Do Credit Constraints Affect SME Investment and Employment?

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Abstract: This paper explores the potential presence of credit constraints confronting Irish SMEs and investigates the impact of these constraints on firms' employment and investment. Using new survey data collected by the Department of Finance, we define firms as credit rationed or discouraged borrowers and link these constraints to employment and the propensity to invest. We find a negative and significant effect of SME credit constraints on employment for firms that are discouraged from applying for credit. We also find a negative effect of constraints on the probability of an SME investing. This effect is driven by firms who are credit rationed when seeking capacity expansion loans.

I INTRODUCTION

The importance of small- and medium-sized enterprises (SMEs) to the Irish economy cannot be overstated. The Central Statistics Office *Business in Ireland Survey* (2010) indicates that SMEs constitute 99.8 per cent of active enterprises, 69.1 per cent of persons engaged, 51.5 per cent of turnover and 46.8 per cent of gross value added in the Irish economy. A lack of demand for their goods and services is undoubtedly the major challenge facing SMEs in the current environment,[1] however, there are many supply-side and structural influences on their operating climate that may also affect their performance. Determining which factors support or hinder SME performance, and developing a supportive business environment for their successful operation, is critical to a sustained, employment-intensive recovery.

Within this context, and given the scale of the crisis experienced post-2007 by the Irish banking sector, there has been considerable research identifying access to finance as a core constraint to SME performance (Forfás, 2012; NESC, 2012; Lawless and McCann, 2011; Holton and McCann, 2012; Holton *et al.*, 2014)This research, as well as through general interest group focus on the issue, has led to a range of policies being implemented as a response.[2]

However, to date no studies have been completed in an Irish context which link access to credit for SMEs to economic outcomes, such as investment and employment activity. This research attempts to fill that gap. Using new survey data collected by the Irish Department of Finance (DoF), we define firms as credit rationed or discouraged borrowers and link these constraints to employment and the propensity to invest.

We also extend the existing work estimating the determinants of access to bank finance in Ireland (Lawless and McCann, 2011; Holton and McCann, 2012) by providing a deeper categorisation of types of constraint. We break down financial constraints by firms who applied and were denied finance (credit rationing) and firms that were discouraged from applying due to banking-sector factors (discouraged borrowers). We also break down credit rationing by the type of loan application made, focusing on applications for working capital and capacity expansion. Our empirical methodology uses both bi-variate probit and instrumental variables least squares models to identify a

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[1] See O'Connell, O'Toole and Žnuderl (2013) for a review of the scale of the decline in household consumption in Ireland since the financial crisis. Casey and O'Toole (2013) also show that the firms in the Eurozone perceive finding customers as the main challenge to their operations. We confirm this finding for Ireland and the data is presented in Section III.

[2] For a complete review of the policy measures undertaken to date, please see "Action Plan for Jobs, 2013" available at http://www.djei.ie/publications/2013APJ.pdf.

causal effect of credit constraints on SME employment and investment. Instruments are taken from the ownership of the firm's main bank and the firm's views on the bank lending environment and are motivated by research by Chodorow-Reich (2014), Clarke *et al.*, (2006), Ongena and Sendeniz-Yüncü (2011) and Giannetti and Ongena (2009).

For employment, we find a negative and significant effect of credit constraints on the employment level of SMEs. This finding is in line with international research since the crisis (Campello *et al.*, 2010; Chodorow-Reich, 2014). Splitting credit constraints between credit rationed firms and discouraged borrowers, we find that borrower discouragement is the main driver of this negative effect. Our findings suggest that firms' unwillingness to apply for bank credit due to a belief in inevitable rejection is having an adverse effect on their employment levels. This finding has implications for the appropriate policy response. For discouraged borrowers, policies such as information on lending opportunities, training to improve financial capacities and an improvement in the diversity of financing instruments available should be considered.

We also find a negative effect of being credit constrained on firm investment decisions, again in line with Campello *et al.* (2010) and O'Toole *et al.* (2014). We find that firms which are credit rationed for expansion funds are significantly less likely to undertake investment. In fact the probability of investing is nearly 50 per cent less for these firms than unconstrained firms. We find no effect of borrower discouragement or credit rationing for working capital funds on investment.

That financing constraints are having a detrimental effect on firms' investment decisions is of critical importance to the recovery of the Irish economy. In any recovery scenario, as investment rates increase, an adequate supply of market-priced capital is required to fund this additional investment. If this capital is not forthcoming, credit rationing will act as a drag on growth and serve to lower potential output. In light of this, as Ireland's financial system is particularly bank-based in orientation by international standards (Lawless *et al.*, 2013), policy measures to broaden the diversity of financing options used for investment by Irish SMEs, such as greater shares of risk-capital and equity financing, should help to mitigate the risk of an over reliance on bank funding lowering investment.

The rest of this paper is outlined as follows: Section II provides background context and reviews the relevant literature. Section III outlines the data and our methodological approach. Section IV presents the results of the empirical analysis and Section V concludes.

II BACKGROUND AND RELATED LITERATURE

Since the financial crisis in Ireland, a number of research papers have emerged which study various aspects of the credit market for SMEs. Lawless and McCann (2011) consider the issue of SME credit supply and demand in Ireland drawing on two data sources, the CSO/Eurostat *Access to Finance Survey* and the ECB *Survey on Access to Finance for SMEs* (SAFE). Their methodology uses t-tests and propensity score matching to evaluate firms that were successful or unsuccessful in obtaining credit. They state that while credit applications have declined moderately, there has been a very large increase in rejection rates from under 2 per cent in 2007 to 24 per cent in 2010. Comparing rejected and accepted firms using production data, they also find no evidence that accepted firms were grouped by firm performance. Evaluating the ECB data, they note Irish firms were much more likely than firms in other countries to be rejected credit but no less likely to reduce credit demand.

Holton and McCann (2012) revisit the SME credit market in Ireland, considering both supply and demand indicators. They draw on both the ECB SAFE survey and the Department of Finance (DoF) survey of the Irish credit market. Their research indicates that (a) credit demand in Ireland lies close to the European average, (b) there is a high degree of borrower discouragement in Ireland, (c) rejection rates are high in Ireland relative to European averages and (d) changes in terms and conditions are least favourable in Ireland. While this study does not provide clear econometric evidence, it does provide an international context for evaluating the dynamics in the Irish credit market.

Holton and O'Brien (2011) review the external financing conditions of both large corporates and SMEs in Ireland, the UK, US and Eurozone since the onset of the global financial crisis. Using aggregate data on the cost and volume of outstanding finance, they find that bank lending was adversely affected across all regions. They also find that large non-financial corporations have, to some extent, been able to substitute out of bank lending and into other market financing sources. They state that, while supply constraints are evident, low aggregate demand is also a factor affecting SME credit volumes.

These studies explore the determinants of constraints and their variation across firms and countries; however, they do not link credit access to firm economic outcomes such as investment and employment. Testing this link is vital to understanding the credit market's role in supporting a recovery in the Irish economy.

While the issue of SME credit access and its impact on firms is a long standing research focus in the international literature,[3] a number of papers

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[3] See Chirinko (1993) and Hubbard (1998) for a review of the early literature and Guariglia (2008) and Beck (2006, 2008a,b) for a more recent review of where the debate currently stands.

have emerged since the crisis that focus specifically on testing the impact of constraints on real economy outcomes.[4] Kashyap and Zingales (2010) note that the financial crisis has refocused the debate on how firms finance their activities. Campello, Graham, and Harvey (2010) use survey data from 1,050 Chief Financial Officers in the US, Europe, and Asia to directly assess the effect of credit constraints during the financial crisis. They find that constrained firms planned deeper cuts in technology spending, employment and capital spending while also depleting cash stocks more quickly. Moreover, they find that an inability to borrow caused US firms to bypass attractive investment opportunities.

Duchin, Ozbas and Sensoy (2010) study the effect of the recent financial crisis on corporate investment and find that investment declined significantly, even controlling for firm-level characteristics and time-varying shocks. The decline is 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, there have been few studies that test the effects of access to finance on the firm outcomes such as investment and employment. O'Toole, Newman and Hennessy (2014) test the effect of financial constraints on investment in agriculture since the crisis and find that constraints were much higher in 2007, 2008 and 2009 relative to pre-crisis levels. However, their research is limited to the agricultural sector and is not representative of the economy as a whole. Our paper fills this gap and links credit constraints to investment using a survey that is nationally representative.

To our knowledge, there have been no studies evaluating the impact of credit constraints on firms' employment decisions in Ireland. Therefore, we feel addressing this issue in an Irish context is both highly relevant and desirable.

III METHODOLOGICAL APPROACH AND DATA

In this paper, we use data from the "SME Credit Demand Survey" completed by various survey companies for the Department of Finance (DoF) (DoF, 2012; 2013). We use the two most recent waves of the survey, the first wave encompasses the six months from October 2012 to March 2013 while the

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[4] Our work is also related to the broader literature on investment activity during financial crises. Kalemli-Ozcan *et al.* (2011) test the real effects of credit supply shocks using firm-level data from Latin America between 1990 and 2005 and find that the key factor hindering investment during financial crises is the decline in credit supply.

most recent wave covers April 2013 to September 2013.[5] The survey provides a snapshot of the SME credit market, focusing on both credit supply and demand. The survey captures a representative sample of SMEs in the Irish economy and is stratified by size and economic sector.[6] A cross-section of approximately 1,500 firms is collected in each wave (no panel element is available), providing us with a sample size of 3,000 firms. In our analysis, we exclude firms in financial intermediation, health and social/non-profit activities and public administration, as is standard in the literature. Many of the latter groups are not profit maximising firms thus their behaviour, in terms of standard economic rationale, is difficult to evaluate. Excluding these firms, our final sample contains 2,565 firms. This sample includes firms in primary agriculture, industry and construction, and market and non-market services. Importantly from our perspective, it provides detailed information on firms' decisions about whether or not to apply for credit, and if they applied, information on their success in obtaining credit. Data are collated on the financial institution from which the SME sought financing and on the length of the relationship with their current finance provider. The survey also captures a range of information on firm size, age, trading status, profitability, employment activity and sector of activity.

3.1 *Methodological Approach*

This section presents the methodological approaches used to estimate the effect of constraints on employment and investment. Each approach is presented separately reflecting differing methods and data availability.

3.1.1 Measuring Credit Constraints

A widely debated issue in the international literature relates to the correct strategy to identify firm credit constraints.[7] Fundamental to the definition of being "credit-constrained" is that the firm who requires credit must have either (1) a profitable investment opportunity that has a positive net present value at the current market cost of capital or (2) have a profitable ongoing operation which requires normal credit facilities. The credit supply constraint must, therefore, arise due to imperfections in capital markets which distort the proper allocation of credit and its transmission to firms as opposed to being determined by borrower-related factors.

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[5] It is only for these two waves that information on employment levels, and investment, are available.

[6] For more information on the sampling process or survey design please see the Mazars or Red C reports accompanying the Department survey (DoF, 2012; 2013).

[7] Casey and O'Toole (2014) and O'Toole (2014) provide an overview of the various approaches which have been used in the literature. This definition is also discussed in Byiers *et al.* (2010) and Bigsten *et al.* (2003).

To identify constraints we use two main categories of firms:

Credit Rationed: Firms that applied for finance but were refused or received less than 70 per cent of the amount sought; and

Discouraged Borrowers: Firms that did not apply for finance due to a bank-based reason.

The constraints are detailed in Table 1 and are binary indicators taking the value of 1 if the firm is constrained and 0 otherwise. Our definition of credit rationing counts any firm which is refused credit or receives less than 70 per cent of the requested amount as being credit rationed, regardless of the reasons given to the firm by the bank for this rejection. While the DoF/RedC Survey does contain data on the reason given for the rejection of an application for credit, we choose to include all rejections in our definition of credit constraints for two reasons: (1) banks may cite firm-related reasons in a rejection letter when in fact the decision not to grant a loan was due to the sector a firm is in; this would lead us to underestimate credit rationing, (2) banks may quote bank-related reasons, such as a changed sectoral lending policy, when in fact the rejection was related to firm characteristics; in that case, we would overestimate the prevalence of credit rationing in our sample. Rather than using the reasons given by banks to measure credit constraints, we control for borrower quality in our analysis by including variables for turnover, profit, repayment difficulties and existing debt levels. A more detailed discussion of the variables included in our analysis can be found below in the "credit constraints and employment" subsection.

As firms use different bank-finance products for short-term operational activities and longer-term investment financing, and due to the fact that credit for ongoing operations and credit for new capital investments have different impacts on the overall economy, we create two further indicators of constraints which are subgroups of credit-rationed firms: (a) firms that were *credit-rationed for working capital* loans and (b) firms that were *credit-rationed for expansion/capacity building*. We have grouped firms into the working capital category if they stated one of the following reasons for applying: working capital/cash flow, decline in business revenues, slow down in debtor collection, and increasing bad debts. We have grouped firms into the expansion/capacity building category if they provided one of the following reasons for applying: new business venture, expansion, acquisition of assets and purchase, replacement, or lease new vehicle and/or equipment.

The final group of constrained firms we focus on are those who did not apply for finance due to a bank-based factor. These "*discouraged borrowers*" are constrained in that they are potential bank-finance applicants who are

deterred due to their views on banks' lending activity. The bank-based factors we use as criteria in this definition are also presented in Table 2. Adding firms who were denied finance and those who did not seek bank finance gives an estimate of the *overall* level of *SME credit constraints* in the economy.

Table 1: *Overview of SME Credit Constraint Definitions*

Constraint	Definition
Credit rationed	Constrained if applied for bank finance, were refused finance or received less than 70 per cent of the amount sought
Credit rationed for expansion	As per above but application was for an expansion loan
Credit rationed for working capital	As per above but application was for working capital finance
Discouraged borrowers (did not seek bank finance)	Did not apply due to a bank-based reason, i.e.: – No trust in banks – Believe banks not lending, or – Turned down before /possible rejection/procedure too difficult – Cost of credit too high (interest and terms)
Overall credit constraint	Credit rationed + Discouraged borrowers

Note: All variables are binary indicators taking the value of 1 if the firm is constrained by that definition and 0 otherwise.

3.1.2 Credit Constraints and Employment

Existing research suggests a number of channels through which access to finance can impact the employment decisions of firms (Nickell and Nicolitsas, 1999; Spaliara, 2009; Campello, 2003). The first direct channel is through access to working capital finance which can directly determine a firm's labour input choices. The second channel works through the firm's choice of capital inputs and their optimal capital labour ratios (Spaliara, 2009). If a firm cannot access credit to invest in capital goods, assuming that the capital is not a complete substitute for labour, this may curtail any plans they have to augment their labour force to complement the new fixed assets. In this case, we assume that firms potentially augment both inputs to production and hold the capital labour ratio relatively constant. However, Spaliara (2009) argues that, as long as there is some substitutability between capital and labour, firms that cannot access investment capital may increase employment activity as an alternative thus altering the capital labour ratio. Given this ambiguity, estimating the direction of the relationship is an empirical question.

While the research by Spaliara (2009) is relevant, it estimates the effect of financing on the capital labour ratio for the manufacturing sector only. The

relative factor demands are potentially very different in non-manufacturing sectors. In this context, the findings of this paper are not completely comparable to our broader sample which includes all industrial and market-services sectors. In addition, Spaliara (2009) does not directly identify financing constraints but instead uses indicators of financial health as a proxy.[8] Hernando and Martinez-Carrascal (2008) also use dynamic GMM to test the effects of financial health indicators on firms' real performance, including employment. They find that financial pressures have a detrimental effect on employment.

Recent research by Chodorow-Reich (2014) is also relevant to our work. This paper tests the effect of bank lending frictions on employment outcomes following the 2008/2009 financial crisis. The research finds that firms with relationships with more distressed lenders reduced employment more than those with better performing financial institutions. The effects are evident for SMEs but not for large firms.

Building on the literature, we use the direct measures of financing constraints outlined above and link these to employment. We estimate an employment equation in levels as a function of constraints, firm-characteristics, and other controls. Our dependent variable is the log of the number of employees. As the data are cross-sectional, certain econometric concerns arise. First, constraints and employment decisions are potentially contemporaneously endogenous i.e., it might be the case that a firm might lay off workers because it did not get funding or alternatively firms might apply for credit giving consideration to changes in labour inputs. Additionally, a simple estimation strategy runs the risk that the findings are driven by certain omitted variables. To treat these two sources of potential endogeneity, we use an instrumental variables strategy. We estimate the following 2SLS model:

$$\textit{Stage 1: } CC_i = \alpha_1 + \boldsymbol{\gamma Z_i} + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j} + \varepsilon_i$$

$$\textit{Stage 2: } LnEmp_i = \alpha_2 + \text{Ø}CC_i + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j} + \varepsilon_i$$

Subject to the following exogeneity condition on the instruments:

$$E[\boldsymbol{Z_i}\varepsilon_i] = 0$$

As our main interest lies in the effect of credit constraints, *CC*, on employment, we test the following hypothesis:

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[8] We thank an anonymous referee for noting this drawback of this research in the literature.

H1: SME credit constraints affect firms' employment decisions, $\phi \neq 0$. While there is some ambiguity concerning the direction of this effect, we would expect, given the majority of the literature, that the effect would be negative. i.e. that $\phi < 0$.

General firm-level characteristics are contained in the vector X_i. In selecting these factors, we draw on existing research which suggests common indicators such as firm size, age and profitability (Ferrando and Greisshaber, 2011; Beck *et al.*, 2006; 2008a; 2008b; Holton and McCann, 2012; Casey and O'Toole, 2014; Canton *et al.*, 2012). These indicators are selected to control for borrower quality, risk and performance. We therefore include the following controls: firm age (in log years), the log of turnover, a binary variable for whether or not the firm posted a profit in the previous six months, and a binary indicator for whether or not the firm has missed a loan repayment in the past six months. 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. Such controls also 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. We also include a variable to control for the managerial quality of the firm. This variable takes the value of one if the firm performs all three of the following business tasks and zero otherwise: (a) maintains regular business accounts (b) maintains an existing business plan and (c) estimates cash flow requirements for coming months.

We also include controls for debt overhang by adding the log of total debt as a variable. The effects of debt overhang on firm performance and credit access is well established in the literature (Bernanke and Gertler, 1989; Moyen, 2007; Hennessy, 2004; Hennessy, Levy, and Whited, 2007). Higher levels of outstanding debt can pose a direct challenge to SMEs' future investment and employment plans. An analysis of the impact of existing debt levels is particularly interesting in the Irish context due to the considerable property related debts built up by SMEs in the boom period. We also include two variables to capture the effect of trade credit on employment. If access to working capital from trade credit is substituted for bank financing, as found by Casey and O'Toole (2014), this factor should be controlled for. We include two indicators: (a) the share of working capital financed using trade credit and (b) an indicator variable for whether or not the average amount of time taken to receive customer payments has decreased. The vector S_j includes sector dummies.

3.1.3 Credit Constraints and Investment

There exists a well developed literature which documents how improved access to finance, or greater financial development in general, can foster

growth through higher volume and more efficient capital investment (Chirinko, 1993; Bond and Meghir, 1994; Gilchirst and Himmelberg, 1995; Hubbard, 1998; Wurgler, 2000; Love, 2003; Guariglia, 2008; Galindo *et al.*, 2007). If external finance is unavailable to firms looking to fund capital expenditures, this can impact economic activity by reducing the productive capacity of firms and restraining potential output.

In the DoF Survey, firms were asked whether or not they purchased fixed assets and, if they did, what the amount purchased was. However, one of the difficulties in estimating investment equations with cross-sectional data, and especially for SMEs, is the fact that a considerable number of zero value investments are evident. This is due to the fact that many SMEs invest on a multi-annual horizon and their purchases of fixed assets are, in many, cases lumpy and infrequent. As we do not have panel data available, we cannot take into account this lumpy behaviour by averaging over time or estimating dynamic models. As we also have no data on disinvestments, we do not know whether the 0 values actually represent censoring (which can be dealth with using a tobit model) or "infrequency of purchase" which would require a sample selection model.[9] Additionally, we do not have data on capital stocks, so estimating investment level equations as in Love (2003), Guariglia (2008), and Ryan *et al.* (2014) is not possible.

Given these concerns, we therefore focus on estimating investment propensity models for Irish SMEs. Using the DoF data, we are able to identify whether or not a firm actually purchased capital assets. We can therefore generate a binary indicator for investment as follows:

$$I = \begin{cases} 1 \; if \; I^* > 0 \\ 0 \; if \; I^* \leq 0 \end{cases}$$

The variable I takes the value of 1 in the case where firms undertake positive investment $I^* > 0$ and the value of zero if they reported no fixed asset purchases.[10] We then can test the degree to which constraints effect the probability that SMEs invest in fixed assets. Testing the effects of constraints on investment, as is the case with employment outlined above, is subject to concerns about endogeneity. However, in this case, we have the added complication that both our dependent variable and constraint indicators are binary. The standard approach suggested in the literature to estimate this

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[9] A further methodological consideration arises in estimating two-stage sample selection models with binary endogenous variables in both stages.

[10] The zeros may include firms who had net divestments therefore the latent variable I* can be < or = 0.

type of model is to apply treatment effects methods and estimate a bivariate probit model (Nicols, 2011; Chiburis *et al.*, 2011). Assuming linearity of the indicator function and joint normal errors provides the following bivariate probit model for our investment equation:

$$I_i = 1[(\alpha + \text{Ø}CC_i + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j}) > v_i]$$
$$CC_i = 1[(\delta + \boldsymbol{\gamma Z_i} + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j}) > e_i]$$

Where $(v, e) \sim N(0, \Sigma)$. Our interest lies in identifying the parameter ϕ above. Given the findings in the literature, where a credit constraint is present, we expect to find a negative relationship with investment. We therefore test the following hypothesis:

H2: SME credit constraints are negatively related to investment in the Irish economy, $\phi < 0$.

The control vector $\boldsymbol{X_i}$ includes the variables presented in the employment equation, only excluding the trade credit indicators.[11] Additionally, we add size controls (Small (between 11 and 49 employees; Medium, between 50 and 250 employees)) in the investment model. These variables are not included in the employment level equation as they are based on employee numbers and are by construction endogenous.[12]

In our regressions in Section 4.2 below, we present the average treatment effects of constraints and the other controls on investment in the bi-probit model. In this section, we estimate the marginal effect of SME credit rationing on investment. With a bivariate probit model including binary dependent, binary endogenous variable and binary instruments, calculating the marginal effect is non-trivial.[13] Chiburis *et al.* (2011) state that the effect of interest, the average treatment effect (ATE) is:

$$\Delta_{\text{ATE}} = E[I_1] - E[I_0]$$

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[11] These are excluded: trade credit variables are included to control for working capital facilities which are not necessarily required in an investment model. However, if these variables are included in the main estimations, they are insignificant and do not alter the main findings. These results are available on request from the authors.

[12] The log of turnover controls for size continuously in the employment model.

[13] This consideration also relates to the other marginal effects for the other exogenous regressors. As our main focus is on the effect of constraints on investment, we only present estimates for this specific marginal effect.

Where I_1 is a firm's potential investment propensity given that they are credit constrained (CC = 1) and I_0 is a firm's potential investment propensity given that they are not credit constrained (CC = 0). Given our bivariate probit model with error correlation ρ, the ATE is:

$$\Delta_{\text{ATE}} = \Phi(\alpha_2 + \text{Ø} + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j}) - \Phi(\alpha_2 + \text{Ø} + \boldsymbol{\beta X_i} + \boldsymbol{\mu S_j})$$

where Φ represents the standard normal distribution function and Ø is the "treatment effect" or coefficient on the credit constraint variable, in this case the credit rationing for expansion variable. In all our results below, the coefficients presented are marginal effects estimated in the treatment effects style.

3.1.4 Instrumental Variables and Exclusion Criteria

With any type of instrumental variables model estimated on cross-sectional data, the methodology requires available instruments in the 2SLS model or exclusion criteria in the bi-variate probit. In our case, such a variable must be correlated with credit constraints but uncorrelated with employment or investment, except through the constraints channel.

First, focusing on credit rationing, our instruments are drawn from information on the ownership of the main bank the firm uses. There is an existing literature which suggests that foreign-owned and domestic lenders can apply different allocation criteria (Clarke *et al.*, 2006; Ongena and Sendeniz-Yüncü, 2011; Giannetti and Ongena, 2009).

Exploiting the ownership information on the main bank the firm uses, we develop three indicators: (a) if the bank was covered by the Irish state Eligible Liabilities Guarantee Scheme (capturing domestic lenders) (b) if the bank is foreign-owned[14] and (c) other banks and financial institutions. As this information relates to the banking institution, if included in the constraints equation, it should capture supply-side factors impacting SME credit availability. However, it should be uncorrelated with the employment or investment of the specific firm, except when the firm approaches the bank for credit. Indeed, this exogenous variation in bank supply of finance is a main element in the identification strategy used in Chodorow-Reich (2014). Using this information should provide instruments, uncorrelated with firm performance but correlated with the degree of financing constraints they face.

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[14] This relates to the following banks: Ulster Bank, Danske Bank, ACC, KBC, Bank of Scotland Ireland, Rabobank, and GE Capital/Woodchester, all of which appear in our data.

As noted, the instruments used for discouraged borrowers are different. For this constraint, we draw on two instruments. First, an indicator of whether or not the firm believes that the banks are lending with this belief being based on factors not related to the firm's own experience (i.e., coming from media reports, lobby group information, or business peers). We title this variable "Banks not lending". As this variable captures the firm's views on bank lending based on external factors, we believe it to be correlated with whether or not they apply for credit but that it should not effect employment except through credit access.[15] We also include in the discouraged borrowers equations the instrument for bank ownership. We do this because the exit of a number of foreign banks (such as Bank of Scotland Ireland, Rabobank and Danske Bank) may have had an impact on the degree of discouragement felt by firms, depending on whether or not they were customers of those institutions which have exited, or are in the process of exiting, the Irish market. If the firm hears that their bank is exiting the market, this may discourage them from applying for credit. Table 2 below outlines the instruments used for each constrained indicator.

Table 2: *Overview of Instruments Used for Each Constraint Indicator*

Constraint	*Instruments*
Credit rationed and sub-indicators (working capital/expansion)	Binary indicators for (1) ELG covered banks and (2) other banks (foreign banks are the omitted comparison category).
Discouraged borrowers	Binary indicators: "Bank not lending" = 1 if firm believes banks are not lending and this view is not based on its own experience (influenced by business peers, media or lobby groups). Binary indicators for (1) ELG covered banks and (2) other banks (foreign banks are the omitted comparison category).
Overall credit constraint	Binary indicators: "Bank not lending" = 1 if firm believes banks are not lending and this view is not based on its own experience (influenced by business peers, media or lobby groups) Binary indicators for (1) ELG covered banks and 2) other banks (foreign banks are the omitted comparison category).

[15] Indeed, regressions which include this variable in both the first and second stages indicate that it impacts borrower discouragement but has no direct, and significant, effect on employment in the second stage.

The validity of instruments is tested in each model using Hansen/Sargan tests of over-identifying restrictions and the first stage estimates are also provided for these variables to test their significance.

3.2 *Data and Summary Statistics*

3.2.1 Summary Statistics for Employment

A well documented feature of the current economic crises in Ireland has been the considerable increase in the unemployment rate since 2008. Figure 1 presents the unemployment rate and the level of employment in Ireland over the period Q1 2000-Q3 2013. The rate of unemployment increased from 4.9 per cent at the end of 2007 to a peak of 15 per cent in early 2010. It has slipped back marginally to 13.7 per cent in Q1 2013. While the recent decreases in the unemployment rate are positive, much has been driven by increased emigration and very little inroads have been made into the worryingly high level of long-term unemployment (FitzGerald *et al.*, 2013).

Figure 1: *Quarterly Trends in Employment and Unemployment Rate – Ireland – 2000-2012*
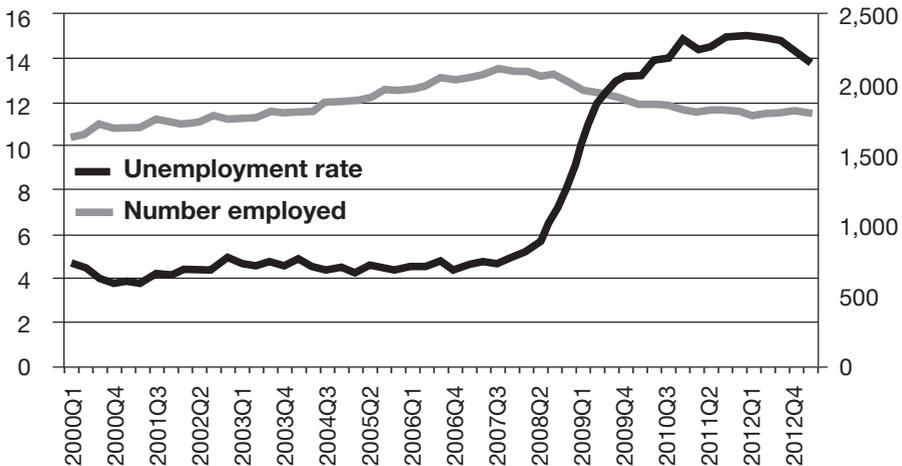
Source: Eurostat data.

Our interest lies in the employment contribution of SMEs and in particular how this is affected by access to finance. Given the importance of SMEs for job creation, any sustained recovery in their operating environment should provide an important employment boost. We carry out our analysis of the effect of financing constraints on SME employment decisions by examining the effect of constraints on the level of employment in the firm. Table 3

outlines the average level of employment (in logs) across the full sample and selected sub-samples by age, size and sector. Unsurprisingly, the largest firms are those greater than 20 years of age. The sectors with highest average employment in our sample are hotels, closely followed by manufacturing.

Table 3: *Employment Summary Statistics*

	ln(employees)
Overall	2.61
By size:	
Micro	1.28
Small	2.97
Medium	4.45
By age:	
< 2 years	2.68
3-5 years	2.46
5-10 years	2.50
11-20 years	2.47
20+ years	2.72
By sector:	
Manufacturing	3.15
Construction and real estate	2.37
Wholesale and retail	2.30
Hotels	3.20
Other	2.60

Source: Department of Finance/RedC Survey.

3.2.2 Summary Statistics for Investment

During the period prior to the financial crisis, Ireland experienced very considerable growth in investment. Figure 2 presents the quarterly trend in gross fixed capital formation over the period 2000-2012. The acceleration of growth in domestic construction and housing led to heightened and unsustainable levels of investment between 2002 and 2007. Following the onset of the crisis, the level of investment has dropped considerably.

While the aggregate charts document the investment cycle for the wider economy, it is important to consider the within-economy variation in investment changes. In particular, we are interested in considering how investment has changed for SMEs both across firms and across time. Figure 3 compares the proportions of firms engaging in investment by firm size in the year 2005 and for the periods April to September 2012 and October to March 2013. The 2005 data come from the European Bank for Reconstruction and Development's Business Environment and Enterprise Performance Survey

Figure 2: *Quarterly Gross Fixed Capital Formation – Ireland in Q1 2000-Q4 2012 – Volume Index (2005 = 100)*
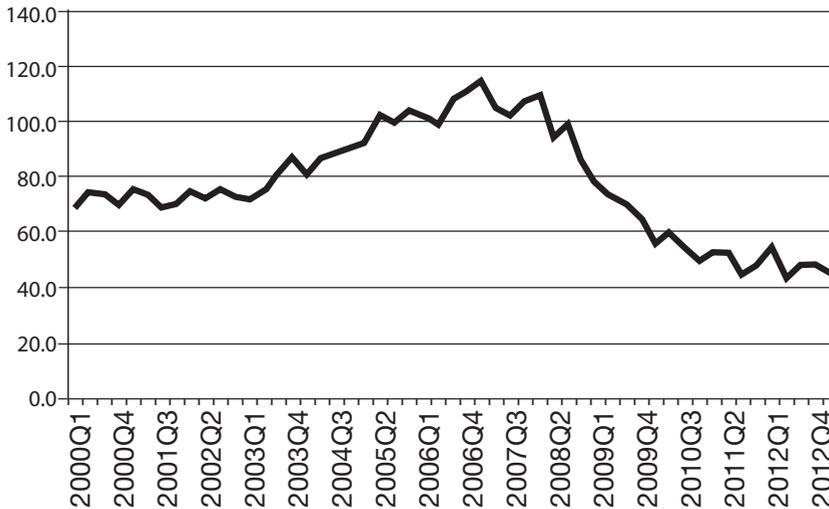
Source: Eurostat.

Figure 3: *Share of Firms Investing – Pre and Post-crisis*
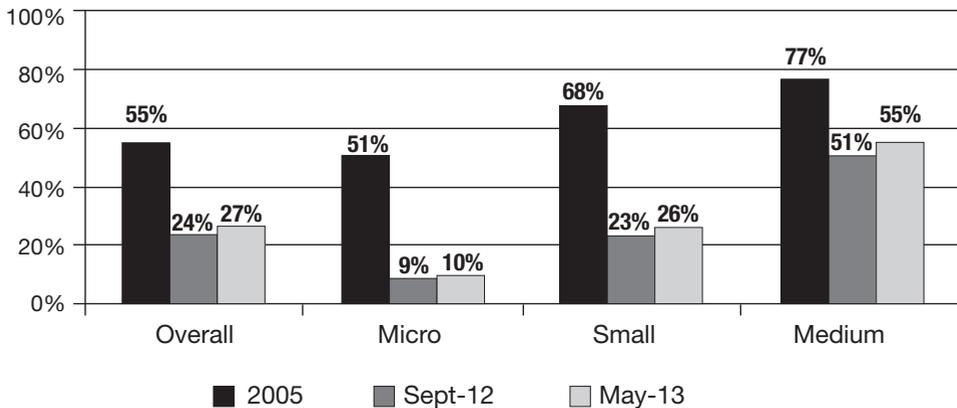
Source: Authors' calculations using RedC data and EBRD BEEPS survey data.

(BEEPS). As you would expect given the contrasting macroeconomic performance of the Irish economy in the two periods, investment is significantly lower across all firm sizes in 2012 and 2013. The trend across both periods is similar in that medium-sized firms invest the most while micro firms invest the least. The gap between levels of investment by small firms and medium firms is, however, much larger in the 2012/2013 samples than

was the case in the 2005 sample. Additionally, the number of micro-sized firms investing has fallen much more steeply than the number of small- and medium-sized firms.

We carry out our analysis of the effect of financing constraints on SME investment decisions by examining the effect of constraints on the propensity of a firm to undertake positive investment of any kind. Table 4 illustrates the share of firms reporting positive investment in the previous six months across our full sample and across sub-samples according to firm age, size and sector. Over a quarter of all firms report making a positive investment of some kind in the previous six months. Medium sized firms report the highest share of firms investing. In terms of age, the sub-sample of firms less than two years old demonstrates the highest proportion of firms undertaking investment in our sample with around one-third of firms reporting investment in the last six months. Across sectors, firms in the manufacturing sector report by far the highest share of investing firms at 42 per cent.

Table 4: *Investment Summary Statistics*

	Share of Firms Investing %
Overall	28
By size:	
Micro	12
Small	28
Medium	56
By age:	
< 2 years	32
3-5 years	29
5-10 years	26
11-20 years	26
20+ years	29
By sector:	
Manufacturing	42
Construction and real estate	23
Wholesale and retail	22
Hotels	29
Other	30

Source: Department of Finance/RedC Survey.

3.2.2 The Credit Environment in Ireland and Indicators of SME Credit Constraints

Domestic business lending grew rapidly in the years before the crisis in Ireland. Figure 4 presents data from the Central Bank of Ireland on

outstanding loans to domestic non-financial corporates. We can observe the rapid growth in outstanding credit between 2003 and the peak in 2008, followed by the dramatic decline since. This data is for all domestic non-financial corporate lending in Ireland and not purely lending to SMEs, however, the trend in the data is so pronounced that it is likely to be indicative of the credit market conditions faced by SMEs as well as larger firms. A fall in demand for credit doubtless played a role in the sharp contraction in lending to enterprises in the wake of the crisis; however, given the stress under which the banking sector was operating, it is likely that the pressure to deleverage and consolidate their balance sheets also lead the banks to impose a supply side constraint on credit flows. It is the impact of these supply side constraints that is the main focus of this paper.

Figure 4: *Outstanding Credit to Domestic Non-Financial Corporates*
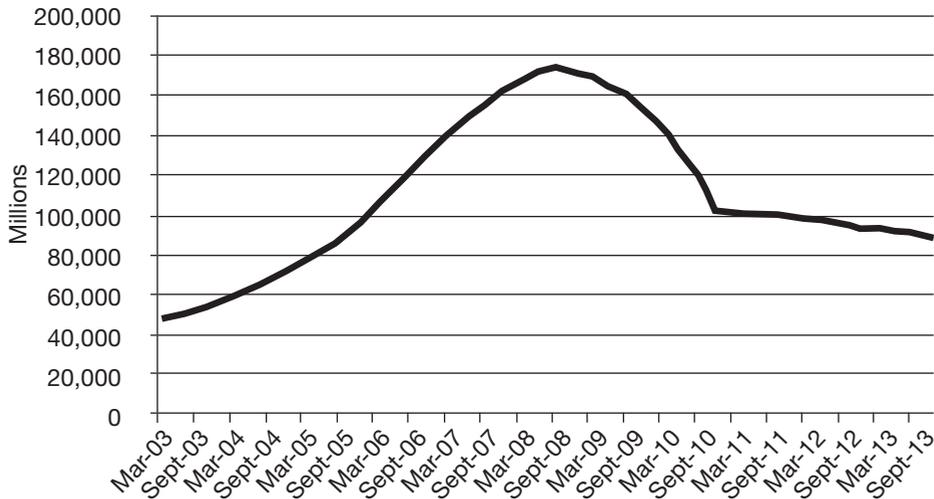
Source: *Central Bank of Ireland.*

Given our definition of credit constrained firms, and the various sub-definitions of credit constraints used in our analysis, Table 5 provides a breakdown of the proportion of credit constrained firms in our sample and across several sub-samples according to firm age, size and sector. We find that across the full sample, 16.5 per cent of firms are overall credit constrained, i.e., are either bank constrained or are classified as discouraged borrowers. Of firms in our sample 7.1 per cent are bank constrained while 9.4 per cent are classified as discouraged borrowers. We can observe that smaller firms are the most constrained size category in our sample while firms aged 3-5 years old are the most constrained age category. Unsurprisingly, hotels, followed by

firms in construction and real estate, are the most constrained sectors in our sample. The trend in our sample is also for firms to be more constrained for application for working capital than applications for credit to fund expansion.

Table 5: *Percentage of Credit Constrained Firms in the Sample*

	Overall Constrained	*Credit Rationed*	*Discouraged Borrowers*	*Credit Rationed – Working Capital*	*Credit Rationed – Expansion*
	%	%	%	%	%
Overall	16.5	7.1	9.4	4.7	3.7
By size:					
Micro	22.2	7.8	14.5	5.6	3.9
Small	14.7	7.8	6.9	5.0	4.0
Medium	9.2	4.8	4.3	2.5	2.9
By age:					
< 2 years	14.3	7.1	7.1	7.1	0.0
3-5 years	26.4	13.2	13.2	12.1	3.3
5-10 years	15.4	7.5	7.8	5.4	2.7
11-20 years	17.5	7.1	10.4	4.7	4.0
20+ years	15.7	6.6	9.1	4.0	4.0
By sector:					
Manufacturing	14.1	8.0	6.1	4.2	5.4
Construction and real estate	18.8	7.3	11.5	3.8	5.2
Wholesale and retail	17.4	6.3	11.1	4.8	2.8
Hotels	23.9	11.2	12.7	8.0	4.7
Other	13.4	6.2	7.2	4.0	3.2

Source: Department of Finance/RedC survey data.

3.2.4 Control Variables and Instruments

As discussed previously, we include a number of control variables in our analysis in order to capture the differing levels of borrower quality between firms. The variables we include are firm age, lagged debt, turnover, whether or not the firm made a profit and a measure of the share of working capital composed of trade credit. We also include controls for whether or not receivables have decreased in the previous six month period, a measurement of managerial capacity and whether or not the firm has had difficulty making repayments on existing debt in the last six months. A more detailed discussion of these variables is included in the estimation section.

Table 6 contains the means of the control variables included in our analysis across the full sample. A more detailed breakdown of the means across the sub-samples by age, size and sector can be found in the Annex.

Of the firms in our sample 44 per cent report that they made a profit in the previous 6 month period. We observe that 11 per cent of our sample experienced a decrease in receivables over the same period. Nearly 60 per cent of the sample display competent management capacity according to our definition. Of our sample firms 7 per cent report experiencing difficulties in meeting the repayments on their existing debt.

Table 6: *Means of Control Variables*

Variable	ln(age)	Receivables Decreased	Trade Credit Percentage of Working Capital	Management Capacity
Mean	3.03	0.11	15.84	0.57
Variable	Repayment problems	ln(lagged debt)	ln(turnover)	Profit
Mean	0.07	7.81	1.48	0.44

Source: Authors' analysis of Department of Finance/RedC Survey data.

The credit market for SMEs in Ireland has traditionally been dominated by the large domestic banks. This traditional dominance of the market is reflected in our data. Table 7 illustrates that the majority of firms in our sample report their main business account as being with the institutions eligible for the government guarantee. Of firms 16 per cent report their main business account as being with foreign-owned banks, while the final 2 per cent of the market is composed of those firms banking with domestic institutions that were not covered by the government guarantee.

Table 7: *Bank Ownership*

Bank Ownership	Percentage of Firms with Main Business Account with Bank %
ELG covered banks	82
Foreign owned banks	16
Other banks	2

Source: Department of Finance/RedC Survey data.

Table 8 reports data for the indicator "Banks not lending". The data indicate that 41 per cent of firms in our sample have a negative outlook on the lending environment. We class as having a negative outlook all those firms

who state that they believe that the banks are not lending and that the reason for this belief is not based on the experiences of their own firm. Those firms that answer that they believe the banks are not lending due to the experience of their business peers, media reports or statements by business representative organisations are thus classed as having a negative outlook on the lending environment in our analysis.

Table 8: *Perceptions of Lending Environment*

	Percentage of Firms
Banks not lending	41%

Source: Department of Finance/RedC Survey Data

3.2.5 Test of Means Between Constrained and Unconstrained Firms

Table 9 shows the results for a test of the means of the constrained and unconstrained firms in our sample. The levels of investment and employment are significantly different between the constrained and unconstrained for all facets of constraint that we consider, apart from investment by credit rationed and non-credit rationed firms. For those subsamples where the difference is significant, employment and investment are uniformly higher for the unconstrained firms. The proportion of micro firms is significantly higher in the constrained sample than the unconstrained sample. Unconstrained firms display significantly higher managerial capacity, have a lower average level of repayment difficulties, have been more profitable and have lower average debt levels.

Table 9: *Mean Comparison Tests of All Variables (Constrained to Unconstrained Groups)*

	Credit Constrained			Discouraged Borrowers			Credit Rationed		
	No	*Yes*	*T/Z Value*[1]	*No*	*Yes*	*T/Z Value*[1]	*No*	*Yes*	*T/Z Value*[1]
Main Dependent Variables									
Investment	0.28	0.18	*4.58*	0.28	0.17	*3.82*	0.27	0.27	*−0.17*
Ln employees	2.72	2.15	*9.02*	2.70	1.96	*9.20*	2.65	2.40	*2.88*
General Firm Characteristics									
Ln age	3.05	2.95	*2.16*	3.04	2.97	*1.27*	3.04	2.93	*1.64*
Hotels	0.11	0.15	*−2.51*	0.11	0.14	*−1.62*	0.11	0.15	*−1.79*
Manufacturing	0.13	0.12	*0.53*	0.13	0.09	*1.76*	0.12	0.15	*−1.21*
Other	0.12	0.07	*3.37*	0.12	0.07	*2.45*	0.12	0.07	*2.10*

Table 9: *Mean Comparison Tests of All Variables (Constrained to Unconstrained Groups) (Contd.)*

	Credit Constrained			Discouraged Borrowers			Credit Rationed		
	No	*Yes*	*T/Z Value[1]*	*No*	*Yes*	*T/Z Value[1]*	*No*	*Yes*	*T/Z Value[1]*
Wholesale and retail	0.32	0.35	*−1.23*	0.32	0.39	*−2.46*	0.32	0.29	*0.99*
Construction and real estate	0.11	0.12	*−1.17*	0.11	0.13	*−1.19*	0.11	0.12	*−0.34*
Medium	0.24	0.12	*5.91*	0.23	0.10	*5.14*	0.23	0.15	*2.74*
Small	0.39	0.34	*2.23*	0.39	0.27	*3.89*	0.38	0.42	*−1.17*
Micro	0.37	0.54	*−7.24*	0.37	0.63	*−8.24*	0.39	0.43	*−1.16*
Controls for Firm Quality/Risk									
Managerial capacity	0.59	0.52	*2.80*	0.59	0.46	*3.88*	0.58	0.59	*−0.33*
Repayment problems	0.06	0.16	*−8.25*	0.07	0.12	*−3.13*	0.06	0.22	*−8.37*
Profit	0.47	0.29	*7.31*	0.45	0.28	*5.44*	0.45	0.29	*4.41*
Receivables decreased	0.10	0.12	*−1.14*	0.11	0.12	*−0.46*	0.11	0.13	*−1.12*
Ln turnover	1.51	1.32	*7.08*	1.50	1.24	*7.33*	1.48	1.48	*0.02*
Ln lagged debt	7.58	9.01	*−4.70*	7.79	8.05	*−0.66*	7.72	10.14	*−4.13*
Percentage trade credit/ working capital	14.87	22.45	*−4.41*	15.23	24.66	*−4.05*	16.03	16.96	*−0.30*
Exclusion Criterion/Instruments									
Foreign-owned bank	0.15	0.17	*−1.21*	0.16	0.13	*1.35*	0.15	0.24	*−3.28*
ELG covered bank	0.82	0.79	*1.47*	0.82	0.84	*−0.94*	0.82	0.73	*3.20*
Other bank	0.02	0.03	*−0.43*	0.02	0.02	*0.04*	0.02	0.03	*−0.67*
Banks not lending	0.36	0.65	*−11.97*	0.38	0.61	*−7.23*	0.38	0.70	*−9.11*

Source: Authors' calculations using Department of Finance/RedC data.
Notes: (1) For binary variables, means tests are conducted using probability testing and z-statistics are reported. For continuous variables, t-tests of means are conducted and the t-states are presented.

IV ESTIMATION RESULTS

4.1 *SME Credit Constraints and Employment*

Our estimates of the employment levels equation are presented in Table 10. First, in column (1) we estimate a simple model including the firm controls. We control for the log of firm age, sectoral dummies, working capital/trade credit controls, the managerial capacity of the firm, whether or not the firm has missed debt repayments in the past six months, the log level of debt in the preceding six months, the log level of turnover, and whether the firm reported making a profit in the last six months. In all cases, the standard errors are cluster robust to heteroscedasticity. In column (2) we include the overall

Table 10: *Estimates of Effects of Constraints on Employment Levels –*
Instrumental Variables Analysis

	FGLS Column (1)	IV 2SLS Column (2) Constrained	IV 2SLS Column (3) Discouraged	IV 2SLS Column (4) Rationed
Ln age	0.043*	0.038	0.047*	0.049*
	(0.024)	(0.024)	(0.026)	(0.026)
Construction and real estate	−0.308***	−0.276***	−0.242***	−0.311***
	(0.070)	(0.074)	(0.086)	(0.074)
Wholesale and retail	−0.561***	−0.541***	−0.502***	−0.556***
	(0.057)	(0.060)	(0.068)	(0.061)
Hotels	0.423***	0.469***	0.500***	0.405***
	(0.074)	(0.079)	(0.088)	(0.079)
Other	−0.143**	−0.155**	−0.144**	−0.139**
	(0.062)	(0.064)	(0.070)	(0.066)
Receivables decreased	0.026	0.036	0.023	0.019
	(0.060)	(0.062)	(0.071)	(0.064)
Percentage trade credit/working capital	−0.001*	−0.000	0.000	−0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Managerial capacity	0.373***	0.366***	0.328***	0.357***
	(0.041)	(0.042)	(0.048)	(0.046)
Repayment problems	−0.176**	−0.073	−0.139	−0.277*
	(0.083)	(0.093)	(0.095)	(0.149)
Ln lagged debt	0.013***	0.016***	0.015***	0.010**
	(0.003)	(0.003)	(0.003)	(0.005)
Ln turnover	1.697***	1.632***	1.566***	1.700***
	(0.058)	(0.062)	(0.075)	(0.060)
Profit	0.121***	0.067	0.054	0.150***
	(0.039)	(0.045)	(0.049)	(0.054)
Credit constrained		−0.808***		
		(0.265)		
Discouraged borrowers			−1.873***	
			(0.626)	
Credit rationed				0.863
				(1.132)
N	2,320	2,306	2,306	2,306
R²	0.581	0.552	0.450	0.544
Instruments (1st stage estimated coefficients)				
ELG covered		−0.0187	0.014	−0.039 **
Other banks		0.0318	0.002	0.027
Banks not lending		0.1449 ***	0.068 ***	
Hansen/Sargan Test (p-value)		0.359	0.926	0.971

Notes: (1) Omitted sectoral control is manufacturing. Standard errors are cluster robust at the firm level.

constraints indicator and estimate the model using 2SLS methods. In columns (3) and (4) we separate constraints and include the indicators for discouraged borrowers and credit rationed firms separately, also estimated by 2SLS. The Hansen test of overidentifyng restrictions is undertaken and presented in the table. In all regressions, we fail to reject the null of instrument validity.

Focusing on the results in column (1), we find some evidence of a positive association between age and employment which is significant at the 10 per cent level. Such a positive relationship is in line with our expectations. There is considerable variation across sectors. We find that firms in construction and real estate and firms in wholesale and retail have significantly lower employment levels than firms in manufacturing. These effects are significant at the 1 per cent level. Firms with higher turnover and higher debt volumes have higher employment levels. Both of these variables are potentially picking up size factors. We also find that profitable firms have higher employment.

We find a positive and significant effect of improved management capabilities on employment levels; however, this result is not to be interpreted as directly causal. We also find that firms who missed debt repayments have lower levels of employment. This may indicate difficulties in debt sustainability running through into firms' real decision making. We find very little effect of the trade credit controls.

In column (2) the main constraint indicator is included. As noted, the instruments for this estimation are indicators for "ELG covered banks", "Other banks" and "Banks not lending". We find that it has a negative effect on employment that is significant at the 1 per cent level. This evidence clearly indicates that credit constraints are having a detrimental effect on employment in the Irish economy. Column (2) includes the indicator for discouraged borrowers. It is negative and significant at the 1 per cent level. This finding suggests that borrower discouragement is having a detrimental effect on the employment levels of SMEs. In column (3) we include the indicator for credit rationing. As noted in Section 3.3 above, we do not include "Banks not lending" as an instrument in this regression. We do not find an effect of this constraint on employment. Table 11 splits the credit rationing down by whether the application was for working capital or for expansion/investment purposes. Again we do not find an effect of either of these sub-indicators on employment.

In conclusion, we find a negative and significant effect of credit constraints on employment in the Irish economy. However, our evidence suggests that the effect of constraints is coming through borrower discouragement as opposed to actual credit rationing by banks. This is important from a policy perspective as interventions such as guarantee schemes and risk-sharing

Table 11: *Estimates of Effects of Constraints on Employment Levels –
Instrumental Variables Analysis – Sub Categories of Credit Rationing*

	IV 2SLS Column (1) Rationed	IV 2SLS Column (2) Rationed (Working Capital)	IV 2SLS Column (3) Rationed (Expansion)
Ln age	0.049*	0.058*	0.037
	(0.026)	(0.034)	(0.026)
Construction and real estate	−0.311***	−0.299***	−0.317***
	(0.074)	(0.076)	(0.080)
Wholesale and retail	−0.556***	−0.574***	−0.530***
	(0.061)	(0.063)	(0.078)
Hotels	0.405***	0.397***	0.432***
	(0.079)	(0.085)	(0.082)
Other	−0.139**	−0.145**	−0.121
	(0.066)	(0.067)	(0.078)
Receivables decreased	0.019	0.015	0.029
	(0.064)	(0.067)	(0.065)
% trade credit/working capital	−0.001*	−0.001*	−0.001
	(0.001)	(0.001)	(0.001)
Managerial capacity	0.357***	0.349***	0.359***
	(0.046)	(0.053)	(0.047)
Repayment problems	−0.277*	−0.323	−0.273*
	(0.149)	(0.213)	(0.162)
Ln lagged debt	0.010**	0.010*	0.011**
	(0.005)	(0.005)	(0.005)
Ln turnover	1.700***	1.713***	1.697***
	(0.060)	(0.066)	(0.059)
Profit	0.150***	0.178**	0.127***
	(0.054)	(0.087)	(0.042)
Credit rationing	0.863		
	(1.132)		
Credit rationing (working capital)		1.452	
		(2.004)	
Credit rationing (expansion)			1.592
			(2.363)
N	2,306	2,306	2,306
R^2	0.544	0.517	0.520
Instruments (1st stage estimated coefficients)			
ELG covered Banks	−0.039 **	−0.019	−0.022 *
Other banks	0.027	0.029	−0.013
Hansen/Sargan Test (p-value)	0.971	0.845	0.753

Notes: (1) Omitted sectoral control is manufacturing. Standard errors are cluster robust at the firm level.

policies are only effective where firms interface with a financial institution. For discouraged borrowers, as they do not apply for finance, a different approach is required. Information on lending opportunities, training to improve financial capacities and the development of a more diversified range of financing instruments for SMEs may be potential policy avenues to reduce borrower discouragement.

4.2 *SME Credit Constraints and Investment*

Table 12 presents the estimation results for the tests of constraints on the probability of a firm investing. In column (1), we report the results of a probit analysis on the likelihood of firms investing in our sample, independent of credit constraints. In an identical manner as our employment model, we include controls for the log of firm age, sectoral dummies, the managerial capacity of the firm, whether or not the firm has missed depth repayments in the past six months, the log level of debt in the preceding six months, the log level of turnover, and whether the firm reported making a profit in the last six months. Columns (2), (3) and (4) contain the results of the bi-variate probit analysis including the credit constraint variables. In column (2) we include the overall constraints indicator while in columns (3) and (4) we split the overall constraints indicator to separately include discouraged borrowers and credit rationed firms in columns (3) and (4) respectively. The exclusion restrictions are presented at the bottom of the table. We can see that "Banks not lending" is a significant restriction variable for discouraged borrowers and "ELG covered banks" is a significant factor influencing credit rationing. To test the robustness of these models, linear probability 2SLS models were estimated and the Hansen test for instrument exogeneity computed. In all cases, the tests deem the instruments valid with p-values in excess of 0.1.

Starting with column (1), we find that small- and medium-sized firms are more likely to undertake investment than micro firms by 11 and 26 per cent respectively, with these results significant at the 1 per cent level. Firms in the construction, wholesale and retail and hotels sectors are less likely to undertake investment than firms in the manufacturing sector. These results for the wholesale and retail and hotels sectors are significant at the 1 per cent level while the result for the construction sector is significant at the 5 per cent level. We also find that firms with superior management capacity, firms reporting a profit in the last six months and firms with higher turnover are more likely to undertake investment. These results are also all significant at the 1 per cent level. For the most part these initial results are in line with our expectations. We anticipate profitable firms, better managed firms and firms with higher turnover to be more likely to engage in investment. It is also unsurprising that firms in the construction and real estate, wholesale and retail and hotels sectors are significantly less likely to undertake investment

Table 12: *Estimates of effects of constraints on investment propensity - Bi-Probit treatment model*

	Probit		Bi-Probit	
	Column (1)	Column (2) Constrained	Column (3) Discouraged	Column (4) Rationed
Ln age	−0.008	−0.010	−0.008	−0.011
	(0.010)	(0.010)	(0.010)	(0.010)
Small	0.106***	0.089***	0.094***	0.100***
	(0.023)	(0.024)	(0.025)	(0.024)
Medium	0.260***	0.230***	0.247***	0.239***
	(0.029)	(0.031)	(0.030)	(0.032)
Construction and real estate	−0.072**	−0.068**	−0.067**	−0.077**
	(0.033)	(0.033)	(0.034)	(0.033)
Wholesale and retail	−0.097***	−0.096***	−0.092***	−0.106***
	(0.026)	(0.026)	(0.027)	(0.026)
Hotels	−0.096***	−0.082**	−0.090***	−0.093***
	(0.033)	(0.033)	(0.034)	(0.033)
Other	−0.046*	−0.056**	−0.049*	−0.057**
	(0.026)	(0.025)	(0.026)	(0.026)
Managerial capacity	0.051***	0.050***	0.048***	0.055***
	(0.018)	(0.018)	(0.018)	(0.018)
Repayment problems	−0.070*	−0.033	−0.062	−0.021
	(0.038)	(0.041)	(0.039)	(0.048)
Ln lagged debt	−0.002	−0.001	−0.002	−0.001
	(0.001)	(0.001)	(0.001)	(0.002)
Ln turnover	0.116***	0.103***	0.106***	0.116***
	(0.026)	(0.027)	(0.028)	(0.026)
Profit	0.058***	0.040**	0.050***	0.045**
	(0.017)	(0.018)	(0.018)	(0.019)
Credit constrained		−0.242***		
		(0.076)		
Discouraged borrowers			−0.205	
			(0.131)	
Credit rationed				−0.327**
				(0.154)
N	2,502	2,488	2,488	2,488
Exclusion criteria (constraint equation)				
ELG covered bank		−0.013	0.019	−0.032***
Other bank		0.008	−0.003	0.006
Banks not lending		0.136***	0.068***	
Hansen Test (p-value)				
(Linear 2SLS model estimate)	0.145	0.281	0.175	

Notes: (1) Omitted sectoral control is manufacturing. Standard errors are cluster robust at the firm level. (2) Hansen test calculated on instruments using a linear 2SLS probability model.

than manufacturing firms, given the differing outlooks for these sectors in Ireland.

Column (2) presents the results for overall constrained firms. The sign and significance for all control variables remain from column (1), apart for a weaker significance for the profit and hotel sector variables. Additionally, we find a negative and significant effect of being credit constrained on the probability of the firm undertaking investment. This finding is significant at the 1 per cent level.

Focusing on the components of credit constraints, in column (3) we find no effect of being a discouraged borrower on the probability of undertaking investment. In column (4), we find a significant and negative effect of being credit rationed on the likelihood of undertaking investment. This finding is significant at the 5 per cent level and indicates that the primary channel through which credit constraints impact on investment is through rejections of applications for finance and not discouragement from applying in the first place.

Table 13 splits the credit rationed variable between those firms which report being credit rationed for application for funding for working capital and those firms reporting being credit rationed for applications for funding for expansion of the business. Column (1) contains the results for the full credit rationed variable, column (2) the results for those firms rationed for working capital and column (3) the results for those firms rationed for credit for expansion. We find no effect of credit rationing for working capital on the probability of the firm undertaking investment. We do, however, find a negative and significant effect of rationing for expansion on the probability of a firm undertaking investment. This finding is significant at the 1 per cent level. These findings are in line with our expectations as rejection of applications for funding for working capital purposes are less likely to impact on investment decisions than rejections of credit applications explicitly earmarked for business expansion purposes. A rejected application for expansion funding is much more likely to curtail a firm's investment plans and lower the likelihood of that firm undertaking investment.

To sum up, we find a negative and significant effect of overall credit constraints on investment for Irish SMEs. Our findings suggest that the primary driver of this negative effect is credit rationing by banks and not borrower discouragement. Furthermore, and unsurprisingly, we find that it is credit rationing of funds for expansion that is driving the effect of constraints on investment. We find no effect of credit rationing for working capital funding on the probability of firms undertaking investment in the period.

Table 13: *Estimates of Effects of Constraints on Investment Propensity –*
Bi-Probit

	Column (1) Rationed	Column (2) Rationed (Working capital)	Column (3) Rationed (Expansion)
Ln age	−0.011	−0.009	−0.006
	(0.010)	(0.011)	(0.010)
Small	0.100***	0.106***	0.092***
	(0.024)	(0.023)	(0.023)
Medium	0.239***	0.259***	0.233***
	(0.032)	(0.031)	(0.030)
Construction and real estate	−0.077**	−0.073**	−0.070**
	(0.033)	(0.034)	(0.033)
Wholesale and retail	−0.106***	−0.097***	−0.115***
	(0.026)	(0.026)	(0.026)
Hotels	−0.093***	−0.098***	−0.102***
	(0.033)	(0.034)	(0.033)
Other	−0.057**	−0.048*	−0.061**
	(0.026)	(0.026)	(0.025)
Managerial capacity	0.055***	0.052***	0.051***
	(0.018)	(0.019)	(0.018)
Repayment problems	−0.021	−0.063	−0.016
	(0.048)	(0.054)	(0.040)
Ln lagged debt	−0.001	−0.002	−0.001
	(0.002)	(0.002)	(0.001)
Ln turnover	0.116***	0.116***	0.116***
	(0.026)	(0.026)	(0.027)
Profit	0.045**	0.056**	0.054***
	(0.019)	(0.022)	(0.017)
Credit rationing	−0.327**		
	(0.154)		
Credit rationing (working capital)		−0.066	
		(0.455)	
Credit rationing (expansion)			−0.473***
			(0.068)
N	2,488	2,488	2,488
Exclusion Criteria (Constraint Equation)			
ELG covered banks	−0.032***	−0.011	−0.019**
Other banks	0.006	0.032	−0.022
Hansen Test p-value (Linear 2SLS model estimate)	0.175	0.431	0.102

Notes: (1) Omitted sectoral control is manufacturing. Standard errors are cluster
robust at the firm level. (2) Hansen test calculated on instruments using a linear 2SLS
probability model.

V CONCLUSIONS

The existing literature has established a role for credit constraints in investment and employment decisions in the United States (Duchin *et al.*, 2010). We expand this analysis to Ireland. We find a negative and statistically significant effect of discouragement on employment growth. In light of this, policy measures that encourage discouraged borrowers to apply for credit and use such capital productivity should thus be supportive of employment in the SME sector.

On the link between SME credit constraints and investment, we find a negative and significant effect of being credit rationed for funding for expansion purposes on the likelihood of a firm undertaking investment. From a policy perspective, this negative effect suggests that there is a willingness to invest amongst a portion of Irish SMEs that is currently being constrained by a lack of access to credit. We would thus expect that policy measures aimed at easing the flow of credit to this subsection of Irish SMEs would have a positive effect on the aggregate level of investment in the Irish SME sector.

Looking to future economic recovery, SMEs will almost certainly require additional capital for expansion as the economy grows and a more positive outlook develops. In such a scenario, a lack of credit and binding credit constraints could pose an even more serious impediment to growth. Careful monitoring of the prevalence and impact of credit constraints will therefore remain crucial as the recovery progresses. Additional measures to broaden and deepen the financing mix available to Irish SMEs can facilitate a weaning off of these SMEs from their dependence on bank credit while also serving to mitigate the risk of heightened constraints when faced with bank-lending shocks.

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ANNEX

A1 *Additional Summary Statistics*

Table A1: Means of Controls

	ln(age)	*Receivables Decreased*	*Trade Credit Percentage of Working Capital*	*Management Capacity*
Overall	3.03	0.11	15.84	0.57
By size:				
Micro	2.92	0.12	16.58	0.40
Small	3.08	0.11	15.54	0.61
Medium	3.14	0.08	15.04	0.83
By age:				
< 2 years	0.00	0.14	17.60	0.64
3-5 years	1.10	0.12	13.66	0.60
5-10 years	2.05	0.10	15.17	0.61
11-20 years	2.75	0.11	16.58	0.56
20+ years	3.65	0.10	15.73	0.57
By sector:				
Manufacturing	3.24	0.13	16.56	0.62
Construction and Real Estate	3.04	0.12	16.77	0.52
Wholesale and Retail	3.14	0.11	19.28	0.51
Hotels	2.74	0.05	17.11	0.63
Other	2.93	0.11	11.54	0.63
	Repayment Problems	*ln (Lagged Debt)*	*ln (Turnover)*	*Profit*
Overall	0.07	7.81	1.48	0.44
By size:				
Micro	0.10	6.76	1.11	0.35
Small	0.05	8.15	1.63	0.45
Medium	0.04	9.19	1.91	0.59
By age:				
< 2 years	0.04	5.34	1.10	0.11
3-5 years	0.07	7.51	1.39	0.43
5-10 years	0.06	7.81	1.41	0.52
11-20 years	0.08	7.52	1.40	0.45
20+ years	0.06	8.05	1.56	0.42
By sector:				
Manufacturing	0.05	8.26	1.66	0.48
Construction and Real Estate	0.07	7.06	1.42	0.37
Wholesale and Retail	0.06	8.09	1.51	0.40
Hotels	0.12	9.48	1.47	0.43
Other	0.07	7.10	1.42	0.50

Source: Authors' calculations of Department of Finance/RedC Survey Data.

Table A2: *Mean Comparison Tests of All Variables (Constrained to Unconstrained Groups) – Sub-Groups of Credit Rationed Firms by Working Capital and Expansion Applications*

	Credit Rationing (Working Capital)			Credit Rationing (Expansion)		
	No	*Yes*	*T/Z Value*	*No*	*Yes*	*T/Z Value*
Main Dependent Variables						
Investment	0.28	0.10	4.54	0.27	0.27	–0.17
Ln employees	2.65	2.23	3.99	2.64	2.52	0.98
General Firm Characteristics						
Ln age	3.04	2.83	2.58	3.03	3.09	–0.70
Hotels	0.11	0.16	–1.75	0.11	0.13	–0.49
Manufacturing	0.12	0.12	0.05	0.12	0.19	–1.95
Other	0.11	0.07	1.56	0.11	0.06	1.75
Wholesale and Retail	0.32	0.35	–0.59	0.33	0.24	1.92
Construction and Real Estate	0.11	0.10	0.33	0.11	0.16	–1.56
Medium	0.23	0.11	3.32	0.22	0.18	1.13
Small	0.38	0.41	–0.65	0.38	0.42	–0.79
Micro	0.39	0.48	–2.18	0.39	0.40	–0.17
Controls for Firm Quality/Risk						
Managerial capacity	0.58	0.60	–0.50	0.58	0.59	–0.24
Repayment problems	0.06	0.27	–9.35	0.07	0.20	–4.90
Profit	0.45	0.19	5.94	0.44	0.39	0.96
Receivables decreased	0.11	0.13	–0.85	0.11	0.13	–0.65
Ln turnover	1.49	1.35	3.11	1.48	1.48	0.02
Ln lagged debt	7.68	10.60	–6.65	7.72	10.14	–4.13
% trade credit/working capital	15.74	22.58	–2.29	16.03	16.96	–0.30
Exclusion Criterion/Instruments						
Foreign-owned bank	0.15	0.20	–1.60	0.15	0.27	–3.14
ELG covered bank	0.82	0.77	1.59	0.82	0.71	2.78
Other bank	0.02	0.03	–0.51	0.02	0.02	0.20
Banks not lending	0.39	0.72	–7.78	0.39	0.71	–6.34