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No money, no honey? Financial versus knowledge and demand constraints on innovation

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ABSTRACT

The paper adds to the literature on the barriers to innovation in two ways. First, we assess comparatively what mostly constrains firms' ability to translate investment in innovation activity into new products and processes, whether it is mainly finance, as most of the literature would suggest, or whether it is mostly knowledge and market-related aspects. Second, we suggest a method to correct for the sample selection bias that often affects empirical contributions to this scholarship. By filtering out firms that are not interested in innovation from those that struggle to engage in it, we obtain a relevant sample of potential innovators, which allows us to analyse the comparative effect of financial and non-financial barriers on innovation success. We find that demand-side factors, particularly concentrated market structure and lack of demand, are as important as financial constraints in determining firms' innovation failures. This evidence redirects attention from financial to non-financial barriers by considering traditional demand, market structure and regulation factors involved in reduced firm innovation performance. The empirical analysis is based on an unbalanced panel of firm-level data from four waves of the UK Community Innovation Survey (CIS) between 2002 and 2010 merged with data from the UK Business Structure Database.

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1. Introduction

Recent empirical innovation studies are devoting increasing attention to perception of the obstacles to innovation and their deterrent effect on firm propensity to engage in innovation activity, on the intensity of such engagement and the likelihood of innovating (for more detail see Section 2 and Baldwin and Lin, 2002; Galia and Legros, 2004; Canepa and Stoneman, 2008; Segarra-Blasco et al., 2008; Tiwari et al., 2008; Savignac, 2008; Iammarino et al., 2009; Mancusi and Vezzulli, 2014, among others).

Assessing the actual impact of the obstacles to innovation on the rate of innovation failure/success has clear policy relevance, since removing or alleviating these barriers could enlarge the population of innovators and increase the innovation performance of current innovators (D'Este et al., 2008, 2012, 2014). A substantial number

of works focus on the impact of financial obstacles. The emphasis on the financial conditions that enable innovation originates in the traditional cash-flow models (see Hall, 2002 for a review), which focus on the financial constraints to firms' R&D investments, and likely reflects the recent unfavourable financial downturn. Also, there is a rationale implied by an analytical focus on financial constraints. For instance, if it can be shown that firms do not innovate because they lack liquidity, struggle to access external financial sources or perceive innovation costs as excessive, it is relatively more straightforward for policy makers to alleviate these barriers by providing liquidity. This can take the form of additional subsidies, tax credits or channelling public funds to Venture Capital (VC) to increase (mainly R&D) innovation investments (Arqué-Castells, 2012; Bertoni and Tykvová, 2015).

In this paper, we argue that firms might encounter other types of obstacles and, despite access to or availability of financial liquidity to invest in innovation, might still perceive the conditions as not favouring innovation. These other constraints might include high barriers to market entry, lack of qualified personnel and lack of adequate information on technologies and markets. All of these difficulties might produce persistent systemic failure to engage

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in innovation activities and/or to translate financial efforts into R&D and extend innovation activity into the introduction of new goods, services and processes.¹ Thus, it is more important for policy to extend analysis to non-financial obstacles. This will provide evidence on whether firms do not innovate due to the lack of appropriate information on technologies and market, lack of adequate skills or, and most likely during a financial downturn, because of sluggish destinations markets with low levels of demand, or markets dominated by established firms.²

This paper adds to the literature on barriers to innovation in two main respects. First, we build on and extend D'Este et al. (2008, 2012), who distinguish between 'detering' and 'revealed' barriers,³ by assessing the impact of revealed barriers on the translation of innovation activity into actual innovation output.^{4,5} We take care to distinguish financial and non-financial obstacles and, unlike Tiwari et al. (2008) and Blanchard et al. (2013), we provide comparative evidence on whether access to knowledge, a concentrated market structure, uncertain demand or regulation have comparable or more substantial effects than finance on constraining firms' ability to translate innovation investments into new outputs.

Second, we build on other contributions (Savignac, 2008; Mancusi and Vezzulli, 2014; as well as D'Este et al., 2008, 2012), and suggest a method to correct for the sample selection bias that usually characterises empirical contributions to this scholarship, which has led to the counterintuitive finding of a positive relation between intensity of innovation investments and perception of the obstacles to innovation (Mohnen and Rosa, 2001; Baldwin and Lin, 2002). We use a 'relevant sample of potential innovators', which we would suggest should represent the working sample of any CIS-based empirical contributions to the literature on barriers to innovation. Our sample is obtained by filtering out firms not willing to innovate and, therefore, which do not engage in any innovation activity for other reasons than the obstacles to this activity, from those that struggle to engage in innovation activity.

We draw on the UK CIS4, 5, 6 and 7 waves, which we merge with UK Business Structure data. Our longitudinal data provide descriptive evidence of whether there is a degree of persistence over time of "not innovation oriented", "failed innovator" or "innovator" status. This information, coupled with evidence on the type of barrier most likely to affect firms' innovation status, is of primary importance for policy making since it identifies the relevant population to which interventions should be targeted.⁶

¹ In what follows, we use innovative products to refer to innovative goods and innovative services.

² Recent micro and macro level empirical evidence on the effects of the economic downturn on innovation investments by firms and countries, is provided in Archibugi and Filippetti, 2011; Archibugi et al., 2013).

³ The distinction is based on the relation between the degree of engagement in innovation activity and the perceived importance of the constraints to innovation. Detering barriers prevent firms from engaging at all in innovation activities, while revealed barriers are those barriers that are experienced "in the making" of innovation, which reflect the firm's awareness of them based on their engagement in innovation inputs.

⁴ It is important here to highlight (see also Section 3) that in the innovation-survey literature the term 'innovation active' describes the degree to which firms devote financial effort to innovation (innovative inputs). It does not mean that the firm necessarily has introduced a new product or process as a consequence of its innovation investment. This distinction is central to our argument and often is blurred in the traditional literature on financing constraints (see Section 2.1).

⁵ For the purpose of this paper, we do not focus on the degree of novelty of the product and therefore do not distinguish between goods or service new to the firm versus new to the market. Rather, we adopt a more conservative choice of focusing on the simple introduction of a product/process new to the firms or new to the market.

⁶ For instance, policy makers might prioritize enlarging the population of innovation-active firms (*innovation-widening*) by removing or alleviating the obstacles to engagement in innovation activity, or strengthening the innovation capacity of the existing population of innovation-active firms (*innovation-deepening*) by

Our findings show that traditional demand and market structure factors are as important as financial constraints for determining firms' innovation failure. While we find no significant evidence that firms attempting to innovate are constrained by lack of knowledge of technologies, we find that regulatory aspects can affect innovation performance, although to a lesser extent than financial constraints.

The paper is structured as follows: Section 2 reviews the literature on the barriers to innovation and highlights the econometric issues. Section 3 describes the data, how our sample was identified, and the econometric strategy applied. Section 4 discusses the results and points to the main contributions made by this analysis to the existing literature. Section 5 summarises the evidence and discusses some implications for innovation policy.

2. Financial and non-financial barriers to innovation

The literature on firms' innovation failure is relatively smaller than the core innovation literature, which focuses on the determinants of innovation success. This is somewhat puzzling, given the policy relevance of identifying and reducing the barriers to the firm's decision to spend on innovation activity and complete successful innovation projects. It would be short-sighted to suggest that identifying the success factors would also reveal what determines innovation failure. For instance, if large firms are more likely to introduce innovations, this does not mean that all small firms will find it difficult to be successful. Therefore, it is important to identify the types of hindrances firms encounter at different phases in the innovation cycle, that is, during the decision to innovate, engagement in innovation activity and introduction of a new product/process. We review a few of the contributions that deal with these issues, distinguishing between financial and non-financial obstacles.

2.1. Financing constraints and R&D investments

The majority of the work on the direct effect of the barriers to innovation, including innovation-related expenditure (inputs) and the introduction of innovation outputs, focus on (external) financing constraints on the firm's cash flow, which deter R&D investment (for a review, see Schiantarelli, 1996; Hall, 2002; Bond et al., 1999; Hottenrott and Peters, 2011). These contributions focus on the effect of financial constraints on the risk of sub-optimal and welfare-reducing investment. In particular, they are concerned with the high uncertainty, asymmetries and market complexity linked specifically to the financial returns on R&D investment and the ability to attract external funding. Most studies test the presence of financing constraints indirectly, by looking at the sensitivity of R&D investments to changes in cash flow (e.g., Hall, 2008). However, some (Canepa and Stoneman, 2008; Savignac, 2008; Hottenrott and Peters, 2011) employ innovation surveys to access direct information on firms' perceptions of financing constraints. The empirical findings tend to confirm that encountering financial constraints significantly reduces the likelihood that firms will engage in innovation activity (Savignac, 2008) and that this pattern is more pronounced in small firms and in high-tech sectors (Canepa and Stoneman, 2008). Drawing on an ideal test to identify the role of financing constraints proposed by Hall (2008),⁷ Hottenrott and

removing or alleviating the obstacles to successful completion of innovation projects and adequate return from innovation investments.

⁷ Rather than using traditional innovation survey data for perception of the obstacles to innovation, Hall (2008) and Hottenrott and Peters (2011) conduct an ideal experiment by providing firms with exogenous extra cash, and observe whether they decide to spend it on innovation projects. The presence of (external) financing

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