Technological Forecasting & Social Change xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

The innovation debt penalty: Cost of debt, loan default, and the effects of a public loan guarantee on high-tech firms

Marc Cowling[a], Elisa Ughetto[b,c,*], Neil Lee[d]

[a] University of Brighton, Brighton Business School, United Kingdom
[b] Politecnico di Torino, Department of Management and Production Engineering, 10129 Torino, Italy
[c] Bureau of Research on Innovation, Complexity and Knowledge, Collegio Carlo Alberto, 10024 Moncalieri, Italy
[d] London School of Economics and Political Science, United Kingdom

ARTICLE INFO

JEL classification:
G21
G28

Keywords:
Cost of debt
High tech firms
Public loan guarantee scheme
Loan default

ABSTRACT

High-technology firms per se are perceived to be more risky than other, more conventional, firms. It follows that financial institutions will take this into account when designing loan contracts, and that this will manifest itself in more costly debt. In this paper we empirically test whether the provision of a government loan guarantee fundamentally changes the way lenders price debt to high-tech firms. Further, we also examine whether there are differential loan price effects of a public guarantee depending on the nature of the firms themselves and the nature of the economic and innovation environment that surrounds them. Using a large UK dataset of 29,266 guarantee backed loans we find that there is a high-tech risk premium which is justified by higher default, but, in general, that this premium is altered significantly when a public guarantee is provided for all firms. Further, all these loan price effects differ on precise spatial economic and innovation attributes.

1. Introduction

Whilst there are clear economic benefits from innovation and technological advancement (Laeven et al., 2015), innovation processes are highly uncertain in their outcomes (Jalonen, 2012; Scherer et al., 2001). This means that financiers will view funding projects associated with these efforts with caution. As small firms in general face a penalty due to their smallness per se, associated with the relatively high fixed costs of lending (and of providing equity) and asymmetric information problems, being innovative and technologically driven adds a further layer of asymmetry and informational opacity (Carpenter and Petersen, 2002; Guiso, 1998; Hall, 2002; Himmelberg and Petersen, 1994; Ughetto, 2008). In short, the literature predicts that in debt markets, smaller firms already face general access problems and pay a premium on borrowing — but these problems may be worse for high-technology firms (Berger et al., 2007; Hall and Lerner, 2010).

Whilst governments have intervened in this small business finance space explicitly to correct for perceived market failures, or gaps in provision, in many ways, including loan guarantee schemes (Cowling, 2010; Honohan, 2010; Ughetto et al., forthcoming), R & D tax credits (Cowling, 2016), grants, soft loans, hybrid equity schemes (Aernoudt, 2005; Cannone and Ughetto, 2014), and business angel schemes (Ramadani, 2009), the general approach to the financing of innovative and technology based firms has favored equity funding and intervention in equity capital markets (Kortum and Lerner, 2000; Langeland, 2007). This has largely ignored the potential role that debt (Kerr and Nanda, 2014) and particularly loan guarantees might play in the funding of technology based firms. This is interesting in itself as the purpose of a public loan guarantee is to reduce the (default) risk to the lender of providing a loan to an informationally opaque smaller business (Honohan, 2010). In fact, the numerous loan guarantee programs introduced around the world have been conceived to allow lenders to share with the government the risk of default on outstanding loans, with the latter partially or totally covering any potential loss (Beck et al., 2010; Boschi et al., 2014; Cowling and Mitchell, 2003; Honohan, 2010). These public guarantee instruments, although differing in their characterizing features across nations (i.e. percentage of guaranteed coverage, lending criteria, industry and geographical limitations, loss distribution policy), share the common aim of reducing the barriers to additional finance for borrowers that mostly suffer from credit constraints (Cowling and Siepel, 2013).[1]

To the best of our knowledge no empirical works have investigated, in the context of publicly guaranteed schemes, the dynamics of loan pricing and loan default when borrowers are high-tech firms. In

* Corresponding author at: Politecnico di Torino, Department of Management and Production Engineering, 10129 Torino, Italy.
E-mail addresses: m.cowling2@brighton.ac.uk (M. Cowling), elisa.ughetto@polito.it (E. Ughetto), n.d.lee@lse.ac.uk (N. Lee).

[1] However, it has been found that the "credit additionality" effect induced by such schemes may not be achieved when the government coverage falls below a certain threshold (Boschi et al., 2014).

http://dx.doi.org/10.1016/j.techfore.2017.06.016
Received 6 May 2016; Received in revised form 28 April 2017; Accepted 13 June 2017
0040-1625/

particular, we are not aware of any study examining to what extent small high-tech firms face higher default rates and a greater cost premium for the use of debt finance compared to their non-high-tech peers when lending is guaranteed by government. On the one side, it is expected that banks charge a higher cost of capital to high-tech firms because of their higher risk, uncertain returns, and lack of collateral assets. On the other hand, the presence of the public guarantee should somehow attenuate such "innovation debt penalty". The paper adds to extant literature in two respects. First, it is the first study to investigate whether the presence of a government backed loan guarantee alters banks view in respect of the loan risk-premium charged to high-tech firms. Second, it differentiates from previous works in the field because it questions whether there is any spatial variation in both the cost of loans to high-technology firms and in their default rates.

In this paper we explore several key aspects of lending to technology based smaller businesses, using a large UK dataset of 29,266 loans issued under the Small Firm Loan Guarantee (SFLG) public Scheme. The scheme, established in 1981 by the UK Government, targets young and small businesses (up to five years old and with an annual turnover of up to £5.6 million) that lack track records or collateral to secure loans and has been conceived in eight distinct phases.

Our analysis, which concentrates on the phases VI and VII of the Scheme (2000–2005), is twofold. Firstly, we quantify whether high-tech firms have a higher default risk than more conventional firms, and whether they face a double-hurdle of being small and being innovative in respect of the price premium they pay on their borrowing, when lending is guaranteed by government (Lee et al., 2015). Indeed, we test the presence of a differential effect in terms of the loan price charged by banks for high-tech firms compared to their more conventional small firm peers. Secondly, we are able to trace out more nuanced loan price effects relating to the specific loan contract terms, the spatial location of the firms and the competitive, innovative and economic environment that surrounds them. In doing so we hope to build upon a growing body of research that has begun to unravel some key questions relating to innovation financing in the context of public loan guarantee programmes (see Cincero and Santos, 2015).

The rest of the paper is set out as follows. Firstly, we review the literature in several related areas including small firm and high-technology firm financing, also in the context of guaranteed lending, and the effects of economic geography on the financing outcomes of smaller firms. Secondly, we discuss the empirical data and present the basic sample descriptive statistics. We then present our empirical modelling of the loan spread (our measure of the price of lending) and of loan default (our measure of loan riskiness) under the UK policy intervention scheme. We conclude by summarizing our findings and setting this in the context of previous literature. Public policy impacts and implications are also discussed given the centrality of publicly supported loan guarantee schemes in the small business finance arena.

2. Literature review

2.1. The financing of high-technology firms

There are longstanding concerns that high-technology or innovative firms may find themselves credit constrained (Revest and Sapio, 2010; Ughetto, 2008; Westhead and Storey, 1997). Work in this area has focused on several explanations. The most important is asymmetric information (Burgstaller, 2013). In the classic explanation of credit constraints for small firms, Stiglitz and Weiss (1981) argued that information asymmetries may cause adverse selection in credit markets making it rational for borrowers to restrict lending to certain types of firms, rather than raising the price of loans. In a similar manner to the classic 'market for lemons' (Akerlof, 1970), higher loan costs drive out the better quality applicants, lowering average quality and leading lenders to restrict financing. For innovative firms, this problem of asymmetric information is mitigated by patenting, which provides an indicator of the quality of innovation to the lender and so reduces loan spreads (Francis et al., 2012; Plumlee et al., 2015).

Yet three additional factors might make it costlier to lend to innovative firms and so raise bank margins. The first is that the expected future revenues arising from investments in scientific and technological research are uncertain. Secondly, an evaluation of the quality and strength of intellectual property rights is expensive and often requires specialist expertise, thus adding to the per unit cost of lending. To some degree, the second is the related challenge of raising collateral. Intangible assets such as new products are hard to value and so difficult to use as collateral (Mina et al., 2013). The third is the reluctance of innovative firms to reveal information to the market for valuation and so forced to rely on internal finance (Magri, 2009). These factors raise screening costs for lenders, making it hard to overcome the information problems identified by Stiglitz and Weiss (1981).

A second explanation is the idiosyncratic nature of risk in the development of new, innovative products (Mina et al., 2013). By their nature, investments in R & D, new products or processes are risky activities — while some such investments will pay off, the majority yield relatively little return (Carpenter and Petersen, 2002; Coad and Rao, 2008; Hall, 2002). Moreover, high-technology firms may be seeking finance for R & D which is more speculative still (Westhead and Storey, 1997). While funders taking equity stakes may be interested in the long-term value of the company, banks are principally interested in the simple ability of lenders to repay and benefit little beyond the repayment of a loan if a product is highly successful.

Empirical work has shown a strong link between banking and technological progress. For example, Amore et al. (2013) show that the deregulation and greater banking competition is associated with increased innovation. Similarly, Hsu et al. (2015) use patenting data to show that firms which have a strong patent portfolio pay lower spreads. However, these studies tend to focus on patenting — an output measure of innovation, which reflects investments in research and development (R & D) which have already been made. In contrast, firm level studies considering firms involved in regular innovative activity often show that innovative firms are more credit constrained. Both Freel (2007) and Lee et al. (2015) find that innovative small firms are more likely to be rejected when applying for bank loans. The precise indicator of innovation seems to matter. But while several studies have considered alternative types of innovation, relatively few studies have considered high-technology firms explicitly. This is important as the link between the firm and the industry is more closely aligned in respect of high-technology, and this in turn more closely maps into the way banks make lending allocation decisions. While the categorization of firms into high-tech and low-tech may cast some firm-level heterogeneity in innovation and R & D propensities, it has been established that banks make annual strategic lending choices at the industry sector level in terms of their broad allocation of credit (see Cowling, 2010 for the UK context). Capital in this sense flows to industries, not firms per se.

2.2. Geographical context and financing high-technology firms

Despite this evidence base, relatively fewer studies have considered regional variation in these patterns of financing. However, there is increasing interest in the idea that regional factors, such as the level of banking development or innovation intensity may matter for firm financing (Crocco et al., 2012; Munari and Toschi, 2015). Studies on IPOs, for example, suggest that underpricing is more likely the further the firm is located from the financial capital (Acconcia et al., 2011). This is an important question, as the availability of firms to access finance is seen as an important determinant of subsequent economic growth — with empirical evidence suggesting finance is particularly important in deprived regions (Craig et al., 2008).

One theoretical position in this area is that distance between providers of finance and potential borrowers may hinder exchanges of information and make it harder for firms to access the finance they need