Innovation, SMEs and the liability of distance: the demand and supply of bank funding in peripheral UK regions

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Innovation, SMEs and the liability of distance: The demand and supply of bank funding in peripheral UK regions

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Abstract

This paper considers geographical variations in the demand and supply of bank finance for innovative firms in the UK. It uses a detailed survey on the finances of almost 40,000 UK Small and Medium Sized Enterprises for 2011 – 2013 to investigate both the extent and type of applications for bank finance by innovative firms in peripheral regions, whether funders accept their applications and whether acceptance rates reflect objective criteria, such as credit scores, or their location. The paper finds evidence of higher demand for bank finance for innovative firms in peripheral areas, but that these firms are more likely to be discouraged from applying. However, there is strong evidence that innovative firms in peripheral regions are more likely to have their applications for finance rejected, even when controlling for factors such as credit score. The findings suggest that geography matters in the financing of innovative firms and firms in peripheral areas may suffer a "liability of distance" which potentially reinforces regional disparities. The implications of these findings for public policy are outlined.

Keywords: Finance; SMEs; Innovation; Thin Markets; Peripheral Regions

JEL: M13; 031; R30

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1. Introduction

There is increasing interest in the relationship between innovation, the financial system and economic growth (King and Levine, 1993; Mazzucato, 2013). A number of studies have considered whether the financial system properly supports innovative firms (Freel, 2007; Mina, Lahr, & Hughes, 2013; Lee, Sameen, & Cowling, 2015). Information asymmetries, the cost and difficulty of valuing intellectual property (IP), or the erratic returns to innovation may all discourage potential investors and make innovative firms reliant on a smaller number of financial providers. Economic geographers meanwhile have suggested that the availability of finance is embedded in wider processes of uneven development (Hall, 2013). While the financial system in the UK is increasingly geographically concentrated in London and a few secondary cities (Marshall et al., 2012; Wójcik & MacDonald Korth, 2015), firms in peripheral regions face a challenge in accessing finance, as they may be distant from the key institutions which offer it. Yet relatively little research has considered the relationship between these two issues: does geography matter for the financing of innovative firms?

There is good evidence on the uneven geography of *equity* finance, such as venture capital (VC) or stock markets (Martin et al, 2002; Martin et al, 2005; Clark, 2005; Mason and Pierrakis, 2013; Wójcik, 2011). However, less research has considered how *debt* finance varies geographically, although the empirical literature suggests that this too has its own particular geography (Alessandrini et al, 2009a; 2009b; 2009c). While traditionally small business finance was thought to be a local "close-knit affair" (DeYoung et al, 2008, 114), over the past few decades the distances between small business and bank lenders has increased markedly (Petersen and Rajan, 2002; Degryse and Ongena, 2005). During this time, banking has undergone significant changes. Amongst the most significant have been changes in the set of "lending technologies" used by banks to evaluate lending decisions.[3] As Udell (2015) sets out, there are a variety of potential ways in which banks can evaluate borrowers, each of which has its own information requirements. Traditional relationship lending, based on long-term engagement between bank and applicants, has been declining relative to new lending technologies reliant on automated decision making (Berger and Udell, 2006). Relationship lending was more likely to be based on "soft" information and the bank's understanding of the applicant's business model whereas newer lending technologies tend to be based on "hard" information such as balance sheet information or credit scores (Udell, 2015).

The economic geography of the UK's banking system has also been changing, as a response to new technology, institutional change and the global financial crisis (GFC). Work on the changing

[3] A lending technology is defined by Berger and Udell (2006, p. 2948) as the "unique combination of the primary source of information, screening and underwriting policies/procedures, structure of loan contracts, and monitoring strategies".

nature of banking systems has highlighted two key changes which may have spatial implications for lending behaviour in banks (Berger and Udell, 2002; Alessandrini et al., 2009b). First, the "operational distance", the proximity between bank branches and borrowers, has increased. Secondly, the "functional distance" between a bank's branches and a bank's headquarters has also increased. The more hierarchically organized and distant (both physically and culturally) banks are from local economies, the more problematic are channels of communication (Berger and Udell, 2002; Stein, 2000; Scott, 2004). While these processes have been extensively analysed in the Italian context (Alessandrini et al., 2009b), little work has examined these changes in the UK.

However, the interaction of these two factors – the increased reliance on 'hard information' in bank lending decisions and the changing geographical structure of the banking industry – present a challenge for innovative firms in UK peripheral regions. Asymmetric information between firm and financier has long been seen as a problem for innovative firms seeking finance (Mina et al. 2013). Innovative firms in peripheral regions may face a number of additional challenges. First, as bank-lending decisions become less based on local discretion and more on hard sources of information (Agarwal and Hauswald, 2010), innovative companies in peripheral regions may be distant from decision makers, and so simply perceive themselves as less likely to access finance than those elsewhere. Second, as they are less able to access the relatively geographically clustered markets for equity finance, firms in peripheral regions may actually be more reliant on bank lending than firms elsewhere. And finally, the combination of increased demand due to lack of alternatives and lower supply may mean that applications for finance from peripheral innovators may be more likely to be rejected.

These firm level phenomena underpin theory in economic geography which considers interactions between finance flows and peripherality. As Hall (2013, 286) argues: "Financial circuits and flows are grounded in, produced by and thoroughly entangled with wider economic geographies beyond the inter-national financial system." The literature on financialization suggests that the supply of capital will have increasing impact on the actions of firms (Dore, 2008). As capital markets are disembedded from local economies, flows may begin to both reflect and reinforce growing unevenness between places (French et al, 2009; Pike & Pollard, 2010). Capital flows may become 'sticky' (Clark, 2005) with finance clustering in certain core regions, rather than spreading to where returns are the greatest. Geographical distance will also reflect other forms of proximity, such as cognitive, organisational or institutional, which may all serve to create geographical unevenness in financial markets (Wójcik, 2011). This leads to a significant concern: innovative firms in peripheral regions may find it harder to access finance, and this may then potentially reinforce disparities.

To date little research has considered the availability of bank finance for innovative firms in peripheral UK regions. This is an important omission as research typically finds innovative firms to have more restricted access to credit than typical SMEs in the UK (Freel, 2007; Lee et al, 2015). This paper addresses this gap with an analysis of the demand and supply of finance for innovative SMEs in peripheral areas of the UK. Given its banking system is notoriously "thin and centralized" (Degryse et al, 2015, 28), the UK provides an excellent context for this research (see also Martin et al, 2005; Gardiner et al, 2013), particularly given evidence that the spatial concentration has been increasing since the financial crisis of 2007/8 (Wójcik & MacDonald Korth, 2015). We use a large, high quality dataset on the finances of almost 40,000 SMEs which contains excellent firm level information, including credit scores and postcode areas in which the firm is based. We then use a series of regression models, controlling for selection effects where appropriate, to address the following research questions:

(1) Are there differences in the *demand* for finance, measured either through (i) applications or (ii) discouragement, for innovative firms in peripheral regions?
(2) Are there differences in the *supply* of finance for innovative firms in peripheral and non-peripheral regions?

This study makes a number of contributions to the literature on the geography of banking and finance. Despite multiple claims to its importance (e.g. Pollard 2003; Pike & Pollard, 2010), the relationship between firm financing and patterns of uneven development has been "largely overlooked" (Hall, 2013, 286). To our knowledge, this is the first attempt to investigate the geography of both demand and supply of bank finance for innovative firms in a single paper. The paper is also among the first to consider the financing of innovative firms in the regional context (Coronado, Acosta, & Fernández, 2008; Alessandrini et al, 2009b), and the first to do so in the UK.

The research reported also has important implications for government policy. Following the recent establishment of the British Business Bank some policy makers have proposed a network of regional banks as a potential solution to the presumed lack of finance in peripheral regions (van der Schans, 2015). The Scottish Government are already in the process of establishing a Scottish Business Development Bank to support innovative SMEs with high growth potential (Scottish Government, 2015). Yet the evidence base for such interventions is weak and past efforts to increase the supply of specialised finance in peripheral regions have typically resulted in limited success (Mason and Harrison, 2003; Martin et al., 2005; Nightingale et al., 2009; Lerner, 2010; Grilli and Murtini, 2014).

The paper is structured as follows. Section two reviews the literature and develops a set of hypotheses to test. Section three describes the dataset and presents the empirical model. Section

four considers both demand for finance and rejection rates, a measure of supply. Section five tests whether our results apply to lagging regions. Section six concludes with a discussion of the implications for theory and policy.

2. Finance, geography and innovative firms

Financing innovative firms

Since Schumpeter highlighted the role of finance in innovation (Schumpeter, 1939), researchers have considered the importance of the supply and demand of finance in enabling innovative firms to grow (e.g. Freel, 2007; Mazzucato, 2013; Mina et al., 2013). Research suggests a number of reasons why innovative firms may find it harder to access finance than less innovative firms. Innovation is "essentially a speculative process" (Freel, 2007, p. 23) which involves "a bet on the future, and most attempts fail" (Mazzucato, 2013, p. 851). While some firms achieve large returns from innovation, many others fail to benefit (Coad & Rao, 2008). As a result, financiers may be reluctant to invest, particularly those who are dependent on debt repayment rather than equity stakes. In addition, innovations can often involve expenditure on unrecoverable sunk costs, reducing the collateral required by some lenders (O'Brien and Folta, 2009). Finally, there may be information asymmetries between providers of finance, especially small innovative informationally opaque SMEs (Colombo and Grilli, 2007). Finance providers reliant on 'hard' information such as credit scores and balance sheet data may be unwilling to accept 'soft' information such as a new business plan. The result may be that innovative small firms cannot obtain the external finance they need. Yet the counter argument is that innovative firms will offer greater returns, be more attractive to specialist VC funders and so find it easier to find finance.

Unsurprisingly, given these contrasting arguments, the evidence on whether a finance gap exists specifically for innovative firms is quite mixed. Freel (2007) finds small innovative firms who apply for finance are less likely to receive it than others. Lee et al. (2015) similarly find that innovative SMEs in the UK are more likely to be turned down for finance but, while their chances of rejection worsened in the recession, it improved relative to other firms. In contrast, in a nuanced, comparative study of larger firms Mina et al. (2013) found that innovative firms find it no harder to access finance in the UK than other firms, but actually easier in the US. Their results differ according to the measure of innovation used. Hain and Christensen (2013) find that incremental innovators are able to access the finance they need, yet firms which introduce radical innovations or technology-based innovations are often credit rationed. Others have suggested that process innovation, which often requires substantial levels of capital investment, will also require recourse to external finance (Hall and Khan, 2003).

Demand and supply of finance in peripheral regions

Despite a vast literature on access to finance for small firms, until quite recently relatively little research has considered how it varies spatially. Economists have tended to assume no friction of distance between places and so no spatial variation in access to finance (Dow & Rodríguez-Fuentes, 1997). Indeed, when contextualising firm finance all too often the literature treats firms as "placeless entities" (Pollard, 2003, pp. 440) despite the fact that "financial systems are inherently spatial" (Mason, 2010, pp. 167). Economic geographers on the other hand have highlighted the potential problem of the UK's highly spatially concentrated markets for small firm equity, and suggested that this may lead to a problem for firms seeking external finance (Klagge and Martin 2005). A number of commentators have suggested that firms outside London and the South East of England may find it harder to obtain finance and that this problem, in turn, exacerbates regional disparities (Cox and Schmueker 2013).

There are essentially two positions on the existence of regional finance gaps. The first is that location does not matter and technology has rendered location unimportant (Petersen and Rajan, 2002). Lending technologies such as computerised credit scoring and other automated systems may make face-to-face contact a less significant part of the financing decision (Beck and Demirguc-Kunt, 2006; Berger and Udell, 2006). Banks will see geography as unimportant and focus only on apparently objective balance sheet activity. 'Mundane' finance from banks is, if this view is correct, unlikely to vary spatially.

A second view is that geography fundamentally shapes the financing of innovative firms. The literature on financialization provides strong evidence that finance capital does not flow automatically to the most profitable firm, but rather reflects other factors. In explaining this tendency, Clark (2005, pp. 106) amongst others has used the metaphor of Mercury to describe money, arguing that it "runs together" - accumulating in pools rather than being evenly spread. Wójcik (2011) shows that firms near financial centres are more likely to offer equity on stock markets than those elsewhere. One reason for this might be the tendency for institutions providing finance to focus on specific geographical areas. Such patterns became clear in the 2008 financial crisis where, faced with a complex and opaque financial system (Christophers, 2009), a 'herd instinct' led banks to follow similar strategies to each other, seeking short-term profit (Marshall et al. 2012). The result is that the capital market is not efficient, with finance flowing readily to some areas (classically, Silicon Valley) even as similar firms are unable to fund themselves in more disadvantaged regions. In contrast to a view of financial markets as being efficient allocators of capital, this position suggests that the lending decisions of banks are embedded in wider geographical structures which shape which firms receive the capital they seek. Rather than being objective, the lending technologies used by banks are part of a complex system aimed at accumulation - and these processes will have their own geographical implications (Christophers, 2014; Ashton and Christophers, 2015).

Indeed, it might be that changes in lending technologies have made it harder for firms in peripheral areas to access finance as banks have moved from relationship banking, based on long-term engagement and localized discretion, to automated and computerized lending decisions based on "hard information" on the actual financial performance of the firm (Udell, 2015). Research in the US has found that distance erodes a lender's ability to collect soft proprietary intelligence (Agarwal and Hauswald, 2010). For innovative firms in peripheral regions, such changes may create problems. Rather than discussing new product development with a local decision-maker who then decides the potential for repayment, innovative firms may face the challenge of obtaining finance based primarily on the calculation made by the bank of their ability to repay, rather than the potential of their innovation to achieve growth. These issues may be compounded by a lack of autonomy amongst local bank branches, along with the characteristics of staff in peripheral areas. In his study of bank lending in rural New Zealand, Perry (1988) argued that staff in these areas were exposed to fewer types of lending decisions and, partly as a consequence, were less able to deal with non-standard applications and given less autonomy to do so. While they may have access to banks, distance from the core areas may make it harder for applicants to access the right sort of banking provision.

A further explanation comes from the literature on the 'spatial fix' of finance (Sokol, 2013). In this case, finance flows to the most profitable location, regardless of the consequences for other regions. In this case, finance may flow to those regions where it is already available and abundant, as credit scores will be better, collateral may be more apparent or firm balance sheets will be healthier. This may be a rational act, but it will have consequences for regional development as banks focus on: "financial returns above producing sustainable economies in peripheral regions" (Hall, 2013, 288). The UK context may make this process particularly acute. The 1990s saw period of de-mutualisation of previously locally embedded building societies in the UK (Marshall et al. 2012). Finance then becomes an integral part of the processes reinforcing uneven economic geographies (Pollard, 2003; Pike & Pollard, 2010).

These theoretical channels may have a two-way relationship with local cultural and institutions.[4] For example, the nature of entrepreneurial culture is seen as important for explaining variations in start-up rates (Huggins and Thompson, 2014a) and networks are important in the sharing of knowledge about business success (Witt, 2003; Huggins and Thompson, 2014b), the so-called "network success hypothesis" (Brüderl & Preisendörfer, 1998). These effects may both discourage and reduce the success of applications from entrepreneurs in peripheral regions where these factors are more anaemic. Thus, innovative firms in peripheral regions may be less likely to be aware of specialised financiers or financial alternatives (Seghers, Manigart, & Vanacker, 2012) as they have fewer peers who have accessed finance (Wójcik, 2011). They may also have less

[4] We are grateful to a referee for this point.

contact with financiers based in core regions. Conversely, local cultures of debt or equity finance may develop among groups of entrepreneurs in more dynamic areas (Wójcik, 2011,). This corresponds with the 'embeddedness' view of finance where these kind of social relations and networks heavily shape "who gets credit and what that credit costs" (Uzzi, 1990, 502).

These theoretical perspectives seem to be supported by empirical evidence. Alessandrini et al. 2009c, for example, find clear evidence of a spatial relationship between credit availability and peripheral regions. Their analysis conducted during the period 1996-2003, found that greater functional distance has accentuated financing constraints in firms. These adverse effects are particularly evident for small firms located in the southern Italian provinces (Alessandrini et al. 2009c). A further study examining credit availability in Italy found a similar picture during a different time period, 2001-2008, and noted a strong reliance on internal funds for peripheral SMEs (Donati and Sarno, 2015). Similarly, research in Belgium found that loan rates "decrease with the distance between the firm and the lender" as a consequence of greater transportation costs (Degryse and Ongena, 2005, 262). Research in the US also shows that both distance and credit scoring are associated with higher default probabilities (DeYoung et al, 2008). Some studies do report results to the contrary: for example, Carling and Lundberg (2005) analysed lending by Swedish banks and found no evidence of geographical credit rationing. Overall the findings from empirical studies show a fairly consistent picture of geographical variation in either the demand or supply of finance, suggesting a bias against firms in remote areas.

There are limitations within this existing literature however. First the majority of the evidence is based on data from the Italian banking sector (Alessandrini et al. 2009c; Donati and Sarno, 2015). At present empirical evidence from other centralised banking systems is lacking. It makes it hard to know whether these "distance effects" are applicable in countries like the UK. Second, most work treats SMEs as a singular classification rather than differentiating between those who are innovative and non-innovators. Yet, going back to Schumpeter's core thesis (1939) a considerable body of work has shown that innovative growth-oriented SMEs are much more likely to contribute to regional development than less dynamic ones (Coad and Rao, 2008; Mason and Brown, 2013). This is important because existing research suggests a lack of credit significantly hinders both product and process innovation in Italian SMEs in peripheral regions (Alessandrini et al. 2009b). Third, most of these studies use data from before the GFC. During times when there are sharp reversals of capital flows, some scholars have speculated that there may be a "flight to quality" whereby banks contract credit to smaller and/or riskier firms (Popov and Udell, 2012; Cowling et al, 2012). However, recent evidence examining Italian manufacturing firms by Presbitero et al (2014) discovered that rather than a flight to quality there appears to be a "home bias" on the part of distantly headquartered banks. Financially healthier firms were

affected more in functionally distant credit markets, corroborating earlier pre-GFC work (Alessandrini et al, 2009b; Donati and Sarno, 2014).

A final limitation of the literature on small business funding is a lack of theoretical development around the issue of debt finance and geography. Scholars have conceptualised similar spatial processes for equity finance using the concept of "thin markets" (Nightingale et al, 2009). Thin markets arise when "limited numbers of investors and entrepreneurial growth firms within the economy have difficulty finding and contracting with each other at reasonable costs" (Nightingale et al, 2009, 5). The authors highlight this problem with regard to public VC investments in peripheral regions of the UK. In these environments "thin-markets" make it expensive for specialist investors and entrepreneurs to find each other outside of the core regions of the UK. The process can be cumulative: search costs are higher outside core areas, and so financiers are discouraged from looking; those providers of finance in peripheral areas which remain are less likely to specialise in financing innovative firms; they tend to focus on less resource-intensive early stage finance; and do not develop the appropriate specialisms to fund them. Clearly, these arguments apply primarily to equity, rather than bank, finance. But if it is hard to obtain equity finance in peripheral areas, or if awareness of these finance types is lower, firms may be forced to choose less suitable finance – i.e. innovative peripheral firms may make applications to banks as they lack access to equity finance.

Hypothesis Development

Taken together, the limitations within the literature point to the need for more empirical work and theoretical development around the issue of credit availability within innovative SMEs since the GFC. Building on the omissions identified, three testable hypotheses can be developed. The first is that innovative firms in peripheral regions may be discouraged from applying for finance. In their classic paper on discouragement, Kon & Storey (2003) develop a model where there are good and bad firms and there is a cost (financial, time or "psychic") which dissuades firms from seeking external sources of funding. In the context of asymmetric information and the knowledge that they lack the track record or collateral to successfully apply, some firms will be discouraged from borrowing. However, Freel et al. (2012) use a large sample of over 9,000 firms but find no statistically significant evidence that innovative firms are more likely to be discouraged. However, if the ability to obtain financing is embedded in local cultures or networks, and entrepreneurs believe that financing is harder to obtain in their location, it might be that cultures of discouragement develop. From this, the first hypothesis is:

> H_1 Innovative firms in peripheral regions are more likely to be *discouraged* from applying for bank finance than non-innovative firms or innovative firms elsewhere

Second, supply side issues may simultaneously make bank finance even more important for innovative firms in peripheral regions than those elsewhere (Klagge and Martin 2005). The classic explanation of the firm financing decision is the 'pecking-order' theory of finance (Myers and Majluf, 1984). To avoid losing control of a business, this theory suggests firms will choose first to use internal finance, then debt finance and will only reluctantly use equity finance as a last resort (Frank and Goyal, 2003). While this principle seems to hold for larger firms it does not always apply to smaller firms. Due to information asymmetries, small firms "do not seem to follow a pecking order" of preferences (Vanacker and Manigart, 2010, 55), as investors perceive them to be 'riskier bets'. This will be particularly true for small firms who have untested technologies or IP as their core source of competitive advantage. In these particular cases, the pecking order may be reversed with firms' first seeking equity funding and then seeking other forms of funding. In the absence of VC funding firms may turn to general lenders such as banks. Therefore, innovative firms in peripheral regions faced with 'thin markets' for equity funding may thus be pushed towards bank finance even if other forms of finance are more suitable. This is the second hypothesis:

> H_2 Innovative firms in peripheral regions are more likely to *apply* for bank finance than non-innovative firms or innovative firms elsewhere

The third potential effect is that it may be harder for innovative firms in peripheral regions to access bank finance – a case of regional finance gaps. As set out above, the literature on economic geography of finance suggests a number of reasons why this might be the case. The value of specialist IP and/or business models may not be immediately obvious to these providers of finance, a problem exacerbated by a lack of deal flow from innovative firms. It might also be the result of banks having a focus on repayment of loans, rather than firm growth, and so being less willing to lend to companies introducing new innovations. These factors will be compounded by a scarcity of specialist financiers and banking organisations which lack the knowledge of how to value innovations (Nightingale et al., 2009). The potential result is that firms in peripheral regions are unable to access equity markets (Wójcik, 2011), and so make less suitable applications for bank finance instead. Cultural factors or a lack of local networks might also reduce the quality of applications. Meanwhile, regions with higher house prices and so collateral may make loans more attractive to banks. So innovative firms in peripheral regions may find it harder to persuade distant banks that loans and overdrafts are repayable, increasing rejection rates. Evidence from Italy suggests that due to bank consolidation the geographical concentration of decision making within banks has increased the functional distance of the banking system from local communities, making access to credit for "informationally opaque firms in peripheral regions still harder" (Alessandrini et al, 2009b, 303). Building on this, a third

hypothesis suggests that innovative firms in peripheral regions may face particular credit constraints:

> H_3 Innovative firms in peripheral regions face higher *rejection rates* for bank finance than non-innovative firms or innovative firms elsewhere

3. Data and methodology

Data

To investigate geographical variations in financing patterns for innovative firms this paper uses the UK Small and Medium Sized Enterprise Finance monitor survey (UKSMEF) from Q1 2011 – Q3 2013 (BDRC Continental, 2014). This is a large cross sectional survey which gives comprehensive information on firms, their balance sheets and financial history, applications for finance, and the success of these applications and costs of financing. It is conducted by BDRC Continental and the data is made available through the UK Data Archive. The survey had a quota for size (with firms having between 1 – 249 employees), sector and region. Enterprises needed to have a turnover of less than £25million, be a for-profit enterprise and not be more than 50% foreign-owned. To focus on established firms we exclude firms with zero employees. The turnover of £25 million is slightly smaller than the EU's definition of SME (Verheugen, 2005), but weights are used to make the results representative of the business stock of this size.

The key strength of the data is that it has information on both demand for bank finance and whether firms successfully obtain it, so developing on other studies which investigate only aggregate lending (e.g. Henry et al, 2014). It also has a strong set of control variables, including firm characteristics, location and finances. A significant strength is that the data includes credit ratings: as is standard, firms are sampled via a database of companies kept by credit rating agency and the credit score is kept along with the firm ID. This means that the credit scores used in the data are the same as those used by banks to evaluate loans. Policymakers, including the Bank of England, now use the data to test UK credit conditions (e.g. Bank of England, 2015).

Model and estimation strategy

Demand for bank finance

Following Mina et al. (2013) we investigate both the demand and supply of finance for innovative firms using a probit model and, where appropriate, a Heckman correction for selection effects. Our approach begins with an investigation into the demand for bank finance (for similar applications see Fraser 2009; Lee & Drever 2014). The basic model here is one where DFIN is a measure of whether a firm applies for finance in a given period:

$$DFIN_i = \alpha + \beta_1 FIRM_i + \beta_2 FINANCE_i + \beta_3 GEOGRAPHY_i + \beta_4 WAVE_i + \varphi + \varepsilon \quad (1)$$

Where FIRM is a set of variables for the characteristics of the firm, such as size, sector and age. FINANCE controls for the credit score and balance sheet of the firms and whether they have had issues paying previous debt. GEOGRAPHY is one of two variables for the location of the firm. WAVE is a control for the survey wave in which the firm was sampled. "φ" is a sectoral dummy variable. The constant is "α" and "ε" is the error term.

The UKSMEF has data on two sources of bank finance: loans and overdraft. It also gives information on discouragement, and whether firms do not apply because they believe applications will not be successful (Han et al., 2009; Kon & Storey, 2003). In this case, we follow the official statistics and define those who are discouraged as those who do not apply for finance because they do not trust banks or think they will be turned down (BDRC, 2014). These three variables – applications for loans, overdrafts and discouragement – are the key measures of demand for bank finance.

Supply of finance

While equation 1 gives an indicator of the demand for bank finance, the second question is the extent to which supply differs across geographical locations. This is given as equation 2.

$$SFIN_i = \alpha + \beta_1 FIRM_i + \beta_2 FINANCE_i + \beta_3 GEOGRAPHY_i + \beta_4 WAVE_i + \varphi + \varepsilon \quad (2)$$

Controls are as before. The basic indicator of supply of finance is whether firms are successul in the applications for either bank loans or overdrafts. However, the likelihood of a firm being rejected for finance is conditional on their probability of applying for it. Because of this, we also estimate this model using the common Heckman selection approach (for applications see Fraser, 2009; Mina et al., 2013; Lee & Drever, 2014).

Variables and definitions

Defining innovative firms

Studies suggest that the success of firms in accessing finance depends on the type of innovation (Hain and Christensen, 2013). Our definition of innovation is whether firms have introduced a new product or service in the past 3 years. This is similar to the measure used by Lee et al (2015) in their study of access to bank finance in the recession and one incorporated in the study of Mina et al. (2013). This is also broadly consistent with the definition of product innovation used within the Community Innovation Survey (Hashi, & Stojcic, 2013).[5]

Defining 'peripheral regions'

[5] Innovations are new to the firm, rather than new to the market. Note that we also experiment with an alternative, broader measure of innovation: "Whether firms have significantly improved an aspect of the business" with similar results.

No single definition of "peripheral" exists. Our measure of peripheral regions is developed from the European Spatial Planning and Observation Network (ESPON) Multimodal accessibility statistics (ESPON, 2009). We use the multimodal accessibility index, calculated using the total population of other European regions, but weighted according to travel time using road, rail and air. This means that rather than being a simple measure of proximity to London, the indicator presents a more detailed picture of accessibility. Areas near London tend to score highly, but so do places such as Manchester and Birmingham which combine air accessibility with good rail and road links. The statistic is indexed relative to the EU average with 100 being the average level of accessibility. These are defined as NUTS regions, whereas the UK SME Finance Monitor contains data at a postcode area level. To address this, we calculate a weighted average accessibility index for each postcode area, based on share of postcode units (a good proxy for population size) across each area. We then define 'peripheral regions' as those in bottom ten percent in the UK. This methodology gives us a sub-set of areas mainly in the South West of England, Northern Scotland the Islands and North Wales (see Figure 1 below).[6] Note that one limitation of this is that it is based on 2006 data, although it is highly unlikely that changes since will significantly affect the results. This is the most robust indicator possible and has the significant advantage of being multimodal rather than being based on a single mode of transport. We also consider an alternative measure of peripherality in the robustness tests with little change to the main results.

Insert figure 1 around here

Control variables

A series of controls are used to account for other factors which may influence both demand and supply of bank finance. Summary statistics and variable definitions are given in table 1.

Insert table 1 around here

First we consider firm size and age. Size can be measured in a number of ways, but in an effort to avoid endogeneity with loan size, total employment is used here. This is given in six employment size categories: 1 – 9; 10-49; 50 – 99; 100 – 199 and; 200 – 249. Age is also considered. An unweighted 10 percent of the sample are 'start-ups' defined here as being two years old or younger. The other categories are 2 – 5 years old, 6 – 9 years, 10 – 15 years with the largest

[6] The postcode areas included are: Carlisle (CA), Dumfries and Galloway (DG), Dorchester (DT), Exeter, the Outer Hebrides (HS), Inverness (IV), Kilmarnock (KA), Orkney (KW), Northern Lancashire (LA), Llandudno (LL), Perth (PH), Plymouth (PL), Taunton (TA), Galashiels (TD), Torquay (TQ), Truro (TR) and Shetland (ZE).

category being older than 15 years. Categories are used in this case for two reasons: to identify potential non-linearities and to avoid collinearity with other variables.

Legal structure may determine the extent to which banks are willing to lend. We control for four types of structure: sole proprietorship, partnership, limited liability partnership and limited liability company. Note that "not for profits" are not included in the survey.

Finally, we include a variable for the growth ambition of the firm. This takes the value one if respondents say they want to grow substantially or moderately when asked about their ambitions for the firm. Firms which aim to grow will be more likely to be applying for bank finance for investment, rather than working capital. They may also be more likely to be innovative.

Four variables are included for the finance of the firm. The first two are dummy variables for whether the firm has made a profit or a loss in their most recent trading period (the reference category is whether firms have broken even). A control is also used for past financial problems (Armstrong et al. 2013). This takes the value 1 if a firm has missed a loan repayment, an unauthorised overdraft, bounced cheques or used the government's "Time to Pay Scheme" which is for insolvent firms.

Some argue gender may influence access to bank finance, potentially through discrimination but more likely because gender influences the type of advice sought by management (Scott & Irwin, 2009). We control for this with a dummy variable for whether firms are woma`n owned.

In addition, a set of controls are used for the risk rating of the firm. One problem is that credit score is likely to be endogenous with the decision to apply for bank finance. As is now standard in the literature using these surveys, following authors such as Han et al. (2009), an instrumented credit score is used to address this problem. The credit score of each firm is predicted using an ordinal logit model and the base characteristics of the firm.

Two additional variables control for the firms activities. The first of these is whether a firm exports. The second is whether a firm has a business plan. Firms with business plans will be more able to access bank finance as this can be a requirement of some providers. It will also signal a better-managed firm (Smith, 1998). Sector will also be important and seven dummy variables are used to control for this.

As the period in question is one in which lending to small firms fluctuated significantly, dummy variables are also included for the quarter of the survey in which the firm was sampled (e.g. Q1

2013; Q2 2014 etc).[7] These dummy variables will account for aggregate changes in the supply of finance.

4. Results: Demand and supply of bank finance in peripheral regions

Demand for bank finance

The first research question is whether innovative firms in peripheral regions have a lower demand for bank finance than firms elsewhere. Table 2 gives simple cross tabulations related to the financing variables according to whether firms are innovators and their location. Significance tests are given in parentheses (to accommodate weights, these are the result of a probit regression with column 4 as the reference category).

Insert table 2 around here

Relative to normal firms (non-innovative firms in the periphery), innovative firms are more likely to apply for bank finance. The difference is relatively small, but statistically significant and it applies for both loans and overdrafts. "Normal" firms in peripheral regions are also particularly likely to apply for both loans, although not overdrafts. Innovative firms in core regions are also more likely to apply for both loans and overdrafts.

The basic regression results for these three measures of demand for bank finance - loan applications, overdraft applications and discouraged borrowers - are given in table 3. Models are estimated as probit regressions with weights. For each of the three dependent variables, models are first given with simple variables for peripheral firms and innovators but no controls, then with interactions between the periphery/innovation variables but no controls, and then for both basic variables and interactions but with full controls.[8]

Insert table 3 around here

The first hypothesis is the extent to which these firms are discouraged from borrowing. There is no evidence that peripherality matters here, although innovators are certainly more likely to be discouraged than other firms. When considering interaction effects (columns 3 and 4), the results suggest non-peripheral innovators are more likely to be discouraged from borrowing than firms elsewhere, even when controlling for other characteristics such as their risk profiles. The effect is, if anything, even more pronounced for innovative firms in peripheral regions (the coefficient is more than double). We find both that innovative firms are particularly likely to be discouraged

[7] Note that the first two waves (Q1 2011 and Q2 2011) are amalgamated in the data file. This small issue is unlikely to significantly affect the results.

[8] As is standard, models are run with robust standard errors. There is some evidence of collinearity – as might be expected - between the instrumented credit scores and other controls. Yet removing the collinear variables makes no difference to the main results.

from borrowing but also that the effect is even larger in peripheral regions. There is no grounds to reject our first hypothesis, that innovative firms in peripheral regions are more likely to be discouraged from seeking bank finance.

Considering next loan applications (columns 5 – 8), peripheral firms make more applications than do innovative firms. These results hold when interactions are included and are robust to controls. Innovative firms outside of peripheral regions are more likely to apply for loans even when controlling for their other characteristics. This 'demand' effect seems, if anything, to be greater for innovative firms in peripheral regions where the coefficient is slightly larger. Similarly, 'normal' firms in peripheral regions have higher loan application rates. Considering overdraft applications (columns 9 – 12) provides more nuance to this story. As with loans, innovative firms are more likely to apply for overdrafts than other firms – but in this case, there is no effect from being in a peripheral region. As with loans, the effect is larger for peripheral innovators than those in non-peripheral areas.

In short, the results show higher demand for external finance for both innovative and peripheral firms – and innovative firms in the periphery are more likely to apply for both overdrafts and loans than normal firms. Given that we also find evidence of discouragement, this provides no grounds to reject our hypotheses related to increased demand for bank finance amongst peripheral innovators. It might be that, given that other types of entrepreneurial finance display distinct geographical bias, innovators in peripheral regions have fewer options for external financing than those elsewhere and so feel unable to access the specialist finance they need. But this lack of options – along with an absence of internal or other resources - means innovative firms in peripheral regions are also more reliant on bank funding than other firms.

Rejection rates and the supply of bank finance

Next we consider the extent to which firms who apply for loans or overdrafts are able to successfully obtain them. We estimate these models using two types of regression. In the basic regressions (columns 1 – 4) these are simple probit regressions where the dependent variable is whether a firm is rejected for a loan or overdraft. Yet these regressions will suffer from selection bias: as certain types of firm are more likely to apply for bank finance, we need to control for this when estimating regression equations. To address this, we use the common two-step Heckman selection equation (see Fraser, 2009; Armstrong, Davis, Liadze, & Rienzo, 2013; Lee & Drever, 2014). The exclusion criteria for these models are legal status and age (for loan rejections) or whether firms have a business plan (for overdraft rejections). We do not report the first stage equation as these will be very similar to those given in table 3.

Insert table 4 around here

The basic results are given in columns 1 – 4. These show that being located in a peripheral region seems to have no impact on loan or overdraft rejection – in this respect, the dominant narrative that geography is unimportant seems correct. Innovation, in contrast, does seem to matter both without considering geography and – for loans – when considering interactions with peripherality. There is no effect when considering overdrafts.

The results when controlling for selection are more definitive: while we continue to find no effect on non-innovative peripheral firms, we find that innovative firms in peripheral regions find it harder to access both loans and overdrafts. In short, there seems to be a penalty for firms located in peripheral regions, but this only applies to innovative firms. We find no reason to reject our third hypothesis, that innovative firms in peripheral regions will have higher rejection rates. One potential factor is lower property values in peripheral areas making it harder for these firms to use collateral. As Perry (1988) sets out, lending decisions are made on the ability to repay, the equity of the ownership, and the collateral included. Yet rural or peripheral firms may find it harder to issue collateral, with the assets of peripheral businesses harder to borrow against than more liquid assets such as urban property with high land values (Perry, 1988).

The control variables also yield some insights. Firms making losses are particularly likely to find it hard to access loan finance, but not overdrafts when controlling for selection. Profitable firms are particularly likely to be turned down for loans, once selection is controlled for. This may simply be because of the reasons they are seeking finance. Firms who have experienced financial problems such as missed payments in the past also find it harder to access finance, but we find no evidence of discrimination about female owned firmed (if anything, the reverse) which may suggest they apply for smaller sums. Similarly, firms seeking finance who have business plans are more likely to be rejected. One reason is that they may be making more ambitious requests or seeking debt finance where equity finance may be more appropriate.[9]

5. Lagging regions

The above analysis has used an indicator of peripherality. Using such a measure has an advantage that it is plausibly exogenous with financing, in the short term at least. Yet more historical specific, longer-term processes may be operating which shape patterns of uneven development (Hall, 2013). Transport accessibility will be partly determined by economic development with, for example, affluent areas having more connections and so being seen as less "peripheral" relative to elsewhere. An example is Aberdeen which has, until recently, had a highly successful oil & gas industry and been well connected, despite its relative geographic isolation. Uneven geography

[9] We are grateful to a referee for this interpretation.

may become partly self-reinforcing, as bank finance is less likely to reach regions with weak economies.

To test whether our results apply for lagging regions as well as peripheral ones, we apply a measure based on eligibility for European regional development funding. Firms are aggregated into two groups to match EU regional policy: (1) Less developed regions – these are regions with less than 75% of the EU average GDP.[10] (2) Transition regions – these are those with GDP between 75 and 90 percent of the EU average GDP. For clarity of interpretation and to avoid small sample sizes both sets of regions are included in a single variable. These are defined according to NUTS regions, however, and these do not perfectly overlap with postcode areas. All postcode areas which overlap with the relevant NUTS areas are used.

The results for 'lagging regions' are broadly similar to those for peripheral regions. Table 5 shows the results for demand, discouragement and supply of bank finance. All regressions include full controls as in tables 3 and 4. Innovative firms, as before, seem to have higher demand for external finance but also find it harder to access. They are more likely to apply for bank finance, yet no more or less likely to be discouraged. They are more likely to be rejected regardless of whether we correct for selection.

Insert Table 5 about here

6. Conclusion

This paper has considered the demand and supply of bank finance for innovative firms and how this varies in peripheral versus core regions. Using detailed firm-level data, it has focused on the demand and supply of bank loans and overdrafts. Our first question related to the demand for bank finance. We find that innovative firms in general are more likely to be discouraged from applying for bank finance, but that innovative firms in peripheral regions are particularly so. It may be that innovative firms in peripheral areas feel they are unlikely to pass the hard information tests required when making applications. Yet demand is actually higher for innovative firms in peripheral regions – as shown by higher probabilities of loan or overdraft applications. One potential explanation for this is the pecking order hypothesis. Peripheral innovators may be forced to seek bank loans or overdraft funding as they lack internal capital

[10] The regions in category 1 are: Cornwall and the Isles of Scilly (postcode areas: TR, PL), West Wales and the Valleys (LL, SY, SA, LD) (note we exclude Cardiff and Newport from this definition). The UK regions in category 2 are: Cumbria (CA, LA), Devon (EX, TQ, TA), East Yorkshire and North Lincolnshire (YO, HU), Highlands and Islands (KW, IV, PH, PA, ZE), Lancashire (LA, PR, BB, BD, FY – note exclude Manchester, Oldham, Wigan and Blackburn), Lincolnshire (LN, DN), Merseyside (L, CH, WA), Northern Ireland (BT), Shropshire and Staffordshire (ST, TR), South Yorkshire (YO, S), Tees Valley and Durham (DH, TS, DL).

(e.g. because property values are lower in peripheral areas, so firms have less collateral) or because access to specialised bank finance in peripheral areas with thin markets for entrepreneurial finance is more limited. This demonstrates the interplay between different sources of finance within thin markets.

Our second finding relates to supply: innovative firms in peripheral regions are more likely to have their applications for bank finance rejected, even when controlling for selection effects and a wide set of firm-level variables such as credit score. This suggests that the idea that geography does not matter for firm financing is mistaken. On the contrary, innovative SMEs located in remote regions seem to suffer a "liability of distance" in terms of accessing funding, providing further evidence for claims that lending practices by banks and other funders "can be spatially discriminatory" (Martin and Sunley, 2015, pp. 32). In so doing, it reflects the wider literature on spatial bias in equity markets (Wójcik, 2011) Meanwhile, it also supports other research in this area (Alessandrini et al., 2009c; Degryse et al, 2015; Donati and Sarno, 2015), while extending this work to innovative firms.

Overall, our results support the argument that patterns of bank lending are intertwined with both the geography and institutional structures of financial systems (Clark and Wójcik, 2007; Wójcik, 2011). The tighter financing constraints facing innovative firms experience in some regions often dovetail with a strong presence of large non-local bank branches. It also seems to confirm the presence of a "flight to headquarters" effect in UK banks intent on rebalancing their loan portfolios across different local markets since the GFC (Degryse et al, 2015). The increasingly pervasive use of lending technologies and reduced local autonomy in loan decisions have resulted in the largest increase in spatial concentration in the UK for at least four decades (Wójcik & MacDonald Korth, 2015). In other words, organisational and technological changes are reducing the relational proximity between banks and SMEs. These problems seem to be particularly acute for innovative firms, who are more informationally opaque that traditional SMEs, further exacerbating their "liability of distance". Therefore, this lack of local decision making autonomy in loan decisions may be hindering the innovation process in some disadvantaged UK regions.

Our results may partially be explained by a lack of alternative financing options for innovative firms in peripheral areas, as thin-markets for equity finance or a lack of internal capital mean they are forced to make poor quality applications to banks instead. A lack of local banking institutions and limited autonomy within branches of distantly headquartered banks seem to be key features of these thin markets. It therefore seems logical to extend the nature of how banks are structured as a key aspect underpinning thin financial markets and indeed to incorporate financial issues into the wider concept of organizationally "thin regions" (Isaksen, 2015). Overcoming the existence of thin markets is not just a question of supply of funding but rather about building a vibrant funding ecosystem of many "complex component parts" (Nightingale et al, 2009, 28) which

covers a range of different types of finance for innovative SMEs. Regions with a richer and more varied "financial ecology" (Degryse et al, 2015), including locally headquartered financial institutions and a more diverse array of alternative funding sources, may be less prone to restrictions in accessing credit. More empirical work is needed to examine the entire range of funding institutions constituting thin markets, especially as SMEs in peripheral regions seem to face similar difficulties whether it is accessing debt, equity and alternative sources of finance.

These "liability of distance" effects align with other research on this topic and raise important policy questions. This seems especially prescient for countries with highly centralised and monopolistic banking systems where a lack of credit for SMEs is one of the reasons it is "problematic to do business in the UK" (NAO, 2013, 15). Overall, the research suggests that policy makers are right to consider the concept of regionalised networks of banks but that such institutions need to prioritise innovative SMEs, who seem particularly disadvantaged in certain regions. However, the design and construction of these banks needs to be very carefully considered so that they genuinely augment existing lending provision, by increasing competition, rather than crowding it out as some government-funded VC programmes have done (Cumming & MacIntosh, 2006). Other additional interventions might include promoting the growing range of alternative forms of small business funding such as crowdfunding and peer-to-peer lending within SMEs. Initiatives designed to improve the financial acumen of SMEs is another approach to help increase access to finance (Seghers et al, 2012). Building endogenous financial capacity in regions should be a central task underpinning these policy frameworks in thin peripheral financial markets.

Of course, there are potential methodological explanations for these results. The first is some sort of omitted variable bias and more information on balance sheets may be needed to address this problem. Alternatively, further consideration of the type of finance requested may further address this concern. The second is some sort of selection issue, with firms in peripheral areas introducing new products which are simply less commercially viable than in other areas. Regardless, it is a potentially troubling finding. There are a number of limitations to the paper as stands which open up avenues for further empirical research. It is hard to find appropriate measures of innovation and while those used here are inclusive, they are inevitably limited and may disguise sectoral variation and hide the significance or quality of any innovation. Future work may want to address these issues. Finally, other factors such as regulation, legal frameworks and banking culture will also impact on the geographical disparities identified here. Future work comparing multiple countries could help address this concern. In particular, it might be that the organisation of banks, and their decision making in particular, will influence the access to finance decision, particularly where there are relatively centralised financial systems such as the UK. Future work may wish to replicate these results in more decentralised countries.

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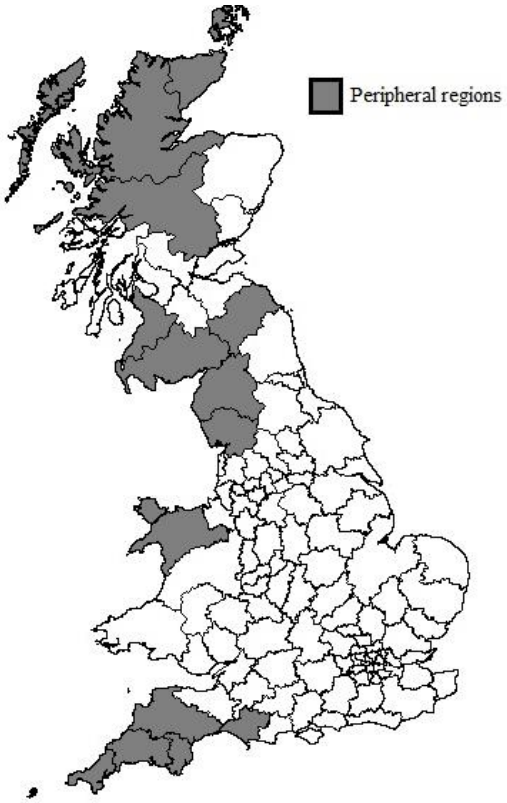
Tables & Figures

Figure 1. Peripheral postcode areas



Note: Also includes Northern Ireland & Shetland

Table 1. Variable descriptions and summary stats

Variable	Details	Obs	Mean
Loan application	Firm has made new application for term loan in previous 12 months	39994	0.05
Overdraft application	Firm has made new application for overdraft in previous 12 months	39994	0.06
Loan rejection	Firm applied for loan but was rejected	39994	0.02
Overdraft application	Firm applied for overdraft but was rejected	39994	0.03
Discouraged	Discouraged	35970	0.03
Periphery	Firm located in peripheral postcode area	39994	0.09
Innovator	Firm has introduced a new product or service in past 36 months	39994	0.23
Profit	Firm made profit in last financial year	39994	0.68
Loss	Firm made loss in last financial year	39994	0.13
Aims to grow	Firm aims to grow	39994	0.52
Financial problem	Firm has experienced financial issues in past 3 years	39994	0.18
Women owned	Firm owned by a woman	39994	0.33
IV Credit risk 2	Instrumented credit score	39994	0.18
IV Credit risk 3	Instrumented credit score	39994	0.31
IV Credit risk 4	Instrumented credit score	39994	0.38
1 – 9 Emps	Employment size, 1 – 9	39994	0.86
10 – 49 Emps	Employment size, 10 - 49	39994	0.12
50 – 99 Emps	Employment size, 50 - 99	39994	0.01
100 – 199 Emps	Employment size, 100 – 199	39994	0.01
200 – 249 Emps	Employment size, 200 – 249	39994	0.01
0 – 5 years	Firm age, 2 – 5 years	39994	0.24
6 – 15 years	Firm age, 6 – 9 years	39994	0.29
15 + years	Firm age, 15 years +	39994	0.45
Sole Prop	Legal structure: Sole Prop	39994	0.26
Partnership	Legal structure: Partnership	39994	0.14
LLP	Legal structure: LLP	39994	0.03
LLC	Legal structure: LLC	39994	0.57
Exports	Firm exports	39994	0.12
Business plan	Firm has business plan	39994	0.43

Table 2. Cross-tabulations: Applications by geography, firm type

% of firms:	**Peripheral**		**Non-peripheral**	
	Product innovator	**Not product innovator**	**Product innovator**	**Not product innovator**
Applying for loans	7.7	5.4	6.6	4.0
	(0.000)	(0.015)	(0.000)	
Applying for overdraft	9.4	6.2	7.7	5.4
	(0.000)	(0.244)	(0.000)	

Notes: sample size 50,175. P-values in parentheses from simple probit regressions (with weights) with the reference category of column 4 – the 'normal' firm.

Table 3. Regression: Demand for finance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Discouraged				New loan application				New overdraft application			
Periphery	-0.0821	-0.0414			0.130**	0.118**			0.0725	0.0824		
	(0.0675)	(0.0704)			(0.0513)	(0.0523)			(0.0500)	(0.0510)		
Innovator	0.160***	0.170***			0.240***	0.162***			0.178***	0.117***		
	(0.0453)	(0.0509)			(0.0367)	(0.0392)			(0.0364)	(0.0407)		
Non-periph / Innov			0.136***	0.147***			0.245***	0.169***			0.175***	0.114***
			(0.0475)	(0.0532)			(0.0388)	(0.0411)			(0.0384)	(0.0427)
Periph / Non-innov			-0.172**	-0.131			0.145**	0.138**			0.0637	0.0756
			(0.0808)	(0.0826)			(0.0601)	(0.0610)			(0.0576)	(0.0582)
Periph / Innov			0.286**	0.328**			0.326***	0.223**			0.276***	0.219**
			(0.122)	(0.131)			(0.0920)	(0.0944)			(0.0977)	(0.101)
Profit		-0.0604		-0.0595		0.0908		0.0905		0.128**		0.128**
		(0.0708)		(0.0708)		(0.0561)		(0.0561)		(0.0551)		(0.0552)
Loss		0.298***		0.297***		0.226***		0.226***		0.189***		0.189***
		(0.0810)		(0.0811)		(0.0752)		(0.0752)		(0.0636)		(0.0636)
Aims to grow		0.0321		0.0311		0.204***		0.204***		0.107***		0.107***
		(0.0508)		(0.0508)		(0.0403)		(0.0403)		(0.0384)		(0.0384)
Financial problems		0.376***		0.376***		0.510***		0.510***		0.534***		0.534***
		(0.0888)		(0.0888)		(0.0702)		(0.0702)		(0.0650)		(0.0650)
Women owned		0.0161		0.0170		-0.0468		-0.0468		0.0377		0.0378
		(0.0501)		(0.0501)		(0.0387)		(0.0387)		(0.0376)		(0.0376)
Exports		-0.0753		-0.0752		-0.0296		-0.0298		0.0649		0.0649
		(0.0798)		(0.0798)		(0.0612)		(0.0612)		(0.0621)		(0.0621)
Business plan		0.0682		0.0669		0.181***		0.181***		0.122***		0.122***
		(0.0463)		(0.0463)		(0.0363)		(0.0363)		(0.0350)		(0.0350)
IV Credit risk 2		1.345		1.351		-0.102		-0.104		1.319		1.319

		(1.992)		(1.992)		(1.238)		(1.239)		(1.247)		(1.246)
IV Credit risk 3		1.442**		1.439**		-1.419***		-1.419***		0.303		0.303
		(0.690)		(0.690)		(0.452)		(0.452)		(0.459)		(0.459)
IV Credit risk 4		2.059		2.063		-1.068		-1.068		1.057		1.056
		(1.667)		(1.667)		(1.165)		(1.165)		(1.121)		(1.121)
10 – 49 employees		0.108		0.109		-0.180		-0.180		-0.0250		-0.0251
		(0.150)		(0.150)		(0.114)		(0.114)		(0.109)		(0.109)
50 – 99 employees		0.0869		0.0889		-0.271**		-0.271**		-0.157		-0.157
		(0.183)		(0.183)		(0.136)		(0.136)		(0.131)		(0.131)
100 – 199 Emps		-0.305		-0.306		-0.184		-0.184		-0.0125		-0.0130
		(0.224)		(0.224)		(0.154)		(0.154)		(0.151)		(0.150)
200 – 249 Emps		-0.261		-0.272		-0.138		-0.137		-0.171		-0.171
		(0.285)		(0.281)		(0.150)		(0.150)		(0.161)		(0.161)
6 – 15 years		-0.0122		-0.0126		0.00401		0.00413		-0.0267		-0.0267
		(0.0455)		(0.0455)		(0.0391)		(0.0391)		(0.0358)		(0.0358)
15 years +		0.0903		0.0911		-0.158**		-0.158**		0.0632		0.0633
		(0.0970)		(0.0969)		(0.0702)		(0.0702)		(0.0676)		(0.0676)
Constant	-1.825***	-3.526***	-1.818***	-3.518***	-1.543***	-0.789	-1.545***	-0.791	-1.414***	-2.495***	-1.413***	-2.494***
	(0.0586)	(1.363)	(0.0585)	(1.363)	(0.0477)	(0.923)	(0.0478)	(0.923)	(0.0442)	(0.907)	(0.0443)	(0.906)
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector & legal status controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	35,970	35,970	35,970	35,970	39,994	39,994	39,994	39,994	39,994	39,994	39,994	39,994
Pseudo R2	0.00723	0.0849	0.00806	0.0856	0.0126	0.0513	0.0126	0.0514	0.0117	0.0644	0.0117	0.0644

Notes: Estimated as probit regression. Unreported Controls: legal structure, sector and survey wave. Weights applied. Robust standard errors in parenthesis. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Supply of finance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Rejection: Loan		Rejection: Overdraft		Rejection: Loan		Rejection: Overdraft	
Estimation method	Probit	Probit	Probit	Probit	Heckman probit	Heckman probit	Heckman probit	Heckman probit
Periphery	-0.0118		0.0517		0.0433		0.0956	
	(0.0702)		(0.0585)		(0.0509)		(0.0629)	
Innovator	0.199***		0.184***		0.169***		0.170***	
	(0.0492)		(0.0485)		(0.0341)		(0.0435)	
Non-periph / Innov		0.191***		0.194***		0.150***		0.172***
		(0.0512)		(0.0508)		(0.0358)		(0.0456)
Periph / Non-innov		-0.0421		0.0851		-0.0296		0.102
		(0.0881)		(0.0668)		(0.0638)		(0.0729)
Periph / Innov		0.252**		0.137		0.332***		0.259**
		(0.113)		(0.114)		(0.0829)		(0.110)
Profit	0.0683	0.0687	0.0642	0.0633	0.148***	0.149***	0.104	0.104
	(0.0671)	(0.0671)	(0.0669)	(0.0668)	(0.0456)	(0.0455)	(0.0692)	(0.0688)
Loss	0.266***	0.265***	0.175**	0.175**	0.188***	0.188***	0.116	0.117
	(0.0848)	(0.0848)	(0.0747)	(0.0747)	(0.0566)	(0.0565)	(0.0897)	(0.0886)
Aims to grow	0.168***	0.168***	0.0819*	0.0825*	0.175***	0.176***	0.0180	0.0196
	(0.0515)	(0.0515)	(0.0452)	(0.0452)	(0.0332)	(0.0331)	(0.0534)	(0.0528)
Financial problems	0.485***	0.484***	0.532***	0.532***	0.396***	0.397***	0.378***	0.380***
	(0.0824)	(0.0824)	(0.0759)	(0.0759)	(0.0349)	(0.0349)	(0.0959)	(0.0944)
Women owned	-0.116**	-0.116**	-0.0214	-0.0217	-0.0682*	-0.0697**	-0.0335	-0.0333
	(0.0500)	(0.0500)	(0.0456)	(0.0456)	(0.0355)	(0.0355)	(0.0451)	(0.0447)
Exports	-0.0130	-0.0124	0.0397	0.0393	-0.0201	-0.0201	0.120	0.118
	(0.0811)	(0.0811)	(0.0737)	(0.0738)	(0.0456)	(0.0455)	(0.0741)	(0.0735)
Business plan	0.203***	0.203***	0.0468	0.0470	0.131***	0.130***		
	(0.0442)	(0.0442)	(0.0409)	(0.0409)	(0.0323)	(0.0323)		
IV Credit risk 2	-0.584	-0.583	-0.0380	-0.0521	-0.953	-0.889	1.474	1.439
	(1.655)	(1.655)	(1.423)	(1.424)	(0.795)	(0.796)	(1.376)	(1.366)
IV Credit risk 3	-0.732	-0.732	0.106	0.104	-0.0436	-0.0378	1.000*	0.989*
	(0.584)	(0.584)	(0.537)	(0.537)	(0.237)	(0.237)	(0.554)	(0.550)

IV Credit risk 4	-0.837	-0.837	0.730	0.720	0.123	0.151	2.792**	2.755**
	(1.473)	(1.473)	(1.308)	(1.309)	(0.388)	(0.389)	(1.412)	(1.398)
10 – 49 employees	-0.162	-0.162	0.0141	0.0142	0.0106	0.00777	0.183	0.181
	(0.140)	(0.140)	(0.130)	(0.130)	(0.0485)	(0.0485)	(0.136)	(0.135)
50 – 99 employees	-0.326*	-0.326*	-0.152	-0.152	-0.110	-0.109	0.0317	0.0292
	(0.167)	(0.167)	(0.157)	(0.157)	(0.0730)	(0.0730)	(0.168)	(0.167)
100 – 199 Emps	-0.379*	-0.380*	-0.0681	-0.0661	-0.0971	-0.0980	0.0401	0.0396
	(0.195)	(0.195)	(0.180)	(0.180)	(0.0943)	(0.0943)	(0.198)	(0.197)
200 – 249 Emps	-0.143	-0.145	-0.427*	-0.429*	0.0535	0.0458	-0.117	-0.115
	(0.189)	(0.188)	(0.221)	(0.221)	(0.127)	(0.127)	(0.247)	(0.246)
6 – 15 years	-0.0313	-0.0315	-0.00945	-0.00954			0.00535	0.00460
	(0.0462)	(0.0462)	(0.0424)	(0.0424)			(0.0466)	(0.0461)
15 years +	-0.0416	-0.0414	0.0692	0.0686			0.156*	0.155*
	(0.0885)	(0.0885)	(0.0813)	(0.0813)			(0.0818)	(0.0812)
Partnership	-0.0203	-0.0192	0.0746	0.0725				
	(0.110)	(0.110)	(0.0996)	(0.0996)				
LLP	0.0848	0.0862	0.127	0.124				
	(0.177)	(0.177)	(0.164)	(0.164)				
LLC	-0.0157	-0.0150	0.176	0.175				
	(0.126)	(0.126)	(0.112)	(0.112)				
Constant	-1.550	-1.547	-2.470**	-2.465**	-2.189***	-2.203***	-3.881***	-3.861***
	(1.183)	(1.182)	(1.051)	(1.052)	(0.310)	(0.311)	(1.053)	(1.046)
Wave & Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39,994	39,994	39,994	39,994	39,994	39,994	39,994	39,994
Pseudo R2	0.0595	0.0596	0.0698	0.0700				
Wald Test					426.31	432.17	457.30	460.58
P-value					0.0000	0.0000	0.0000	0.0000
LR Test					4.46	3.82	5.46	5.56
p-value					0.0347	0.0508	0.0195	0.0184

Notes: Estimated as probit regression (columns 1 – 4) with Heckman correction (columns 5 – 8). First stage regressions for 5 – 8 not reported. Weights applied. Robust standard errors in parenthesis. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Demand and supply of finance: Lagging regions

	(1)	(2)	(3)	(4)	(5)	(6)	(8)
Application for	Demand			Rejection		Loans	Overdraft
	Loan	Overdraft	Discouragement	Loans	Overdraft	Rejection rate	Rejection rate
Non-lagging / Innovator	0.147***	0.131***	0.0996*	0.146***	0.189***	0.201***	0.199***
	(0.0417)	(0.0403)	(0.0536)	(0.0531)	(0.0481)	(0.0365)	(0.0243)
Lagging / Non-innov	-0.0228	0.0223	-0.180	0.0507	0.0769	0.0752*	0.141***
	(0.0568)	(0.0531)	(0.249)	(0.0690)	(0.0651)	(0.0442)	(0.0466)
Lagging / Innovator	0.185***	0.154***	0.0945	0.164**	0.170***	0.264***	0.282***
	(0.0540)	(0.0512)	(0.244)	(0.0658)	(0.0590)	(0.0416)	(0.0417)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation method	Probit	Probit	Probit	Probit	Probit	Heckman probit	Heckman probit
Obs	40,115	40,115	36,086	40,115	40,115	39,994	39,994
Pseudo R^2	0.0519	0.0657	0.0881	0.0581	0.0717		
Wald Test						438.74	673.51
P-value						0.0000	0.0000
LR Test						5.92	11.31
p-value						0.0150	0.0008

Notes: Estimated as probit regression. Regressions 6 – 9 use Heckman correction. Controls: Size, age, sector, growth ambitions, exports, business plan, profits, loss, financial problems, risk rating, survey wave and legal structure (used as selection variables for regressions 6 & 8). Robust standard errors in parenthesis. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.