



BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers

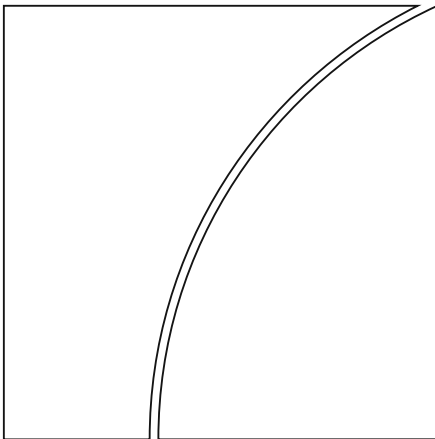
No 475

SMEs, financial constraints and growth

by Ryan Banerjee

Monetary and Economic Department

December 2014



JEL classification: E22, G30, L16, O16

Keywords: Firm age, firm size, SMEs, financial constraints, economic growth

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

© *Bank for International Settlements 2014. All rights reserved. Brief excerpts may be reproduced or translated provided the source is stated.*

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

SMEs, financial constraints and growth

Ryan Banerjee*

Abstract

The SME sector is often hailed as an important engine of economic growth. But recent research suggests that young rather than small firms are the main contributors to employment growth. This paper shows that young firms are also key contributors to profit growth across advanced economies. It then examines the impact of financial constraints on profitability across the age distribution of SMEs. We find that start-ups which report finance as their greatest constraint receive smaller new loans and evidence that financing constraints reduce start-up profitability. We do not find a similar relationship for older SMEs in pre-crisis data. Therefore, policy initiatives which ease financing constraints for start-ups could play an important role in boosting economic growth. However, following the protracted financial crisis in Europe, we also find that financial constraints reduced profitability in the cohort of more mature firms that were start-ups just before the financial crisis.

Keywords: Firm age, firm size, SMEs, financial constraints, economic growth

JEL classification: E22, G30, L16, O16

* Bank for International Settlements, email: ryan.banerjee@bis.org

I would like to thank Peter Dittus, Dietrich Domanski, Enisse Kharroubi, Dubravko Mihajek, Philip Turner and seminar participants at the Bank for International Settlements for the helpful comments and suggestions. The view expressed in this paper are those of the author and do not necessarily reflect those of the BIS.

Table of contents

Abstract	i
1. Introduction	1
2. The role of firm age and size in employment, sales and profit growth.....	3
The contribution of SMEs to economic activity	3
Does firm size or age matter for growth?	5
Firm-level survey evidence on profits and employment	8
3. The impact of financial constraints on firm financing and profitability by firm age and size.....	11
4. Conclusion.....	15
References.....	16
Appendix.....	17

1. Introduction

SMEs comprise an important share of economic activity in advanced economies. In the non-government sectors of advanced economies, SMEs account for over 95% of the total number of enterprises, 60% of total employment and over 50% of value added. The SME sector is often considered an important engine of economic growth (Helfand et al, 2007; de Kok et al, 2011). However, recent academic research has identified that young rather than small firms are the main contributors to employment growth (Haltiwanger et al 2010; Dixon and Rollin, 2012; Lawless, 2013; Criscuolo et. 2014). These studies show that, because young firms also tend to be small, there is a mistaken perception that small rather than young firms are the drivers of growth.

In this paper we contribute to the literature by first analysing the importance of young firms for employment and profit growth across advanced economies using both business register data and firm-level surveys. We then use firm-level survey data to examine how financial constraints affect firm profitability over the age distribution of firms and how this relationship has changed over the recent financial crisis.

We find that business register and firm-level survey data present a consistent picture of the importance of young firms for economic growth. US Business register data show that net employment growth rates of SMEs less than five years old have been around 20% higher than those of similarly-sized older SMEs. While European business register data show that net job creation by young firms is similar in magnitude to that found in the US. Firm level-survey data show that in addition to creating more jobs, young firms also have higher sales growth and are more likely to experience profit increases than experience profit decreases compared to similarly-sized older firms.

In terms of the relationship between firm financing and growth over the age distribution, we find that start-ups, defined as firms less than 2 years old, are more likely to take larger new loans, in comparison to middle aged SMEs between 2 and 10 years old. Although the size of new loans has declined since the financial crisis we find that start-ups are still more likely to take out large new loans than middle-aged firms. This suggests a life-cycle pattern in firm borrowing, with start-ups initially taking large loans and then spending the middle-part of their life cycle repaying the initial loans or taking smaller additional loans.

We also find a relationship between start-ups reporting access to finance difficulties and the amount of credit they receive. Start-ups reporting access to finance as their greatest constraint on activity or had a loan refused are more likely to have smaller initial loans than those not reporting financing constraints, while there is no similar relationship for firms aged 5 years or older.

Given the negative relationship between a firm reporting access to finance difficulties and the amount of credit received, we also examine the impact of financial constraints on firm profitability. We find that before the financial crisis, start-ups which reported access to finance as their greatest constraint were less likely to report rising profits. For older firms in the pre-crisis data, we do not find a significant relationship between financial constraints and profitability. However, by 2013 this effect had spread to the cohort of middle aged firms between 2-10 years

old, but not to firms older than 10 years. The 2-10 year old cohort is exactly the cohort of firms that had taken out larger new loans just before financial crisis deepened in Europe. Our results suggest that difficulties repaying this debt or receiving extensions due to bank deleveraging might have played a role in constraining profitability in this cohort of maturing firms.

Because our results show that young firms are important for growth and that financial constraints reduce profitability in start-ups, policy initiatives which ease financing constraints for start-ups could play an important role in boosting economic growth. If official sector schemes that encourage lending to the SME sector also considered the particular funding difficulties of young firms, they could have a greater impact on growth.

At the same time, because we find a specific post-financial crisis impact of financial constraints on the cohort of firms that were start-ups just before or early on in the financial crisis, policy initiatives which reduce financing constraints for more mature SMEs, such as improving record keeping on firm credit histories or the creation of mini-bond markets for SMEs such as MARF in Spain and Extramot Pro in Italy could be effective in boosting growth for this cohort of SMEs.

Our paper is closely related to Beck et al (2006) and Beck et al (2007) who examine the impact of financing conditions on firm growth. However, they focus on the impact of financial constraints on SMEs rather than young firms. Our paper is also related to Ferrando and Griesshaber (2011) and Artola and Genre (2011) who examine whether SMEs are more likely to experience financial constraints compared to larger firms using the EC/ECB SAFE survey. They find that firm age, rather than firm size is a more important factor determining whether a firm faces financing constraints. In contrast to Ferrando and Griesshaber (2011) and Artola and Genre (2011), we study how financial constraints affect the amount of additional credit a firm receives and its impact on firm profitability. Furthermore, these studies do not analyse how financial constraints have changed relative to the pre-crisis period.

Robb and Robinson (2012) examine the capital structure choices of firms in their first year of operation. Similar to our results, they find that start-ups rely heavily on external debt finance. They also find a link between housing markets and the reliance on bank debt. In US states with high housing supply elasticity, start-ups rely more heavily on financing through bank loans, because house prices are more stable and therefore provide a better source of collateral for bank loans. Fort et al (2012) find that house prices have an additional impact on job creation: in US states with larger house price declines, young and small businesses experienced larger declines in net job creation. These relationships between housing markets and young firms suggest that banks use housing collateral to overcome some of the agency problems associated with lending to young firms.

The paper is organised as follows, section 2 examines the relationship between firm age and size for employment, sales and profit growth. Section 3 examines the how SME financing and financial constraints vary by firm age. It also examines how financial constraints affect SME financing and profitability. Section 4 discusses policy conclusions.

2. The role of firm age and size in employment, sales and profit growth

The contribution of SMEs to economic activity

SMEs comprise a major share of economic activity in advanced economies. SMEs account for over 95% of enterprises, 60% of employment and over 50% of value added in the non-government private sector (Table 1). In the EU, SMEs created 85% of net new jobs between 2002 and 2010 (de Kok et al, 2011) while in the United States, small firms created about 64% of new jobs from 1990 to 2005 (Helfand et al, 2007). There is a lot of dynamism in the SME sector, for example, in the United States around 30% of SMEs are less than 5 years old.

Loans to SMEs account on average for around one-third of total bank loans to the non-government sector in countries listed in Table 1, although there is wide dispersion across countries. Despite their economic contribution, data on SMEs are scarce and often arrive with significant lags.

Economic contribution of SMEs¹

As a percentage of the non-government sector²

Table 1

Country	Enterprises		Employment		Value added		SME loans as a share of total business loans	
	2005	2011	2005	2011	2005	2011	2007	2010
Denmark	99.7	99.6	66	66	67	64	12	11
Finland	99.7	99.7	56	62	52	57	27	14
France	99.8	99.8	61	64	54	59	26	26
Germany	99.5	99.5	60	63	53	54
Italy	99.9	99.9	81	80	71	68	19	19
Portugal	99.9	99.9	82	78	70	68	78	77
Netherlands	99.8	99.7	67	65	61	63
Spain	99.9	99.9	79	76	69	66	40	33
Sweden	99.8	99.8	63	64	56	58	89	92
United Kingdom	99.6	99.6	54	55	52	50	11	12
United States	99.7	99.7	50	49 ³	46	45 ³	30	29

¹ Definitions of SMEs vary across countries. The EU defines an SME as a firm that employs less than 250 workers and has a turnover of less than €50 million, or a balance sheet of less than €43 million. In the United States, SMEs are firms with less than 500 employees, while loans to SMEs are those with an initial value less than \$1 million. ² For EU, the non-government sector excludes agriculture, forestry, fishing, education and health. For the United States, the non-government sector includes nonfarm business categories. ³ 2010 data.

Sources: European Commission, *Enterprise and industry SBA countries fact sheets*; US Census Bureau, *Statistics of US businesses: main US NAICS sectors, 2005 and 2010*; US Small Business Administration, *Small business GDP: update 2002–10*; OECD, *Financing SMEs and entrepreneurs 2012: an OECD scoreboard*.

In the United States, there is no standard definition of SMEs. Academic research using US data usually defines a firm as an SME if it has less than 500 employees (Table 2). The US Small Business Administration definitions vary by industry, which requires a 46-page document to describe the definition of a small business. EU definitions depend on firms' employment, turnover and balance sheet size.

To complicate matters, even within a single country, different statistical agencies that collect information on SMEs often use different definitions. For instance, in a number of countries loans to SMEs are determined by the size of the

initial loan, not by firm size. Furthermore, there are only sparse data at the firm level combining balance sheet information, information on financing obstacles and measures of firm economic activity.

Definitions of small and medium-sized enterprises Table 2

Company category	European Union			United States
	Employees	Turnover	or Balance sheet total	Employees ¹
Medium-sized	< 250 ≤ 50	≤ € 50 < 10 m	≤ € 43 < 10 m	< 500 ≤ 20
Small	< 50 ≤ 10	≤ € 10 < 2 m	≤ € 10 < 2 m	< 20
Micro	< 10	≤ € 2 m	≤ € 2 m	...

¹ Definition used by T Fort, J Haltiwanger, R Jarmin, J Miranda (2013), "How firms respond to business cycles: The role of firm age and size", NBER Working Paper Series, number 19134.

Source: European Commission and Fort et al (2013).

Data based on firm employment recorded in official business registers are considered the best source of data used by researchers to analyse the importance of firm age relative to firm size for growth. In this paper we use business register data from the US Census Bureau and the Eurostat Structural Business Statistics. These data have the benefit of capturing both changes within firms and across firms through entry and exit, which is important to capture the up or out process in business experimentation. Business register data however, suffer from significant time lags, of at least 2–3 years and also lack information about the balance sheets of firms and soft information about possible financial constraints.

Firm-level surveys are a useful source of information about the economic contribution of SMEs and young firms. The big drawback with firm-level survey data arises from survival biases because surveys fail to capture firm exits. It is also difficult for surveys to capture new entrants in the early stages of their life-cycle. However, firm-level surveys benefit from being timelier than business register data. They can also provide more data beyond employment, to include information on profitability and qualitative data such as perceived constraints on growth or whether a loan request had been rejected. Despite the biases that are present in firm-level surveys, we find that survey evidence on the importance of young firms for growth is consistent with business register data.

In this paper our main results about the impact of financial constraints on firm activity are based on the European Commission/ECB SAFE survey which started in 2009. We complement this with a 2005 pilot survey of SMEs from the European Commission which provides a pre-crisis benchmark. To analyse the contribution of SMEs to growth across the age distribution, we also use the World Bank's World Business Environment Survey (WBES), a one-off survey of firms across many countries carried out between 1999 and 2000. Although this survey is now somewhat dated, relative to the SAFE survey it has the benefit of asking questions about the magnitude of changes to firm employment and sales which allows quantification of the differences across firms while the SAFE survey only asks about the direction.

Does firm size or age matter for growth?

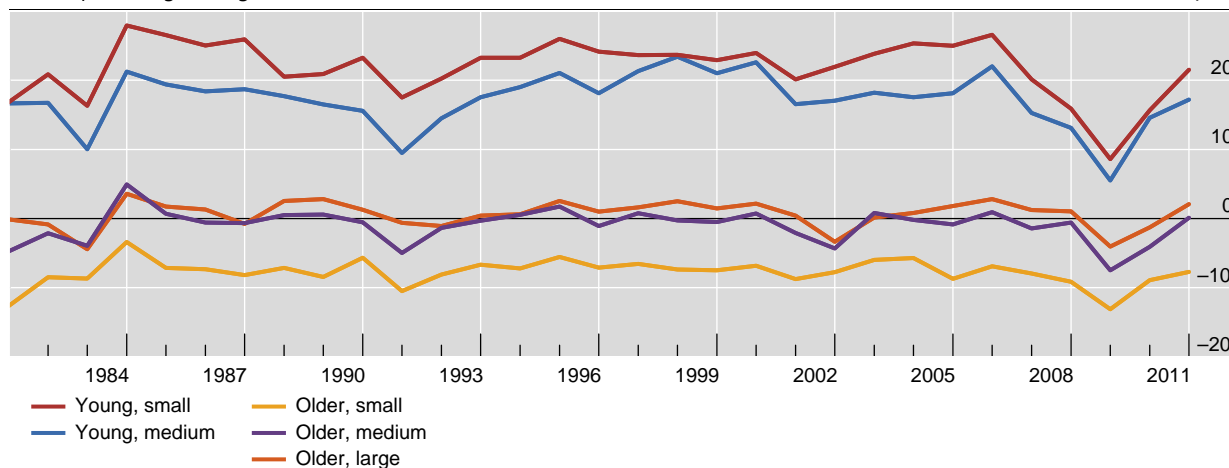
Recent academic research based on business register data, has identified that a firm's age rather than its size is the key determinant of net job creation (Haltiwanger et al, 2010; Dixon and Rollin, 2012; Lawless, 2013). These papers show that because young firms also tend to be small, there is a mistaken perception that small firms rather than young firms are the drivers of employment growth in the economy. This section examines business register data to examine the importance of young firms for growth.

In the United States, net employment growth rates of young-small and young-medium-sized firms are between 18 to 20 percent higher than in similarly sized older firms (Graph 1). Indeed, old-small firms have consistently experienced negative net employment growth rates over the past 30 years. This highlights the importance of firm-age rather than size as the key driver of job creation. Fort et al (2012) study how net job creation varies by firm age and size over the business cycle in the United States. They find that net job creation in young small firms is more sensitive to the business cycle relative to larger mature firms. Graph 1 provides some visual evidence of this finding: net job creation of young firms (red and blue lines on the top) fell particularly steeply during the financial crisis of 2007–09 in comparison to similar sized old firms (purple and yellow lines).

Net employment growth of US firms, by size and age

Annual percentage changes

Graph 1



The net employment creation rate is defined as the sum of all employment gains in expanding establishments minus the sum of all employment losses in contracting establishments divided by the number of jobs available in that age/size group. Young refers to firms less than 5 years old; small firms with 1 to 19 employees, medium firms with 20 to 499 employees. Sector coverage: agricultural services, forestry, and fishing, mining, construction, manufacturing, transportation and public utilities, wholesale trade, retail trade, finance, insurance, and real estate and services.

Source: United States Census Bureau; author's calculations.

Over the recent financial crisis, net employment growth of young European firms has been similar in dynamics and magnitude to that in the United States (Graph 2).¹ The performance of old firms accounts for the heterogeneous labour

¹ Unfortunately, the Eurostat SBS data cannot be simultaneously by firm age and size as done in Graph 2.

market performance across countries. The black dots in Graph 2 show net employment growth in the non-government sector while the red and blue bars decompose the contribution into net employment growth by young and old firms, respectively.² Although overall net employment growth was negative in these economies in 2009, the positive red bars in the top panel of Graph 3 show that young firms were consistent net job creators across these economies. The negative blue bars show that old firms were net destroyers of jobs.

Overall, young firms continued to be net creators of jobs in 2010 while old firms were net destroyers of jobs (middle panel). Net job destruction of older firms remained high in crisis hit euro area economies and in central and eastern Europe. They were also high in the United Kingdom and Netherlands, two countries whose banking systems were particularly badly hit by the financial crisis.

By 2011 the reduction in the drag from older firms contributed to a general improvement in net job creation across most economies (Graph 2, lower panel). However, Euro area crisis hit economies stand out with continued significant net job destruction by older firms, along with Poland which had been relatively unaffected during the initial stages of the financial crisis.

Due to changes in industry definitions, consistent longer time series of net job creation growth by firm age from Eurostat's SBS is only available for the industrial sector (manufacturing, construction and utilities) for selected European countries. There is a common pattern of high net job creation rates in young firms that was particularly strong before the financial crisis, but remained positive during the financial crisis (Graph 4 red lines). France, the Netherlands, Spain and Sweden all experienced a sharp fall in young firm employment growth in 2008, while Italy only experienced a significant drop in 2009. By 2011, young firm employment growth appears to have returned to pre-crisis rates in Netherlands, Sweden and Hungary, but has remained weaker in Italy, Spain and to some extent France. The blue lines indicate that net employment growth of old firms in the industrial sector has been in general been consistently negative, even before the financial crisis with the exception of the Netherlands. The greater swings of net employment growth in young firms around the financial crisis suggest that job creation in young firms is more sensitive to the business cycle. Because the share of employment is significantly higher in older firms, the contribution to changes in net employment growth is dominated by the behaviour of older firms (Appendix Graph A1).

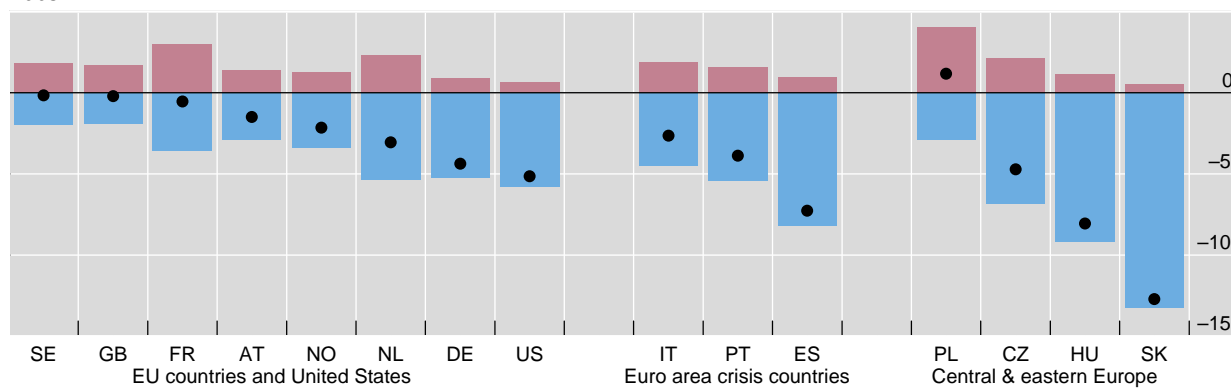
² Data availability and changes to definitions in 2008 restrict the consistent use of business registry data in EU countries.

Net employment growth in non-government sector, contributions by firm age

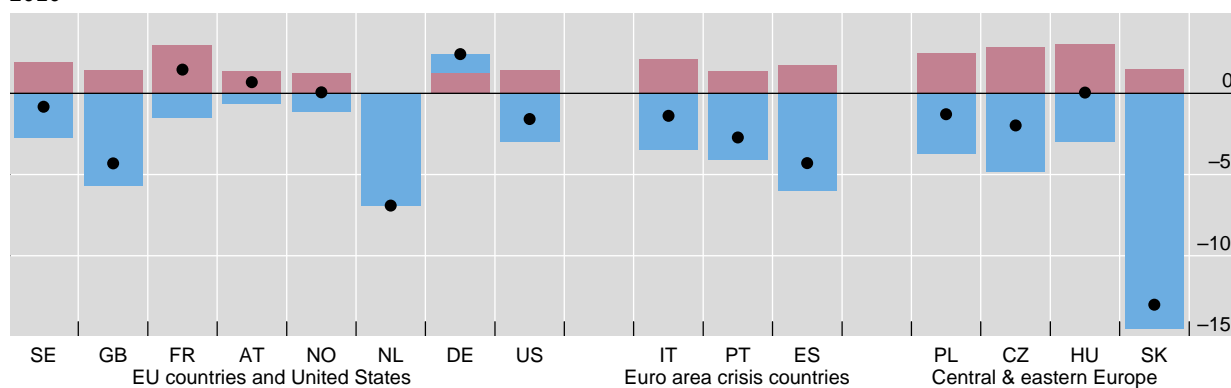
In per cent

Graph 2

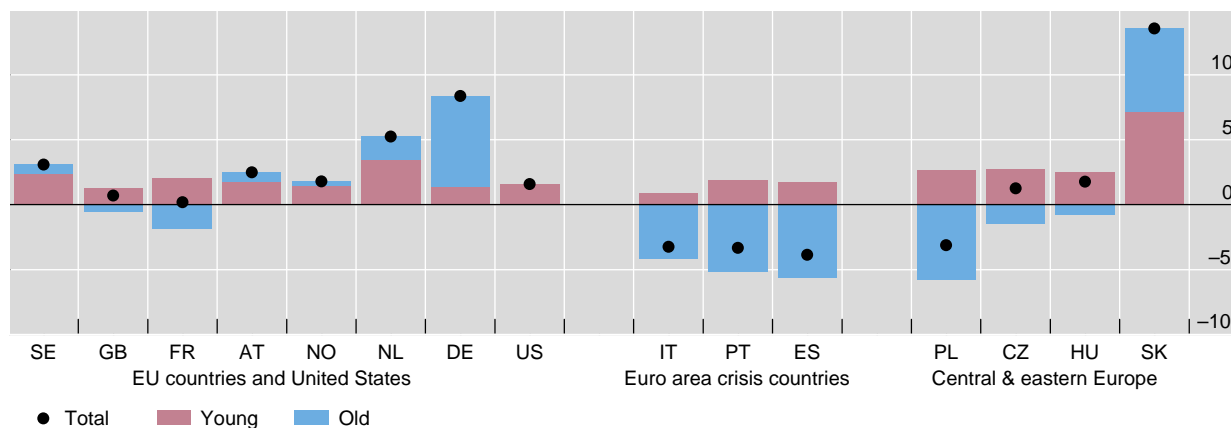
2009



2010



2011



● Total ■ Young ■ Old

AT = Austria; CZ = Czech Republic; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; HU = Hungary; IT = Italy; NL = Netherlands; NO = Norway; PL = Poland; PT = Portugal; SE = Sweden; SK = Slovakia; US = United States.

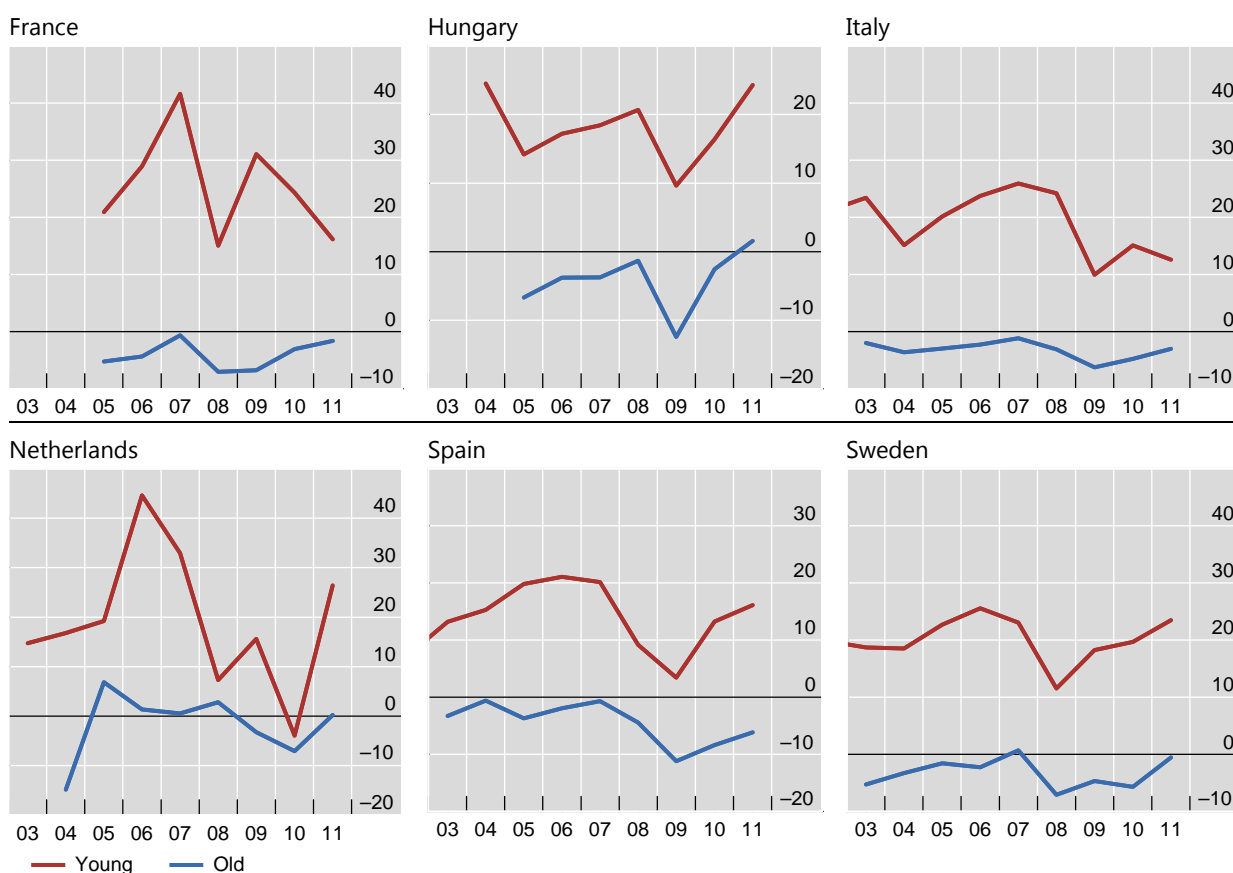
Young refers to firms less than 5 years old. The net employment creation rate is defined as the sum of all employment gains in expanding firms minus the sum of all employment losses in contracting firms divided by the number of jobs available in that age/size group, except for the United States where the unit is establishments. For European countries, the sector coverage is: manufacturing, mining, utilities, construction, trade and services sectors. For the United States, the sector coverage is: agricultural services, forestry and fishing, mining, construction, manufacturing, transportation and public utilities, wholesale trade, retail trade, finance insurance and real estate services.

Sources: Eurostat; United States Census Bureau; author's calculations.

Net employment growth of European firms by age, industrial sector

Annual percentage changes

Graph 4



Young refers to firms less than 5 years old. Sector coverage: manufacturing, mining and utilities.

Sources: Eurostat; author's calculations.

Firm-level survey evidence on profits and employment

Firm-level survey data present a consistent picture of the importance of young firms for economic growth. Table 3 shows regression estimates of firm employment and sales growth in advanced economy firms sampled by the World Bank's World Business Environment Survey (WBES), a particularly useful one-off survey of firms across many countries carried out between 1999 and 2000.³ Column (1) in Table 3 shows the results from regressing firm employment growth over the past three years on various firm characteristics in advanced economies. Employment growth in young firms less than five years old is estimated to have been around 18% higher than that of older firms in advanced economies. Reassuringly, the size of the difference in employment growth between young firms relative to old is strikingly similar to that obtained from US Census Bureau data shown in Graph 3. However, in contrast to the US Census level data, column (1) also shows that employment

³ This survey has been used extensively to assess the impact of financing conditions on growth, although the focus has been on small rather than young firms (eg Beck et al 2006; Beck et al, 2007).

growth is around 9% greater for SMEs compared to large firms, even after controlling for firm age. This divergence in the results could be due to survey data missing job destruction from SME exits.

Employment/sales growth and firm characteristics

World Bank survey conducted in 1999/2000

Table 3

Dependent variable	Employment growth	Sales growth
Young firms	18.0** (8.6)	20.2*** (6.4)
Small firms	9.1* (5.0)	-3.1 (3.3)
Medium firms	9.7** (4.2)	0.8 (3.3)
Service sector	5.6*** (1.5)	2.8 (2.0)
Construction sector	7.9 (5.4)	1.5 (2.8)
Listed firms	2.2 (4.3)	3.9 (3.2)
Subsidiaries	-2.6 (4.4)	-1.2 (5.0)
No. obs.	429	510
Adj. R ²	0.21	0.36

Young firms are defined as less than five years old, small: between 5 and 49 employees, medium: between 50 and 500, large: greater than 500. Survey question: "Please estimate the growth of your company's employment/sales over the past three years?" Firms sampled in Canada, France, Germany, Italy, Spain, Sweden, Portugal, the United Kingdom and the United States. The reference sector is a large, manufacturing, unlisted, independent firm. All regressions include country dummies. Robust standard errors, clustered by country, are shown in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels.

Source: World Bank World Business Environment Survey (WBES) and author's calculations

The regression in column (2) examines how sales growth, a proxy for economic growth, is related to firm characteristics. Sales growth of young firms is estimated to be around 20% higher than for older firms. For SMEs, sales growth is not significantly higher than larger firms; with the point estimate of the small firm variable negative. This result highlights the importance of young firms, rather than small firms for overall economic growth.

The European Commission/ECB *Survey on the Access to Finance* (SAFE) is a more recent firm level-survey that provides information about firm age and firm size.⁴ Unfortunately, this survey only started in 2009 which makes it hard to evaluate the impact of the financial crisis. To provide a pre-crisis benchmark, in this paper we use an earlier one-off European Commission pilot survey on SME access to finance administered in 2005 which asked a number of questions about profitability and financing constraints that overlap with the SAFE survey.⁵ Due to the fact that the 2005 survey was limited to SMEs, for comparability across time the following

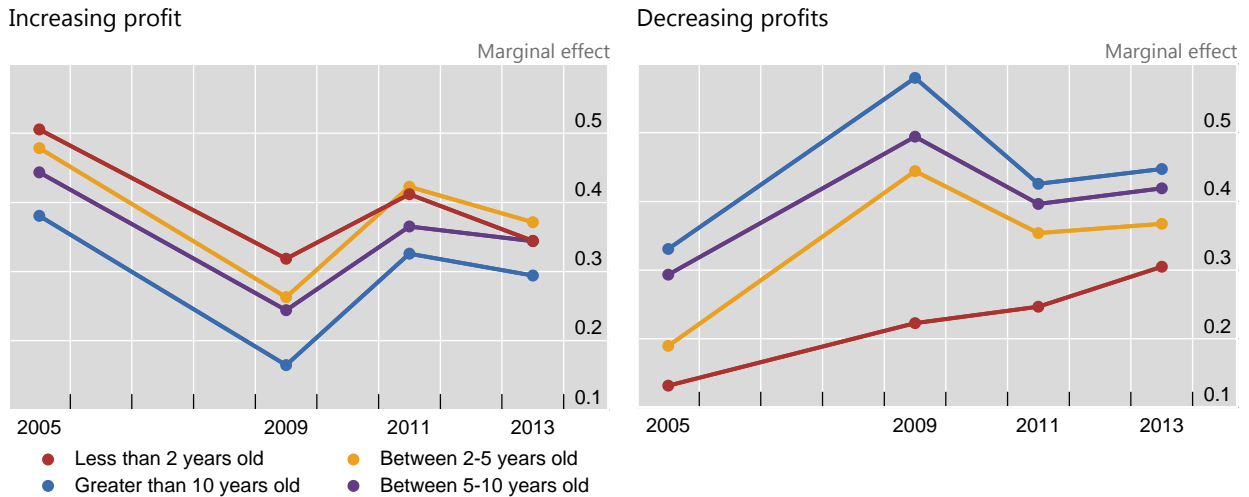
⁴ For more details on the SAFE survey see ecb.europa.eu/stats/money/surveys/sme/html/index.en.html

⁵ For more details on the European Commission's survey of SME access to finance see http://ec.europa.eu/enterprise/policies/finance/data/index_en.htm

analysis does not include the responses from firms that have greater than 250 employees in the SAFE survey.

Proportion of SMEs reporting profitability changes, by firm age

Graph 5



Share of firms reporting profit increases (decreases) after controlling for firm size and sector differences with a linear regression. Country sample: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. The 2009 survey did not sample firms in Denmark, Sweden and the United Kingdom. Excluding these countries from the other surveys does not qualitatively change the results.

Source: European Commission and author's calculations.

The surveys ask firms whether profitability increased, decreased or remained the same over the past six months.⁶ The left-hand panel of Graph 5 plots the share of SMEs by firm age reporting increases in profits after controlling for firm size. The Graph shows that in 2005, the probability of a SME reporting increasing profits declines with firm age. In 2009, the probability that a firm reported increasing profits was lower than in 2005, but the ordering by firm age was maintained. In 2011, the probability that a SMEs reported increasing profits recovered somewhat but dropped again in the 2013 survey as the Euro area crisis intensified. By 2013, there is some evidence that drawn out financial crisis has affected profit growth of start-ups less than 2 years' old (red line) relatively more than older firms.

The right-hand panel of Graph 5 plots the probability of a SME reporting profit decreases. It shows that older firms in general are more likely to experience profit decreases than younger firms. If one uses the difference in the probability of SMEs reporting profit increases relative to profit decreases as a measure of the net economic activity of each age group, in 2009 only start-ups experienced a greater share of firms experiencing profit increases compared to decreases. By 2011, there was a general improvement across the age distribution, although only the group of firms less than 5 years old had a higher probability of reporting profit increases than profit decreases. The overall situation deteriorated again in 2013. Overall, the survey based evidence on profitability performance shows that young firms are important for profit growth in the economy in addition to their importance for employment growth derived from business registry data.

⁶ The 2005 survey asks how profitability changed over the past year, rather than six months.

3. The impact of financial constraints on firm financing and profitability by firm age and size

SME financing has attracted considerable attention from policymakers in the wake of the recent financial crisis with a number of central banks creating programmes that target bank lending to the SME sector. In this section we examine if the reporting of financial constraints affects the amount of financing a SME receives. We also investigate the impact of financing constraints on SME profitability.

To examine the relationship between financial constraints, firm characteristics and the size of new loans to SMEs we estimate the following probit regression

$$\begin{aligned}
 y_i = & \Phi[\beta_0 D_i + \beta_1 FirmAge_i + \beta_2 FirmSize_i + \\
 & + \beta_3 D_i * FirmAge_i + \beta_4 D_i * FirmSize_i \\
 & + \delta'(Other\ control\ variables)_i \\
 & + (Country\ and\ sector\ dummy\ variables)] + \varepsilon_i \\
 y_i = & \begin{cases} 1, & \text{if new loan size} > \text{€}100,000 \\ 0, & \text{else} \end{cases}
 \end{aligned}
 \tag{1}$$

where $\Phi[\cdot]$ is a cumulative normal distribution function, D_i is a dummy variable that equals one if firm i reports access to finance as its most pressing problem and zero otherwise. $FirmAge_i$ and $FirmSize_i$ are vectors of dummy variables for firm age and size groups. The interaction terms between the access to finance dummy and firm age and size class dummy variables, are included to examine if there are any differences in the impact from reported financial constraints on new loans size across the age and size distribution of SMEs. Because of improvements to the 2013 SAFE survey we can include additional control variables that are likely to affect firm activity in addition to financial constraints. These additional variables capture the difficulty of finding customers, strength of competition, input costs, difficulty finding staff and regulation.

Table 4 shows the results from estimating the above regression on the 2005 European Commission survey and the 2013 SAFE survey. Our preferred specification is column 2013(1) which controls for additional factors that could affect firm demand for loans, such as difficulty finding customers. In 2013, the other control variables show that firms which had difficulty finding customers and faced high input costs were less likely to have large new loans. We also include a second specification 2013(2) which omits these extra variables but allows direct comparison with the 2005 survey. Comparing estimates in the 2013(1) vs. 2013(2) specifications suggests limited omitted variables bias in the 2013(2) and 2005 regressions, as the coefficient estimates and statistical significance barely change.

The point estimates on the age variables in the 2005 regression in Table 4 show that start-ups aged less than 2 years and firms over 10 years old were more likely to have had a new loan greater than €100,000 over the past two years compared to a middle aged firms between 2 and 10 years old. This result is suggestive of a life-cycle pattern in firm borrowing behaviour, where start-ups take large new loans and then spend the middle-part of their life-cycle repaying those initial loans or only taking on smaller additional loans. The heavy use of external loans by start-ups is consistent with recent evidence from Robb and Robinson (2012) which finds that start-ups rely heavily on external debt finance.

Determinants of new loan size

Table 4

Probit marginal effect estimates	$y_i = \begin{cases} 1, & \text{if new loan size} > \text{€}100,000 \\ 0, & \text{else} \end{cases}$		
	2013 (1)	2013 (2)	2005
Year of survey			
Firm age: 5–10 years	-0.015* (0.008)	-0.015 (0.009)	-0.116*** (0.023)
Firm age: 2–5 years	0.005 (0.010)	0.008 (0.010)	-0.101* (0.055)
Firm age: <2 years	0.031 (0.029)	0.032 (0.030)	-0.041 (0.058)
No. of employees: 1–9	-0.133*** (0.009)	-0.133*** (0.008)	-0.526*** (0.035)
No. of employees: 10–49	-0.077 *** (0.005)	-0.079 *** (0.005)	-0.221 *** (0.032)
Access to finance most pressing problem	0.032 *** (0.011)	0.039 *** (0.012)	0.116 (0.096)
Age: 5–10 x Access to finance most pressing problem	-0.006 (0.020)	-0.005 (0.021)	0.034 (0.072)
Age: 2–5 x Access to finance most pressing problem	-0.034 *** (0.011)	-0.036 *** (0.011)	0.189 (0.140)
Age: <2 x Access to finance most pressing problem	-0.036** (0.016)	-0.037** (0.016)	-0.191** (0.075)
No. of employees: 1–9 x Access to finance most pressing problem	-0.042*** (0.011)	-0.044*** (0.012)	-0.016 (0.095)
No. of employees: 10–49 x Access to finance most pressing problem	-0.029*** (0.007)	-0.030*** (0.007)	-0.052 (0.099)
Difficulty finding customers	-0.004 *** (0.001)		
Competitive pressures	-0.0003 (0.001)		
Labour and production costs	-0.003 *** (0.001)		
Availability of skills staff	0.008 (0.011)		
Regulation	0.002 (0.001)		
Country and industry dummies	Yes	Yes	Yes
N	8364	8364	2694

***, **, * indicate significance at the 1%, 5% and 10% levels respectively. Standard errors clustered by country. Country sample: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. Baseline is a firm aged greater than 10 years with 50 to 250 employees.

Source: European Commission and author's calculations.

The interaction terms between firm age and finance as their most pressing problem show that in 2005, start-ups which reported access to finance as their most pressing problem were less likely to take out a large new loan in the past two years. A similar relationship is not evident in older firms.

Comparing results from the 2005 survey to the 2013 survey, Table 4 shows that in 2013, firms which reported access to finance as their most pressing problem were

more likely to have received larger new loans over the past two years than those that did not. This effect was not evident in 2005 and is suggestive of debt-overhang problems in these firms that had recently taken on large new loans.

Similar to 2005 there is also important variation across the age distribution of firms. Start-ups that reported access to finance as their most pressing problem were less likely to take out a large new loan in the past two years. In addition we also find that this relationship had spread to firms between 2-5 years which was not evident in 2005.

We now test if financial constraints affect profit growth across the age distribution of firms. To do so we estimate probit regression (1) but change the dependent variable to measure if a firm reported increasing profits over the past 6 months or not.

$$y_i = \begin{cases} 1, & \text{if profits increased} \\ 0, & \text{else} \end{cases}$$

Table 5 presents the marginal effects from probit regressions estimated on the 2005 and 2013 surveys. Similar to Table 4, the omission of additional control variables in the 2013(2) regression specification does not significantly change the coefficients on the access to finance variables. This suggests that the 2005 regression does not suffer from omitted variable bias. Although the control variables do not affect the coefficients on the other variables the coefficient estimates are again economically meaningful. Firms which face difficulty finding customers, greater competitive pressures and higher labour and production costs are less likely to report increasing profits.

The 2005 column of Table 5 shows that the probability of a firm reporting profit increases, monotonically decreases with firm age. The significant negative coefficients on the firm size coefficients for micro-firms (1-9) and small firms (10-49) show that they were less likely to report profit increases than larger SMEs with 50-250 employees.

In 2005, the interaction term between the access to finance dummy variable and firms less than 2 years old is negative and significant. This indicates that start-ups which reported access to finance as their most pressing problem were less likely to report profit increases; suggestive evidence that before the crisis, financial constraints faced by start-ups reduced profitability. For older age cohorts there is no relationship between a firm reporting access to finance as their most pressing problem and reporting profitability increases.

However, by 2013 the negative impact of financing constraints on firm profit growth had spread to the cohort of middle-aged firms between 2-5 and 5-10 years old. This is the cohort of firms that were start-ups just before (or early on in) the financial crisis. The negative impact of financing constraints on firm profit growth could be related to the interaction of the protracted financial crisis with the life-cycle in firm borrowing. Table 5 showed that start-ups in 2005 were more likely to take out larger loans. As the financial crisis deepened, difficulties repaying this debt or receiving extensions due to bank deleveraging might have played a role in constraining the ability of this cohort of maturing firms to grow.

The measure of financial constraints used in Table 5 is subjective; as it measures a firm's perceived financial constraint but not necessarily an actual financing constraint. As a robustness check the 2013 regressions are re-estimated using a measure of actual financing constraints suggested by Artola and Genre (2011) which

based on loan applications refusals.⁷ Appendix Table A1 shows that the findings above are consistent with this alternative measure of financial constraints across the two regression specifications.

Determinants of rising profits		Table 5		
Probit marginal effect estimates		$y_i = \begin{cases} 1, & \text{if profits increased} \\ 0, & \text{else} \end{cases}$		
Year of survey		2013 (1)	2013 (2)	2005
Firm age: 5–10 years		0.070 *** (0.017)	0.071*** (0.018)	0.077*** (0.029)
Firm age: 2–5 years		0.091 *** (0.027)	0.097*** (0.028)	0.099** (0.039)
Firm age: <2 years		0.010 (0.032)	0.012 (0.032)	0.121 * (0.063)
No. of employees: 1–9		-0.120 *** (0.019)	-0.108*** (0.020)	-0.191*** (0.032)
No. of employees: 10–49		-0.032 * (0.017)	-0.027 (0.019)	-0.084 *** (0.029)
Access to finance most pressing problem		-0.016 (0.018)	-0.012 (0.036)	-0.009 (0.066)
Age: 5–10	x Access to finance most pressing problem	-0.066 ** (0.031)	-0.065** (0.031)	0.008 (0.049)
Age: 2–5	x Access to finance most pressing problem	-0.094 *** (0.033)	-0.101 *** (0.035)	0.046 (0.126)
Age: <2	x Access to finance most pressing problem	-0.029 (0.090)	-0.011 (0.104)	-0.236*** (0.037)
No. of employees: 1–9	x Access to finance most pressing problem	0.043 (0.043)	0.030 (0.039)	0.052 (0.095)
No. of employees: 10–49	x Access to finance most pressing problem	0.009 (0.039)	0.010 (0.040)	-0.063 (0.093)
Difficulty finding customers		-0.009 *** (0.003)		
Competitive pressures		-0.011*** (0.003)		
Labour and production costs		-0.016 *** (0.002)		
Availability of skills staff		0.010*** (0.002)		
Regulation		0.001 (0.002)		
Country and industry dummies		Yes	Yes	Yes
N		8364	8364	2694

***, **, * indicate significance at the 1%, 5% and 10% levels respectively. Standard errors clustered by country. Country sample: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. Baseline is a firm aged greater than 10 years with 50 to 250 employees.

Source: European Commission and author's calculations.

⁷ This measure cannot be constructed using the 2005 survey.

One should interpret our results with some caution. It is possible that causation runs in the opposite direction: banks successfully screen lending so that credit only goes to more promising firms resulting in a negative relationship between financing constraints and profitability. However, since the financial constraint interaction terms is not significant for other age and size classes, this alternative direction of causation seems unlikely because it would require banks to be good at screening start-ups but not older firms. Furthermore, the inclusion of additional control variables that potentially capture this reverse causality in the 2013(1) regression barely alter the coefficients estimates on the variables of interest.

4. Conclusion

The evidence on the economic importance of young rather than small firms in generating employment and profit growth suggests that policy initiatives which encourage new business start-ups and experimentation could boost economic growth. Given our finding that financial constraints faced by start-ups affect profit growth, easing financing constraints for start-ups could play an important role in future policy initiatives. However, agency problems when lending to young firms are difficult to overcome.

Somewhat worryingly, the superior profit growth of European start-ups relative to older firms appears to have been negatively affected by the financial crisis. We do not find direct evidence that this is related to access-to-finance difficulties, but we do find that start-ups which report access to finance difficulties were less likely to receive large new loans. This suggests that financing constraints could have negatively affected start-up activity. It is also possible that access to finance difficulties may have reduced entry of potentially high-growth business start-ups that is not measureable with our firm level data.

At the current juncture, our results also suggest that credit availability is also affecting growth of middle-aged firms in Europe, a relationship that was not evident before the crisis. We find that in 2013, financing constraints might have reduced profit growth in older firms aged between 2 and 10 years. Unfortunately, the limited data recorded in the EC/ECB SAFE on the balance sheet health of SMEs makes it difficult to determine the appropriate policy prescriptions. Our results could suggest that easing credit availability to this cohort of firms could boost growth. If this is the case, then recent policy initiatives which are more likely to affect this middle-aged cohort of firms, such as improving the collection and dissemination of firm credit histories or the creation of mini-bond markets for SMEs, could be beneficial for growth. However, our results also potentially identify debt-overhang problems that might not be solvable by further extension of credit.

Although our results suggest that there is a link between financial constraints and firm growth that varies across the age distribution of firms, future research would be greatly aided by relatively small improvements in the collection of firm-level survey data. The EC/ECB SAFE survey is a very large firm-level survey which captures a good cross-section of firms by both size and age. However, it lacks firm-level balance sheet data and quantitative data on firm activity such as the percentage growth of sales, profits and employment. The addition of these questions, together with the existing questions on financing constraints, would

greatly improve our understanding of the relationship between financing constraints and growth in firms.

References

Artola, C and Veronique, G (2011): "Euro area SMEs under financial constraints: belief or reality?" CESifo Working Paper No 3650.

Beck, T Demircuc-Kunt, A, Laeven, L and Maksimovic, V (2006): "The determinants of financing obstacles", *Journal of International Money and Finance* Vol 25, 932–952.

Beck, T Demircuc-Kunt, A and Maksimovic, V (2005): "Financial and legal constraints to growth: does firm size matter?" *Journal of Finance* Vol 60(1), 137–177.

Berger, A. N. and Udell, G. F. (1998): "The economics of small business finance: the roles of private equity and debt markets in the financial growth cycle." *Journal of Banking and Finance* Vol 22(6-8), 613-673.

Criscuolo, C, Gal, P and Menon, C (2014): "The dynamics of employment growth: new evidence from 18 countries", OECD Technology and Industry Policy Papers No. 14.

Dixon, J and Rollin, A (2012): "Firm dynamics: employment growth rates of small vs large firms in Canada", *The Canadian Economy in Transition* Series No 25.

Ferrando, A and Grieshaber, N (2011): "Financing obstacles among euro area firms, who suffers the most?" ECB Working Paper No 1293.

Fort, T C, Haltiwanger, JC, Jarmin, RS and Miranda, J (2013): "How firms respond to business cycles?" The role of firm age and firm size," NBER Working paper No 19134.

Haltiwanger, JC, Jarmin, RS and Miranda, J (2010): "Who creates jobs? Small vs large vs young", NBER Working paper No 16300.

Helfand, J, A Sadeghi and D Talan (2007): "Employment dynamics: small and large firms over the business cycle", *Monthly Labor Review*, Vol 130, March, 39–50.

De Kok, J, Vroonhof, P, Verhoeven, W, Timmermans, N, Kwaak, T, Snijders, J and Westhof, F (2011): "Do SMEs create more and better jobs?", European Commission Study on the SMEs impact on the EU labour market.

Lawless, M (2013): "Age or size? Determinants of job creation", Central Bank of Ireland Research and Technical Papers 02/RT/13.

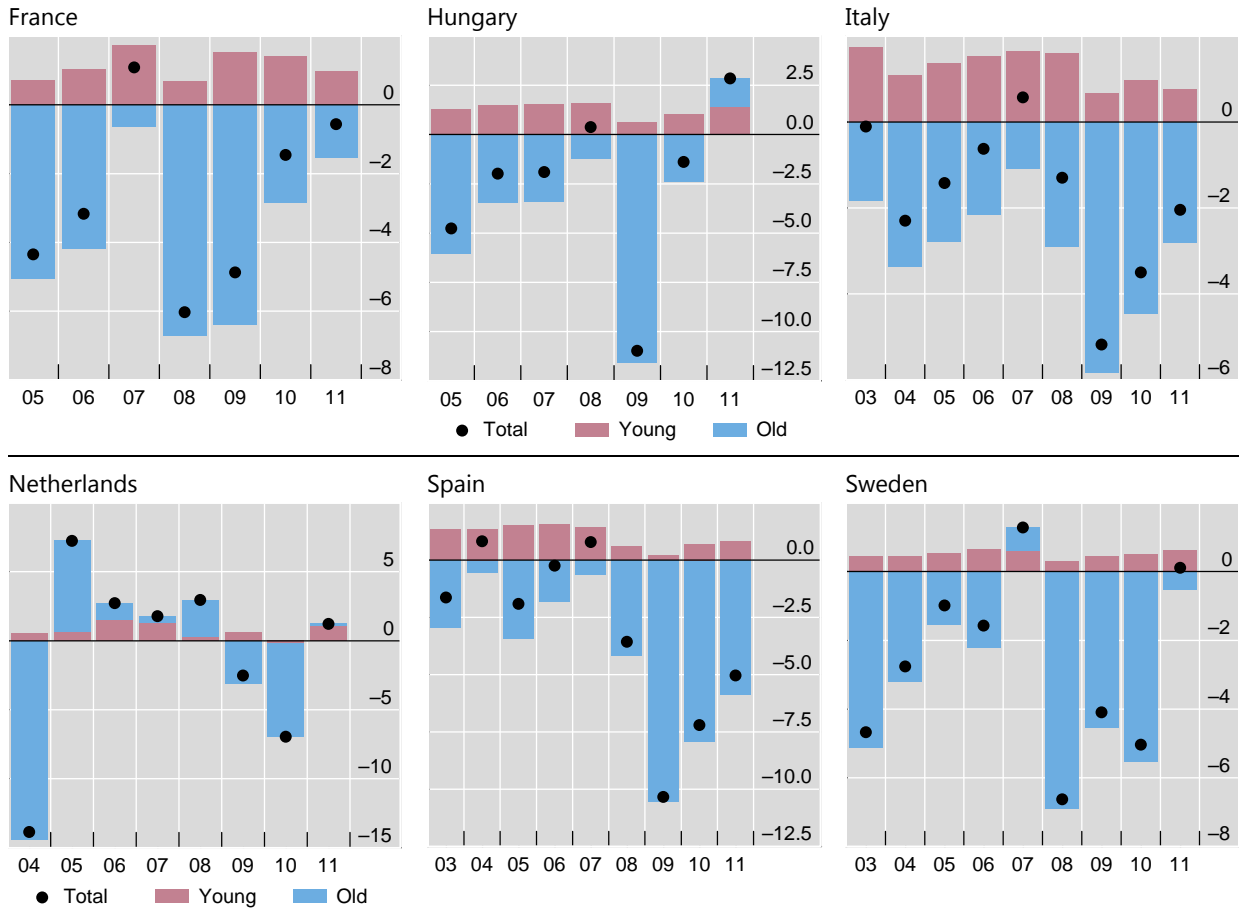
Robb, AM and Robinson, DT (2012): "The capital structure decisions of new firms", *Review of Financial Studies*, Vol 1(1), 1–27.

Appendix

Firm age and contribution to net employment growth, EU industrial sector

In per cent

Graph A1



Young refers to firms less than 5 years old. Sector coverage: manufacturing, mining and utilities.

Sources: Eurostat; author's calculations.

Determinants of rising profits

Table A1

Probit marginal effect estimates	$y_i = \begin{cases} 1, & \text{if profits increased} \\ 0, & \text{else} \end{cases}$	
	2013 (1)	2013 (2)
Year of survey		
Firm age: 5–10 years	0.072 *** (0.014)	0.074*** (0.015)
Firm age: 2–5 years	0.094 *** (0.027)	0.100*** (0.027)
Firm age: <2 years	0.011 (0.024)	0.017 (0.024)
No. of employees: 1–9	-0.109 *** (0.018)	-0.097*** (0.019)
No. of employees: 10–49	-0.027 * (0.018)	-0.022 (0.018)
Loan application refused or partially refused	-0.037 (0.034)	-0.046 (0.034)
Age: 5–10 x Loan application refused or partially refused	-0.051 * (0.027)	-0.050** (0.027)
Age: 2–5 x Loan application refused or partially refused	-0.062 * (0.035)	-0.062 * (0.035)
Age: <2 x Loan application refused or partially refused	0.005 (0.076)	0.006 (0.077)
No. of employees: 1–9 x Loan application refused or partially refused	-0.027 (0.032)	-0.037 (0.033)
No. of employees: 10–49 x Loan application refused or partially refused	-0.018 (0.042)	-0.021 (0.044)
Difficulty finding customers	-0.009 *** (0.003)	
Competitive pressures	-0.010*** (0.003)	
Labour and production costs	-0.016 *** (0.002)	
Availability of skills staff	0.010*** (0.002)	
Regulation	0.003 (0.002)	
Country and industry dummies	Yes	Yes
N	8364	8364