Do incubatees form more alliances?

Nature of the alliance and start-up ownership as contingencies

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Abstract

Incubators are reputed to be key institutions for the creation and growth of viable and successful entrepreneurial ventures. One mechanism through which their beneficial action should unfold is that incubatees could be more likely to stipulate alliances with third parties. We explore, both theoretically and empirically, the possibility that this crucial bridging function performed by incubators is indeed contingent on both a) the type of alliance that start-ups are seeking for, where we distinguish between R&D and commercial alliances; b) the specific ownership structure of the start-ups. Our analysis is based on a dataset of 1,766 incubatees and non-incubatees young innovative companies. Results highlight that incubators accomplish their bridging role depending on the two above mentioned contingencies. In particular, incubated start-ups show higher probabilities than non-incubates to stipulate R&D alliances only if they are university-backed, while commercial alliances figure as a prerogative of incubatees only when these latter are business-backed.

Keywords: start-ups; ownership structure; incubators; R&D alliances; commercial alliances.

JEL codes: L25; L26; O32; G32**.**

Acknowledgments: The authors would like to express their gratitude to the editor, the anonymous reviewers, and the participants of the R&D Management Conference 2022 in Trento for their valuable feedback during the development of this paper. Additionally, Luca Grilli acknowledges the support of the PRIN MUR Research Grant No. 2022AYY9RK (IEES: Institutions, Education and Entrepreneurship Studies: a Novel Perspective on University Impact) for its contribution to the completion of this research.

1. Introduction

Innovative start-ups are considered an important engine for ensuring economic growth (Acs et al., 2006; Baumol and Strom, 2007). Playing the leading role in Schumpeterian dynamics of creative destruction (Schumpeter, 1934; Audretsch, 1995; Aghion and Howitt, 1992; 2005), their function is however threatened by several hurdles and imperfections (Audretsch et al., 2020), from the initial entrepreneurial idea to later stages of life. The lack of any prior experience due to their young age and the inherently risky and uncertain nature surrounding their activities make it difficult to obtain the necessary financial, labor, and knowledge resources (Peneder, 2008; Knockaert et al. 2013; Revest and Sapio, 2012). Furthermore, difficulties to access key complementary assets may seriously hinder their development (Teece, 1986).

For this reason, innovative start-ups are often the target of several interventions and institutional arrangements whose ultimate aim is to support their creation and nurture their first steps (Grilli, 2014; Grilli at al., 2023). In the vast array of instruments offered to innovative start-ups, the institution known as "business incubator" surely figures as one of the most prominent. Defined in very broad terms as "a shared office space facility that seeks to provide its incubatees with a strategic, value-adding intervention system of monitoring and business assistance" (Hackett and Dilts 2004, p.57), potentially overlapping but not to be confounded with other programs such as "accelerators", this organization has evolved from merely offering physical space to tenants to the coaching and networking functions generally offered today by the *third generation* of incubators (Bruneel et al. 2012).

Needless to say, the capability of incubators to enhance the performance of tenants along a series of dimensions has been under scrutiny by an extensive research endeavor (Klingbeil and Semrau, 2017). This literature, which is often based on the comparison between incubates and non-incubatees (Barbero et al., 2012), show that, on average, incubated start-ups perform better than non-incubatees (e.g. Colombo and Delmastro, 2002; Lukeš et al., 2019). However, the ultimate reasons behind this superior capacity remains rather underexplored, and so it is the determination of possible contextual factors and contingencies at work (Eveleens et al., 2017, p. 697). In this domain, a commonly suggested factor for substantiating an "incubation effect" is the purported increased likelihood for those undergoing incubation to establish alliances with third parties (e.g. Bøllingtoft and Ulhøi 2005). No systematic evidence on this presumption exists, except for the companion paper to this study, i.e. Grilli and Marzano (2023), who find that the positive correlation between the two dimensions is significantly influenced by specific incubators' attributes. In particular, a significant research gap exists concerning how incubation processes and environments interact with the characteristics of tenants to most effectively leverage incubation and realize its benefits, particularly in terms of the formation and success of strategic alliances, which are crucial for startups' expansion and sustainability.

In this study, we explore the topic from both a theoretical and an empirical point of view by looking at possible contextual factors more on the tenant's rather than the incubator's side. We analyze to what extent the relationship between incubators and alliance formation by tenants is subject to important contingencies rooted not only in the type of alliance but also in the specific ownership structure of an innovative start-up. In particular, while keeping the distinction between R&D and commercial alliances, we investigate whether the probability to stipulate (different types of) alliances changes if an innovative start-up located in a business incubator is backed by another business (i.e. either another company, or a venture capitalist or a business angel figure as shareholders at foundation) or by a university (i.e. a university or a research organization figure as shareholders at foundation).

Our analysis is based on 1,766 incubated and non-incubated innovative start-ups that participated in the "Start-up Survey" conducted jointly by the Italian Ministry of Economic Development (MISE) and the National Institute of Statistics (ISTAT) in April-May 2016, with the goal of conducting an assessment of Italy's "Start-up Act" that was enacted in 2012. The results of several econometric models show that *because of* incubation, university-backed start-ups enhance their chances to establish R&D alliances, whereas incubated business-backed start-ups are more likely to establish commercial alliances. Thus, incubation is associated to greater chances for tenants to stipulate alliances, but these greater chances crucially depend on both the type of alliance and the specific ownership structure of the firm. This evidence has important strategic implications for entrepreneurs, insofar as it elucidates that incubation *per se* does not always lead to a networking advantage. Beside incubators' characteristics (Grilli and Marzano, 2023), we show that this advantage may materialize only in the presence of a specific ownership structure of the start-up. In other words, the nature of initial shareholders may define the alliance possibilities of an incubatee, and to some extent, determine its effective alliance activity, directing it towards the type of alliance which is more suited to this nature.

These results contribute to our understanding of the contingencies affecting the bridging function of incubators by broadening the range of important contextual factors, i.e., by focusing on the genetic traits of startups. In addition, they provide valuable insights to the growing field of entrepreneurial ecosystems (Stam and Van de Ven, 2021), highlighting the essential need to explore the interactions among various participants within these ecosystems to better understand their functioning.

The remainder of the paper is organized as follows. Section 2 develops the two hypotheses. Section 3 describes the data and the empirical model. Section 4 reports the results along with robustness checks performed to strengthen the findings. Finally, Section 5 concludes by providing a discussion of the main findings along with their implications.

2. Hypotheses

Analogously to Grilli and Marzano (2023), our theoretical reasoning is based on the starting point that both *social capital* and *legitimacy* can enhance the networking possibilities for incubatees and help them form alliances with third parties (Aldrich and Zimmer, 1986; Gulati, 1995). From one side, incubation in a renowned incubator may signal the quality of the entrepreneurial idea to third parties (Bøllingtoft and Ulhøi, 2005). On the other side, incubation almost by definition raises the social capital of incubatees through the almost automatic enlargement of their networking possibilities due to the adjunct of both new internal and external connections. Extant literature has put forward alternative mechanisms through which incubation may contribute to start-ups' development and growth (Giudici et al., 2018). However, we contend that the two lenses above identified are particularly suitable for an institutional setting in which incubators are still relatively less mature than they are in other contexts (e.g., the United States, the United Kingdom).

However, incubation may not be sufficient on its own to help innovative start-ups successfully attract potential partners, whereas incubators differ in the "certification" function they are capable to exert and in the extension of the network they can offer to incubatees. In this respect, it is also reasonable to assert that the legitimacy effect due to incubation is only one possible mechanism. Incubators provide entrepreneurs with a wide array of business services and help them expand their network horizon, but seldom go beyond. While, when present, we argue that a parallel source of legitimacy for start-ups can be represented by the backing of recognized organizations (Stuart et al., 1999). More specifically, an organization achieves its legitimacy as long as the community of reference perceives its assets and operations as desirable (Suchman, 1995; Suddaby et al., 2017). Given that start-ups lack a track record because they are just newly-born, stakeholders will likely base their perceptions on the nature and identity of the individuals and institutions that are backing the entrepreneurial venture and the credit these actors have into the surrounding socio-economic system.

In this respect, universities are often considered one of the main drivers of basic research and innovation development (Mansfield and Lee, 1996), and are often among the main R&D investors in many different economic systems. From this point of view, by a kind of osmotic process (see also the arguments and references cited in Grilli and Marzano, 2023), the qualities of "recognisability" and reputation in the R&D sphere of the university should also spill over to the "gems" that emerge from there, ergo university-backed start-ups. Equity backing from the academic institution is likely to be viewed by stakeholders as much stronger evidence of the academic nature of the start-up than other potentially weaker signals, such as the simple affiliation of (some) founders as former students and/or researchers (e.g. Colombo et al., 2012). This enhanced legitimacy in R&D matters should enable the incubated university-backed start-up to better exploit the enhanced social capital that incubation brings especially towards those potential partners who are mainly interested in its (supposedly higher) R&D capabilities. In other words, we posit that if incubation is able to enlarge the social capital of start-ups, it is mainly their university-backed status that is capable to strengthen their R&D legitimacy. Following this line of reasoning, we formulate the following research hypothesis regarding the probability for university-backed start-ups of establishing R&D alliances *because of* incubation.

H1: *Incubation of university backed start-ups has a positive effect on the probability of establishing R&D alliances.*

Key figures typically involved in the backing of new entrepreneurial ventures, such as independent venture capital firms, business angels and corporate venture capital funds, are often deemed as essential engines for the financing of innovative start-ups (Gompers and Lerner, 2001). This macro-category of investors, which naturally has numerous differences and nuances within it along many dimensions, not least investment strategies and scope (e.g. Fitza et al., 2009; Bertoni et al., 2013; Manigart and Wright 2013), is also reputed to share important common traits. Specifically, when compared with banks and debt providers, equity investors, through specialization, should possess superior screening capabilities and be better able to gauge *ex-ante* the commercial potential of a new target venture (Sahlman, 1990; Amit et al., 1998; Ueda, 2004). Furthermore, professional equity investors, as those here considered, are by their very nature all (very) selective (Maier II and Walker, 1987). Whether one considers business angels or venture capitalists, these investors typically invest in a tiny portion of ventures, even in advanced economies (e.g. Maxwell et al., 2011; Mulcahy, 2013), so as to be able to concentrate their financial resources and value-adding activities on a manageable set of prospects. In a typical context characterized by strong information asymmetries as the one here analyzed, where start-ups do not possess neither vested position in markets nor a solid track record on performance to rely on, being sponsored by such institutional investors could well send a strong signal to third parties, revealing their market attractiveness (Stuart et al., 1999; Stuart and Sorenson, 2007). Therefore, business-backed start-ups should be seen by interested stakeholders as relatively more auspicious partners than other types of start-ups, especially in terms of the commercial attractiveness of their offer (e.g. Hsu, 2006).

Thus, if, as said before, incubation is capable to enlarge the social capital of start-ups, we now argue that especially business-backed start-ups should be particularly able to exploit this increase in networking possibilities, given their legitimacy advantage in commercial matters.

We therefore posit the following research hypothesis regarding the probability for business-backed start-ups of stipulating commercial alliances *because of* incubation.

H2: *Incubation of business backed start-ups has a positive effect on the probability of establishing commercial alliances.*

3. Data and model

3.1. The Italian Start-up Survey

Studying alliances formed by start-ups in Italy is particularly interesting and relevant. Italy, although historically characterized by a strong entrepreneurial vocation (e.g. Blanchflower et al., 2001), does not have a great tradition in the creation of successful innovative start-ups (Grilli and Murtinu, 2014) and is generally considered to have a rather fragile national innovation system (Nuvolari and Vasta, 2015). Therefore, the analysis could offer insights into the economic and policy-driven factors that can determine the success of start-ups in a landscape that is not particularly favorable to the introduction of technological innovations. In such a scenario, alliance activity becomes more valuable.

We use data collected through a survey launched by the National Committee of the Italian Ministry for Economic Development and titled 'Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Start-ups'. The survey was administered by the Italian National Institute of Statistics (ISTAT) from April to May 2016 and makes available information on Italian innovative start-ups on several aspects that range from human capital to financial structure, from innovation strategies to adoption of public policy instruments put in place to sustain innovative entrepreneurship.

The questionnaire targeted the whole population of Italian innovative start-ups (see the Italian Law no. 221/2012 or Grilli and Marzano, 2023 for further details on the legal requisites for the 'innovative start-up' status), which was equal to 5,150 firms as of December 2015. The questionnaire was partially or completely filled by 2,275 start-ups (i.e., the response rate was 44%). The surveyed start-ups are representative of the targeted population along dimensions such as firms' geographic location, industry affiliation, age and legal status (see MISE 2016, for further details).

3.2. Sample

The final sample of our analysis comprises 1,766 innovative start-ups for which we were able to construct all the variables of interest. The sample consists of a treatment group, which includes 502 incubated start-ups, and a control group of 1,264 non-incubated start-ups.

Table 1 shows the distribution of treatment and control group start-ups by type of established alliance (Panel A), backing at foundation (Panel B) and industry (Panel C). The distributions of the two groups differ in the first two dimensions, but not in the third.

[Table 1]

Table 2 shows the distribution of the sampled start-ups by type of stipulated alliance across start-ups age.[1] Nearly 46.5% of the start-ups established an alliance (21.7% an R&D alliance, 12.9% a commercial alliance and the remaining 11.9% both of them). Start-ups that established alliances are more likely to be elder. The trend is noticeably due to R&D alliances, as start-ups that established commercial alliances appear to be more uniformly distributed across start-up age.

[Table 2]

3.3. Variables and model specification

3.3.1. Dependent variables

Given our focus on two different types of alliances, we built two dependent variables. In particular, *R&D Alliance* is a binary variable set equal to 1 if the start-up has ever settled a formal agreement (i.e. a contract) focusing on R&D activities with third parties, and 0 otherwise. Similarly, *Commercial Alliance* is a binary variable set equal to 1 if the start-up has ever settled a formal agreement (i.e. a contract) focusing on commercial activities with third parties, and 0 otherwise.

[1] 16 (ex-)innovative start-ups exceeded the law threshold of 5 years (accounting for less than 1% of the sample) and we include them in the analysis. All findings here exposed are unaffected by the choice of including or excluding these start-ups.

3.3.2. *Independent variables*

The first independent variable of interest is *Incubation*. It is a dummy variable set equal to 1 if the start-up is or has ever been located in an incubator, and 0 otherwise. At the moment of the survey in Italy there were 39 certified incubators that might have supported through incubation the surveyed innovative start-ups.[2]

In order to measure the financial structure of start-ups at foundation, we introduce two binary variables: *Business Shareholders at Entry* and *University Shareholders at Entry*. *Business Shareholders at Entry* is set equal to 1 if the start-up, at its foundation year, was partly backed either by another company, or by a venture capitalist or a business angel, and 0 otherwise. *University Shareholders at Entry* is set equal to 1 if the start-up, at its foundation year, was partly backed by a university or a research center and 0 otherwise.

3.3.3. *Control variables*

Our model specification includes a set of control variables to capture the legitimacy that innovative start-ups may obtain though external or internal resources (see Grilli and Marzano, 2023).

For what concerns legitimacy from internal resources, adhering to Becker (1964) and subsequent operationalizations (e.g. Colombo and Grilli, 2005), we rely on the two covariates *Specific Human Capital* and *Generic Human Capital*. The former is the average number of years of experience among cofounders of the same start-up obtained through pre-entry work experience in the same sector of the newly founded firm and previous managerial and entrepreneurial experiences. The latter is the average experience start-up's founders gained through (university) education and work in sectors different from the one of the focal start-up. Then, the variable *Operative Shareholders* captures the size of the entrepreneurial team,

[2] The Italian Startup Act also "introduced the notion of certified incubator, with the objective of encouraging the recognition and valorisation of enterprises having a solid, proven experience in supporting the creation and development of high-potential innovative startups." (MISE 2017, p. 21).

whereas *Employees* is the number of employees hired with an open-ended contract. Additionally, we also control for a potential signaling effect that the possession of intellectual property rights by the focal start-up may exert towards providers of complementary assets (e.g. Hsu and Ziedonis, 2013): *Patents* is set equal to 1 if the start-up is depositary or owner of a patent or software, and 0 otherwise. To conclude, *Firm Age* is the age (in years) of the start-up at the survey time.

All variables used in the analyses are summarized in the Appendix (see Table A1).

3.3.4. Model Specification

To test our hypotheses, we employ a standard framework based on a two-way interaction model that can differentiate the effects of incubation for university-backed and business-backed start-ups, respectively. In particular, we estimate the following model-type for both R&D and commercial alliances (equation 1):

$$Alliance_{ik}=\alpha_0 + \beta_1\, Incubation_i + \beta_2 Incubation * University\ Shareholders\ at\ Entry_i + \beta_3 Incubation * Business\ Shareholders\ at\ Entry_i + \beta_4 University\ Shareholders\ at\ Entry_i + \beta_5 Business\ Shareholders\ at\ Entry_i + \sum_j X_{ji} + \varepsilon_i; \quad (1)$$

where *k* = *R&D Alliance, Commercial Alliance*, X_j are controls and the *i* subscript denotes the individual sampled start-up. Testing H1 implies to reject the null hypothesis $H_0\!: \beta_1 + \beta_2 = 0$, while testing H2 implies to reject the null hypothesis $H_0\!: \beta_1 + \beta_3 = 0$. [3]

3.4. Descriptive statistics

Descriptive statistics for the variables of this study are illustrated in Table 3.

[Table 3]

[3] More precisely the test of the hypotheses is as follows: for what concerns H1, $H_0\!: (\beta_1 + \beta_2 + \beta_4) - \beta_4 = 0$ (i.e. the fact that a university backed start-up is incubated has a positive effect on its probability of establishing R&D alliances); while for what concerns H2, $H_0\!: (\beta_1 + \beta_3 + \beta_5) - \beta_5 = 0$ (i.e. the fact that a business backed start-up is incubated has a positive effect on its probability of establishing commercial alliances).

The correlation matrix is also illustrated in Table 4. None of the pairwise Pearson correlation coefficients seem remarkable in magnitude and significance.[4] To further examine potential multicollinearity, a variance inflation factor (VIF) analysis was also run before each regression. Relying on Belsley et al. (1980), we can rule out any major multicollinearity issue, given that the mean VIF is always far below the threshold of 5 and the VIF of each independent variable is always far below the usually adopted threshold of 10.[5]

[Table 4]

4. Results

4.1. Main results

Table 5 reports the results of the two probit models. In columns 1 and 3, we include only *Incubation*, *Business Shareholders at Entry* and *University Shareholders at Entry* stand-alone. The interaction terms *Incubation*University Shareholders at Entry* and *Incubation*Business Shareholders at Entry* are added in columns 2 and 4, for the complete specification reported in equation (1). In each model, a set of industry (at NACE Level 1 codes) and regional dummies (at NUTS 2 level) are included.[6] Estimated standard errors are heteroskedasticity-robust.

[Table 5]

The marginal effects of the control variables are similar across models. Specifically, *Operative Shareholders* is positive and statistically significant (at the 1% and 5% statistical level in the R&D alliance and Commercial alliance equations, respectively). Having one more operative shareholder in the start-up increases the likelihood of establishing an R&D alliance

[4] Since our specification includes a combination of continuous and binary variables, we also computed point biserial correlation coefficients for each couple of variables belonging to different formats. Results confirm that pairwise correlation is never an issue.

[5] We also computed alternative indicators commonly used to detect collinearity, i.e., the condition index and the determinant of the correlation matrix. All these measures undisputedly indicate that collinearity is not problematic.

[6] Some industry dummies predict the outcome (*R&D Alliance* or *Commercial Alliance*) perfectly. Thus, depending on the model, we have to drop 14 or 15 start-ups from the sample.

by 2.8% and a commercial alliance by 1.5% in absolute terms. Since the sample mean values are 33.6% and 24.8% for the two types of alliance, the effect translates into an 8.3% increase in the probability of establishing an R&D alliance and a 6.0% increase in the probability of establishing a commercial alliance. In line with the descriptive evidence illustrated in Table 2, a strong positive effect is also exerted by *Firm Age*. One year older start-ups are approximately 14.6% (4.9/33.6) more likely to establish an R&D alliance and 10.9% (2.7/24.8) more likely to establish a commercial alliance with third parties. In both cases, the effect is statistically significant at the 1% level.

Our main independent variable, i.e. *Incubation*, has a positive and statistically significant (at the 1% level) marginal effect in both specifications that include only stand-alone variables (see columns 1 and 3). However, when the full-fledged models in columns 2 and 4 are considered, the marginal effects of *Incubation* are no longer statistically significant at the conventional levels. This result seems to suggest that non-backed start-ups do not experience any change in the probability of establishing alliances due to incubation. To test our hypotheses, we have to sum up the probit coefficients of *Incubation* and *Incubation*University Shareholders at Entry* ($\beta_1 + \beta_2$) and *Incubation*Business Shareholders at Entry* ($\beta_1 + \beta_3$), respectively. We start by considering the R&D alliance equation. We test the null hypothesis that the marginal effect of incubation for university backed start-ups is zero and the χ^2 test rejects the hypothesis at the 1% statistical level (the value of the statistic is 9.06). This result supports hypothesis H1. Incidentally, it should be noticed that the same test does not reject the null hypothesis for business-backed start-ups. Let us switch to the commercial alliance equation. Also in this case, the test rejects the null hypothesis for business-backed start-ups at the 10% statistical level (the value of the statistic is 3.03). This latter result supports hypothesis

H2. Again, the marginal effect of incubation for university-backed start-ups is not statistically different from zero.[7,8]

4.2. Robustness checks

4.2.1. ML recursive bivariate probit estimator

Analogously to Grilli and Marzano (2023), we subjected these results to the same robustness tests performed there, but also others. As a first important check, we focus on a possible endogeneity of *Incubation*. In fact, it could be argued that the certain (unobserved) characteristics of start-ups may influence the likelihood of their incubation, but at the same time, also affect the probability (and nature) of their alliance activity. For example, incubators might have chosen to incubate promising start-ups that would have stipulated alliances with third parties even in the absence of incubation.[9]

The ML recursive bivariate probit model reliably estimates models where the dependent variable and the potentially endogenous independent variable of interest are both dummies (see Grilli and Murtinu, 2018). The model is a recursive simultaneous equations model made by two probit equations (Bhattacharya et al., 2006). In our case, we estimated twice, since we have two outcome equations, i.e., one for *R&D Alliance*, the other for *Commercial Alliance*. These outcome equations have the same specification as in columns 2 and 4 of Table 5. While, the

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[7] We re-estimated our models by excluding observations related to start-ups with mixed ownership, meaning those backed by both universities and businesses. The results remain unchanged.

[8] We also compute the correct marginal effects of a change in the two interacted variables - i.e., *Incubation* and *University Shareholders at Entry* for the R&D alliance equation and *Incubation* and *Business Shareholders at Entry* for the commercial alliance equation - for a probit model, as well as the correct standard errors by using the procedure by Norton et al. (2004). Results are consistent with those reported in Table 5.

[9] We are conscious that the same line of reasoning can also lead to the speculation of endogeneity for the variables *University Shareholders at Entry* and *Business Shareholders at Entry*. However, two features, one relative to the way in which the variables are operationalized and the other relative to our empirical strategy should mitigate the concern. First, we measure backing at foundation, a stage at which the screening ability of investors should be considerably weaker. Second, in order to test our hypotheses, we are interested in comparing the probabilities of establishing alliances with and without incubation between homogenous groups, i.e. within the groups of university-backed and business-backed start-ups. In other words, by using interaction terms, our control groups are no longer non-incubated start-ups of any sort, but non-incubated university-backed start-ups for hypothesis H1, and non-incubated business-backed start-ups for hypothesis H2.

incubation equation is the same across the two outcome equations, and it also exhibits the same covariates of the two outcome equations (except for using a higher level disaggregation of business backing at foundation by discriminating between independent venture capital, business angels and ownership by other companies) plus an exclusionary restriction, i.e. *Incubation Supply*. This variable measures the number of incubators located in the province (NUTS 3 territorial units) in which the start-up is located at the year the start-up was established. Correlating with incubation probability, once regional fixed effects are taken into account, this variable should be rather uncorrelated with a startup's likelihood of entering into alliances.

[Table 6]

Columns 1 and 4 of Table 6 report the results of the ML recursive bivariate probit estimations. In both equations, the coefficient of *Incubation* is not statistically significant at the conventional levels. *Incubation*University Shareholders at Entry* has a positive and statistically significant coefficient (at the 1% statistical level) in the R&D alliance equation. On the contrary, *Incubation*Business Shareholders at Entry* is not statistically significant in the commercial alliance equation. When we test the hypotheses that $\beta_1 + \beta_2 = 0$ in the R&D alliance equation and $\beta_1 + \beta_3 = 0$ in the commercial alliance equation, the first one is rejected at the 5% statistical level, while the second one is close to rejection.

4.2.2. Two-stage Least Square

Another way to address endogeneity is to use a standard two-stage least squares (2SLS) estimator. Adhering to Angrist and Pischke (2008), the procedure would require, first, to regress, through a linear probability model, the supposedly endogenous independent variable, i.e. *Incubation*, against an exclusionary restriction and the remaining independent variables, and then instrument *Incubation* in the second stage with the fit after the first stage.

In order to mitigate the "covariate ambivalence" problem (Angrist and Pischke, 2008, p. 189), we implement a slightly modified version of the above mentioned estimation strategy. Namely, the (supposedly) endogenous independent variables in the second-step regressions (*Incubation* and its interaction terms with *University Shareholders at Entry* and *Business Shareholders at Entry*) are instrumented with the predicted value of *Incubation* (after a linear probability model) and its interactions with *University Shareholders at Entry* and *Business Shareholders at Entry*. Thus, from the first stage we get three instruments (the predicted value of *Incubation*, the predicted value of *Incubation*University Shareholders at Entry* and the predicted value of *Incubation*Business Shareholders at Entry*) for the three potentially endogenous independent variables in the second-step (for a similar approach, see Grilli and Murtinu, 2018).[10] The estimates of the first stage model are reported in Table A2 included in the Appendix (column 1 is added only for comparison; column 2 is the one used to compute the instruments).[11] Table 6 reports the results of 2SLS where the second stage is estimated through linear probability model (columns 2 and 5) and probit (columns 3 and 6), respectively.

Incubation is always not statistically significant. The result confirms that non-backed start-ups do not experience any change in the probability of establishing alliances after having been incubated. For each of the four models (columns 2, 3, 5 and 6), we re-test the null hypotheses that $(\beta_1 + \beta_2)$ and $(\beta_1 + \beta_3)$ are zero. The χ^2 test rejects the hypothesis that incubation has no effect on the university-backed start-ups' probability of establishing R&D alliances for the

[10] Note that the second stage equation includes two interaction terms as independent variables (i.e. *Incubation*University Shareholders at Entry* and *Incubation*Business Shareholders at Entry*) which cannot be included in the first stage by construction. This discrepancy may give raise to the so-called "covariate ambivalence" problem (Angrist and Pischke (2008, p. 189). Grounding on Grilli and Murtinu (2018), the modification depicted in the main text aims at tackling this issue. Note also that in the first stage, we prefer to use a higher level of disaggregation of business backing at foundation, by discriminating between independent venture capital, business angels and ownership by other companies, so to increase the strength of our instruments related to *Incubation.* However, given these differences between first and second stage (besides the exclusionary restriction) and our remedies which can only be partial, we recommend to interpret results with caution.

[11] In order to increase the strength of our instruments we also chose to estimate the first stage on a sample with a greater size than our benchmark (1,766), since more information in the database is available on incubation than alliance activity.

probit model (the value of the statistic is 2.86, thus implying significance at the 10% statistical level) and on the business-backed start-ups' probability of establishing commercial alliances for both LPM and probit models (the value of the statistic is 2.75 and 3.20, respectively; thus implying significance at the 10% statistical level). The p-value of the χ^2 statistic is only slightly higher than 0.1 when the test is performed for $(\beta_1 + \beta_2)$ after the LPM estimates of the R&D alliance equation. The same test does not reject the null hypothesis for business-backed start-ups in the R&D alliance equation and for university-backed startups in the commercial alliance equation. Cumulatively, these results again support hypotheses H1 and H2.

4.2.3. Bivariate probit model

We have so far considered the probability of establishing R&D and commercial alliances in isolation one from the other. However, the two events may be driven by common unobservable factors and be sometimes simultaneous. If so, estimating the two equations (R&D and commercial alliance) simultaneously would capture the above mentioned interdependencies.

Table 7 reports the estimates of two bivariate probit models. For each of them, the two equations (*R&D Alliance* and *Commercial Alliance*) are simultaneously estimated. In order to keep mitigating the endogeneity of incubation, just like in Table 6, the variable *Incubation* along with the interaction terms are instrumented by the fit of the model in column 2 of Table A2, stand-alone and interacted with *University Shareholders at Entry* and *Business Shareholders at Entry*.

[Table 7]

In both models, *Rho*, i.e. a measure of the correlation between the error terms in the two equations, is positive and statistically significant (at the 1% level). This suggests that there are actually unobservable factors driving the probability of establishing the two types of alliances and that these factors are very likely to be the same.

The results do not change and our hypotheses are again corroborated: the usual tests confirm that university-backed start-ups are more likely to establish an R&D alliance (the χ^2 statistic is 3.25, thus rejecting the null hypothesis at the 10% statistical level) and business-backed start-ups are more likely to establish a commercial alliance (the χ^2 statistic is 2.66, thus rejecting the null hypothesis only at the 11% statistical level) because of incubation.

4.2.4. Endogenous switching regression and "what if" analysis

As an alternative to 2SLS, a way to mitigate endogeneity issues is to use an endogenous switching regression model (see Chemmanur et al., 2011; Guerini and Quas, 2016, for applications in the entrepreneurship literature). It consists of two stages (Heckman, 1979; Maddala, 1986). The first stage is a probit model for incubation selection, whereas in the second stage, the probabilities of establishing an R&D (commercial) alliance are estimated by using a probit model and the full set of regressors used in the full-fledged models described before.

In the endogenous switching regression model, the probabilities are estimated separately for incubated and non-incubated start-ups. To control for the unobservable characteristics that may affect a start-up's probability of falling into one of the two subsamples, an inverse Mills ratio (*IMR*) is computed after the first stage and added to the regressors (see Fang, 2005). Then, the predicted probabilities of establishing each of the two types of alliance from the second-stage estimates are used to conduct a "what if" analysis. Specifically, we estimate the probability of establishing each of the two types of alliance for the incubated start-ups based on the coefficients of the control group regression (by using the data on incubated start-ups). These probabilities correspond to what would have occurred (in terms of alliances) if the incubated start-ups had not been incubated. Similarly, we estimate the probability of establishing each of the two types of alliance for the control group of start-ups based on the coefficients of the incubated group regression (by using the data on start-ups in the control group). These probabilities correspond to what would have occurred if the non-incubated start-ups had been incubated. Finally, we compare the estimated "what if" probabilities of establishing each of the two types of alliance with the actual probabilities of the two events.

In column 1 of Table 8, the estimates of the selection equation are reported. They are very much in line with estimates reported in column 2 of Table A2. Columns 2 and 3 of Table 8 report the probit results of the models in which the dependent variable is *R&D Alliance* for incubated and non-incubated start-ups, respectively. Similarly, columns 4 and 5 report the estimates of the *Commercial Alliance* equations for the two groups of start-ups.

[Table 8]

Table 9 shows the results of the "what if" analysis. For each type of alliance, we compare the estimated probability of stipulation for the incubated start-ups if they had fallen into the control group with the actual probability of establishing such an alliance. Similarly, we compare the estimated probability of stipulating an alliance for the control group of non-incubated start-ups if they had fallen into the incubated group with the actual probability of stipulation. In line with our hypotheses, we focus on university-backed start-ups in the case of R&D alliances and on business-backed start-ups in case of commercial alliances.

[Table 9]

Panel A of Table 9 shows that if the incubated university-backed start-ups had not been incubated, they would have had a lower probability of establishing an R&D alliance. Similarly, if the control group of university-backed start-ups had been incubated, they would have exhibited a higher probability of establishing a R&D alliance. Both differences are significant at the 1% level.

Panel B of Table 9 shows the estimates relative to the probabilities of establishing commercial alliances for business-backed start-ups. If the incubated business-backed start-ups had not been incubated, they would have had a lower probability of establishing a commercial alliance. Likewise, if the control group of business-backed start-ups had been incubated, they would have exhibited a higher probability of establishing a commercial alliance. Again, both differences are significant at the 1% level.

Cumulatively, these results strengthen the robustness of previous findings and support our hypotheses H1 and H2.

5. Concluding remarks

5.1. Summary of results and contribution

In this study, we investigate the extent to which a superior capability of incubated start-ups to stipulate alliances with third parties depends on the nature of the partnership, i.e. where we distinguish R&D activities from commercial exploitation purposes, and on the presence of specific typology of equity financiers at foundation, where we distinguish universities and research centers from more business-oriented actors, i.e. other companies, independent venture capitalists and business angels. The empirical analysis based on a sample of 1,766 incubatees and non-incubatees ventures shows that there is a positive relationship between incubation and the probability to establish formal R&D alliances for university-backed start-ups and formal commercial alliances for business-backed ones.

As its companion paper Grilli and Marzano (2023), this study is clearly not immune from limitations. Starting from our dependent variables and due to inevitable data limitations, we are, for instance, unable to further characterize the alliance activity of innovative start-ups, except for the dichotomous distinction between R&D and commercial alliances. Or, turning to our main independent variables of interest, our analysis here is based on certified incubators in Italy. Certified incubators are an important ingredient of the Italian entrepreneurial ecosystem, but they certainly do not exhaust all the different support institutions that can still contribute to the development of innovative startups (e.g. non-certified incubators, venture studios, co-working spaces).

Said that, we believe that the findings here exposed offer intriguing insights into the potential role of incubators. First of all, they enlarge our knowledge on the contingencies surrounding the bridging function of incubators, by extending the list of important contextual factors from incubators' characteristics (Grilli and Marzano, 2023) to specific genetic characteristics of start-ups. More specifically, Grilli and Marzano (2023) show how the likelihood to establish an R&D alliance is significantly higher for incubatees in academic incubators, while commercial alliances appear more within reach for incubatees in public (rather than commercial) affiliated incubators. Here the additional focus on the ownership's structure of a start-up allows us to compose a more articulated picture, and complete the analysis. Globally, it is shown how for R&D alliances what truly matters is the *academic nature* of *any* sponsoring organization (incubator or firm) behind the incubated start-up. Conversely, the same institutional homophily does not seem to distinguish the main antecedents of commercial alliances for incubatees, where there is a mismatch between the nature of the incubator (i.e. public) and the type of backing (i.e. business-related) that are more conducive to this type of alliances. While business-related shareholders give supported start-ups a legitimacy that proves important to them in the formation of business alliances, tensions may arise when business-backed start-ups are incubated in corporate incubators, due to the more pronounced exploitative attitude of corporate-related actors on both sides; tensions that are mitigated when the incubator is public.

The identification of this twofold avenue towards commercial alliances for incubatees clearly enlarges the informative domain of prospective entrepreneurs on the most effective ways to enter into this type of partnership.

In doing so, the research presented here aligns with the work of Eveleens et al. (2017), which advocates for more detailed examinations into the factors that may influence how incubators affect incubatees' performance, either positively or negatively. Furthermore, it offers insights to the burgeoning field of entrepreneurial ecosystems, emphasizing the critical need for a deep dive into the dynamics among various participants within these ecosystems to gain a clearer understanding of their operations (Kuckertz, 2019, p. 2). In this respect, this study highlights that an important strategic domain such as firms' alliance activities strongly depends on *how actors combine one with the other*, i.e. the incubator with different types of innovative start-ups' shareholders, and, in turn, *how this combination fits* with the type of alliance searched by the start-up.

5.2. Policy implications

We believe that important implications may descend from our analysis. First, our study prescribes a (more) synergistic action in technology transfer activities between incubators and academic venture capital. If venture capital made by universities is a recent phenomenon and still at an infancy stage especially in Europe (see Croce et al., 2014), our study shows that the combination of these instruments and their alleged coordination could significantly increase the possibilities of start-ups to establish R&D alliances. This has also interesting repercussions for what concerns student and academic entrepreneurship and policies which aim at sustaining it. In fact, to the extent that universities may face severe physical constraints in accommodating promising start-ups established by (former) students and researchers in their own premises, our findings show that the formal participation of the university as a shareholder (with whatever stake) could have the same beneficial sponsoring effect on R&D alliances of "their" start-ups even if these start-ups are incubated elsewhere.

Second, Latins used to say that "*pecunia non olet*" to exemplify the fact the money's provenience does not matter, as long as it can be (proficuously) used. If this statement remains valid, however we show that the identity of "who" provides the equity in a start-up does indeed matter insofar as this specific distinctiveness can shape the boundaries of the strategies actually available to the newly-born firm. Thus, on the one hand, entrepreneurs seeking investment for their entrepreneurial idea should consider the fact that specific types of investors will be particularly suited to pursue some specific types of alliances, but not others. On the other hand, incubators' managers may consider the possibility to leverage the potential legitimacy and social capital effect stemming from incubation towards specific types of alliance activities by taking into duly consideration the type of backing and sponsorship of the start-ups they wish to incubate.

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Disclosure Statement

The authors report there are no competing interests to declare.

Tables

Table 1. Sample distribution by incubation, alliances, backing at foundation and industry

	Incubated		Control		Total
	No	%	No	%	No
Panel A - Alliances					
R&D	126	25.10	258	20.41	384
Commercial	78	15.54	150	11.87	228
R&D and Commercial	70	13.94	140	11.08	210
No Alliances	228	45.42	716	56.65	944
Total	502	100.00	1,264	100.00	1,766
Panel B - Backing at foundation					
University Shareholders	13	2.59	19	1.50	32
Business Shareholders	260	51.79	613	48.50	873
University and Business Shareholders	14	2.79	19	1.50	33
No External Equity Investors	215	42.83	613	48.50	828
Total	502	100.00	1,264	100.00	1,766
Panel C - Industry					
Manufacturing	85	16.93	227	17.96	312
Wholesale and retail trade	17	3.39	44	3.48	61
Information and communication	208	41.43	537	42.28	745
Professional, scientific and technical activities	157	31.27	364	28.80	521
Administrative and support service activities	9	1.79	37	2.93	46
Others	26	5.18	55	4.35	81
Total	502	100.00	1,264	100.00	1,766

Table 2. Distribution of alliances by start-up age

		Alliances				
		R&D	Commercial	R&D and Commercial	No Alliances	Total
Age						
0	No	12	1	5	20	38
	%	31.58	2.63	13.16	52.63	100.00
1	No	87	71	42	332	532
	%	16.35	13.35	7.89	62.41	100.00
2	No	122	78	58	332	590
	%	20.68	13.22	9.83	56.27	100.00
3	No	74	44	52	143	313
	%	23.64	14.06	16.61	45.69	100.00
4	No	46	19	33	74	172
	%	26.74	11.05	19.19	43.02	100.00
5	No	37	14	17	37	105
	%	35.24	13.33	16.19	35.24	100.00
6	No	6	1	3	6	16
	%	37.50	6.25	18.75	37.50	100.00
Total		384	228	210	944	1,766

Table 3. Summary statistics

Variable	Mean	S.d.	Min	Max
R&D Alliance	0.336	0.473	0	1
Commercial Alliance	0.248	0.432	0	1
Incubation	0.284	0.451	0	1
University Shareholders at Entry	0.037	0.188	0	1
Business Shareholders at Entry	0.513	0.500	0	1
Specific Human Capital	9.150	8.130	0	55
Generic Human Capital	10.45	10.86	0	49
Operative Shareholders	2.377	1.542	1	15
Employees	0.186	0.978	0	21
Patents	0.350	0.477	0	1
Firm Age	2.242	1.256	0	6

Legend. Statistics are based on 1,766 observations.

Table 4. Correlation matrix

	Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	*R&D Alliance*	1.00									
(2)	*Commercial Alliance*	0.17	1.00								
(3)	*Incubation*	0.07	0.07	1.00							
(4)	*University Shareholders at Entry*	0.17	-0.00	0.06	1.00						
(5)	*Business Shareholders at Entry*	0.04	0.03	0.04	-0.00	1.00					
(6)	*Specific Human Capital*	0.03	-0.02	-0.02	0.02	-0.00	1.00				
(7)	*Generic Human Capital*	-0.02	-0.03	-0.08	-0.04	0.07	-0.46	1.00			
(8)	*Operative Shareholders*	0.14	0.06	0.07	0.17	0.06	0.06	-0.08	1.00		
(9)	*Employees*	0.05	0.01	-0.03	-0.01	0.03	0.02	-0.01	0.02	1.00	
(10)	*Patents*	0.06	0.02	0.01	-0.02	0.02	0.00	0.09	-0.03	0.04	1.00
(11)	*Firm Age*	0.17	0.08	-0.01	0.07	-0.02	-0.00	-0.03	-0.02	0.06	0.09

Legend. Correlation coefficients are pairwise correlations.

Table 5. Probit estimates

	R&D Alliance		*Commercial Alliance*	
	(1)	(2)	(3)	(4)
Incubation	0.062*** (0.024)	0.051 (0.035)	0.059*** (0.023)	0.055 (0.034)
*Incubation*University Shareholders at Entry*		0.362*** (0.136)		0.098 (0.108)
*Incubation*Business Shareholders at Entry*		-0.000 (0.048)		-0.001 (0.045)
University Shareholders at Entry	0.274*** (0.062)	0.176** (0.079)	-0.038 (0.055)	-0.083 (0.073)
Business Shareholders at Entry	0.042** (0.022)	0.042* (0.025)	0.017 (0.021)	0.017 (0.025)
Specific Human Capital	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Generic Human Capital	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Operative Shareholders	0.028*** (0.007)	0.028*** (0.007)	0.015** (0.007)	0.015** (0.007)
Employees	0.029** (0.014)	0.028** (0.014)	0.005 (0.012)	0.005 (0.012)
Patents	0.040* (0.022)	0.039* (0.022)	0.021 (0.022)	0.021 (0.022)
Firm Age	0.049*** (0.008)	0.049*** (0.008)	0.027*** (0.008)	0.027*** (0.008)
Incubation + Incubation University Shareholders at Entry*		9.06***		2.01
Incubation + Incubation Business Shareholders at Entry*		2.40		3.03*
Industry dummies	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
Observations	1,752	1,752	1,751	1,751

Legend. The table reports the estimated marginal effects after probit models. The dependent variable is *R&D Alliance* in columns 1 and 2 and *Commercial Alliance* in columns 3 and 4. Middle rows report the statistic of a $\chi 2$ test whose null hypothesis is that the sum of the two coefficients on the left-side column is equal to zero. Standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 6. ML recursive bivariate probit and 2SLS estimates

	R&D Alliance			*Commercial Alliance*		
	ML recursive bivariate probit (1)	LPM (2)	Probit (3)	ML recursive bivariate probit (4)	LPM (5)	Probit (6)
Incubation	0.130	0.102	0.385	0.489	0.305	0.910
	(0.427)	(0.224)	(0.668)	(0.390)	(0.229)	(0.633)
*Incubation*University Shareholders at Entry*	1.113***	0.423	1.902	0.304	-0.181	-0.557
	(0.418)	(0.276)	(1.269)	(0.349)	(0.312)	(0.990)
*Incubation*Business Shareholders at Entry*	0.001	-0.049	-0.200	-0.022	-0.050	-0.204
	(0.148)	(0.179)	(0.555)	(0.148)	(0.179)	(0.562)
University Shareholders at Entry	0.544**	0.112	0.192	-0.296	0.014	0.026
	(0.245)	(0.132)	(0.532)	(0.239)	(0.137)	(0.440)
Business Shareholders at Entry	0.131*	0.053	0.181	0.048	0.022	0.086
	(0.079)	(0.052)	(0.161)	(0.081)	(0.051)	(0.164)
*Incubation + Incubation*University Shareholders at Entry*	4.55**	2.63	2.86*	2.67	0.12	0.10
*Incubation + Incubation*Business Shareholders at Entry*	0.11	0.14	0.18	1.69	2.75*	3.20*
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,766	1,766	1,752	1,766	1,766	1,751

Legend. The table reports the estimated coefficients after ML recursive bivariate probit and two different implementations of the 2SLS model. Columns 1 and 4 report results using the ML recursive bivariate probit model, columns 2 and 5 report 2SLS results obtained using OLS in the second stage (i.e. a linear probability model, LPM), whereas columns 3 and 6 report 2SLS results using probit in the second stage. The dependent variable is *R&D Alliance* in columns 1, 2 and 3 and *Commercial Alliance* in columns 4, 5 and 6. *Incubation* along with the interaction variables are treated as endogenous and instrumented by the fit of the model in column 2 of Table A2, stand-alone and interacted with *University Shareholders at Entry* and *Business Shareholders at Entry* in LPM and probit models. Middle rows report the statistic of a $\chi 2$ test whose null hypothesis is that the sum of the two coefficients on the left-side column is equal to zero. Standard errors are in parentheses. * $p < 0.10$; ** $p< 0.05$; *** $p< 0.01$.

Table 7. Bivariate probit model estimates

	R&D Alliance	*Commercial Alliance*	*R&D Alliance*	*Commercial Alliance*
	(1)		(2)	
Incubation	0.241	0.744*	0.447	0.919
	(0.433)	(0.448)	(0.664)	(0.689)
*Incubation*University Shareholders at Entry*			3.067*	-0.488
			(1.800)	(1.530)
*Incubation*Business Shareholders at Entry*			-0.259	-0.184
			(0.546)	(0.565)
University Shareholders at Entry	0.814***	-0.191	-0.438	-0.001
	(0.199)	(0.186)	(0.770)	(0.660)
Business Shareholders at Entry	0.126*	0.033	0.196	0.081
	(0.068)	(0.070)	(0.159)	(0.164)
Incubation + Incubation University Shareholders at Entry*			3.25*	0.07
Incubation + Incubation Business Shareholders at Entry*			0.19	2.66
Rho	0.309***		0.310***	
Firm controls	Yes		Yes	
Industry dummies	Yes		Yes	
Regional dummies	Yes		Yes	
Observations	1,766		1,766	

Legend. The table reports the estimated coefficients of two bivariate 2SLS models. For each model, two equations are simultaneously estimated: they differ only in the dependent variable, which is *R&D Alliance* in the first equation and *Commercial Alliance* in the second one. *Incubation* is instrumented by the fit of the model in column 2 of Table A2. Middle rows report the statistic of a $\chi 2$ test whose null hypothesis is that the sum of the two coefficients on the left-side column is equal to zero. Rho is the estimated correlation between the errors in the two equations. Standard errors are in parentheses. * $p < 0.10$; ** $p< 0.05$; *** $p< 0.01$.

Table 8. Endogenous switching regression estimates

	Selection	*R&D Alliance*		*Commercial Alliance*	
	Full sample	Incubated	Control	Incubated	Control
	(1)	(2)	(3)	(4)	(5)
Incubator_supply	0.078***				
	(0.027)				
University Shareholders at Entry	0.128**	0.627***	0.157**	0.057	-0.130*
	(0.053)	(0.137)	(0.080)	(0.103)	(0.075)
VC Shareholders at Entry	0.180***				
	(0.036)				
BA Shareholders at Entry	0.114**				
	(0.058)				
Corporate Shareholders at Entry	-0.002				
	(0.021)				
Business Shareholders at Entry		0.046	0.045*	0.003	0.008
		(0.046)	(0.026)	(0.046)	(0.024)
Specific Human Capital	-0.003**	-0.000	0.002	-0.001	-0.000
	(0.001)	(0.004)	(0.002)	(0.004)	(0.002)
Generic Human Capital	-0.004***	0.003	0.000	0.002	-0.001
	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)
Operative Shareholders	0.013*	0.015	0.033***	-0.013	0.023***
	(0.007)	(0.013)	(0.009)	(0.013)	(0.008)
Employees	-0.015	0.056	0.026*	-0.027	0.011
	(0.010)	(0.038)	(0.016)	(0.040)	(0.012)
Patents	0.021	0.012	0.048*	-0.006	0.026
	(0.022)	(0.044)	(0.027)	(0.044)	(0.026)
Firm Age	-0.011	0.036**	0.052***	0.018	0.031***
	(0.008)	(0.016)	(0.010)	(0.017)	(0.009)
IMR		-0.002	-0.031	-0.112	-0.086
		(0.117)	(0.091)	(0.120)	(0.084)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes	Yes
Observations	1,761	479	1,223	476	1,223

Legend. The table reports the estimated marginal effects of a set of probit models. The dependent variable is *Incubation* in column 1, *R&D Alliance* in columns 2 and 3 and *Commercial Alliance* in columns 4 and 5. Standard errors are in parentheses. * p < 0.10; ** p< 0.05; *** p< 0.01.

Table 9. "What if" analysis after endogenous switching regression estimations

Panel A - R&D Alliances for University-backed start-ups		
Incubated		
	Mean	ttest
Probability of alliance	0.965	
Probability of alliance if they were not incubated	0.664	
Difference	0.301	***
Control group		
	Mean	ttest
Probability of alliance if they were incubated	0.883	
Probability of alliance	0.598	
Difference	0.285	***
Panel B - Commercial Alliances for Business-backed start-ups		
Incubated		
	Mean	ttest
Probability of alliance	0.323	
Probability of alliance if they were not incubated	0.261	
Difference	0.062	***
Control group		
	Mean	ttest
Probability of alliance if they were incubated	0.314	
Probability of alliance	0.236	
Difference	0.077	***

Legend. The table reports the actual and hypothetical probabilities of establishing an R&D alliance for university-backed start-ups (Panel A) and a commercial alliance for business-backed start-ups (Panel B) for incubatees and the control group of non-incubatees along with the differences in probabilities and relative t-tests. *** $p < 0.01$.

Appendix

Table A1. Variables description

Dependent Variables	**Operationalization**
R&D Alliance	Dummy variable equal to 1 if the start-up has ever settled a formal alliance (i.e. a contract) with third parties for R&D purposes, 0 otherwise.
Commercial Alliance	Dummy variable equal to 1 if the start-up has ever settled a formal alliance (i.e. a contract) with third parties for commercial purposes, 0 otherwise.
Explanatory Variable	
Incubation	Dummy variable equal to 1 if the start-up has been belonging or belongs to an incubation program, 0 otherwise.
Moderators	
Business Shareholders at Entry	Dummy variable equal to 1 if the start-up, at its foundation year, was backed, with any percentage of share, by a VC, a business angel or a mature company, 0 otherwise.
University Shareholders at Entry	Dummy variable equal to 1 if the start-up, at its foundation year, was backed, with any percentage of share, by a university, 0 otherwise.
Controls	
Specific Human Capital	Average number of years of experience among cofounders of the same firm gained through work experience in the same sector of the start-up before firm's foundation and previous managerial and entrepreneurial experiences.
Generic Human Capital	Average number of years of experience among cofounders of the same firm gained through (university) education and work in sectors different from the one of the start-up, before firm's foundation.
Operative Shareholders	Number of operative shareholders in the start-up.
Employees	Number of employees hired with an open-ended contract.
Patents	Dummy variable equal to 1 if the start-up is patent holder or software proprietary, 0 otherwise.
Firm Age	Difference, expressed in year, between the 31/12/2015 and the year of subscription to the special section of young innovative companies in the register for start-ups.

Legend. Variables are based on the Italian Start-up Survey.

Table A2. Probability of incubation

	Incubation	
	(1)	(2)
Incubator Supply	0.078***	0.080***
	(0.024)	(0.027)
University Shareholders at Entry		0.142**
		(0.061)
VC Shareholders at Entry		0.200***
		(0.043)
BA Shareholders at Entry		0.125*
		(0.068)
Corporate Shareholders at Entry		-0.001
		(0.021)
Specific Human Capital		-0.004**
		(0.001)
Generic Human Capital		-0.004***
		(0.001)
Operative Shareholders		0.013*
		(0.007)
Employees		-0.010
		(0.006)
Patents		0.019
		(0.023)
Firm Age		-0.011
		(0.008)
Industry dummies	Yes	Yes
Regional dummies	Yes	Yes
Observations	2,213	1,801

Legend. The table reports the estimated coefficients of linear probability models (LPMs). The dependent variable is *Incubation*. Column 1 is added only for comparison purposes, column 2 is the one effectively used to compute the instruments. Estimations are run on a greater sample size than our benchmark (1,766) since more information in the database is available on incubation than alliance activity, so to increase the strength of our instruments. Standard errors are in parentheses. * $p < 0.10$; ** $p< 0.05$; *** $p< 0.01$.