employ structural econometric methods and link finance to firm activity. The analysis using the Amadeus data set will cover the period 2002 – 2011.

EFIGE

The *EFIGE* database was recently compiled within the EFIGE project (European Firms in a Global Economy: internal policies for external competitiveness), supported by the Directorate General Research and Technological Development of the European Commission through its 7th Framework Programme and coordinated by the Bruegel Institute. The EFIGE dataset contains information on international activities, R&D and innovation, labour organisation, financing and organisational activities, and pricing behaviour. The firm-level data was collected for the years 2007 to 2009 for seven European economies. The database combines measures of firms' international activities (e.g. exports, outsourcing, FDI, imports) with quantitative and qualitative information on about 150 items ranging from R&D and

innovation, labour organisation, financing and organisational activities, and pricing behaviour. The database also includes information on firm behaviour during the crisis. Data consists of a representative sample (at the country level for the manufacturing industry) of almost 15,000 surveyed firms (above 10 employees) in seven European economies (Germany, France, Italy, Spain, United Kingdom, Austria, and Hungary).

TABLE A-1 - Definitions of variables

SAFE, AMADEUS and EFIGE variables and definitions				
Topic	Variable	SAFE	Amadeus	Other
Demand for finance	Dummy for whether or not the firm applied for a) bank loans, b) bank overdrafts or short term loans, c) trade credit or d) other external finance in the past six months	Yes	No	n.a.
	Dummy for whether or not the firm used external finance in the past 6 months	Yes	No	n.a.
	Categorical variables for whether demand for the following types of finance has increased, remained the same or decreased 1) bank overdrafts, 2) bank loans, 3) trade credit, 4) equity, 5) debt securities, 6) other	Yes	No	n.a.
	Categorical variables for whether demand for external finance has increased, remained the same or decreased for 1) fixed investment, 2) inventories and working capital 3) availability of internal funds	Yes	No	n.a.
Financing constraints	Dummy for whether or not the firm perceives access to finance as the biggest growth obstacle	Yes	No	n.a.
	Dummy for whether or not the firm has a) applied for finance and been rejected b) applied but rejected the offer due to cost or c) did not apply due to possible rejection	Yes	No	n.a.
	Cash stock investment sensitivity	No	Yes	n.a.
	Reliance on external funds defined as the ratio of external finance usage to internal finance available	No	Yes	n.a.
	Index of financing constraints following Whited and Wu (2006)	No	Yes	n.a.
Firm characteristics (General)				
	Age of incorporation (continuous)	No	Yes	n.a.
	Age of incorporation (categories, >10, 5-10,2-5,less 2)	Yes	Yes	n.a.

Firm characteristics (General)	Ownership categories for listed, family or entrepreneurs owned, other firm owned, venture capital owned, sole traders or other	Yes	Sample does not include sole traders or non-limited firms. Can distinguish between listed firms and firms owned by other enterprises but we cannot distinguish firms owned by venture capital or business angels	n.a.
	Dummy for whether the firm is a subsidiary of another enterprise	Yes	Yes	n.a.
	Total number of employee's	No	Yes	n.a.
	Employment categories (Micro 1-9pp, Small 10-50 pp., Medium 50-250 pp, Large > 250 pp)	Yes	Yes	n.a.
	Country indicators	Yes	Yes	n.a.
	Regional indicators	No	Yes	n.a.
Financial characteristics	Debt to total asset ratio	No	Yes	n.a.
	Categorical variable for increase, decrease or no change in debt to asset ratio	Yes	Yes	n.a.
	Interest coverage ratio – ratio of interest payments to interest payments + cash flow	No	Yes	n.a.
	Measure of collateral 1 – Ratio of total liabilities to total assets	No	Yes	n.a.
	Measure of collateral 2 – Ratio of tangible to intangible assets	No	Yes	n.a.
	Accounts receivable and payable as well as working capital	No	Yes	n.a.
	Dummy for whether or not the firm payed positive dividends	No	Yes	n.a.
	Ratio of current assets to current liabilities	No	Yes	n.a.
Industry	NACE Codes for 2 and 3 digit sectors	No	Yes	n.a.
	Indicators for construction, industry, trade and service sectors	Yes	Yes	n.a.
Demand factors and performance measures				
	Total firm turnover/sales	No	Yes	n.a.
	Categories for firm turnover/sales (< €2m, €2m-€10m, €10m-€50m, > €50m)	Yes	Yes	n.a.
Demand factors and performance	Firm fixed investment expenditure	No	Yes	n.a.

measures				
	Firm R&D expenditure	Yes	No	n.a.
	Operating profits	No	Yes	n.a.
	Categorical variables for whether or not firm profit (net income after taxes) 1) increased, 2) remained the same or 3) decreased	Yes	Yes	n.a.
	Export revenue	No	Yes (poor data availability)	n.a.
	Inventories	No	Yes	n.a.
	Indicator for whether or not the firm undertook product or process innovation	Yes in H1 2011	No	
	Has the following improved, remain unchanged or deteriorated:1) general economic outlook 2) your firms sales and profit outlook	Yes	No	n.a.
Supply factors	Has the following improved, remain unchanged or deteriorated: 1) willingness of banks to provide loans 2) willingness of partners to provide trade credit and 3) willingness of investors to provide debt or equity finance	Yes	No	n.a.
	Categorical variables for whether the availability for the following types of finance will increase, remain the same or decrease 1) bank overdrafts, 2) bank loans, 3) trade credit, 4) equity, 5) debt securities, 6) other			
	Has the following improved, remain unchanged or deteriorated:1) your firms capital position 2) your firms credit history	Yes	No	n.a.
	Country-level measure of financial structure (Market capitalisation of listed companies to private sector banking credit)	n.a.	n.a.	Cehik et al. (2013) financial structure database
	Country-level measure of financial development (market capitalisation + outstanding bond issuances + bank credit as a percentage of GDP)	n.a.	n.a.	Cehik et al. (2013) financial structure database
Supply factors	Median bank credit default swap	n.a.	n.a.	Datastream
	Government bond yields	n.a.	n.a.	Datastream
	Government gross debt	n.a.	n.a.	Eurostat
	Outstanding private sector credit	n.a.	n.a.	Eurostat

	GDP	n.a.	n.a.	Eurostat
	Country Consumption	n.a.	n.a.	Eurostat
	Country Investment	n.a.	n.a.	Eurostat
	Country Exports	n.a.	n.a.	Eurostat
	Inflation	n.a.	n.a.	Eurostat
	Money supply (M2)	n.a.	n.a.	Eurostat/ECB
	Outstanding loans to corporates in EU 28	n.a.	n.a.	Eurostat/ECB
	Interest rates on loans to corporates in EU 28	n.a.	n.a.	Eurostat/ECB
	Categorical variables for whether or not the following terms and conditions of bank financing increased, remained unchanged or decreased: 1) interest rates 2) non-interest costs 3) size of facility 4) collateral 5) other (covenants, guarantees, information, time to process, procedures)	Yes	No	n.a.
Financial structure	Ratio of bank finance to total finance	No	Yes	n.a.
	Ratio of equity to debt	No	Yes	n.a.
	Ratio of bank finance to other external finance	No	Yes	n.a.
	Ratio of trade credit to short term bank credit + trade credit	No	Yes	n.a.
	Dummy for whether or not the firm used the following types of finance in the past six months 1) Retained earnings, 2) bank overdrafts, credit lines or credit card overdrafts, 3) bank loans, 4) trade credit 5) other loans (from firms, or friends or family) 6) Leasing, factoring or hire-purchase 7) Debt securities issued 8) Subordinated loans or equivalent 9) Equity	Yes	No	n.a.
	Dummy for whether or not the firm was involved in mergers/acquisitions or corporate restructuring in past six months	Yes	No	n.a.
Public policy supports	Categorical variables for whether the availability of access to public financing support including guarantees has increased, remained the same or decreased	Yes	No	n.a.
	Dummy indicator variable for whether or not the firm used publicly supported finance in the past six months	Yes	No	n.a.
Public policy supports	Dummy indicator for whether the firms do not feel public supports are relevant for their firm			

EFIGE VARIABLES AND DEFINITIONS

Category	Variable	Definition	EFIGE Variable Code
Financial Constraints	Perceived	Dummy for firm which believed financial constraints hampered growth in 2008.	e6_m_c1
	Actual	Dummy for firm which was unsuccessful in application for more credit	F14
Firm Characteristics Standard	Age	Three categories for age<6, >6 and <20, >20	
	Size	2 variables (i)Total number of employees in 2008, (ii) categorical variable with firms grouped in size categories	B3
	Turnover	Categorical variable, firm turnover classified into 1 of 8 intervals.	A3
	Human Capital	(i)Number of skilled blue collar workers. (ii) R&D employees	
	Management	Dummy if decision making is centralised	A23
	Type of ownership structure	Dummy if firm is family run or run by an individual	A20
Innovation measures	Product	Dummy if firm product innovates between 2007-2009.	C14
	Process	Dummy if firm process innovates between 2007-2009.	C14
	IPR application	Dummy if firm applied for patent, copyright, trade mark.	C17
	Innovation turnover	Percentage of turnover due to innovative product sales between 2007-2009.	C15
	Investment	Percent of turnover that investment represented between 2007-2009	C5
	RandD Investment	Percent of turnover that R&D investment represented between 2007-2009	C21
Internationalisation	Foreign owned	Dummy if firm belongs to foreign group	A8
		Dummy if firm belongs to foreign group or one of top three shareholders is foreign and has 10% shareholding. Correct identification can only be done for firms where information on top three shareholdings sums to 91%.	A16 and A19
	Foreign Subsidiaries	(i) Dummy if firm has foreign affiliates (ii) number of affiliates	A15\A
	Exporter	Dummy if firm exports	D4
		Percentage of exports in turnover	D4
		Dummy if firm exported before 2008	D5
		Number of countries firm has exported to	D6
Service sourcing		Dummy if firm purchased services for domestics production in home country	D23
		Dummy if firm purchased services for domestics production from foreign country	D23
		Share of purchased services per turnover	D23

		Share of purchased services per turnover from abroad	D26
		Dummy if firm purchased services prior to 2008	D27
Interim goods sourcing		Dummy if firm purchased intermediate goods for domestics production from anywhere	D30
	Importer	Dummy if firm purchased intermediate goods for domestics production from abroad	D30
		Share of purchased intermediate goods per turnover	D30
		Share of purchased intermediate goods per turnover from abroad	D32
		Dummy if firm purchased intermediate goods prior to 2008	D33
	Offshoring	Dummy if firm has part of production activity in another country through arms length contracts	D37
		Percentage of turnover due to production through arms length contracts	D49
	FDI	Dummy if firm has part of production activity in another country through direct investment	D37
		Percentage of turnover due to production through foreign direct investment	D38
Industry Characteristics		Nace Id (randomised) Pavitt Classification	
Demand Factors and Firm performance measures			
	Turnover decline	Categorical variable denoting ranges of percentage declines in turnover in 2009	A6
	Employment Change dummy	Categorical variable denoting if firm experienced increase, decline or no change in employees in 2009	Preb21
	Employment Change %	Percentage change in employees in 2009	B21
	Investment change	Percentage reduction in planned investment in 2009	C13aperc
	Foreign production activities	Dummy if firm experienced reduction of turnover from production activities abroad in 2009	
	Closure of Foreign production unit	Dummy if firm closed production unit abroad in 2009	
	Foreign production activities	Dummy if firm experienced reduction of turnover from production activities based on arms length contracts abroad in 2009	
	ExFinance	Dummy if firm recurred to external finance	F0
	ExFinance_Ind	Categorical ranking of firms' perception of dependence of other firms in their industry on ExtFin	F3
Supply Factors		Number of banks firm deals with	F9
		Dummy if deals with domestic or foreign bank	F8
		Length of relationship with main bank	F11

		Percentage of debt at main bank	F10
Financial Structure			
	ExFinance_type	Percentage of external finance accessed through: ST bank debt, LT bank debt, ST securities, Other	F1
	Finance_Instruments	Dummy variable for financial instruments used Equity, VC and private equity, ST bank credit, LT bank credit, Securities, Public Funds, Tax incentives, Leasing or Factoring, Other financing methods	F6
	Investment per turnover	Investment in plants, machines, equipment, ICT as percentage of turnover during 2007-2009	C5
	Investment by financial instrument	Share of investment funded by self-financing, intra-group financing, VC, Bank Credit, Public Funding, Leasing and Factoring, Other.	C10
	R&D investment per turnover	Investment in R&D as a percentage of turnover during 2007-2009	C21
	R&D Investment by financial instrument	Share of R&D investment funded by self-financing, intra-group financing, VC, Bank Credit, Public Funding, Leasing and Factoring, Other.	C22
Competition		Dummy denoting how prices are set	E10
		Dummy variables if size of margin increased, decreased, remained constant during last year	E11
Policy		Dummy if purchased trade/export insurance	D20
		Dummy if financed by trade/export credit	D20A
		Dummy if firm has benefitted from tax allowances and financial incentives on exports	D19
		Dummy if firm has benefitted from tax allowances and financial incentives on R&D activities	C27
		Dummy if firm has benefitted from tax allowances and financial incentives on investment during 2009	C13A
		Dummy if received public or private Institutions assistance for internationalisation activities	D57
		Dummy if firm received financial incentives provided by the public sector during last year	F23
		Distribution of the financial incentives received in percentage terms between European	F24
		Distribution of the financial incentives received in percentage terms between National	F24
		Dummy if firm received tax incentives provided by the public sector during last year	F25
		Distribution of the tax incentives received in percentage terms between European	F26
		Distribution of the tax incentives received in percentage terms between National	F26

A3 - Amadeus Sample Description

A3.1 Sample Construction

The Amadeus database provides information on firms between the years 2003 and 2012. We began construction of our sample by downloading financial data from Amadeus for all those firms in the EU with employee, fixed assets, sales and turnover data for 2009. This was an initial prerequisite for inclusion in our sample as we want to exclude firms who were not active at the beginning of the financial crisis period from our analysis.

Firms were then dropped from the dataset if they lacked information on their age or the sector in which they operate. We exclude all medium and large firms which lack information on their ownership i.e. whether the firm is foreign or domestically owned. For micro and small firms, we include these firms in the sample whether they have ownership data or not. If these micro and small firms lack ownership data, we assume that they are domestically owned. We also exclude firms in the financial sector as these firms act as financial intermediaries and are not appropriate for inclusion in analysis of the impact of financial constraints on firm performance; this is standard in the literature. Additionally, we exclude those firms operating in NACE sectors 84 to 93. These sectors include education, health, social work, arts and recreation. These sectors are generally non-market orientated and thus not suitable for inclusion in our analysis.

Having cleaned the data of entire firms lacking vital information, we turned to cleaning the data of annual observations which had missing values in vital categories. We drop observations which have missing values for total assets, fixed assets, output[17], intangible assets, interest costs, cash flow, depreciation, value added, long term debt, loans, working capital, cash and cash equivalents, current liabilities, debtors, creditors, operating profit, and tangible assets as these variables are necessary for the construction of key component of our analysis. We also drop all observations for which the firm's legal status was not defined as active.

We clean the dataset of all observations for which there are negative values and where, in the context of the variable, a negative value is realistically impossible. The variables for which we permit negative values were profit, cash flow, depreciation and value added.

We then transform our data into real, inflation adjusted values using producer price indices from Eurostat, where available, and a GDP deflator where producer price indices were not available for the given country and/or sector. We also convert the data into national currencies where necessary using exchange rate data from Eurostat.

The remaining observations were then cleaned of outliers. This was achieved by dropping all observations in the top and bottom one percent of the distribution for the key variables used in our analysis.

Finally, we then dropped from the dataset all those firms for which we did not have at least six consecutive years of data. We do this due to our econometric strategy which requires both lagged variables and data transformation and thus requires at least four years of consecutive data per firm. We widen our criteria for inclusion in the sample to six consecutive years in order to only capture firms which were active in both the pre-crisis (2003-2007) and post-

[17] Defined as turnover or sales in cases where turnover information was missing in Amadeus data.

crisis (2008-2012) periods. We do this to insure we can capture changes in the impact of financial constraints across the periods.

A3.2 Sample Composition

The makeup of our sample after cleaning is outlined in Table A-2. Our analysis is based on just over 156,700 observations and 22,540 firms. The majority of our sample firms are from EU-15 states; this is due to the superior data quality in Amadeus for these countries. In terms of firm size, small firms are the most numerous category in the sample. The vast majority of firms in our sample are domestically owned. Those firms classed as operating in the other services sectors are by far the largest subsection of firms present in our sample.

Table A-2 - Summary Statistics - Amadeus Sample

	Total	% of Total Firms
No of observations	156,713	
No of firms	22,540	
Large	257	1%
Medium	1,745	8%
Small	1,2559	56%
Micro	7,979	35%
Age 0-20	10,357	46%
Age 20+	12,183	54%
Foreign owned	271	1%
Domestic owned	22,269	99%
High tech manufacturing	246	1%
High-tech knowledge-intensive services	445	2%
Other Manufacturing	7,718	34%
Other Services	11,362	50%
Construction	2,769	12%

We include firms from all Belgium, Bulgaria, Czech Republic, Germany, Spain, Finland, France, Italy, Portugal, Sweden and the UK. Table A-3 outlines the number of firms in from each country in our sample. Those countries we exclude from our sample are lacking essential data all together or have only an unrepresentative number of observations after the data is cleaned.

Table A-3 - Amadeus Sample – Country Breakdown

Country	Firms	% of Total Sample
Belgium	622	2.8%
Bulgaria	104	0.5%
Czech Republic	95	0.4%
Germany	221	1.0%
Spain	2,296	10.2%
Finland	478	2.1%
France	7,211	32.0%
Italy	8,372	37.1%
Portugal	2,842	12.6%
Sweden	125	0.6%
United Kingdom	174	0.8%

A3.4 Sample Weighting

We weight our final sample using firm population data from the Structural Business Statistics available from Eurostat. We construct a representative weighting for each firm on a country, industry, size basis where possible. The weight is recalculated for each year of our sample. We replicate the weighting approach of the EFIGE dataset and construct our relative weight as follows:

$$rw_{ks} = \frac{Pfirms_{ks}/Pfirms}{Sfirms_{ks}/Sfirms}$$

$Pfirms_{ks}$ is the number of firms in industry k and size class s for the population in a given country. $Sfirms_{ks}$ is the number of firms in industry k and size class s in our sample; $Pfirms$ and $Sfirms$ are the total number of firms in the population and sample respectively. The sum of weights over the firms is equal to the total number of firms in the sample by country.

A3.5 Construction of Main Financial Variables

Our analysis includes several financial variables aimed at capturing the influence of both internal and external financing on firm outcomes. Below is a list of these financial variables and their definitions.

Financial Variables	Construction
Cash Flow	Cash Flow / Total Assets*
Cash Stock	Cash Stock / Total Assets*
Trade Credit	(Creditors + Debtors) / Total Assets
Leverage	Total Debt / Total Assets
Long Term Credit Flows	Δ Long Term Debt / Total Assets
Short Term Credit Flows	Δ Short Term Debt / Total Assets
Interest Burden	Interest Costs / Cash Flow

*For the investment analysis, the cash flow and cash stock variables are scaled by fixed tangible assets, as is standard in the literature.

A3.6 Sub-Samples used in Analysis

The analysis is carried out on several sub-samples of firms from the Amadeus data. The sub-samples, a short description of the firms included in these sub-samples and the number of firms in each sub-sample are outlined below.

Sub-Sample	Firms Included	Number of Firms
All Firms	All firms in our sample regardless of firm size, age, ownership or sector.	22,540
All Domestic SMEs	All domestically owned firms with less than 250 employees.	22,040
Micro Enterprises	All domestically owned firms with less than 10 employees.	7,979
Young Enterprises	All firms which have been in existence for less than 6 years.	3,262
Developing / Mid-Age Enterprises	All firms which have been in existence for between 6 and 20 years.	14,810
Mature Enterprises	All firms which have been in existence for more than 20 years.	12,183
Construction	All firms operating in the construction sector.	2,769
High-tech Manufacturing	Based on the Eurostat aggregation method using NACE rev. 2. Includes firms engaged in the manufacture of pharmaceuticals, computer components and aircraft.	246
High-tech Knowledge Intensive Market Services	Based on the Eurostat aggregation method using NACE rev. 2. Includes firms operating in telecommunications, computer related activities and research and development.	7,718
Other Manufacturing	All manufacturing firms not classed as high-tech.	445
Other Services	All firms engaged in the services sectors which are not classed as high-tech knowledge intensive.	11362

A3.7 Summary Statistics for Main Variables

The summary statistics in the tables below provide averages of some of the main variables used in our analysis broken down by firm characteristics including: size, age, ownership, sector and time period. The averages are based on the sample data described above and weighted using firm population data from Eurostat. The tables give averages for investment, total factor productivity, the number of employees, leverage (total debt / total assets), cash flow over total assets, cash stock over total assets, returns to total assets, and total debt over cash flow.

Table A-4 displays summary statistics by firm size. We use the Eurostat definitions for firm size[18]. The trend is generally as anticipated in so far as financial health appears to improve as firm size increases, as does total factor productivity.

Table A-4 - Weighted Summary Statistics – By Firm Size

	All Firms	Micro	Small	Medium	Large
Investment	0.58	0.605	0.468	0.365	0.296
Employees	11.45	5.931	28.184	115.178	516.993
TFP	4.23	4.137	4.657	4.986	5.155
Leverage	0.21	0.203	0.231	0.243	0.229
Cash Flow / Total Assets	0.09	0.090	0.086	0.095	0.104
Cash Stock / Total Assets	0.11	0.109	0.087	0.075	0.079
Returns / Total Assets	0.03	0.034	0.036	0.042	0.039
Total Debt / Cash Flow	14.32	14.676	12.887	9.213	7.023

[18] Micro firms are defined as those firms with less than 10 employees. Small firms are those firms with more than 9 and less than 50 employees. Medium size firms are firms with more than 49 and less than 250 employees. We define large firms as all those firms with greater than 250 employees.

Table A-5 outlines the means of the main variables with the sample broken down by firm age. Our age categories are comprised of firms less than 6 years old, firms between 6 and 20 years of age and firms more than 20 years old.

Table A-5 - Weighted Summary Statistics – By Firm Age

	All Firms	Less than 6 years	6 to 20 years	More than 20 years
Investment	0.580	1.505	0.623	0.521
Employees	11.453	12.100	8.793	15.047
TFP	4.231	3.226	4.121	4.379
Leverage	0.208	0.244	0.211	0.204
Cash Flow / Total Assets	0.090	0.197	0.095	0.083
Cash Stock / Total Assets	0.105	0.257	0.108	0.101
Returns / Total Assets	0.035	0.123	0.037	0.032
Total Debt / Cash Flow	14.317	7.643	15.109	13.248

Table A-6 breaks down the sample by firm ownership. The sample is split between those firms who are domestically owned and those firms who report as being foreign owned. We observe that foreign owned firms are generally larger and more productive than domestically owned firms.

Table A-6 - Weighted Summary Statistics – By Firm Ownership

	All Firms	Domestic Owned	Foreign Owned
Investment	0.580	0.580	0.468
Employees	11.453	11.120	74.188
TFP	4.231	4.227	4.945
Leverage	0.208	0.208	0.184
Cash Flow / Total Assets	0.090	0.090	0.079
Cash Stock / Total Assets	0.105	0.105	0.097
Returns / Total Assets	0.035	0.035	0.029
Total Debt / Cash Flow	14.317	14.328	12.124

We next split the sample by sector using the Eurostat aggregation of the manufacturing industry according to technological intensity.

Table A-7 - Weighted Summary Statistics – By Sector

	All Firms	Construction	High tech manufacturing	Other manufacturing	High-tech knowledge-intensive services	Other Services
Investment	0.58	0.593	0.828	0.525	0.721	0.599
Employees	11.45	9.392	19.873	16.277	7.819	7.840
TFP	4.23	4.267	4.365	4.253	4.253	4.200
Leverage	0.21	0.189	0.202	0.230	0.169	0.197
Cash Flow / Total Assets	0.09	0.102	0.092	0.082	0.111	0.091
Cash Stock / Total Assets	0.11	0.131	0.087	0.086	0.113	0.116
Returns / Total Assets	0.03	0.044	0.035	0.030	0.028	0.038
Total Debt / Cash Flow	14.32	13.665	10.004	13.510	10.827	15.545

Table A-8 displays averages of the key in the pre- and post-crisis periods. We classify the pre-crisis period from 2003 to 2007, and the post-crisis period from 2008 to 2012.

Table A-8 - Weighted Summary Statistics – By Time Period

	All Firms	2003-2007	2008-2009
Investment	0.58	0.614	0.540
Employees	11.45	10.980	12.005
TFP	4.23	4.217	4.247
Leverage	0.21	0.205	0.211
Cash Flow / Total Assets	0.09	0.094	0.084
Cash Stock / Total Assets	0.11	0.099	0.112
Returns / Total Assets	0.03	0.037	0.033
Total Debt / Cash Flow	14.32	14.743	13.822

Table A-9 outlines the means of the dependent variables and the financial variables included in analysis. The table outlines the means across the various sub-samples used in the analysis and across the pre- and post-crisis time periods.

Table A-9 Means Of Firm Growth Indicators And Financial Variables All Firms And By Firm Groups

	Time Period	All Firms	Domestic SMEs	Domestic Micro	Domestic Young	Domestic Developing / Mid-Age	Domestic Mature
Investment	Overall	0.566	0.575	0.634	0.632	0.556	0.530
	Pre-Crisis	0.623	0.632	0.732	0.718	0.575	0.537
	Post-Crisis	0.520	0.529	0.555	0.563	0.540	0.525
TFP	Overall	4.201	4.221	4.271	4.047	4.195	4.226
	Pre-Crisis	4.237	4.263	4.304	4.104	4.249	4.276
	Post-Crisis	4.172	4.188	4.245	3.991	4.153	4.185
Log Employment	Overall	1.946	1.946	1.712	1.719	1.893	2.030
	Pre-Crisis	1.948	1.947	1.712	1.707	1.910	2.066
	Post-Crisis	1.945	1.946	1.713	1.730	1.880	2.000
Cash Flow	Overall	0.086	0.086	0.082	0.091	0.086	0.086
	Pre-Crisis	0.092	0.093	0.087	0.101	0.091	0.092
	Post-Crisis	0.081	0.081	0.077	0.084	0.083	0.081
Cash Stock	Overall	0.105	0.105	0.100	0.100	0.102	0.105
	Pre-Crisis	0.100	0.101	0.096	0.100	0.099	0.100
	Post-Crisis	0.109	0.108	0.103	0.100	0.104	0.109
Leverage	Overall	0.211	0.211	0.212	0.229	0.213	0.211
	Pre-Crisis	0.203	0.201	0.203	0.221	0.200	0.203
	Post-Crisis	0.218	0.218	0.219	0.235	0.223	0.218
Trade Credit	Overall	0.584	0.584	0.618	0.642	0.608	0.584
	Pre-Crisis	0.621	0.622	0.653	0.666	0.631	0.621
	Post-Crisis	0.554	0.555	0.589	0.622	0.589	0.554
Credit Flows – Total	Overall	0.020	0.021	0.022	0.035	0.020	0.020
	Pre-Crisis	0.034	0.033	0.035	0.055	0.032	0.034
	Post-Crisis	0.010	0.010	0.011	0.018	0.010	0.010
Interest Burden	Overall	0.328	0.326	0.352	0.331	0.343	0.340
	Pre-Crisis	0.344	0.341	0.372	0.319	0.354	0.383
	Post-Crisis	0.314	0.315	0.336	0.340	0.333	0.305

*Notes:*Firms in each subsample: Domestic SMEs: 22,040 micro firms: 7979 young firms 3262: developing/mid age firms: 14810 mature firms: 12183

Source: Authors' analysis of Amadeus data

Table A-10 provides a similar breakdown as Table A-9 for the different sector groups included in our analysis.

Table A-10 Means Of Firm Growth Indicators And Financial Variables, By Sector Of Activity

	Time Period	Construction	High-Tech Manu	High-Tech Knowledge Intensive Services	Other Manufacturing	Other Services
Investment	Overall	0.539	0.837	0.804	0.519	0.582
	Pre-Crisis	0.641	0.868	0.679	0.566	0.653
	Post-Crisis	0.458	0.812	0.905	0.482	0.525
TFP	Overall	4.128	4.139	4.191	3.933	4.096
	Pre-Crisis	4.435	4.452	4.194	4.297	4.200
	Post-Crisis	4.229	4.406	4.132	4.202	4.126
Log Employment	Overall	1.917	2.451	1.656	2.211	1.759
	Pre-Crisis	1.937	2.414	1.673	2.207	1.744
	Post-Crisis	1.901	2.493	1.637	2.213	1.773
Cash Flow	Overall	0.096	0.092	0.099	0.081	0.087
	Pre-Crisis	0.103	0.095	0.108	0.087	0.094
	Post-Crisis	0.090	0.091	0.092	0.076	0.081
Cash Stock	Overall	0.129	0.088	0.089	0.085	0.116
	Pre-Crisis	0.130	0.077	0.108	0.081	0.111
	Post-Crisis	0.129	0.096	0.073	0.089	0.119
Leverage	Overall	0.185	0.205	0.187	0.229	0.203
	Pre-Crisis	0.175	0.194	0.196	0.226	0.187
	Post-Crisis	0.194	0.214	0.181	0.232	0.215
Trade Credit	Overall	0.592	0.580	0.691	0.581	0.579
	Pre-Crisis	0.639	0.598	0.657	0.620	0.618
	Post-Crisis	0.555	0.566	0.719	0.550	0.547
Credit Flows - Total	Overall	0.021	0.013	0.020	0.022	0.019
	Pre-Crisis	0.039	0.027	0.052	0.040	0.025
	Post-Crisis	0.006	0.002	-0.005	0.008	0.014
Interest Burden	Overall	0.269	0.226	0.375	0.369	0.308
	Pre-Crisis	0.319	0.242	0.340	0.379	0.326
	Post-Crisis	0.229	0.214	0.404	0.362	0.294

Notes: Firms in each subsample: Domestic SMEs: 22,040 micro firms: 7979 young firms 3262: developing/mid age firms: 14810 mature firms: 12183

Source: Authors' analysis of Amadeus data

A4 - Methodologies

A4.1- Total Factor Productivity (TFP)

Total factor productivity is obtained using the Levinsohn - Petrin methodology (Levinsohn and Petrin, 2003) to correct for simultaneity and selection biases related to firms' decisions on factor inputs and unobserved productivity shocks.

The Levinsohn-Petrin estimation method for TFP uses intermediate inputs as a proxy for unobserved productivity shocks. An alternative TFP estimation method proposed by Olley and Pakes (1996) uses investment as a proxy for unobserved productivity shock. Our choice for the Levinsohn-Petrin method is based on the better data coverage for intermediate inputs than for investment.

A4.2- Using System GMM To Estimate Dynamic Models

In this report, we estimate a number of structural econometric models in panel data which include dynamic components and a lagged dependent variable. In general these models take the form:

$$Y_{it} = \alpha + \delta Y_{it-1} + \boldsymbol{\theta X_{it}} + \boldsymbol{\beta Z_{it-1}} + c_i + \varepsilon_{it}$$

Where the vector X are pre determined contemporaneous variables that are potentially reverse causal with the dependent variable and the vector Z of lagged exogenous variables. Standard OLS estimation requires the assumption that the explanatory variables are uncorrelated with the error structure and that no serial correlation exists in the errors.

In the above model, there are a number of reasons why such assumptions are invalid, namely:

1. The presence of time-invariant unobserved heterogeneity c_i that is potentially correlated with the regressors. This invalidates the assumption of orthogonality between the errors and the regressors.
2. Contemporaneous variables in the vector X that are potentially reverse causal with the dependent variable. This is a standard instrumental variables problem and requires treatment.
3. The lagged dependent variable leads to serial correlation in the error structure as the error term in period t is correlated with the error structure in period t-1

Two well known methodologies for dealing with these suite of issues are system and difference GMM proposed by Arellano and Bond (1995) and Blundell and Bond (1998). In this report, we use the system GMM approach. This model uses the historical differences of the key variables as instruments for the level equation. This instrumentation strips out the firm specific heterogeneity effect, the reverse causality and the serial correlation. The instruments must be selected from lagged differences but period deeper than the serial correlation present in the error structure. In our models, we present tests of serial correlation and the lags are chosen relative to these information.

A5. Additional Information For Chapter 1

Figure A-1 - Relevance of financing sources across firm lifecycle – external market or bank financing - EU - 28

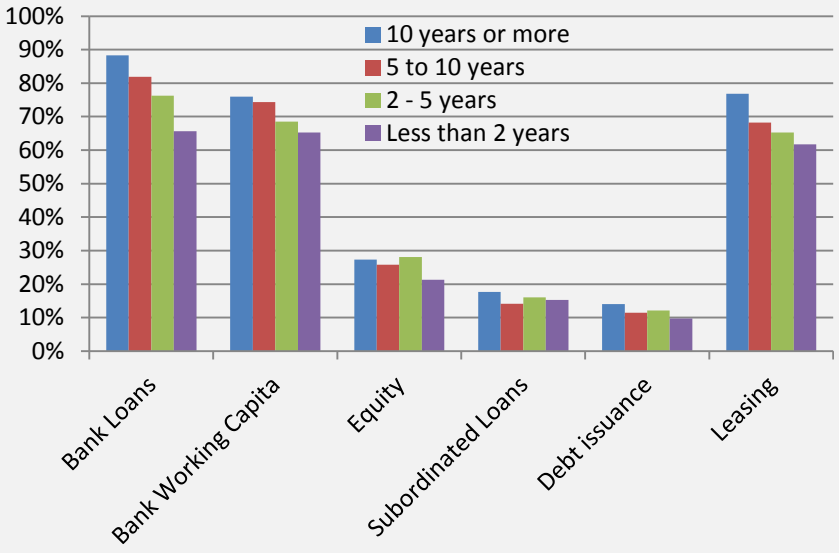


Figure A-2 - Relevance of financing sources across firm lifecycle – public supports, own funds and inter-company financing - EU - 28

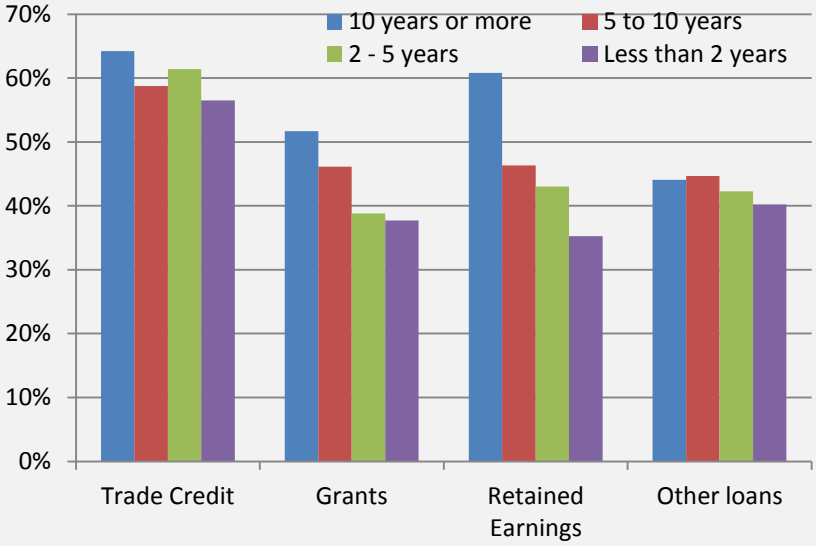


Figure A-3 - Relevance of financing sources by firm size – external market or bank financing - EU - 28

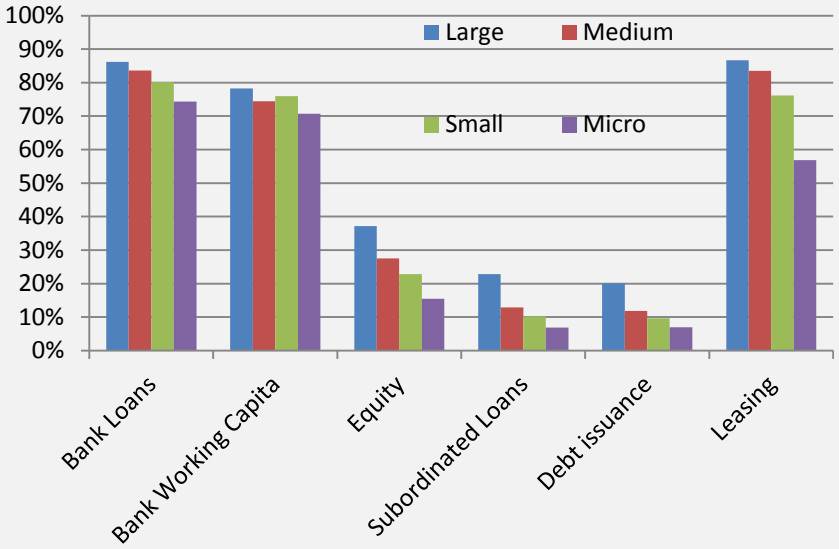


Figure A-4 - Relevance of financing sources by firm size – public supports, own funds and inter-company financing - EU - 28

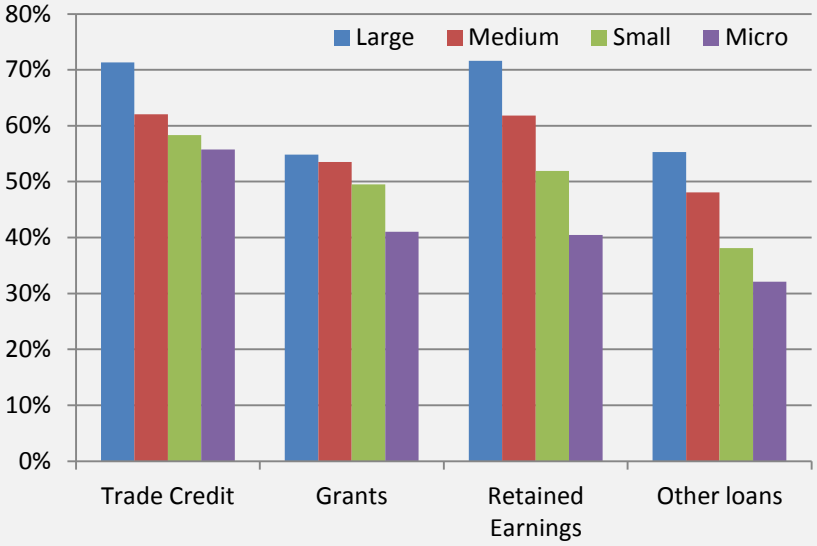


Figure A-5 - Relevance of financing sources by ownership – external market or bank financing - EU - 28

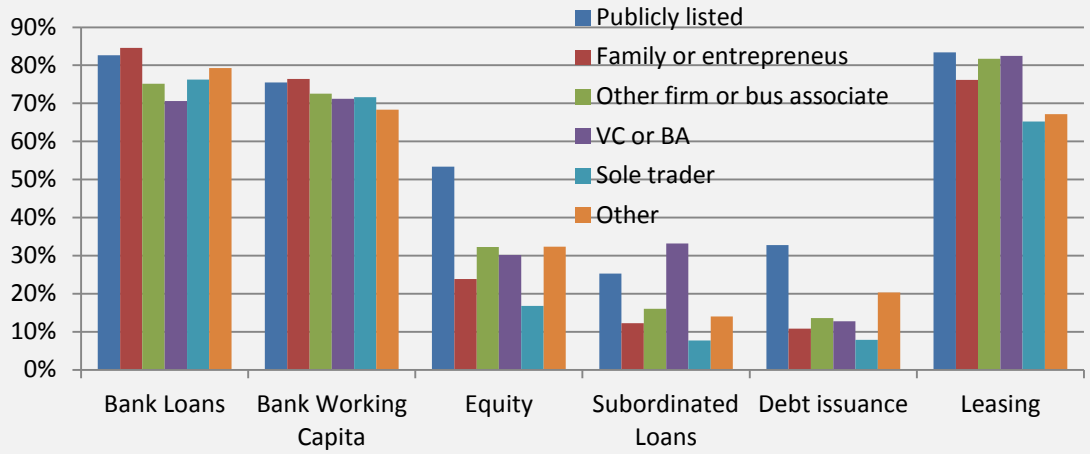


Figure A-6 - Relevance of financing sources by ownership – public supports, own funds and inter-company financing – EU - 28

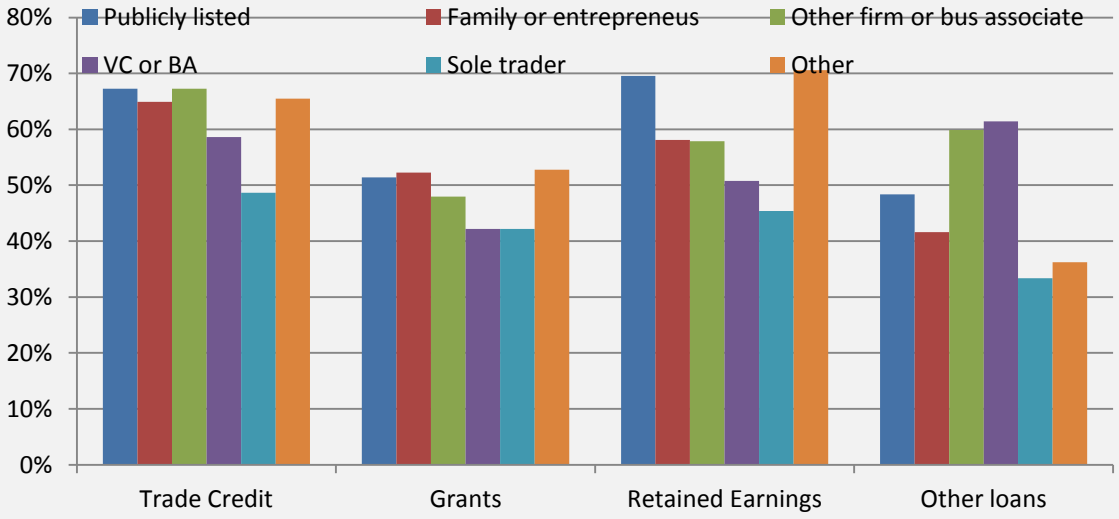


Figure A-7 - Relevance of financing sources across firm lifecycle – external market or bank financing - Eurozone

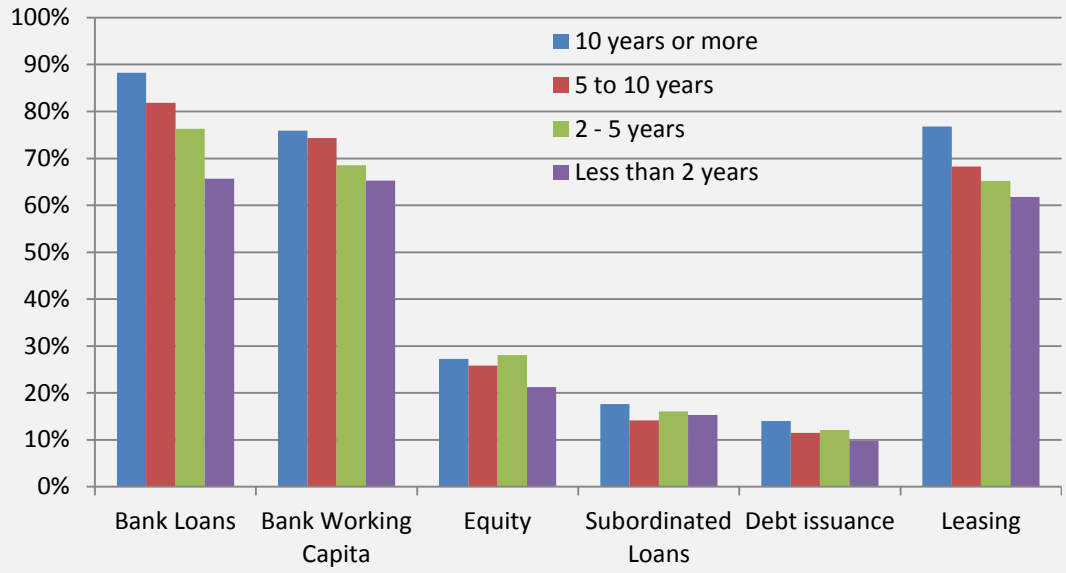


Figure A-8 - Relevance of financing sources across firm lifecycle – public supports, own funds and inter-company financing - Eurozone

Figure A-9 - Relevance of financing sources by firm size – external market or bank financing - Eurozone

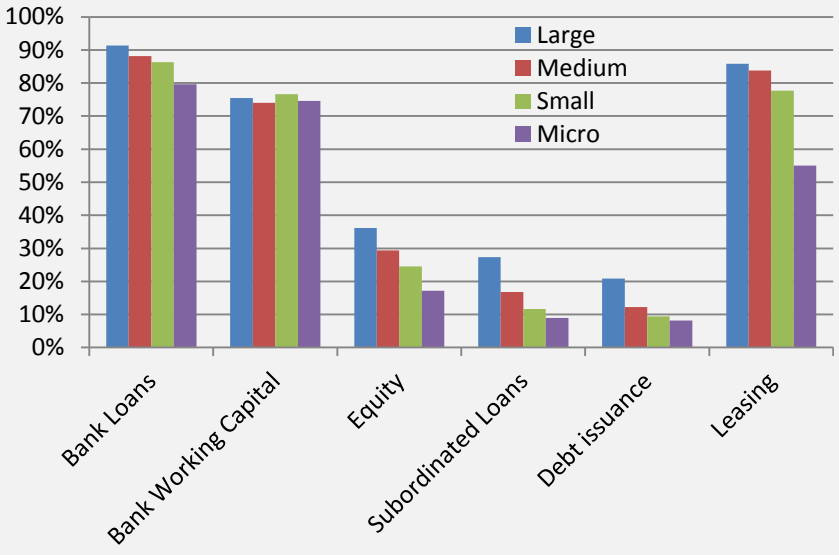


Figure A-10 - Relevance of financing sources by firm size – public supports, own funds and inter-company financing - Eurozone

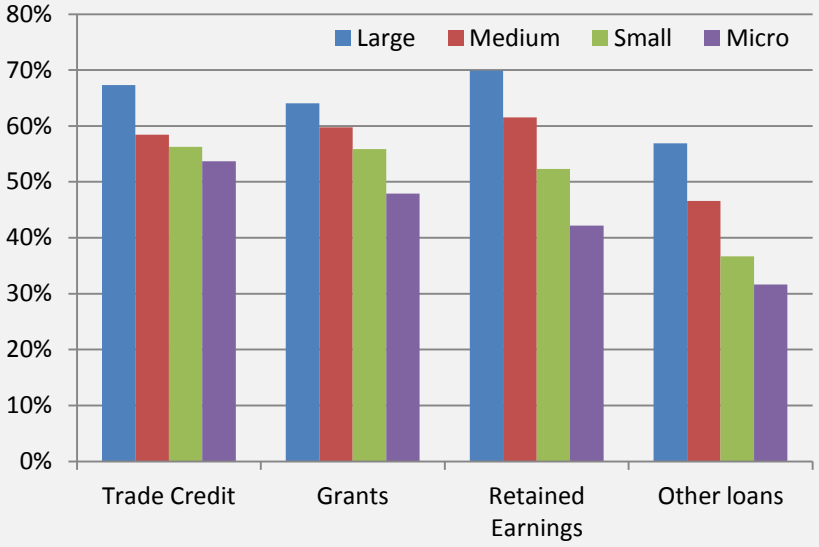


Figure A-11 - Relevance of financing sources by ownership – external market or bank financing - Eurozone

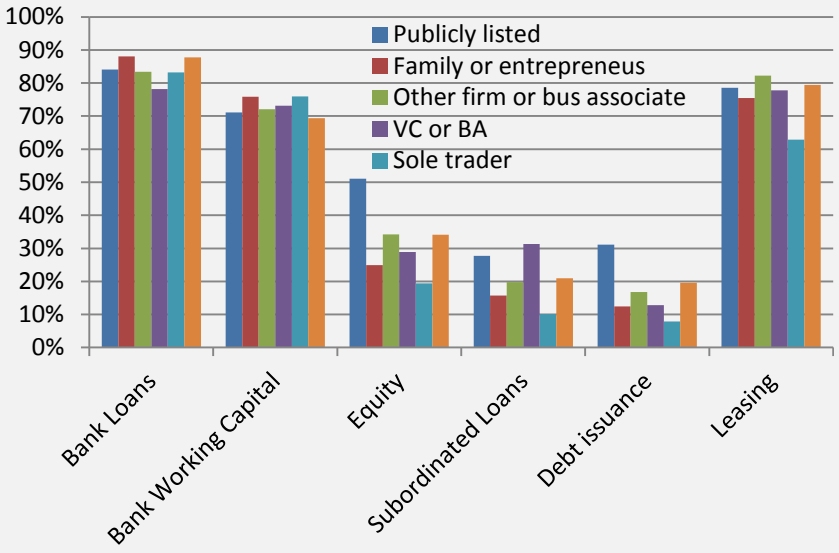


Figure A-12 - Relevance of financing sources by ownership – public supports, own funds and inter-company financing - Eurozone

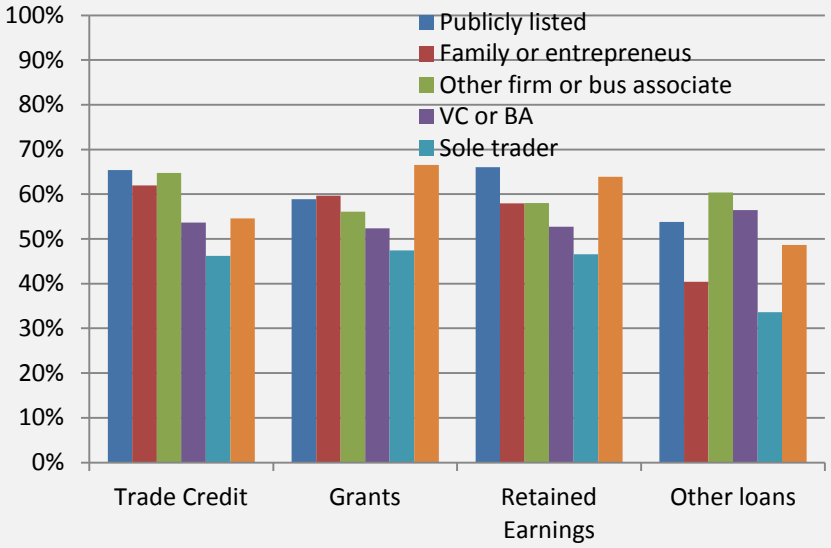
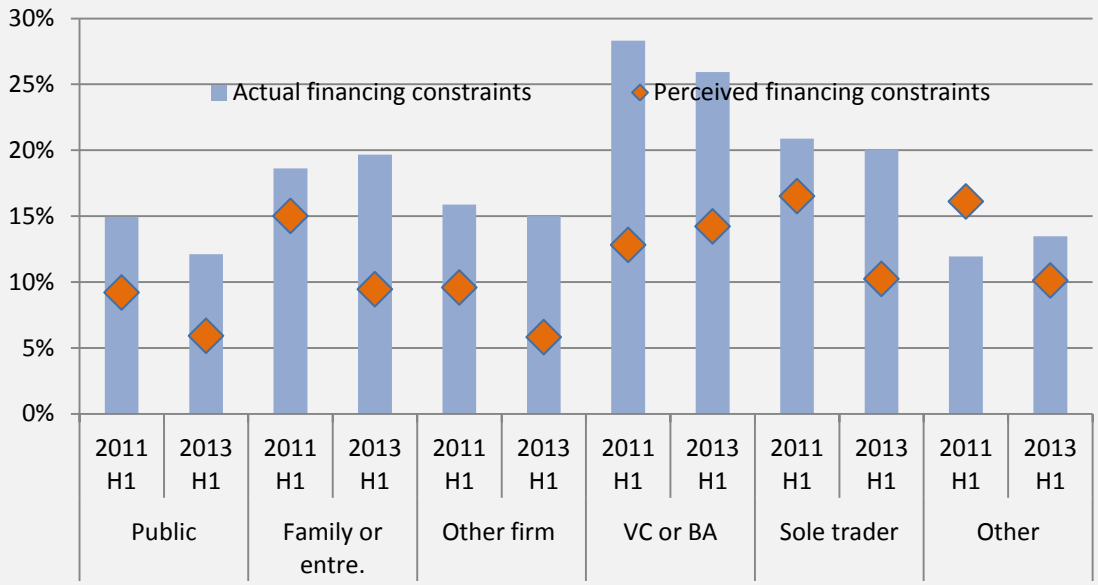
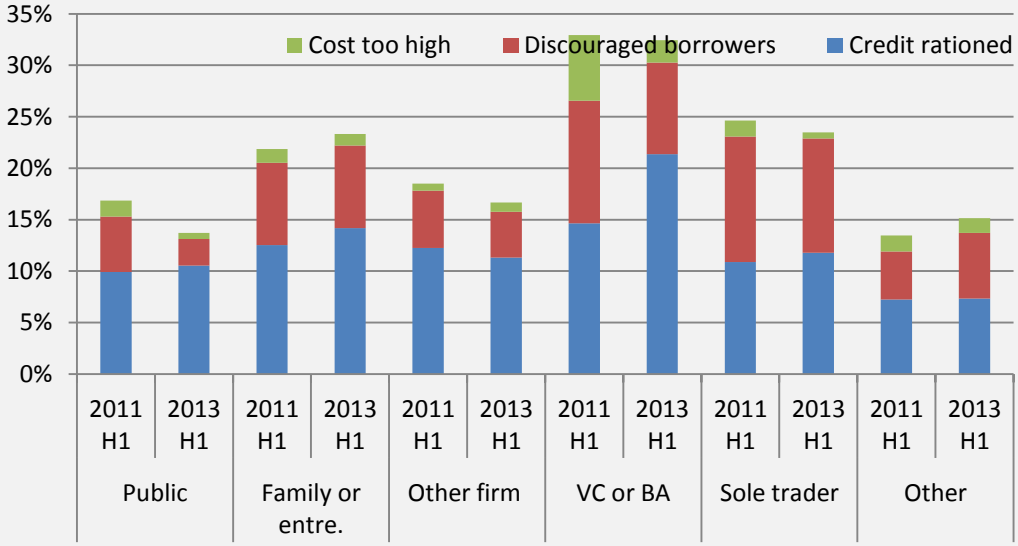


Figure A-13 - Overview of SME financing constraint indicators – by ownership



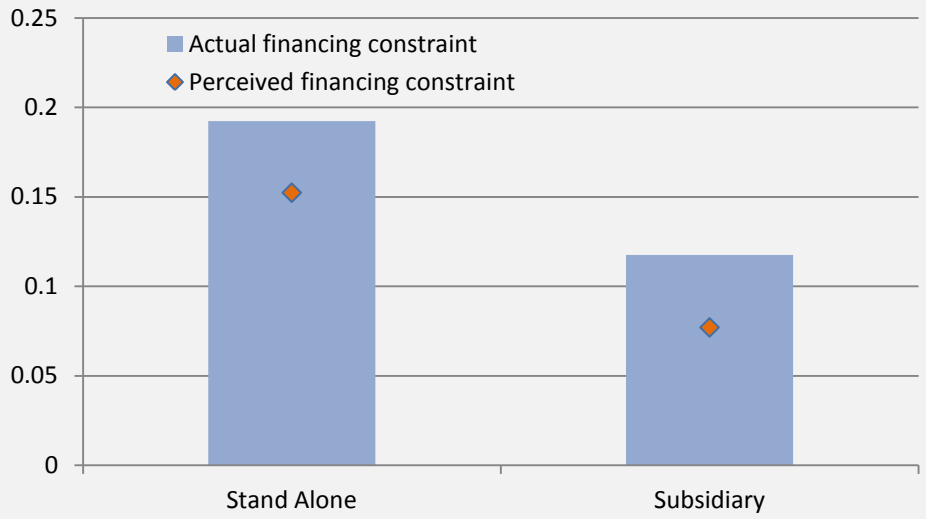
Source: ECB SAFE Data

Figure A-14 - Components of actual constraints – by ownership



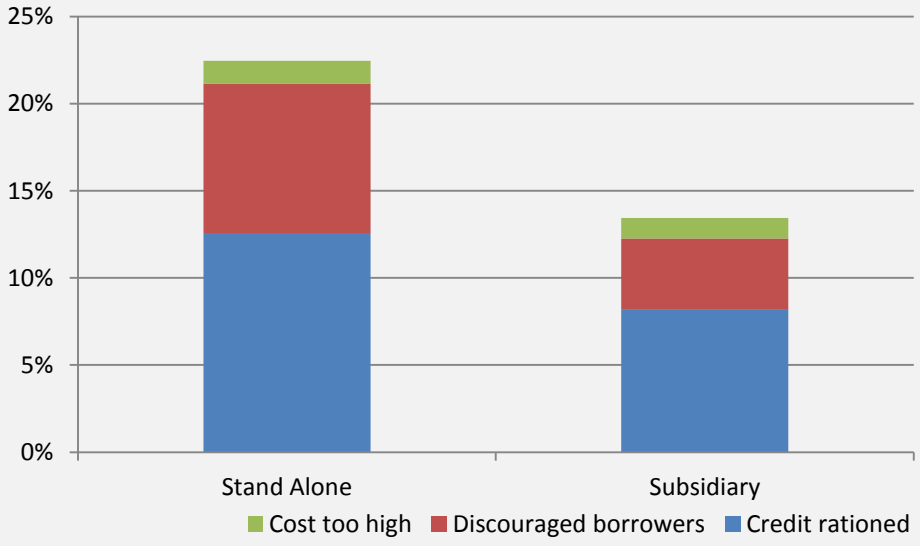
Source: ECB SAFE Data

Figure A-15 - Overview of SME financing constraint indicators – by subsidiary



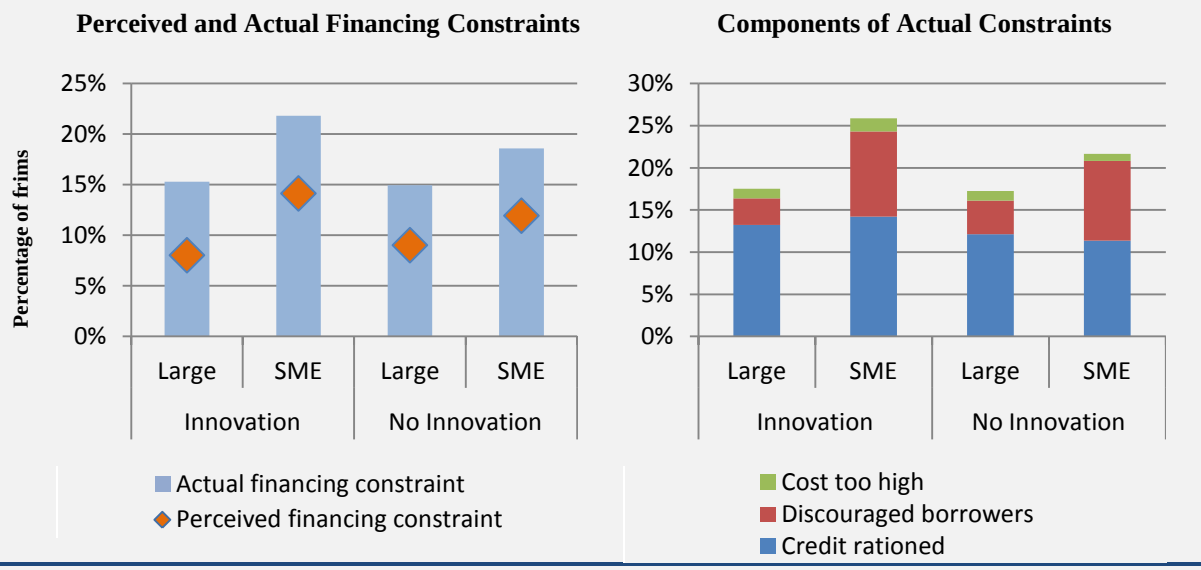
Source: ECB SAFE Data

Figure A-16 - Components of actual constraints – by subsidiary



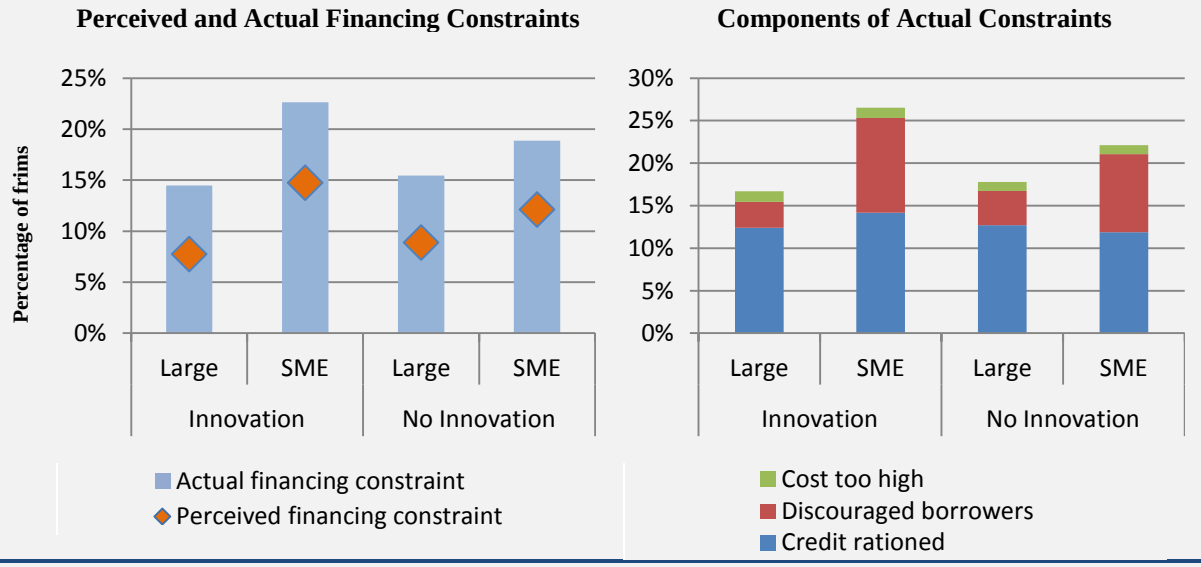
Source: ECB SAFE Data

Figure A-17 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Product Innovating Firms*



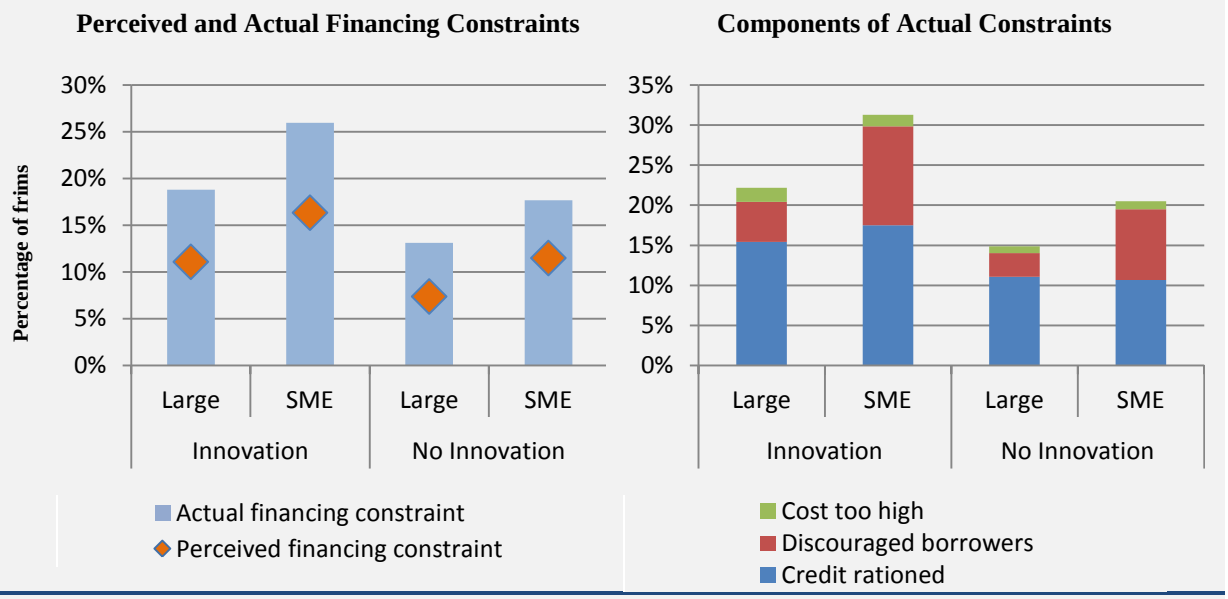
Source: ESRI analysis of Eurostat Access to Finance data.

Figure A-18 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Process Innovating Firms*



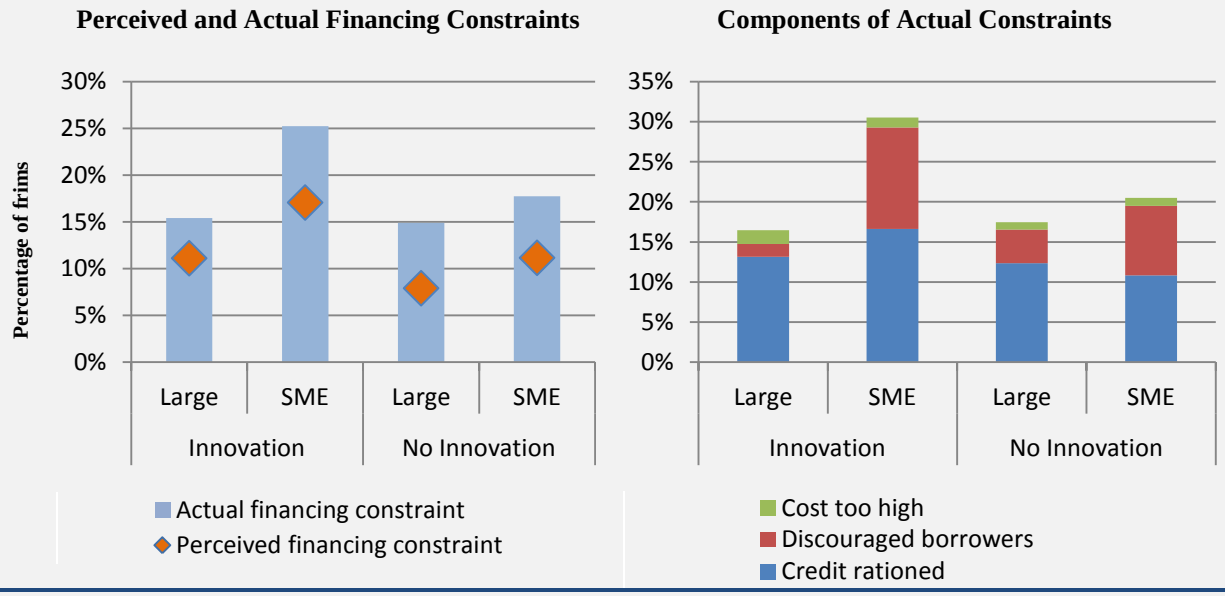
Source: ESRI analysis of Eurostat Access to Finance data.

Figure A-19 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Managerial Innovating Firms*



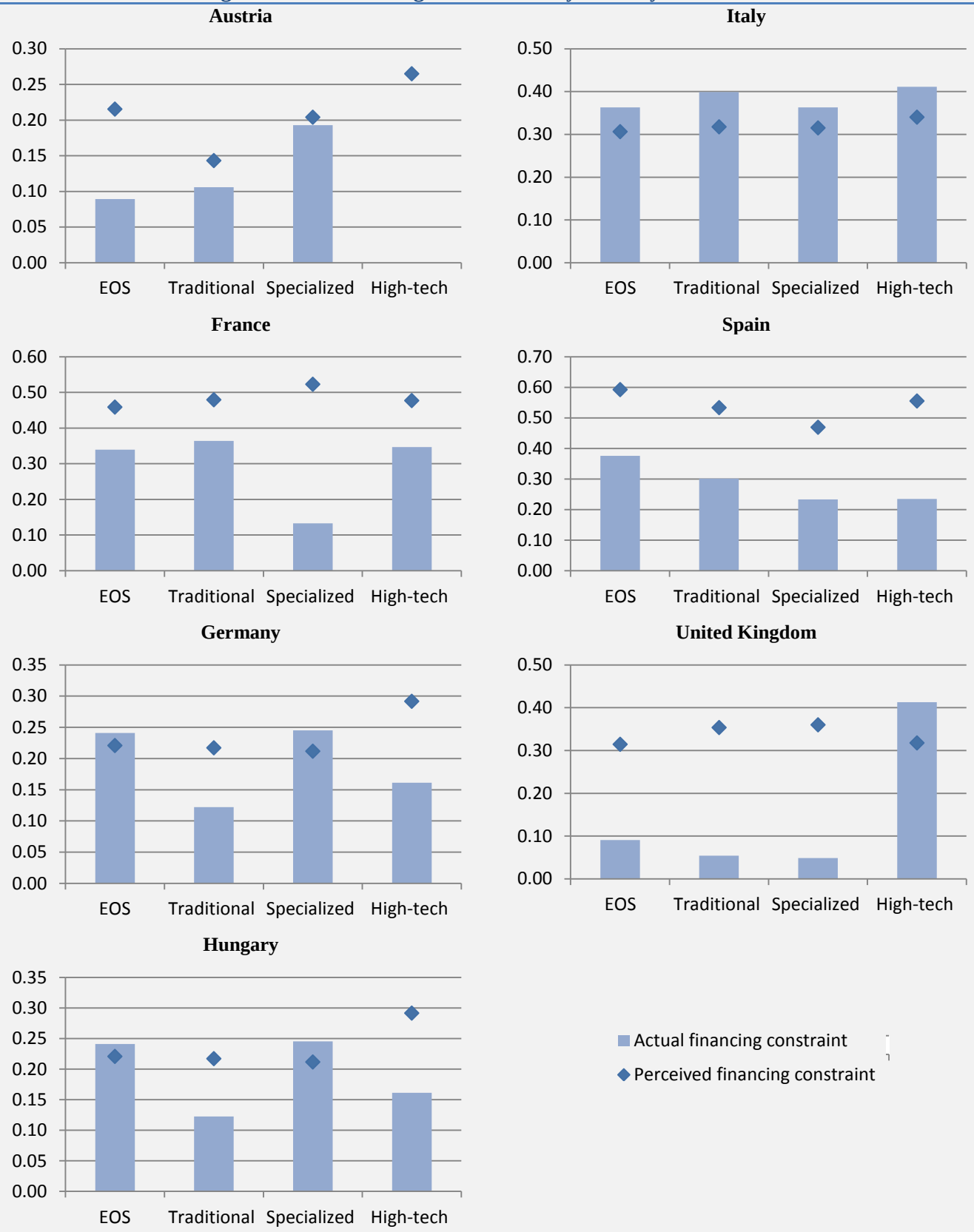
Source: ESRI analysis of Eurostat Access to Finance data.

Figure A-20 Perceived and Actual Financing Constraints for EU 28 (H1 2011 & H1 2013) by Sales Innovating Firms*



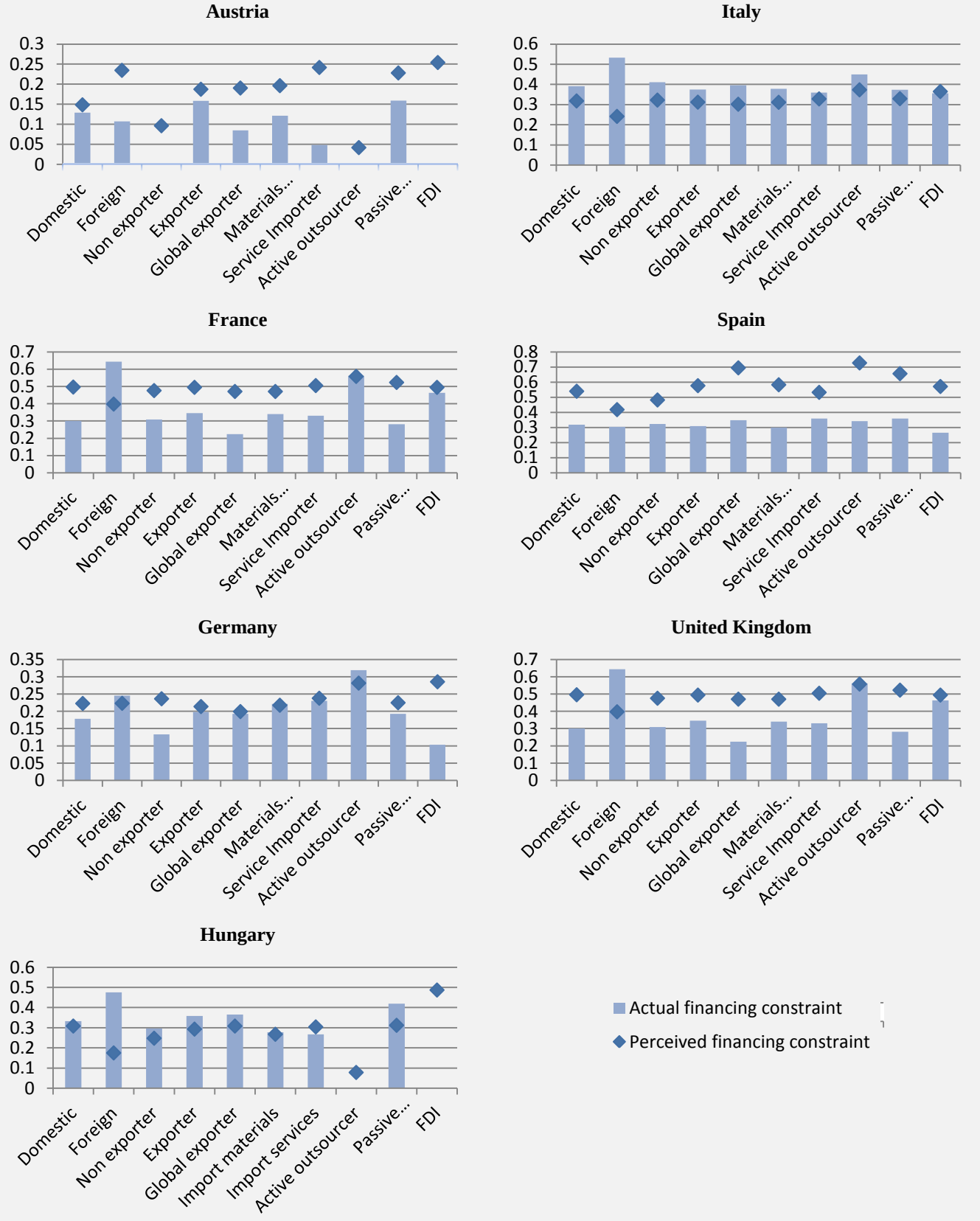
Source: ESRI analysis of Eurostat Access to Finance data.

Figure A-21 - Financing constraints – by industry classification



Source: EFIGE

Figure A-22 - Financing constraints – by trading activity



Source: EFIGE

Table A-11- Determinants of whether or not different financing sources are relevant to the firm – Eurozone

Y =1 if source is relevant	Retained Earnings	Other loans	Bank loans	Bank working capital	Equity	Subordinated loans	Trade credit	Debt financing	Leasing	Grants
Industry	-0.0209	0.0247*	0.0245**	-0.0136	-0.0263**	0.0001	0.0693***	-0.0151	-0.0186	0.1189***
Trade	-0.0137	0.0197	0.0164	-0.014	-0.0366***	-0.0049	0.0644***	-0.0190*	-0.0946***	0.0098
Services	-0.0437***	0.004	-0.0134	-0.0207	-0.0262**	-0.0118	-0.0540***	-0.0246**	-0.0508***	0.0165
Family owned	0.0416	-0.0305	0.0668***	0.0496**	-0.0748**	-0.0116	0.0125	-0.0273	0.0802***	0.0511*
Other firm	0.0291	0.0635**	0.0292	0.012	-0.0565*	0.0017	0.018	-0.0448*	0.0685**	0.0227
Venture capital or bus angel	0.0669*	0.0843*	-0.0079	0.0188	-0.0174	0.1112***	-0.0479	-0.0023	0.1028**	0.0289
Sole trader	-0.0061	-0.0660**	0.0669***	0.0461*	-0.1195***	-0.0233	-0.0351	-0.0376	0.0171	0.0095
Other owner	0.1262**	-0.0102	0.0677**	0.0139	-0.0097	0.0645*	-0.0687	-0.0155	0.0025	0.2136***
Age: 5 to 10	0.0056	0.0087	-0.0393***	-0.0126	0.006	0.0098	-0.0216*	-0.0099	-0.0322**	-0.0289*
Age: 2 to 5	0.0683***	0.0783**	-0.0861***	-0.0415**	0.0141	0.0203	0.0187	-0.0005	-0.0536**	-0.025
Age: less 2 years	0.0496	0.1718***	-0.1716***	-0.0821**	0.006	0.021	-0.0621	-0.0301*	-0.1407***	-0.0332
Small	-0.0887***	-0.0553***	-0.0259***	0.0065	-0.0232***	-0.0400***	-0.0348***	-0.0319***	-0.0476***	-0.0418***
Micro	-0.1485***	-0.0719***	-0.0779***	-0.0036	-0.0671***	-0.0608***	-0.0842***	-0.0510***	-0.2054***	-0.1031***
Subsidiary	-0.0542***	0.0568***	-0.0964***	-0.0575***	-0.0031	0.0067	-0.0258	0.0069	-0.0243	-0.0866***
Turnover - unchanged	-0.0281*	-0.0119	0.001	-0.0109	-0.0064	-0.0145	-0.0011	-0.0028	0.0073	0.0073
Turnover - positive	0.0009	0.0099	0.0223*	0.0156	0.016	-0.0011	0.0253*	-0.0029	0.0541***	0.0436***
Profit - unchanged	-0.0022	-0.0240*	-0.0228**	-0.0319***	0.0086	-0.0002	0.0195*	0.0007	-0.0239**	-0.0077
Profit - positive	0.0043	0.017	-0.0312**	-0.019	0.0091	0.0035	0.0116	0.0184**	-0.0166	-0.0259**
Credit history - unchanged	-0.0223**	-0.0418***	-0.0383***	-0.0715***	0.0138	-0.0178**	-0.0062	-0.0119*	-0.0348***	-0.0210*
Credit history - improved	0.0088	-0.0153	0.0093	-0.0208	0.0109	-0.0107	-0.0138	-0.0008	0.0051	0.0175
Firm capital position - unchanged	-0.0306**	-0.0539***	0.0011	-0.0073	-0.0210**	-0.0251***	-0.018	-0.0044	0.0036	-0.0356**
Firm capital position - increased	0.0340**	-0.0226	0.0206*	-0.0649***	0.0006	-0.0087	0.0387*	-0.0062	0.0087	0.0236
n	17479	17534	17575	17552	17508	17366	17534	17221	17566	17508

Table A-12 - Number of financing sources relevant and firm characteristics

	Eurozone	
Y = No. of Sources (0-10)	**Ordered Probit**	**FGLS**
Industry	0.077***	0.144**
Trade	-0.052	-0.102
Services	-0.132***	-0.244***
Family owned	0.043	0.053
Other firm	0.064	0.086
Venture capital or bus angel	0.136	0.231
Sole trader	-0.145*	-0.284*
Other owner	0.155	0.258
Age: 5 to 10	-0.091***	-0.167***
Age: 2 to 5	-0.174***	-0.298***
Age: less 2 years	-0.332***	-0.554***
Small	-0.194***	-0.369***
Micro	-0.468***	-0.861***
Subsidiary	-0.169***	-0.286***
Turnover - unchanged	-0.059**	-0.109**
Turnover - positive	0.065**	0.112*
Profit - unchanged	-0.037	-0.065
Profit - positive	-0.009	-0.006
Credit history - unchanged	-0.159***	-0.288***
Credit history - improved	-0.016	-0.035
Firm capital position - unchanged	-0.086***	-0.160***
Firm capital position - increased	0.030	0.053
n	20,285	20,285

Source: Author's estimates using ECB SAFE data

Table A-13 - Determinants of whether or not different financing sources are used to the firm – Eurozone

Y =1 if source is relevant	Retained earnings	Other loans	Bank loans	Bank working capital	Equity	Subordinated loans	Trade credit	Debt financing	Leasing	Grants
Industry	-0.0134	-0.0008	-0.0358	-0.0057	0.0268	0.0232	0.0380**	0.0479	-0.0401**	0.0009
Trade	0.0241	0.0054	0.0151	0.0255*	0.0265	-0.028	0.0421***	0.0301	-0.0503***	-0.0068
Services	-0.0038	-0.0015	-0.0293	-0.0082	0.0053	-0.0258	-0.0161	0.0478	-0.0108	0.0188
Family owned	-0.0309	-0.0448	0.0457	0.0105	-0.0412	-0.0252	0.041	0.0073	-0.0428	-0.0620*
Other firm	-0.0706	0.0047	-0.02	-0.0021	-0.0519	0.0409	0.0346	0.0457	-0.0252	-0.0769*
Venture capital or bus angel	0.0111	0.0106	-0.0574	-0.1038*	0.0637	0.0872	0.0685	0.1038	0.0076	-0.0953
Sole trader	-0.0264	-0.0758**	0.0215	0.016	-0.0584	0.0168	0.0135	-0.0232	-0.0469	-0.0806**
Other owner	-0.0209	-0.1108*	-0.0096	-0.0582	-0.1037	0.0158	-0.0776	-0.0592	-0.1366**	-0.0415
Age: 5 to 10	0.0056	0.0087	-0.01	0.0072	0.0172	0.0735**	0.0312**	-0.0019	0.0535***	0.0217
Age: 2 to 5	0.0683***	0.0783**	-0.0332**	0.0406**	0.0343	0.0851**	-0.0135	-0.0557	0.0258	0.0232
Age: less 2 years	0.0496	0.1718***	0.0459	-0.0326	0.1835*	0.0342	0.0472	0.1538	0.1050*	0.1436**
Small	-0.0088	-0.0312	-0.0487***	-0.0026	-0.0007	-0.0025	-0.0494***	0.0767***	-0.0821***	-0.0536***
Micro	0.0041	-0.0026	-0.1338***	-0.0157	0.000	-0.0247	-0.0609***	0.0509	-0.2183***	-0.1008***
Subsidiary	-0.0276	0.1431***	-0.0307**	-0.0475***	-0.0199	0.0335	-0.0047	-0.0443	0.0339	-0.0008
Turnover - unchanged	-0.0092	-0.025	0.0071	-0.0029	-0.036	-0.0275	0.0093	0.0126	0.0191	-0.0044
Turnover - positive	0.0268	0.0231	0.0081	0.0159	-0.0004	-0.0196	0.0142	0.0562**	0.0565***	0.0409*
Profit - unchanged	-0.0496**	-0.0703***	-0.0124	-0.0386***	0.0063	-0.0316	0.0062	0.0084	-0.0155	-0.0047
Profit - positive	-0.015	-0.0652**	-0.0166	-0.0385**	0.0033	0.0402	0.0184	-0.0488	0.0012	-0.0189
Credit history - unchanged	0.0021	-0.0740***	-0.0097	-0.0584***	-0.0064	-0.0677***	0.0106	-0.0044	-0.0075	0.0029
Credit history - improved	-0.0044	-0.0584**	-0.01	-0.0289*	-0.0179	-0.0476*	-0.0075	0.0363	0.0241	0.013
Firm capital position - unchanged	-0.0302*	-0.0319	0.0243	-0.0067	-0.0689**	0.0176	0.0240*	-0.0043	0.0297**	0.0256
Firm capital position - increased	0.0636**	0.0201	0.0456**	-0.0585***	0.0348	0.0317	0.0433**	-0.0006	0.0320***	0.0446**
n	8974	6883	14946	13024	4404	2563	11332	2110	12272	9665

Source: Author's estimates using ECB SAFE data.

Table A-14 - EFIGE variables and definitions

Category	Variable	Definition
Dependent Variables	Perceived Financial Constraints	Dummy variables equal to one for firm which believed financial constraints hampered growth and zero otherwise.
	Actual Financial Constraints	Dummy variable equal to one for firm which was unsuccessful in application for more bank credit in 2009 and zero otherwise.
	Discouraged Borrowers	Dummy variable equal to one if firm was willing to increase its borrowing at the same interest rate as its current credit line but did not apply for more credit.
Firm Characteristics	Size	Categorical variable: Firms grouped into three size categories based on the number of employees; the size groups are (i) 10 -49 employees,(ii) 50 -249 employees and (iii) 250+ employees. In the regression analysis, the reference group is 250+employees. Note there are no firms with less than 10 employees in the sample.
	Age	Categorical variable: The three age groups are (i) firms aged less than 6, firms aged between 6 and 20 and (iii) older than 20 years. In the regression analysis, the reference group is firms older than 20 years.
	Family Managed	Dummy variable equal to one if firm is controlled by an individual or family-owned entity.
	Domestic owned firm	Dummy variable equal to one if firm if is part of national group and foreign shareholders own less of than 10 percent of the firm.
	Industry external financing dependence	Dummy variable equal to one if firm's perceived financing dependence for firms in its industry is ranked greater than 3 on a scale of 1-5.
	Product Innovator	Dummy variable equal to one if firm introduced new product between 2007 and 2009.
	Process Innovator	Dummy variable equal to one if firm adopted new process between 2007 and 2009.
Financial performance measures	Sales growth, 2008-2007	Log growth of firm sales between 2008 and 2007.
	Tangible asset ratio	Tangible fixed asset as a share of total fixed assets
	Leverage ratio	Current liabilities plus non-current liabilities as a share of total assets in 2008.
	Profit margin	Profit or Loss as a share of total sales in 2008.
	Liquidity ratio	Ratio of cash (or equivalents) to total assets in 2008.
	Cash Flow	Cash flow as a share of total assets.
Firm - bank relationship measures	Bank duration	Categorical variable: Firms are grouped based on the duration of the relationship with their main bank; the groups are (1) 0-4 years, (ii) 5-9 years, (iii) 10-20 and (iv) more than 20 years. In the regression analysis, the reference group is firms whose bank relationship is between 0-4 years.
	Foreign bank	Dummy variable equal to one if firm deals with a foreign bank for domestic or foreign activities.
	Numbers of bank	Number of banks a firm deals with.
	Main Bank Debt	Categorical variable: Firms are grouped based on the share of debt that it is liable for at its main bank; the groups are (1) 0-24%, (ii) 25-49%, (iii) 50-74% and (iv)75-100 %. In the regression analysis, the reference group is firms who have debt between 0-24 % at their main bank.

Table A-15 Test of mean differences – constrained and unconstrained firms – indicators of asymmetric information

	Perceived Financing Constraints			Actual Financing Constraints		
	Unconstrained	Constrained	p	Unconstrained	Constrained	**p**
Industry	11%	13%	0.052	11%	12%	0.335
Construction	7%	9%	0.007	6%	9%	0.000
Trade	13%	15%	0.032	13%	14%	0.015
Services	33%	37%	0.010	31%	38%	0.000
Micro	25%	35%	0.000	21%	37%	0.000
Small	19%	22%	0.037	19%	21%	0.173
Medium	19%	16%	0.008	20%	15%	0.000
Large	37%	27%	0.000	40%	27%	0.000
Age > 10	79%	72%	0.000	82%	72%	0.000
Age 5 10	13%	16%	0.028	12%	17%	0.000
Age 2 5	6%	10%	0.000	5%	10%	0.000
Age < 2	1%	2%	0.412	1%	2%	0.039
Publicly listed	7%	4%	0.002	6%	6%	0.320
Family or entrepreneur	53%	55%	0.159	54%	53%	0.362
Firm owned	18%	12%	0.000	19%	14%	0.000
VC or BA	1%	1%	0.433	1%	1%	0.012
Soletrader	19%	23%	0.001	16%	24%	0.000
Other	3%	5%	0.187	4%	3%	0.042
Subsidiary	16%	9%	0.000	17%	12%	0.000
Innovation	63%	70%	0.000	63%	66%	0.026
Innovation product	37%	38%	0.758	37%	37%	0.835
Innovation process	29%	29%	0.821	29%	28%	0.682
Innovation organisation	29%	37%	0.000	28%	34%	0.000
Innovation Sales	25%	33%	0.000	24%	29%	0.000

Source: Author's analysis of ECB SAFE Data, H1 2011, H1 2013

Table A-16 - Test of mean differences – constrained and unconstrained firms – indicators of firm performance

	Perceived Financing Constraints			Actual Financing Constraints		
	Unconstrained	Constrained	p	Unconstrained	Constrained	p
Profit - increased	32%	27%	0.005	37%	24%	0.000
Profit - unchanged	26%	25%	0.592	26%	25%	0.272
Profit - decreased	42%	48%	0.002	37%	52%	0.000
Turnover - increased	46%	44%	0.505	51%	37%	0.000
Turnover - unchanged	26%	25%	0.585	26%	25%	0.607
Turnover - decreased	29%	31%	0.185	23%	38%	0.000
Firm capital position - increased	31%	23%	0.000	34%	23%	0.000
Firm capital position - unchanged	48%	49%	0.633	51%	45%	0.000
Firm capital position - decreased	20%	27%	0.000	15%	31%	0.000
Credit history - improved	28%	24%	0.007	31%	22%	0.000
Credit history - unchanged	15%	29%	0.000	11%	28%	0.000
Credit history - decreased	57%	48%	0.000	58%	51%	0.000

Source: Author's analysis of ECB SAFE Data, H1 2011, H1 2013

Table A-17 Test of mean differences – constrained and unconstrained firms by constraint type – indicators of asymmetric information

	Credit rationed			Discouraged borrowers			Cost too high		
	Unconstrained	Constrained	Z	Unconstrained	Constrained	p	Unconstrained	Constrained	p
Industry	11%	11%	0.942	12%	14%	0.114	11%	12%	0.679
Construction	6%	9%	0.000	6%	9%	0.003	6%	5%	0.608
Trade	13%	12%	0.607	13%	19%	0.000	13%	15%	0.502
Services	31%	32%	0.345	29%	44%	0.000	31%	35%	0.400
Micro	21%	27%	0.000	21%	52%	0.000	21%	39%	0.001
Small	19%	19%	0.937	19%	24%	0.009	19%	19%	0.863
Medium	20%	18%	0.076	20%	11%	0.000	20%	9%	0.000
Large	40%	35%	0.029	40%	13%	0.000	40%	33%	0.347
Age > 10	82%	74%	0.000	81%	67%	0.000	82%	73%	0.119
Age 5 10	12%	16%	0.001	12%	19%	0.002	12%	17%	0.313
Age 2 5	5%	8%	0.004	6%	12%	0.000	5%	9%	0.165
Age < 2	1%	2%	0.117	1%	2%	0.146	1%	1%	0.859
Publicly listed	6%	7%	0.622	7%	6%	0.332	6%	4%	0.297
Family or entrepreneur	54%	54%	0.917	54%	51%	0.183	54%	49%	0.354
Firm owned	19%	17%	0.291	18%	11%	0.000	19%	14%	0.425
VC or BA	1%	1%	0.032	1%	1%	0.256	1%	3%	0.264
Soletrader	16%	18%	0.109	14%	29%	0.000	16%	22%	0.152
Other	4%	3%	0.023	5%	3%	0.015	4%	9%	0.371
Subsidiary	17%	13%	0.035	19%	10%	0.000	17%	20%	0.584
Innovation	63%	68%	0.004	63%	66%	0.237	63%	73%	0.034
Innovation product	37%	40%	0.158	38%	37%	0.527	37%	41%	0.443
Innovation process	29%	29%	0.888	28%	30%	0.460	29%	34%	0.402
Innovation organisation	28%	35%	0.000	27%	32%	0.080	28%	37%	0.123
Innovation Sales	24%	29%	0.001	24%	30%	0.006	24%	28%	0.437

Source: Author's analysis of ECB SAFE Data, H1 2011, H1 2013

Table A-18- Test of mean differences – constrained and unconstrained firms by constraint type – indicators of firm performance

	Credit rationed			Discouraged borrowers			Cost too high		
	Unconstrained	Constrained	p	Unconstrained	Constrained	p	Unconstrained	Constrained	p
Profit - increased	37%	26%	0.000	39%	25%	0.000	37%	29%	0.152
Profit - unchanged	26%	25%	0.373	23%	24%	0.732	26%	32%	0.362
Profit - decreased	37%	50%	0.000	38%	51%	0.000	37%	39%	0.738
Turnover - increased	51%	40%	0.000	56%	35%	0.000	51%	59%	0.165
Turnover - unchanged	26%	25%	0.773	24%	25%	0.577	26%	18%	0.046
Turnover - decreased	23%	35%	0.000	20%	40%	0.000	23%	23%	0.918
Firm capital position - increased	34%	26%	0.000	34%	21%	0.000	34%	26%	0.061
Firm capital position - unchanged	51%	48%	0.078	50%	42%	0.003	51%	52%	0.886
Firm capital position - decreased	15%	26%	0.000	16%	37%	0.000	15%	22%	0.159
Credit history - improved	31%	25%	0.000	29%	20%	0.001	31%	20%	0.005
Credit history - unchanged	11%	26%	0.000	13%	26%	0.000	11%	20%	0.065
Credit history - decreased	58%	50%	0.000	58%	54%	0.257	58%	60%	0.735

Source: Author's analysis of ECB SAFE Data, H1 2011, H1 2013

Table A-19– Determinants of financing constraints - Eurozone

Y = 1 if constrained, 0 otherwise	Model with AI Indicators		Broader Model	
	Perceived Financing Constraints	Actual Financing Constraints	Perceived Financing Constraints	Actual Financing Constraints
Industry	-0.016	-0.041***	-0.01	-0.023
Trade	-0.028**	-0.083***	-0.02	-0.065***
Services	-0.040***	-0.067***	-0.034***	-0.051***
Family owned	-0.008	-0.003	0.033	-0.011
Other firm	-0.02	-0.039	0.021	-0.030
Venture capital or bus angel	0.006	0.094**	0.042	0.071*
Sole trader	0.021	0.042	0.061**	0.025
Other owner	-0.022	-0.038	0.030	-0.057
Age: 5 to 10	0.023**	0.034***	0.024**	0.037***
Age: 2 to 5	0.100***	0.091***	0.096***	0.103***
Age: less 2 years	0.027	0.063*	0.046	0.098**
Small	0.027***	0.037***	0.029***	0.028***
Micro	0.045***	0.128***	0.041***	0.090***
Subsidiary	-0.039***	0.004	-0.041***	0.012
Turnover - unchanged			0.021**	-0.032***
Turnover - positive			0.055***	-0.02
Profit - unchanged			-0.027***	-0.031***
Profit - positive			-0.018	-0.046***
Credit history - unchanged			-0.096***	-0.161***
Credit history - improved			-0.105***	-0.161***
Firm capital position - unchanged			-0.012	-0.101***
Firm capital position - increased			-0.047***	-0.104***
n	20,664	20,664	19,729	19,729
Error correlations (ρ) – p-value	0.000	0.000	0.000	0.000

Source: Author's estimates using ECB SAFE data

Table A-20 – Determinants of actual financing constraints by constraint type - Eurozone

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower	Cost Too High
Industry	-0.023	-0.024	-0.002	-0.007
Trade	-0.065***	-0.046***	-0.035**	-0.009
Services	-0.051***	-0.048***	-0.013	-0.015
Family owned	-0.011	0.023	-0.034	0.009
Other firm	-0.030	0.003	-0.047	-0.004
Venture capital or bus angel	0.071*	0.116**	-0.025	0.031
Sole trader	0.025	0.039	0.007	0.003
Other owner	-0.057	-0.001	-0.072*	-0.003
Age: 5 to 10	0.037***	0.033**	0.027**	-0.004
Age: 2 to 5	0.103***	0.069***	0.076***	-0.001
Age: less 2 years	0.098**	0.105**	0.014	-0.008
Small	0.028***	-0.010	0.052***	0.008
Micro	0.090***	-0.004	0.154***	0.018
Subsidiary	0.012	-0.008	0.019	0.002
Turnover - unchanged	-0.032***	-0.033**	-0.021*	-0.002
Turnover - positive	-0.02	-0.009	-0.033**	0.000
Profit - unchanged	-0.031***	-0.025**	-0.016	-0.007
Profit - positive	-0.046***	-0.047***	-0.003	-0.005
Credit history - unchanged	-0.161***	-0.162***	-0.068***	-0.018
Credit history - improved	-0.161***	-0.055***	-0.113***	0.000
Firm capital position - unchanged	-0.101***	-0.080***	-0.075***	0.003
Firm capital position - increased	-0.104***	-0.055***	-0.113***	0.000
n	19,729	15257.000	14556.000	10781.000
Error correlations (ρ) – p-value	0.000	0.000	0.000	0.000

Source: Author's estimates using ECB SAFE data

Sub categories of constraint by financing type – EU-28

Sub categories of constraint by financing type – Eurozone

Table A-21 – Determinants of actual financing constraints by constraint type - Bank loans - Eurozone

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.031**	-0.026*	-0.008
Trade	-0.069***	-0.040***	-0.034***
Services	-0.052***	-0.045***	-0.013
Family owned	-0.013	-0.024	-0.024
Other firm	-0.038	-0.034	-0.029
Venture capital or bus angel	0.014	0.034	-0.037
Sole trader	0.020	-0.007	0.005
Other owner	-0.056	-0.033	-0.051*
Age: 5 to 10	0.029***	0.019*	0.030***
Age: 2 to 5	0.083***	0.034**	0.079***
Age: less 2 years	0.042	0.037	0.017
Small	0.028***	-0.002	0.039***
Micro	0.077***	-0.000	0.110***
Subsidiary	0.001	-0.032***	0.031**
Turnover - unchanged	-0.023*	-0.027**	-0.009
Turnover - positive	-0.006	-0.006	-0.018*
Profit - unchanged	-0.025**	-0.007	-0.023**
Profit - positive	-0.035***	-0.020*	-0.010
Credit history - unchanged	-0.121***	-0.106***	-0.052***
Credit history - improved	-0.124***	-0.096***	-0.070***
Firm capital position - unchanged	-0.080***	-0.057***	-0.051***
Firm capital position - increased	-0.092***	-0.050***	-0.084***
n	21068	15915	14654

Source: Author's estimates using ECB SAFE data

Table A-22 – Determinants of actual financing constraints by constraint type - Bank working capital - Eurozone

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.012	-0.021*	0.005
Trade	-0.048***	-0.029***	-0.029***
Services	-0.033***	-0.031***	-0.008
Family owned	-0.008	0.003	-0.016
Other firm	-0.025	-0.004	-0.030
Venture capital or bus angel	0.010	0.021	-0.027
Sole trader	0.017	0.012	0.006
Other owner	-0.068**	-0.042	-0.039
Age: 5 to 10	0.009	0.017	0.005
Age: 2 to 5	0.080***	0.058***	0.049***
Age: less 2 years	0.094***	0.099**	0.021
Small	0.019**	-0.008	0.030***
Micro	0.081***	0.004	0.113***
Subsidiary	0.005	-0.012	0.020
Turnover - unchanged	-0.032***	-0.024**	-0.018*
Turnover - positive	-0.016	-0.002	-0.021*
Profit - unchanged	-0.033***	-0.019*	-0.016
Profit - positive	-0.140***	-0.115***	-0.067***
Credit history - unchanged	-0.141***	-0.132***	-0.050***
Credit history - improved	-0.140***	-0.115***	-0.067***
Firm capital position - unchanged	-0.065***	-0.049***	-0.040***
Firm capital position - increased	-0.086***	-0.046***	-0.068***
n	21,068	16,024	14,669

Source: Author's estimates using ECB SAFE data

Table A-23 – Determinants of actual financing constraints by constraint type - Trade credit - Eurozone

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	0.018	0.014	0.010
Trade	-0.007	-0.004	-0.001
Services	-0.028***	-0.024***	-0.010
Family owned	0.041**	0.041***	-0.006
Other firm	0.023	0.036***	-0.018
Venture capital or bus angel	0.061**	0.083***	-0.014
Sole trader	0.041**	0.034***	0.004
Other owner	-0.018	0.002	-0.011
Age: 5 to 10	0.011	0.000	0.016*
Age: 2 to 5	0.052***	0.031**	0.020**
Age: less 2 years	-0.013	0.017	0.001
Small	0.007	-0.011	0.019***
Micro	0.019**	-0.028***	0.060***
Subsidiary	0.030**	0.017	0.021*
Turnover - unchanged	-0.023***	-0.015*	-0.006
Turnover - positive	-0.010	0.001	-0.012
Profit - unchanged	-0.013	-0.014*	-0.004
Profit - positive	-0.033***	-0.031***	-0.013
Credit history - unchanged	-0.069***	-0.055***	-0.033***
Credit history - improved	-0.088***	-0.053***	-0.057***
Firm capital position - unchanged	-0.038***	-0.030***	-0.023***
Firm capital position - increased	-0.031***	-0.014	-0.033***
n	21,035	15,986	13,989

Source: Author's estimates using ECB SAFE data

Table A-24 – Determinants of actual financing constraints by constraint type - Other external financing - Eurozone

Y = 1 if constrained, 0 otherwise	Actual Financing Constraints	Credit Rationing	Discouraged Borrower
Industry	-0.003	0.000	-0.006
Trade	-0.020**	-0.014**	-0.010
Services	-0.011	-0.003	-0.009
Family owned	0.023	0.025***	0.003
Other firm	0.010	0.018*	-0.008
Venture capital or bus angel	0.065**	0.054***	0.011
Sole trader	0.037**	0.025***	0.015
Other owner	-0.010	0.011	-0.008
Age: 5 to 10	0.013*	0.009	0.014**
Age: 2 to 5	0.043***	0.021**	0.032***
Age: less 2 years	0.038	0.030	0.008
Small	0.005	-0.012**	0.017***
Micro	0.018**	-0.025***	0.047***
Subsidiary	0.014	-0.002	0.019**
Turnover - unchanged	-0.016*	-0.010**	-0.012
Turnover - positive	-0.013*	-0.002	-0.014
Profit - unchanged	-0.005	0.002	-0.008
Profit - positive	-0.005	-0.003	-0.004
Credit history - unchanged	-0.057***	-0.032***	-0.032***
Credit history - improved	-0.058***	-0.030***	-0.042***
Firm capital position - unchanged	-0.032***	-0.018***	-0.018***
Firm capital position - increased	-0.028***	-0.009	-0.024***
n	20,949	15,817	14,236

Source: Author's estimates using ECB SAFE data

Table A-25 (ii) The Effect of Financial Factors and The Financial Crisis on Employment, firm size groups

	Small		Medium		Small or Medium	
	Baseline	**Crisis**	**Baseline**	**Crisis**	**Baseline**	**Crisis**
L_{t-1}	1.090***	1.083***	1.099***	1.074***	1.124***	1.111***
	(0.038)	(0.040)	(0.066)	(0.061)	(0.037)	(0.039)
L_{t-2}	-0.126***	-0.114***	-0.072	-0.036	-0.146***	-0.135***
	(0.037)	(0.037)	(0.070)	(0.060)	(0.035)	(0.036)
K_t	0.011*	0.013*	0.002	-0.005	0.010	0.012*
	(0.006)	(0.007)	(0.012)	(0.010)	(0.006)	(0.006)
ΔW_t	-0.677***	-0.662***	-0.660***	-0.655***	-0.673***	-0.666***
	(0.068)	(0.067)	(0.080)	(0.081)	(0.071)	(0.069)
W_{t-1}	0.012	0.010	0.018	0.012	0.003	-0.001
	(0.020)	(0.019)	(0.035)	(0.029)	(0.019)	(0.019)
ΔY_t	0.197***	0.194***	0.218*	0.202*	0.210***	0.207***
	(0.052)	(0.053)	(0.119)	(0.110)	(0.056)	(0.056)
CF/TA_t	-0.033	-0.097	0.167	0.340	-0.040	-0.078
	(0.121)	(0.124)	(0.295)	(0.282)	(0.118)	(0.119)
CS/TA_{t-1}	-0.103	0.024	0.075	-0.265**	-0.024	0.017
	(0.081)	(0.062)	(0.112)	(0.121)	(0.078)	(0.057)
$Leverage_{t-1}$	-0.035	0.004	-0.012	-0.069	-0.017	-0.008
	(0.053)	(0.076)	(0.138)	(0.089)	(0.055)	(0.065)
$Interestburden_{t-1}$	0.007	0.020	-0.024	0.104*	-0.005	0.023
	(0.017)	(0.023)	(0.019)	(0.056)	(0.018)	(0.022)
TC/TA_{t-1}	0.016	0.024	0.060	-0.009	0.025	0.020
	(0.039)	(0.027)	(0.050)	(0.051)	(0.037)	(0.026)
(Long) $Creditflows_t$	0.116	0.813	0.187	0.056	0.109	0.815
	(0.159)	(0.568)	(0.228)	(0.453)	(0.148)	(0.504)
(Short) $Creditflows_t$	-0.202**	-0.005	-0.076	-0.325	-0.217**	-0.063
	(0.103)	(0.528)	(0.125)	(0.327)	(0.101)	(0.465)
Crisis	-0.038***	-0.043***	-0.048***	-0.063**	-0.039***	-0.044***
	(0.004)	(0.014)	(0.009)	(0.025)	(0.004)	(0.014)
CF/TA_t*Crisis		0.211*		-0.219		0.169
		(0.112)		(0.198)		(0.105)
CS/TA_{t-1}*Crisis		-0.040		0.294**		-0.009
		(0.052)		(0.119)		(0.050)
$Leverage_{t-1}$*Crisis		-0.025		0.089		-0.011
		(0.077)		(0.085)		(0.064)
$Interestburden_{t-1}$*Crisis		-0.007		-0.120**		-0.013
		(0.022)		(0.059)		(0.021)
TC/TA_{t-1}*Crisis		-0.007		0.057		0.002
		(0.026)		(0.056)		(0.025)
(Long) $Creditflows_t$ *Crisis		-0.763		0.075		-0.758
		(0.582)		(0.537)		(0.525)
(Short) $Creditflows_t$*Crisis		-0.226		0.354		-0.167
		(0.531)		(0.377)		(0.469)
Observations	70288	70288	9908	9908	80196	80196
No. of firms	15562	15562	2156	2156	17197	17197
AR 2 test	0.797	0.967	0.089	0.075	0.785	0.972
Hansen Test	0.000	0.000	0.039	0.024	0.000	0.000

Notes : Models specifications o include natural log of employment in period t-1 and t-2, wage per employee in t-1, growth in average wage in t, log of capital stock in total assets in t, dummy for nonlisted firms, firm age, growth in firm turnover and a financial crisis dummy. Marginal effects for the pre and post crisis are based on model estimations which include financial crisis dummy and financial variables interaction Instruments : L_{t-1}, W_{t-1}, CS/TA_{t-1}, $Leverage_{t-1}$, $Interestburden_{t-1}$, TC/TA_{t-1} are instrumented with lags t-3 and t-4) ; ΔY_t CF/TA_t, K_t, ΔW_t (Long) $Creditflows_t$ (Short) $Creditflows_t$ and log of Age_t are instrumented with lags t-4 and t-5) . In the models with interactions, interactions with(out) a lagged term are instrumented with (lags t-3 and t-4) lags t-4 and t-5*Source:* Econometric analysis based on Amadeus