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Innovation, asymmetric information and the capital structure of new firms

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INNOVATION, ASYMMETRIC INFORMATION AND THE CAPITAL STRUCTURE OF NEW FIRMS

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ABSTRACT

The paper focuses on the capital structure of firms in their early years of operation. Through the lens of Pecking Order Theory, we study how the pursuit of innovation influences the reliance of firms on different types of internal and external finance. Panel analyses of data on 7,394 German start-ups show that innovation activities are relevant predictors of the start-ups' revealed preferences for finance, and that the nature of these effects on the type and order of financing sources depends on the degree of information asymmetries specific to research and development activities, human capital endowments, and the market introduction of new products and processes.

JEL codes: G32, O16, O30

Keywords: Innovation, information asymmetries, start-up, pecking order, entrepreneurial finance.

1. Introduction

A large amount of research has investigated the capital structure of firms to improve our understanding of the relationship between firm characteristics and financing choices. The increasing importance attributed to new firms in both academic (Haltiwanger et al., 2013) and policy domains (European Commission, 2016, 2021) has strengthened a particular interest in the financing of entrepreneurial ventures as engines of growth. Despite all this interest, however, many aspects of new firms financing are still unclear when the focus is on the provision of capital for high-risk investments in firms that are not only small and young, but also highly innovative. As explained, for example, by Hall (2010) and Hall and Lerner (2010), the financing of R&D and innovation poses very specific challenges, and these go beyond the simple identification of venture capital (VC) as the most appropriate answer to finance gaps in high-tech entrepreneurial contexts.

The academic literature has over time shifted towards the adoption of Pecking Order Theory (POT) as the most effective framework for the analysis of small and young firms. Traditional POT suggests that sources of finance would be picked according to costs determined by information asymmetries, with internal finance being the cheapest – and thus always preferred when available – and with debt dominating equity in the firm's preferences for finance (Myers, 1984; Myers and Majluf, 1984). Since the original formulation of POT, the many empirical studies on this topic have not achieved a consensus on whether and to which extent these hypotheses apply to new firms (Frank and Goyal, 2008). Several authors found evidence in support of traditional pecking order of financing (Cassar, 2004; Cosh et al., 2009; Robb and Robinson, 2014) while others find that new firms tend to approach equity investors before seeking debt capital (Carpenter and Petersen, 2002a; Paul et al., 2007; Vaznyte and Andries, 2019). Moreover, there is of lack of empirical investigations on the intersection and more granular sequencing in the use of different sources of capital (Cumming and Groh, 2018; Farhat et al., 2018). Although several determinants of financing choices have been analysed very

thoroughly (e.g., firm size and age), the role of innovation in capital structure dynamics is relatively under-explored, which is surprising given the importance of financial resources for R&D-intensive firms (Farhat et al., 2018).

In this paper we discuss how different types of innovation are associated with the capital structure of new firms and provide novel longitudinal evidence on the financing choices of start-ups. Building on a POT framework, we use a sample of 8,273 German start-ups to study how innovation is associated with information asymmetries that lead to a particular order and type of financing choices.

Systematic empirical evidence on longitudinal data is rare and fragmented because very few datasets include granular data on the spectrum of new firm financing sources while providing sufficient information on innovation activities. Notable exceptions are the Kauffman Survey (Chemmanur and Fulghieri, 2014) and more recently the IAB/ZEW Start-Up Panel survey (Vaznyte and Andries, 2019). As discussed by Farhat et al. (2018), the availability of suitable data is one of the biggest challenges in the study of entrepreneurial finance. It is important to stress that the vast majority of empirical studies to date has focussed on new VC-backed firms or firms that receive a single type of capital, with counterfactuals defined by the absence of that specific source rather than by the presence of alternative sources (Cumming and Johan, 2017). Overall, only a few studies have investigated how financing choices are broadly shaped by innovative activities (among them Giudici and Paleari, 2000; Cassar, 2004; Paul, Whittam and Wyper, 2007; Vanacker and Manigart, 2010; Robb and Robinson, 2014), and our paper contributes to this stream of literature.

We address three main questions: (i) Do the financing choices of new innovative firms reflect a pecking order based on their informational opacity? (ii) Are different types of innovation relevant predictors of new firms' decisions to use certain sources of finance? (iii) Does innovation affect the likelihood to choose specific types of financing compared to alternative types? In analysing the capital structure of start-ups, we: 1) consider simultaneous

and alternative financing choices; (2) include, on the one hand, different indicators of innovation inputs (i.e. R&D expenditures and human capital) and outputs (e.g. product and process innovation) and on the other multiple of sources of finance (owner capital, family and friends' capital, internal finance, business angels, VC, and bank finance) to provide tests on an extended pecking order; (3) run the empirical analyses in a dynamic setting to alleviate concerns of endogeneity of financing choice.

The paper is structured as follows. In Section 2 we present a review of the literature, identify the specific gap we address in this contribution, and formulate testable hypotheses. Section 3 contains a description of the data and the econometric methods used in the empirical analysis. In section 4 we present and discuss our results. We draw the paper to a close in section 5 by discussing its implications, as well as its limitations, and by suggesting steps that might be considered in further research.

2. Theory and hypotheses

2.1. Information asymmetries and capital structure of new firms

Among existing capital structure theories, the pecking order theory is ideally suited to analyse the financing choices of small and young firms (Cassar, 2004; Cosh et al., 2009; Martinez et al., 2019; Mina et al., 2013; Robb and Robinson, 2014; Vaznyte and Andries, 2019). A key reason is the centrality of adverse selection as a driving construct, stressing the existence of information asymmetries between the managers/owners and potential suppliers of finance, whereby only the former know the 'true' value of the firm. In what follows, we begin by discussing the original formulation of POT, and will then elaborate on how its predictions change in the context of innovative start-ups, that is to say in an investment domain characterised by the strongest information asymmetries.

Building on an information economics framework, the POT original formulation posited the existence of a hierarchy of financing choices (Myers and Majluf, 1984). This order is defined

according to the asymmetric information level that is faced by each financing source: higher levels of asymmetric information lead external investors to demand a "lemon premium" (Akerlof, 1970) because of adverse selection risks generated by a lack of information about the investment opportunity in the finance-seeking firm. According to POT, when choosing between external and internal finance, the latter is always preferred because it does not entail any type of asymmetric information and is therefore the cheapest option. When external funds are necessary, then debt should be preferred to equity because banks can perform efficient screening functions that minimise adverse selection problems (Diamond, 1984; Stiglitz and Weiss, 1981). Conversely, equity investors are unable to discern the 'true' growth potential of the firm. When the owners offer equity, they are implicitly renouncing future cash flow and suggesting that the firm might be overvalued. Hence, the risk perceived by external investors will increase and, since equity investors cannot benefit from collaterals to cover their losses and do not have a priority claim on the firm cash flow, they will ask for higher returns on their capital.

This order of choice, as described in the original POT, has been subject to a large number of empirical tests. It is interesting to notice there is still little agreement as to whether POT can be considered to be a general theory of firm financing choices (Fama and French, 2005; Frank and Goyal, 2003; Lemmon and Zender, 2010). Views differ on the specific contexts in which the pecking order might apply (Leary and Roberts, 2010), and contrasting results are found on the choice of debt vs. equity as external sources of financing (Frank and Goyal, 2008).

When POT is applied to populations of smaller and younger firms, the framework might need substantial adjustments. Deviations from the pecking order emerged in the studies by Frank and Goyal (2003) and Fama and French (2005), which showed that high growth firms were more prone to asymmetric information problems and more likely to rely on equity rather than debt finance. As suggested by Fulghieri et al. (2015), when the level of asymmetric information is high, equity financing can dominate debt financing, with the counterintuitive result that this would happen even in the case where an individual asset could be financed by debt if taken in

isolation. The authors conclude that "the relationship between asymmetric information and choice of financing is more subtle than previously believed" (Fulghieri et al., 2015, p. 33). Extant research shows that start-ups are often forced to raise external funds because they lack internal finance (Fryges et al., 2015). Moreover, new firms have to deal with credit rationing in light of their higher asymmetric information levels compared to larger and more established firms (Carpenter and Petersen, 2002b; Stiglitz and Weiss, 1981). In general, from the traditional POT perspective, debt financiers should face relatively low information asymmetries because the value of debt has a fixed remuneration and is often guaranteed by some collateral, which reduces the "lemon premium". Therefore, once the borrower's asymmetric information levels can be decreased and 'true' value of the firm is revealed, there will be only minor changes in the value of the attached debt securities. Accordingly, debt capital should be relatively cheap. Conversely, equity investors do not require any collateral and expose their funds to substantial risks, thus facing a high level of information asymmetries, which command an additional "lemon premium" compared to debt financiers (Berger and Udell, 1998; Carpenter and Petersen, 2002a; Vanacker and Manigart, 2010; Vaznyte and Andries, 2019).

This line of thought also highlights that standard POT does not account for all the decisions that can be made about different sources of finance. New firms raise funds through a wide set of financing sources, which include owner funds, family and friends' capital, retained earnings, bank debt and private equity (venture capital and business angel)[1]. Therefore, if the financing hierarchy is determined by information asymmetries, we would expect new firms to follow a pecking order where the sources of financing that are better able to cope with informational asymmetries are chosen first. Several studies have observed that start-ups prefer private equity to bank debt (Carpenter and Petersen, 2002a; Fama and French, 2005; Paul et al., 2007), suggesting that a higher cost of private equity capital is offset by superior abilities of professional investors in evaluating new firms and managing information asymmetries through

[1] More recent additions include crowdfunding and initial coin offerings.

screening and monitoring (Gompers and Lerner, 2001). In addition, it is well established in the literature that private equity investors also provide non-financial resources, by participating in the firm's management, supporting the owners with their networks and complementary assets, ultimately contributing to firm growth and positive exit events (Bertoni et al., 2011; Gompers and Lerner, 2001). Then, new firms with higher levels of informational asymmetries would prefer internal finance, and friend and family funds (or owner finance for start-ups) as a first option. Accordingly, when internal funds are exhausted, they would approach business angel and venture capital funds as sources of intermediate equity. This preference would be given because of the advantage that these sources have when coping with high levels of asymmetric information, while being cheaper than debt once non-monetary benefits are accounted for. Lastly, as they consolidate their collaterals, firms will have access to debt and public equity (Berger and Udell, 2006).

2.2. Innovation and firm capital structure

POT posits the existence of a financing hierarchy based on asymmetric information and adverse selection costs. The few prior studies that exist on the validity of POT for start-ups seem to suggest that the existence of a financial hierarchy can be context-dependent and that the adherence to a strict pecking order might be influenced by several firm characteristics. For instance, Robb and Robinson (2014) find evidence that the majority of new firms early operations are financed through a relevant share of debt finance despite their young age. The results of this study seem to be in line with the pecking order predictions, which is surprising considering the problems of informational opacity generally associated with start-ups and the advanced development of private equity markets in the United States. In a more recent contribution Vaznyte and Andries (2019) find that start-ups with different levels of entrepreneurial orientation will make different financing choices, based on the distinct costs and benefits perceived from different types of finance. We extend this line of research and consider

different aspects of innovation as determinants of information asymmetry associated with deviations from standard POT predictions. In addition to the characteristics that they share with all SMEs as investment propositions (no track record and lack of collateral) (Gompers, 1999), innovation projects entail technological and market uncertainty (Coleman and Robb, 2012). Investments in innovation can generate intangible assets (e.g., intellectual property or know-how) which are difficult to evaluate from outside the firm and are illiquid if seen as possible collateral. These features contribute to increase start-ups' overall risk, their informational opacity and their probability of bankruptcy. More innovative start-ups will experience worse asymmetric information problems than less innovative companies (Aghion et al., 2004; Hall, 2010, 2002; Hogan and Hutson, 2005) even though their innovative ideas may be more profitable business opportunities. As a result, credit rationing can be extreme for small, young and innovative firms as far as the most risk-adverse borrowers are concerned (Leary and Roberts, 2010).

Framing these arguments in predictions of POT is a non-trivial task. The preference for internal over external finance can be relatively independent of innovation whenever transaction costs exist (Cosh et al., 2009; Hall, 2009; Mina et al., 2013; Revest and Sapio, 2012), and the importance of internal cash-flow is well documented (see for example Brown et al., 2009).[2] Much more complicated is the relative preference for debt or equity when no internal resources are available and the firm pursues innovation activities. Only few studies have investigated the financing hierarchy of new firms in light of their innovative activities, and almost all of them have focused on one source of finance rather than considering simultaneously the several financing options that are available to entrepreneurs (Cassar, 2004; Giudici and Paleari, 2000; Paul et al., 2007; Robb and Robinson, 2014; Vanacker and Manigart, 2010). This gap in the literature is partly due to the scarcity of good quality data on new firms and partly to the fact that the datasets that do exist rarely incorporate both (multisource) financial *and* innovation data. Also, when appropriate datasets are constructed by matching complementary data sources, they

[2] For a broader discussion on the relationship between Schumpeterian innovation and firm finacial constraints see Hajivassiliou and Savignac (2008), Hottenrott and Peters (2012) and Lahr and Mina (2020).

tend to have information only on a focal source of finance (typically venture capital) rather than a full spectrum of financing options, which is instead necessary for a study of financing hierarchies (Cumming et al., 2019).

Contrasting results about the relative importance of debt are obtained in Fryges et al. (2015) and Brown et al. (2012). Whereas Fryges et al. (2015), analysing 2007-2008 German data, find a positive and perhaps two-way relationship between bank debt and R&D intensity, Brown et al. (2012) found a negative relationship between high-tech firms and use of bank loans for the period 2007-2009. It is possible that these discrepancies are due to turbulence generated by the financial crisis of 2008. Vanacker and Manigart (2010) explore the importance of debt capacity in a pecking order setting, finding that firms with a larger share of intangible assets are more likely to fund their activities with equity rather than debt. Lahr and Mina (2015) argue that innovation can explain the observed deviations from the standard pecking order. However, their comparative study of UK and US SMEs suffers from the limitations of cross-sectional data, which did not allow testing in a longitudinal framework.

Our paper contributes to this literature by using multiple indicators of both innovation and finance types in a dynamic framework, and by testing how different aspects of innovation are associated with a hierarchy of financing choices based on information asymmetries.

According to POT, we posit that the preferences for finance are based on the firms' level of information asymmetries. Thus, when a start-up engages in innovation activities, it will increase its informational opacity. In a financing hierarchy, innovation inputs, such as investments in R&D, would negatively influence the probability of accessing more informationally complex sources of finance, in line with the results of Wang and Thornhill (2010) in the case of large firms. Our first hypothesis is:

Hypothesis 1.a. In a hierarchy of financing choices, new firms with higher levels of R&D investments will be less likely to access more informationally complex sources of finance.

Not all the activities that are usually branded as "innovative" may exacerbate informational asymmetry. The introduction of a new product on the market can be associated with more stable cash flows, which could help service the debt; similarly, new processes could optimise production costs, providing new resources in the balance sheet and reducing adverse selection costs. As a result, firm informational opacity could be reduced, thus facilitating access to more informationally complex sources of finance in a finance hierarchy. We hypothesise that:

Hypothesis 1.b. In a hierarchy of financing choices, new firms that introduced new products or processes to the market will be more likely to access more informationally complex sources of finance.

From a complementary perspective, we are also interested in how individual sources of finance are related to innovative activities. In line with the contribution of innovation to the firm's informational opacity, we would expect that firms with higher investments in R&D will be more likely to use equity and owner finance and less likely to receive debt finance compared to other firms. On the other hand, we would expect an opposite relationship for firms that introduce product or process innovation, since these might be associated with lower informational opacity. We therefore propose that:

Hypothesis 2a: Start-ups with higher investment in R&D will be more likely to rely on owner finance and equity finance than other start-ups, and less likely to receive debt finance.

Hypothesis 2b: Start-ups introducing product or process innovations will be more likely to rely on owner finance and debt finance than other start-ups, and less likely to rely on equity finance.

Finally, against the general prediction of the traditional POT, we expect that innovation will drive firms towards obtaining equity rather than debt or other sources of finance. That is, firms that suffer from worse informational asymmetries would be more likely to choose equity capital compared to debt or other sources of external finance. We hypothesise that:

Hypothesis 3a: Among firms that receive external financing, the likelihood that they will be financed by sources other than external equity is negatively related to their innovation inputs.

Conversely, the introduction of product or process innovations can contribute to decrease firms' informational asymmetries. Therefore, firms that introduced these types of innovation should prefer debt or other sources of finance compared to equity, because these sources face reduced adverse selection problems, and these types of innovations might reduce the level informational opacity. We test that:

Hypothesis 3b: Among firms that receive external financing, the likelihood that they will be financed by sources other than external equity is positively related with innovation outputs (i.e., the introduction of process and products innovations).

3. Data and Methodology

3.1. The sample

The database we use for this study is the IAB/ZEW Start-up Panel[3]. This is one of the few existing datasets that observe very young firms from a longitudinal perspective by building on repeated surveys of German start-ups and micro firms. This segment of the economy is rarely covered in standard surveys of firms, as these do not capture observations until a company has at least one registered employee (many start-ups have no employees at all at the beginning of their life). The IAB/ZEW Start-up Survey draws samples from Creditreform, the largest rating agency in Germany, applying the condition that a firm must be run by at least one full-time entrepreneur

[3] Before 2014 this database was known as KfW/ZEW Start-up Panel.

if it is to be included in the database. An important characteristic of the final sample is that firms have to be three years of age or younger when they are interviewed for the first time. Furthermore, the sample is stratified to cover all industrial sectors, with an over-representation of newly founded technology-based firms. The aim of the survey is to interview about 6,000 firms in each wave. The data collection is done through computer aided telephone interviews (CATI). When approaching a firm for the first time, the operator collects information also for the previous three years. As we have anticipated, this dataset has the rare feature of including information about both financial structure and innovation, and the longitudinal format gives us the opportunity to control for the effects of innovation on capital structure over time.

We use the anonymised 2014 version of the dataset, which covers the 2005-2013 years of activity.[4] We drop firms that are observed for less than three consecutive years. The final panel is made of 8,273 firms observed for a minimum of three consecutive years to a maximum of eight consecutive years.

>>>INSERT TABLES 1-4 ABOUT HERE<<<

3.2. Estimation strategy

We develop our analysis in three steps. In the first step, we perform a test on the order of preferences, investigating how different innovation indicators affect the probability that a firm's capital structure will belong to a class with sources of finance more or less able to deal with informational opacity. A common problem in asking this kind of question is endogeneity due to simultaneity and reverse causality bias. Having a longitudinal dataset greatly reduces this risk because we can control for past values. In the second step of the analysis, we ask whether innovation influences the probability that a firm obtains any type of finance and more than 50% of total finance from a single type of financing source, testing if each one of these relationships stands in a panel framework. Finally, we perform a complementary test on the probability of

[4] The first two years of data (i.e., 2005-2006) only contain information about the firm's cost, investments and revenues and exclude information on innovation. Therefore, they cannot serve the purpose of this study.

obtaining more than 50% of debt or other financing sources compared to the probability of obtaining more than 50% of equity.

We begin by classifying firms in different groups based on the combinations of their financing sources. In this specification we consider internal finance, owner finance, equity funding and debt funding. As shown in Table 1, internal finance includes retained earnings and sales; owner finance consists of owner deposits. Equity finance includes venture capital and mezzanine financing; debt includes long and short-term debt. Our ordinal dependent variable is constructed so that the minimum value is associated with the lowest adverse selection costs (owner finance) and the higher values are associated with sources of finance that face the highest levels of information asymmetries, as represented in Table 6.

The classes we define are mutually exclusive and are used to test how specific firm characteristics influence the probability of accessing a specific type of finance. The order of choice we assume implies that debt is the source with the highest adverse selection costs for start-ups, as we argued in the theory section, and that private equity operators are able to cope with start-ups informational opacity and therefore being competitive in providing capital. We specify two hierarchies. The first includes owner finance, family and government funds (start-up grants and bridge money), equity and debt, combined in 5 and 7 classes respectively. The second drops owner finance to provide a clearer test of the hierarchy between the external sources of finance, which are combined in 4 and 7 classes. Because of the ordinal nature of our dependent variable, we choose an ordered Logit regression model, following Kaplan and Zingales (1997).

We move to the second step in our analysis creating binary dependent variables that indicate whether firms have received a specific type of finance in each year of the panel, and we analyse the determinants of the likelihood to obtain a single type of financing, including owner financing, equity financing and debt financing. In addition, we perform complementary tests on the probability of obtaining more than 50% of a given type of finance in a specific year in a

panel specification. Because of the binary nature of these dependent variables, we apply panel Logit regression models.[5]

At last, we build a categorical variable that reflects whether the largest share of a firm's external finance in a given year comes from debt, equity or other external sources (family and friends, government funds and a residual category). We use a multinomial logit model to investigate if firms that perform innovative activities have a different likelihood to obtain the majority of funds in a given year in form of debt or other sources, compared to equity.

>>>INSERT TABLE 5 ABOUT HERE<<<

3.3. Independent variables

The main objective of this study is to identify the effects of several indicators of innovation activities on the capital structure of start-ups. R&D expenditures indicate the efforts that a firm makes in generating innovations. These are closely linked with the subsequent observation of patents and prototypes and are usually risky investments that increase firms' informational opacity (Griliches et al., 1991; Hausman and Griliches, 1984). We include yearly R&D expenditures scaled by turnover and with a one-year lag, winsorised at 1% and 99%.

To explore how innovation outputs rather than inputs affect financing choices, we use two dummy variables indicating whether the firm has introduced a new product or a new process in the reference year. These variables are good indicators of innovation in line with the European Community Innovation Survey design and the Oslo Manual. New products are innovations associated with measurable market outcomes. As such, they are more transparent signals to investors relative to R&D in that they are directly observable as assets that can be valued by an external supplier of capital. This reduces the overall informational opacity of the firm. New processes are also 'realised' novel ideas but rather than opening up new market niches they tend

[5] The results of simple Logit models are available upon request. All the statistical tests confirmed the better fit of all panel specifications.

to reduce the costs of production, increasing profit margins and the competitive advantage of firms on the market. Interestingly, their effect from an asymmetric information perspective is not straightforward since they might not be recognizable to an external investor, and/or their value might not be easy to estimate.

Our estimates include information about human capital from two different angles. Previous literature has established a connection between the firm's human capital (Berk et al., 2010; Jaggia and Thakor, 1994), the founder's human capital (Baum and Silverman, 2004; Colombo and Grilli, 2005) and the capital structure and financing decisions of the company. We proxy these two dimensions with the number of graduates employed by the firm (standardised on total employment) and with a dummy variable indicating if the founder has a degree. Firms with a higher level of human capital tend to be more knowledge-intensive investment propositions (which adds to the firm's share of intangible over tangible assets), and this contributes to increase informational opacity. We expect these variables to be negatively correlated with financing sources that entail higher adverse selection costs.

The control variables include firm characteristics such as age, size, profit margin, and a dummy indicating if the firm has obtained public support in the form of loans or subsidies. The maximum level of information asymmetry is expected to occur in a firm's first years of life. Then, we expect that younger firms will show a preference toward financing sources able to face lower levels of information asymmetry, such as internal finance, family and friend's finance and owners' finance. Higher profit margins will be negatively related to external finance and of course positively related to the probability of accessing internal finance. Public support in the form of loans or subsidies on the one hand might be important as an incentive to entrepreneurship and on the other hand can provide a strong certification effect for external investors. Thus, we expect that firms that have obtained public support will be more likely to receive external finance (both equity and debt).

All regressions include a set of industry dummies (presented in Table 2) and year dummies.

4. Results

The first step of our analysis is a test on the impact of innovation on the order of financing sources. We do not simply focus on pairwise preferences but aim to identify a hierarchy of combinations of sources of finance on a continuum of adverse selection costs. We divided the sample in four different classes (Table 5), with the first two including owner finance and the last two including types of external finance only. The classes are mutually exclusive combinations of different types of finance, and the lower levels of our ordinal dependent variable are the ones entailing lower adverse selection costs. The ordered Logit models estimate the effect of each covariate on the probability of a firm falling in a higher or lower class. All these models are estimated with a random effect panel specification.

Table 6 and Table 7 present the econometric estimates of ordered Logit models. All models, with or without internal finance, are consistent in identifying a negative relationship between R&D expenditures and an order of choice that reflects increasing adverse selection costs. The negative sign means that, assuming the theorised order of preferences, a higher level of R&D activities will always decrease the probability that a firm is going to be financed with capital associated with higher adverse selection costs.

Introducing product innovation is associated with a coefficient that is always negative but never statistically significant. The opposite sign, still not significant, is observable for the introduction of process innovations.

The effect of firm's human capital is negative and significant. Since this indicator captures intangible assets, this is consistent with the effect of R&D activity, as expected. This effect is stronger once we exclude owner finance from the financing hierarchy, corroborating the idea that a larger portion of educated workforce is associated with activities that are

informationally opaque for external financiers. Surprisingly, we do not observe a clear effect of founder's human capital on the hierarchy of financing choices, with very small coefficients that are never significant.

The signs of control variables coefficients are in line with our expectations. Older and larger firms can access finance types that are more complex from an informational opacity perspective. This pattern is consistent with the prediction of pecking order theory and with the idea that firm's informational opacity decreases as age and size increase. Profit margin also follows the pecking order prediction, indicating that a more profitable firm can afford the higher costs of more complex sources of finance. Finally, public support reduces informational opacity and seems to ease firms' access to costlier sources of finance. The overall results are consistent with our first hypothesis *H1.a*, but we do not find supporting evidence on the consequences of introducing product or process innovations *H1.b*.

>>>INSERT TABLE 6 AND TABLE 7 ABOUT HERE<<<

The Logit estimations of the likelihood to obtain a specific source of finance (Table 8) show that R&D expenditures are positively and strongly correlated with owner finance and equity finance, confirming our expectations. Furthermore, the coefficient of R&D on debt is negative and statistically significant, in line with theoretical predictions. The majority-of-finance results shown in Table 9 fully confirm the negative association between R&D investment and debt and the positive relationship between R&D investments and owner and equity finance.

>>>INSERT TABLE 8 and 9 ABOUT HERE<<<

As expected, introducing a product or a process innovation is associated with an increase in the probability of obtaining all types of finance compared to other firms. The panel logit

estimations of the probability to obtain any amount from specific finance types reveal a clear positive reaction of owner and debt finance to innovation outputs. Results for these two sources are consistent when we focus on the probability to obtain more than 50% of finance (Table 9), whereas the coefficient for equity finance, which was already weak in the previous estimation, loses its significance. Innovation output indicators seem to decrease the informational opacity of the firm as an investment proposition, thus reducing the cost of access to some sources of financing. On the one hand, introducing new products can imply future cash flow that could better service the debt. On the other hand, processes innovations can affect costs, freeing financial resources and leaving balance sheets in better shape, to which debt finance should react positively. However, introducing new product or processes does not seem to affect the probability to obtain equity financing. We instead observe that introducing a product innovation has a negative but not significant coefficient in relation to the likelihood to obtain the majority of equity financing. This can be plausible if the entrepreneur is on course to launch on the market a product that is already developed and is not inclined to share the attached cash-flows with a new investor. Overall, the results are in line with the financing hierarchy based on adverse selection costs and with our expectations.

Firm human capital is an additional indicator of a firm's level of asymmetric information. We find that it is positively and significantly associated with equity financing in both specifications. On the other hand, a negative and significant relationship with debt is observed only in the majority-of-finance complementary analysis. These signs are in line with the expectations that firms employing highly skilled people, whose knowledge can be a source of informational asymmetry relative to potential finance suppliers, are less likely to access more informationally complex source of finance. On the other hand, founder's human capital is never significant when firm-level human capital is taken into account. Interestingly, results for the control variables are very coherent with our expectations and reveal that older firms are more likely to be financed with debt and less likely to be financed with owner finance. Size seems to

increase the probability that a firm is financed through equity and debt and reducing the probability that it will be financed with owner's funds. Profit margins behave as expected, being negatively correlated with external sources of finance and with owner's equity.

Public support exerts a positive effect on the probability to obtain any kind of finance, even when we consider the probability of obtaining more than 50% of a specific source of finance.

From these two sets of econometric estimates, we can draw the following conclusions. We find full support of our first hypotheses *H2.a*, confirming that start-up R&D investment are associated with higher informational asymmetries and, accordingly, they are not suitable to debt financing, but they are positively related to equity and owner's financing. However, we only find mixed support for *H2.b* on product and process innovations, that seem to positively influence the probability to receive owner finance and debt finance but are not significant determinants of the likelihood of equity financing.

Finally, Table 10 shows the results of a multinomial logistic regression. Both columns report the effect that the coefficients have on the probability to choose a majority of either Debt or Other sources of external finance, compared to Equity. The negative and significant coefficient of R&D expenditures in for both choices suggests that higher investments in R&D greatly decrease the probability to choose Debt or Other sources of finance, and as expected this negative relationship is confirmed when we look at the effects of human capital. Founder human capital, instead, has the expected sign but it is not significant.

Introducing a new product or process do not seem to matter when considering alternatives to equity financing. The other control variables are not significant, except for profit margin, which, as expected, is positively related to choosing a different source of financing than debt, in line with the owner's aim to appropriate all the firm's cash flow.

Overall, the multinomial regression results provide support for hypothesis *H3.a* but we do not find any significant evidence on process and product innovation to support *H3.b*.

>>>INSERT TABLE 10 ABOUT HERE<<<

5. Conclusions

During the last two decades, many policy initiatives have been designed to stimulate the birth and growth of new firms. Start-ups have been firmly placed at the core of broader processes of economic growth and net job creation (Haltiwanger et al., 2013). Notwithstanding these efforts, new ventures still face considerable challenges, and one of most concerning remains their access to finance (European Commission, 2021, 2016). Because innovative firms seem especially vulnerable to this kind of barrier to growth, it is extremely important to gain as detailed a picture as possible of how, why and under what circumstances capital flows in certain directions and towards specific types of firms.

In this study we have focused on the role played by different aspects of innovation in the context of start-ups' capital structure decisions. We have adopted a pecking order theory framework, where we posited that innovation is associated with information asymmetries which strongly influence the preference for different types of finance. To the best of our knowledge only a few studies exist that analyse simultaneously a range of financing options and do so in a longitudinal setting. Moreover, not only have we considered the predictors of each type of finance, but we have also accounted for the combinations and order of finance sources. We have analysed rare and high-quality longitudinal data on a sub-population of firms that is systematically under-represented in standard microdata and we found that start-ups' R&D investments and firm human capital as innovation inputs are very important determinants of financing choices, and that their contribution to firms' informational opacity supports the idea that new firms pecking order of finance is based on asymmetric information and adverse selection costs. We do not have clear evidence regarding the effect that product and process

innovation have in reducing firm's informational asymmetries in a hierarchical framework, but we find significant effects when we test the likelihood of accessing individual sources of finance.

These results have relevant practical implications. From a managerial perspective, our result can be useful for entrepreneurs that have started or are planning to start a new innovative business. It is essential that managers take into account the empirical (behavioural) regularity that certain types of investors are less likely to provide finance at reasonable costs depending on the firm's characteristics and innovation activities. This indicates that in developing the firm's business model, financing decisions must be closely aligned with innovation strategies linked to the particular stage of development of the firm. This evidence also has policy relevance, in particular when we consider that innovation influences the firm's preferences for finance, and that government support should consider not only standard firm characteristics such as size and age, but also their innovative profile of firms in view of helping crowding-in, rather than crowding-out, effects in relation to finance coming from different private sources. This result should also be kept in mind in relation to hybrid instruments that can reduce the adverse selection costs associated with different types of finance, reducing asymmetric information and informational opacity. A promising avenue, for instance might be the use of big data analytics to collect and elaborate large amount of information to be used as decision support systems capable of offsetting the inability of certain kind of investors to evaluate innovative firms as investment propositions.

This study has of course some limitations. Despite using a level of detail on the sources of finance which is uncommon in previous studies, we are aware that the last decade has seen the emergence of new types of financing tools, including accelerators and crowdfunding (for a comprehensive list see Block et al., 2017). It is possible that new types of finance will grow from niche markets to mainstream sources of entrepreneurial finance, but it is early day, and these segments of the external capital spectrum are either not yet included in official statistics or not

yet covered by sufficiently long time series. There is no doubt that they can be included in further extensions of POT studies.

We also have to acknowledge that we are only observing data that represent equilibrium levels, where the basic assumption is that firms obtain the desired type of finance according to theory, but within the well-known limitations of studies based on observational data such as ours. Finally, while we have covered in some detail the antecedents of capital structure, the implications of financing hierarchies for the growth of firms would provide an interesting extension of this line of investigation, and therefore fertile ground for further research in this area.

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Tables and figures

Variable name	Variable description
Internal Finance	Firm has obtained internal finance; specifically, the entrepreneurs were asked if in the reference year they used sales from running operations or retained earnings from previous years, or income from interest, royalties or provisions to finance their investment
Owner finance	Firm has obtained owner finance in the reference year, particularly deposits
Equity Finance	Firm has obtained equity finance as private equity, venture capital, capital from business angels or subscription of shares by third parties or mezzanine capital.
Debt Finance	Firm has obtained debt finance as long-term or short-term loans
Maj. of Internal Finance	Firm has more than 50% internal finance
Maj. of Owner Finance	Firm has more than 50% owner finance, defined as above
Maj. of Equity	Firm has more than 50% equity finance, defined as above
Age	Age, number of years from foundation
Size	Log of (Number of employees + 1)
R&D Exp.	R&D Expenditures/Turnover, one year lag, 0.01 winsorised.
Profit margin	Profits on Turnover, winsorised fraction 0.05
Public Support	Dummy equal one if the firm received public support (loans and subsidies)
Product Innovation	Dummy equal one if the firm introduced a new product in reference year
Process Innovation	Dummy equal one if the firm introduced a new process in reference year
Founder Human Capital	Dummy equal one if the founder has a degree
Firm Human Capital	Number of employees with a degree on number of total employees, logarithm
Year dummies	Dummies controlling for yearly effect, omitted
Sector dummies	Sectoral dummies (manufacturing, services, software, construction, and wholesale and retail markets), omitted

Table 1 Variable Description

Industrial sectors			
	Industrial sector (last codification, WZ2008)	Frequency	Percent
Cutting-hedge tech. manuf.	20.20, 21.10, 21,20, 24.46, 25.40, 26.11, 26.20, 26.30, 26.40, 26.51, 26.60, 30.30, 30.40, 32,50	723	8.81
High tech. Manufacturing	20.13, 20.14, 20.16, 20.17, 20.41, 20.51, 20.53, 20.59, 22.11, 22.19, 23.19, 26.70, 27.11, 27.12, 27.20, 27.40, 27.90, 28.11-15, 28.23, 28.24, 28.29, 28.30, 28.41, 28.49, 28.92–96, 28.99, 29.10, 29.31, 29.32, 30.20	585	7.13
Technology intensive sectors	61.1–3, 62 (without 62.01), 63.1, 71.1–2, 72.1	1808	22.03
Software	62.01	735	8.96
Non-high-tech manufacturing	10–33	1034	12.60
Skill intensive services	69.1–2, 70.2, 72.2, 73.1–2	613	7.47
Other business orientated services	49.2, 49.5, 50.2, 50.4, 51.2, 52, 53, 61.9, 63.9, 64, 74.1, 74.3, 74.9, 77.1, 77.3–4, 78, 80–82,	537	6.54
Consumer orientated services	49.1, 49.3–4, 50.1, 50.3, 51.1, 55, 56, 58–60, 65–66, 68, 74.2, 77.2, 79, 85.5-6, 90–93, 95–96	839	10.22
Construction	41–43	868	10.58
Wholesale and retail market	45–47 (without 46.1)	993	12.10
Subtotal		8206	106.45*
Firms for which the sector is missing		67	
Grand Total		8273	

Table 2. Industry distribution of the sample analysed. Several firms change sectors during the panel and this causes the cumulative percentage to be more than one hundred.

Descriptive Statistics						
Variables	Mean	Standard Dev.	Min	Max	Median	N
Owner finance	.27	.44	0	1	0	16,158
Equity Finance	.02	.14	0	1	0	16,158
Debt Finance	.22	.41	0	1	0	16,158
Maj. of Owner Finance	.90	.30	0	1	0	16,158
Maj. of Equity	.01	.09	0	1	0	16,158
Maj. of Debt	.13	.34	0	1	0	16,158
Age	.93	.62	0	2.07	1.09	16,158
Size	.62	.70	0	1.79	0	16,158
R&D Exp/Turnover.	.06	.22	0	1.67	0	16,158
Profit margin	.14	.23	-0.5	0.625	0.10	16,158
Public Support	.26	.44	0	1	0	16,158
Product Innovation	.32	.47	0	1	0	16,158
Process Innovation	.20	.39	0	1	0	16,158
Founder Human Capital	.45	.50	0	1	0	16,158
Firm Human Capital	.36	.67	0	3.40	0.69	16,158

Table 3. This table shows descriptive statistics for the variables included in the regressions. Medians are not shown for dummy variables**.**

Correlations Table									
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Type of finance	**(1) Internal**								
	(2) Owner	-0.014*							
	(3) Equity	-0.034***	0.160***						
	(4) Debt	0.021***	0.430***	0.12***					
Majority of	**(5) Internal**								
	(6) Owner					-0.074***			
	(7) Equity					-0.058***	-0.034***		
	(8) Debt					-0.140***	-0.130***	-0.028***	
	(9) Age	0.019**	0.004	0.011*	0.074***	0.077***	0.004	0.016**	0.060***
	(10) Size	0.094***	0.012*	0.100***	0.140***	0.057***	-0.058***	0.083***	0.140***
	(11) Profit margin	0.130***	-0.200***	-0.170***	-0.120***	0.180***	-0.120***	-0.140***	-0.066***
	(12) Public Support	0.053***	0.120***	0.075***	0.210***	-0.023***	-0.009	0.051***	0.180***
Innovation	**(13) R&D Exp**	-0.050***	0.160***	0.260***	0.013*	-0.075***	0.120***	0.280***	-0.021**
	(14) Product	0.091***	0.085***	0.072***	0.055***	0.064***	0.050***	0.040***	0.033***
	(15) Process	0.110***	0.068***	0.055***	0.058***	0.077***	0.044***	0.032***	0.039***
	(16) Founder Human Capital	-0.0048	0.010*	0.006	0.014**	-0.007	0.003	0.0050	0.012*
	(17) Firm Human Capital	0.071***	0.026***	0.160***	0.033***	0.065***	-0.001	0.150***	0.019**

Table 4. This table shows the pairwise correlations between all the variables included, with the relative significance level. Correlations between dependent variables are omitted.

Correlation Table (continued)

		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	(9) Age									
	(10) Size	0.160***								
	(11) Profit margin	0.150***	-0.190***							
	(12) Public Support	-0.290***	0.140***	-0.140***						
	(13) R&D Exp	-0.070***	0.024***	-0.320***	0.072***					
Innovation	**(14) Product**	-0.098***	0.100***	-0.120***	0.087***	0.190***				
	(15) Process	-0.077***	0.092***	-0.041***	0.088***	0.130***	0.310***			
	(16) Founder Human Capital	-0.005	0.012*	-0.0082	0.007	0.017*	0.012	0.001		
	(17) Firm Human Capital	0.160***	0.410***	-0.150***	0.036***	0.190***	0.160***	0.120***	0.020***	

Classes implemented for ordered Logit estimation.			
	(1)		(2)
	These classes include owner finance, family funds, government finance, equity and debt.		These classes include family funds, government finance, equity and debt.
5 Classes		**4 Classes**	
1	Only owner funds.	**1**	Family and relatives' funds, but no others.
2	Funds from friends and family, but neither gov. funds, equity or debt	**2**	Government funds, but neither debt or equity
3	Gov. funds, but no equity nor debt	**3**	Equity, but not debt
4	Equity, but not debt	**4**	Debt
5	Debt only		
7 Classes		**7 Classes**	
1	Only owner funds	**1**	Only family and relatives' funds
2	Owner funds and, family or relative funds or gov. funds, no debt or equity	**2**	Only government finance
3	Family or relatives or gov. funds, but no other finance.	**3**	Gov. funds and family and relatives' funds, but no equity nor debt
4	Equity, and family or relatives or gov. funds, but no other	**4**	Equity and family or relatives' funds, but no debt and no government funds.
5	Only equity, but no other	**5**	Equity and gov. funds, but no debt nor family funds.
6	Equity and debt	**6**	Equity and debt
7	Debt	**7**	Debt

Table 5. This table shows the composition of the classes used in the ordered Logit. In order to test for the possible different combinations of finance, we define two different classes for two different specifications, with and without owner finance.

Classes Composition: Owner fin., fam. funds, gov. fund, equity and debt.				
	(1)	**(2)**	**(3)**	**(4)**
Dependent Variable	**5 Classes**	**5 Classes**	**7 Classes**	**7 Classes**
Age	0.806***	0.968***	0.768***	0.894***
	(0.151)	(0.190)	(0.146)	(0.181)
Size	0.973***	1.042***	0.849***	0.927***
	(0.084)	(0.118)	(0.080)	(0.111)
Profit Margin	0.309*	0.626**	0.508***	0.804***
	(0.184)	(0.269)	(0.180)	(0.261)
Public support	1.025***	1.118***	0.963***	0.999***
	(0.109)	(0.152)	(0.105)	(0.144)
R&D Exp.		-1.015***		-1.096***
		(0.210)		(0.209)
Product Innovation		-0.018		-0.033
		(0.132)		(0.128)
Process Innovation		0.079		0.084
		(0.154)		(0.148)
Founder Human Capital		-0.003		-0.007
		(0.128)		(0.123)
Firm Human Capital		-0.154		-0.210**
		(0.109)		(0.104)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Owner | FFF, No other	1.971***	0.309		
	(0.217)	(0.302)		
FFF, No other | Gov. Funds, No Eq. No Debt	2.327***	0.751**		
	(0.220)	(0.302)		
Gov. Funds, No Eq. No Debt | Eq. No Debt.	2.479***	0.871***		
	(0.221)	(0.302)		
Eq. No Debt. | Debt	2.658***	0.604***		
	(0.223)	(0.174)		
Own | Own and family or Gov., no debt, no eq.			1.892***	2.686***
			(0.209)	(0.216)
Own and family or Gov., no debt, no eq. | Family or Gov., no others			2.276***	2.686***
			(0.212)	(0.216)
Family or Gov., no others | Equity and family or Gov., no others			2.394***	2.686***
			(0.213)	(0.216)
Equity and family or Gov., no others | Only Eq.			2.401***	2.686***
			(0.213)	(0.216)
Only Eq. | Eq. and Debt.			2.451***	0.828***
			(0.214)	(0.290)
Eq. and Debt. | Debt			2.686***	1.082***
			(0.216)	(0.291)
Random Effects Constant	4.730***	5.844***	4.417***	5.275***
	(0.546)	(0.862)	(0.509)	(0.775)
N	5,353	3,764	5,273	3,705

Table 6. This table shows the ordered Logit regression for the classes specified in Table 5, column 1. Clustered standard errors are in parentheses. Significance levels: *** p<0.01; ** p<0.5 *p<0.1

Classes composition: Family funds, gov. funds, equity and debt				
	(5)	(6)	(7)	(8)
Dependent Variable	**4 Classes**	**4 Classes**	**7 Classes**	**7 Classes**
Age	0.905***	0.971***	0.723***	0.663**
	(0.277)	(0.328)	(0.230)	(0.264)
Size	0.997***	1.306***	0.648***	0.837***
	(0.156)	(0.217)	(0.124)	(0.162)
Profit Margin	1.179***	0.576	1.443***	1.079***
	(0.341)	(0.462)	(0.301)	(0.398)
Public support	0.081	0.509**	0.095	0.335*
	(0.191)	(0.245)	(0.162)	(0.199)
R&D Exp.		-1.715***		-1.365***
		(0.342)		(0.298)
Product Innovation		-0.279		-0.198
		(0.225)		(0.189)
Process Innovation		0.192		0.091
		(0.268)		(0.218)
Founder Human Capital		0.023		-0.016
		(0.220)		(0.182)
Firm Human Capital		-0.413**		-0.395***
		(0.184)		(0.150)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Family only | Gov., no Debt, No Eq.	-3.926***	-2.874***		
	(0.541)	(0.599)		
Gov., no Debt, No Eq.| Eq., No debt	-3.255***	-2.423***		
	(0.515)	(0.581)		
Eq., No debt | Debt	-2.615***	-1.766***		
	(0.491)	(0.558)		
Only Family | Only Gov.			-3.248***	-2.731***
			(0.421)	(0.490)
Only Gov. | Gov. and Fam., no Debt nor Eq.			-2.726***	-2.380***
			(0.405)	(0.478)
Gov. and Fam., no Debt nor Eq. | Eq. and Fam., no Gov. nor Debt.			-2.655***	-2.335***
			(0.403)	(0.477)
Eq. and Family, no Gov. nor Debt. | Eq. and Gov.			-2.613***	-2.291***
			(0.401)	(0.475)
Eq. and Gov. | Equity and Debt			-2.571***	-2.247***
			(0.400)	(0.474)
Equity and Debt | Debt			-1.874***	-1.565***
			(0.382)	(0.454)
Random Effects Constant	8.339***	7.567***	5.255***	4.664***
	(1.909)	(2.167)	(1.144)	(1.306)
N	3657	2768	3555	2695

Table 7. This table shows the ordered Logit regression for the classes specified in Table 5, column 2. Clustered standard errors are in parentheses. Significance levels: *** p<0.01; ** p<0.5 *p<0.1

	(1)	(2)	(3)	(4)	(5)	(6)
Type of finance	**Owner**	**Owner**	**Equity**	**Equity**	**Debt**	**Debt**
Age	-0.420***	-0.307***	0.004	0.067	0.148*	0.265***
	(0.076)	(0.088)	(0.239)	(0.280)	(0.086)	(0.099)
Size	-0.074*	-0.135***	0.886***	0.520***	0.498***	0.438***
	(0.040)	(0.051)	(0.121)	(0.163)	(0.045)	(0.056)
Profit Margin	-1.779***	-1.844***	-4.360***	-3.126***	-1.125***	-1.129***
	(0.102)	(0.134)	(0.330)	(0.450)	(0.119)	(0.153)
Public support	0.299***	0.410***	0.613***	0.729***	0.809***	0.889***
	(0.056)	(0.072)	(0.166)	(0.203)	(0.062)	(0.076)
R&D Exp.		0.826***		1.294***		-0.389**
		(0.126)		(0.238)		(0.153)
Product Innovation		0.271***		0.376*		0.216***
		(0.065)		(0.199)		(0.072)
Process Innovation		0.272***		0.158		0.279***
		(0.075)		(0.216)		(0.083)
Founder Human Capital		0.079		0.292		0.090
		(0.060)		(0.192)		(0.067)
Firm Human Capital		-0.003		0.410***		-0.076
		(0.052)		(0.136)		(0.057)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.135	-0.985***	-6.262***	-6.696***	-2.537***	-2.595***
	(0.110)	(0.144)	(0.424)	(0.569)	(0.135)	(0.168)
Random effects						
Log of Variance	0.446***	0.514***	1.149***	1.085***	0.797***	0.875***
	(0.078)	(0.093)	(0.210)	(0.253)	(0.074)	(0.086)
N	15,197	11,772	15,197	11,772	15,197	11,772

Table 8. Panel Logit estimates for the probability of obtaining any amount of a specific type of finance. Clustered standard errors are in parentheses. Significance levels: *** p<0.01; ** p<0.5 *p<0.1

	(1)	(2)	(3)	(4)	(5)	(6)
Majority of:	**Owner**	**Owner**	**Equity**	**Equity**	**Debt**	**Debt**
Age	-0.530***	-0.444***	0.336	0.660	0.044	0.056
	(0.087)	(0.099)	(0.411)	(0.550)	(0.115)	(0.132)
Size	-0.351***	-0.385***	1.013***	0.321	0.559***	0.654***
	(0.046)	(0.059)	(0.206)	(0.329)	(0.059)	(0.075)
Profit Margin	-1.308***	-1.464***	-5.672***	-3.299***	-0.021	0.194
	(0.111)	(0.147)	(0.553)	(0.837)	(0.165)	(0.219)
Public support	-0.273***	-0.278***	0.621**	0.801**	1.111***	1.238***
	(0.067)	(0.088)	(0.278)	(0.379)	(0.082)	(0.100)
R&D Exp.		0.577***		2.180***		-0.483**
		(0.127)		(0.435)		(0.237)
Product Innovation		0.254***		-0.017		0.192*
		(0.075)		(0.366)		(0.101)
Process Innovation		0.185**		0.345		0.249**
		(0.087)		(0.385)		(0.113)
Founder Human Capital		0.036		0.484		-0.047
		(0.068)		(0.357)		(0.092)
Firm Human Capital		0.070		0.727***		-0.277***
		(0.060)		(0.260)		(0.078)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.143	-1.362***	-8.841***	-9.800***	-3.923***	-4.216***
	(0.123)	(0.165)	(0.815)	(1.329)	(0.191)	(0.243)
Random effects						
Log of Variance	0.412***	0.383***	1.356***	1.573***	0.571***	0.624***
	(0.097)	(0.123)	(0.346)	(0.446)	(0.118)	(0.138)
N	15,197	11,772	15,197	11,772	15,197	11,772

Table 9. Panel Logit estimates for the probability of obtaining more than 50% of a specific type of finance. Clustered standard errors are in parentheses. Significance levels: *** p<0.01; ** p<0.5 *p<0.1

	(1)	(2)
	Debt	**Other**
Age	-0.398	-0.404
	(0.577)	(0.532)
Size	-0.210	0.493
	(0.355)	(0.332)
Profit Margin	1.836*	2.410**
	(1.083)	(1.011)
Public support	0.178	0.594
	(0.414)	(0.380)
R&D Exp.	-1.216***	-2.306***
	(0.470)	(0.431)
Product Innovation	0.280	0.177
	(0.362)	(0.314)
Process Innovation	-0.071	-0.057
	(0.424)	(0.398)
Founder Human Capital	-0.390	-0.363
	(0.365)	(0.339)
Firm Human Capital	-0.929***	-0.861***
	(0.272)	(0.241)
Sector dummies	Yes	Yes
Time dummies	Yes	Yes
Constant	2.468**	4.132***
	(0.973)	(0.913)
N	1684	
Pseudo R-squared	0.207	

Table 10 Multinomial Logit Regression. The categorical variable has a value of 1 if a firm is financed by more than 50% in a given year by other sources (family and friends, government funds, other funds), a value of 2 if the majority of fund comes from short- or long-term debt and a value of 3 if the majority of funds is from equity or mezzanine funds. The latter is the base alternative; This means that, for instance, firms that firms that performed R&D expenses in the previous year are less likely to use debt than firms that did not, compared to using equity. Clustered standard errors are in parentheses. Significance levels: *** p<0.01; ** p<0.5 *p<0.1