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Financial constraints and the failure of innovation projects

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ABSTRACT

Although many innovation projects are abandoned before completion, the empirical evidence has focused on the determinants of innovation, while failed projects have received little attention. This paper analyses the role of financial obstacles on the likelihood of abandoning an innovation project by potentially innovative Spanish firms for the period 2005–2013. Our analysis differentiates between the impacts of internal and external barriers on the probability of abandoning a project, and we examine whether these differ depending on the stage of the innovation process. Controlling for potential endogeneity, we use a bivariate probit model to take into account the simultaneity of financial constraints and the decision to abandon an innovation project. Our results show that it is during the conception stage that financial constraints have their greatest effect on the probability of abandoning an innovation project. In addition, the financial sources are not neutral across the innovation project lifecycle. During the design phase, Spanish firms are more sensitive to internal financial sources while, during the execution stage, they are more sensitive to external sources.

1. Introduction

Innovation projects frequently fail because of their intrinsic characteristics of uncertainty and information asymmetries. Furthermore, theoretical and empirical approaches have stressed the existence of financial constraints in the innovative activities of firms (Hözl and Janger, 2014; Segarra-Blasco et al., 2008) and, specifically, in the development of product and process innovations (Amara et al., 2016; D'Este et al., 2012; Mancusi and Vezzulli, 2014).

In recent years, the increasing empirical literature on financial restrictions on R&D investments and innovation performance at firm level has made substantial advances. This literature has examined several key themes relating to financial constraints. Some papers show that different profiles of firms result in financial constraints having different impacts on innovation activity (Canepa and Stoneman, 2008; Mohnen et al., 2008; Savignac, 2008; Tiwari et al., 2008). Other papers point out the role of firms and sectorial characteristics (Efthyvoulou and Vahter, 2016), but very few papers, other than (Mohnen et al., 2008; Garcia-Vega and Lopez, 2010), have focused specifically on the abandonment of innovation projects. To the best of our knowledge, none of literature takes into account the different phases of innovation projects so it is unknown whether the effect of financial constraints on an innovation project differs depending on the phase of the project.

Our paper aims to reduce this gap in the literature—our main objective is to analyse how financial constraints change the probability of

abandoning an innovation project in its different phases. In addition, we distinguish between internal and external constraints. This paper offers evidence to partially reconcile the seemingly contradictory arguments regarding the role of the limitations of financial resources as inhibitors or facilitators of innovation activities (Hoegl et al., 2008). We consider that, throughout the different phases of the project, an innovative firm offers information to its managers and stakeholders regarding the risks assumed in the project and a firm's capacity to ultimately innovate. Managers will evaluate the financial and technological viability of each innovation project. The decision to abandon an innovation project is not a negative decision “per se”. However, when the decision to stop is due to the existence of financial constraints, this decision becomes crucial.

Hence, this paper analyses the role of financial constraints on the likelihood of Spanish firms abandoning an innovation project during the period 2005–2013. We use two direct indicators of financial constraints, distinguishing between internal and external financial obstacles that are related to the access to funds for financing the investments in R&D and innovation activities. Our panel data is drawn from the Technological Innovation Panel (PITEC) and comprises an extensive sample of Spanish firms from Community Innovation Survey (CIS). Our dataset provides a large variety of indicators on firm's innovative performance for a sample of Spanish firms over a nine-year period. However, it does not include information on innovation projects and this is a common drawback of innovation surveys. Hence, we lack

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detailed information about each project, the number of innovation projects that a firm is conducting, and which of them are abandoned. Nevertheless, we know whether a firm abandons at least one innovation project, and in which stage. Hence, we are able to analyse whether the firms experience financial restrictions and the impact of these on the decision to abandon innovative projects.

Although the access to financial sources may restrict the capacity of potentially innovative firms to carry out innovation projects, the empirical literature is not as conclusive as one might expect regarding the existence of significant financial constraints.¹ We contribute to this stream of empirical literature by differentiating between the impacts of internal and external financial barriers on the probability of abandoning a project. We consider also that these two financial sources may have different impacts at different stages of the innovation project. Hence, we examine the impacts of internal and external financial constraints on the probability of abandoning the innovation project prematurely, or once it has started.

We apply a recursive biprobit model to take into account financial constraints simultaneously with the decision to abandon an innovation project and controlling for potential endogeneity. Our results show that financial constraints are directly correlated with the probability of abandoning an innovation. In addition, internal financial constraints have a greater effect on an innovation project's failure during the conception stage, while external constraints have a greater effect in the execution stage.

The remainder of the article is structured as follows. Section 2 analyses the literature related to financial constraints to innovation and presents our main hypotheses. Section 3 describes the database and main statistics. The following section presents the econometric methodology. Section 5 shows our main empirical results. Finally, Section 6 presents the main conclusions.

2. Innovation projects and financial constraints

The nature of the innovation projects is characterised by the generation and implementation of new knowledge. Consequently, two groups of market failures affect the development of the innovation projects. On the one hand, some failures are due to the nature of knowledge (Arrow, 1962) such as appropriability, high sunk costs, high risk with a skewed distribution of outcomes, and spillovers. Firms have incentives to generate innovations, but they have to evaluate the risk they assume since more novel projects are associated with a higher failure probability (D'Este et al., 2016). On the other hand, there are systemic failures of innovation systems (Nelson and Winter, 1982) such as lack of confidence in cooperating in R&D, the agents involved lacking the scale to cope with the challenges of innovation, and there being few linkages between the agents involved in the innovation process. In consequence, innovative firms find more obstacles to financing their innovation activities in freely competitive financial markets (Hall and Lerner, 2010) and under-invest in R&D activities (Hall, 2002).

In essence, innovative firms encounter financial obstacles to investing in innovative activities through the presence of externalities, problems of informational asymmetries and problems of appropriability with the return on R&D investment (Mina et al., 2013). Consequently, innovative firms experience high costs for R&D investments and induce underinvestment in innovation activities. These problems can generate

¹ Some articles have strongly criticized the positive correlation between R&D and internal financial sources, in particular cash-flow, since it may also reflect that innovative firms anticipate high future profits that, in consequence, lead them to invest strongly (Savignac, 2008). The presence of financial constraints for innovative firms is frequently investigated via the sensitivity of R&D investment to financial factors (Harhoff, 1998; Himmelberg and Petersen, 1994; Mulkay et al., 2001; Tiwari et al., 2008). In recent years, a new line of research has focused on the analysis of the impact of financial constraints on R&D risk projects.

a gap between external and internal costs that leads to R&D underinvestment or liquidity constraints.²

Although the literature has paid less attention to the conceptualization of failure of innovation projects, recent empirical evidence may suggest that facing financial barriers increases the likelihood of failure of innovation projects (Blanchard et al., 2012; Canepa and Stoneman, 2008; Hall, 2002; Savignac, 2008). Consequently, some innovation projects may not be started, must be delayed, or are abandoned because of a lack of access to financial resources. Using the Dutch CIS survey, Mohnen et al. (2008) analyse the impact of financial constraints on the hampering of innovation. According to their results, financial constraints “have a significant and positive impact on the three probabilities of prematurely stopping, seriously slowing down and not starting a project, but not on that of abandoning a project”.

More recently, Garcia-Vega and Lopez (2010) analyse a sample of more than 8,300 innovative Spanish firms for the period 2005–2007. Their results show the importance of the lack of funds on the probability of abandoning innovation projects. In particular, large firms are much more affected, since they invest in innovation projects that involve a larger amount of funds. Based on these analyses, we assume that failures of innovation projects are positively correlated with the presence of financial constraints.

Despite the previous evidence, the literature has not analysed the interaction between the type of financial source and the impact on the failure of the innovation project over its different development stages. We consider that this is relevant because of the nature of innovation projects and because the existence of financial constraints affects managers' decisions when allocating limited financial resources across their project portfolio. The financial strategy of a firm may respond to managerial perception of the sources of firm competitiveness. Hence, managers who aim to develop innovation projects have to understand when to invest, how much to invest and also the type of financial source. The latter is particularly relevant since the nature of financial sources, external or internal, is not neutral to the development stage of innovation projects (Fazzari et al., 1988).

Concerning the stage of the innovation project, the level of risk during the initial stages is significantly higher than once the innovation project has started. This will affect any financial decisions of the different agents involved in the investment (see Carreira and Silva, 2010).

In general, the expected viability of the project will depend on the proximity to the market in temporal and technological terms. External investors may be more prone to investing in innovation projects where the technological viability and market opportunities are clear, and they will be sensitive to riskier projects. However, some investors may prefer low risk and short-term gains, while others may pursue high risk and long-run innovation targets (Mazzucato, 2013). Some external investors, such as venture capitalists, selectively participate in high risk projects. Indeed, venture capital may be critical at the initial stages by providing capital, and also by initiating screening and monitoring processes (Jain and Kini, 2000).

Due to the risky nature of the R&D activity, and as evidenced by Hall (1992), managers may have to finance their projects with internal funds (Bougheas et al., 2003; Chiao, 2002). Hence, if external financial sources are lacking, managers may compensate for this during the initial phases by investing internal funds. In that event, the innovation projects in their initial phases will be more sensitive to internal financial constraints, in particular among young innovative firms. Innovative firms may prefer internal financial sources to finance innovation activities given their lower cost, fewer constraints and lower

² The empirical analysis remarks how financial barriers restrict the capacity of innovative firms to carry out innovation projects (“hampering barriers”) and how financial constraints reduce the capacity of potentially innovative firms to become innovative firms (“detering barriers”). Following D'Este et al. (2012), some barriers may deter some firms from engaging in innovation activities, and other barriers may affect firms which are engaged in innovation and may delay their initial plan.

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