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Industrial policy, innovative entrepreneurship, and the human capital of founders

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Abstract Prior research shows that entrepreneurship enhances economic development. However, it is becoming increasingly evident that it is not the number of new startups that matter but rather their quality. This study investigates the effect of a comprehensive industrial policy intervention targeting innovative startups, i.e., the Italian Startup Act, on the composition of innovative entrepreneurs in terms of their human capital endowment. By decomposing the impact of lowering *entry* and *growth* barriers and by comparing the "before" and the "after" of the reform, we explore if the industrial policy has modified the composition of innovative entrepreneurs in terms of their human capital characteristics. The findings indicate that the reform, and in particular lowering growth barriers, was particularly able to push individuals with a relatively higher level of industry-specific, managerial, and entrepreneurial experience towards the creation of a new innovative venture. Overall, we show that a policy reform that decreases barriers to innovative entrepreneurship may attract entrepreneurs endowed with greater specific human capital than what occurred before the reform.

Plain English Summary The quality of entrepreneurship matters for economic development, and the good news is that industrial policy can affect it. Using micro-data on the human capital endowment of innovative entrepreneurs, and looking at the "before" and "after" of the Italian Startup Act, we show that this comprehensive industrial policy intervention had a beneficial effect on the quality of individuals pursuing an entrepreneurial career in innovative sectors. This beneficial effect is found to be more stimulated by the measures of the reform that aim at lowering growth barriers for startups and particularly associated to industry-specific, managerial, and entrepreneurial experience, where these characteristics of founders are deemed as important drivers of success for startups. Thus, the main implication of this study is that policy-makers can positively influence the quality, in terms of human capital endowment, of entrepreneurs who create an innovative company, with beneficial effects for the economic system.

Keywords Industrial policy · Startup Act · Innovative entrepreneurship · Human capital · Innovation

JEL classification D02 · L26 · L52 · O38

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1 Introduction

Prior experience and personal characteristics of individuals are found to play a significant role in entrepreneurial dynamics, from entrepreneurial entry (e.g., DeTienne & Chandler, 2007; Douglas & Shepherd, 2002; Lévesque & Minniti, 2007; Ucbasaran et al., 2008; Van Praag & Cramer, 2001; Waldinger et al., 1990) to new venture outcomes (e.g., Feeser & Willard, 1990; Marvel & Lumpkin, 2007; Unger et al., 2011). This is especially true for innovative entrepreneurship, i.e., knowledge-intensive startups based on innovation in products, production techniques, and/or commercialization (e.g., Acs et al., 2009; Antonietti & Gambarotto, 2020; Baumol & Strom, 2007).

From one side, human capital is accredited to play an essential part in the recognition and development of new innovative entrepreneurial ideas (Ardichvili et al., 2003; Gruber et al., 2012; Shane, 2000; Ucbasaran et al., 2009). On the other side, performance for any high-tech startup is found to be strongly reliant upon what "the founders can do" (Colombo & Grilli, 2005, 2010; Cooper & Bruno, 1977; Eisenhardt & Schoonhoven, 1990; Gimmon & Levie, 2010).

Being so important for economic and social development (see, for instance, Audretsch, 1995, Audretsch et al., 2006, Baumol & Strom, 2007), but at the same time being reputed to face several market imperfections, ranging from capital to labor markets (e.g., Grilli, 2014; Peneder, 2008; Storey & Tether, 1998; Teece, 1986), this type of entrepreneurship has greatly attracted the interest of policy-making. Allegedly, a conspicuous body of research has been endeavored to evaluate policy interventions in this domain (see, e.g., Schneider & Veugelers, 2010). While this literature has focused mostly on specific (albeit important) aspects concerning the life of innovative startups and, in particular, on the effectiveness of policy measures in alleviating hurdles in financing (e.g., Giraudo et al., 2019; Grilli & Murtinu, 2014), and thus affecting performance (e.g., Colombo et al., 2013; Hottenrott & Richstein, 2020), much less attention has been paid on the characteristics and quality of individuals who found them (e.g., Shane, 2009; Wong et al., 2005). But the extent to which entrepreneurship is found to matter for both economic and social development is strongly contingent on the inflow of high-quality individuals into the domain of entrepreneurship pursuing innovative projects (Beckman et al., 2007; Colombo & Grilli, 2005, 2010; Eisenhardt & Schoonhoven, 1990). In this study, we claim that there is a salient need to understand if and to what extent a specific policy reform can create a favorable environment that may increase the willingness of high human capital individuals to found an innovative startup. In doing that, we distinguish between different types of human capital and we also explore whether, from a policy perspective, the reduction of entry barriers rather than the lowering of growth barriers could be equally effective for triggering founders' human capital-enhancing effects.

Indeed, few are the studies that attempted to examine how a specific policy can influence different types of individuals to enter the entrepreneurship arena, and none has a specific focus on innovative entrepreneurship. Unlike the preceding stream of literature addressing barriers to entry (Branstetter et al., 2014; Sine & David, 2003; Sine & Lee, 2009), which is inherently limited to observing the founding rate as the outcome, these more recent studies emphasize the impact of lowering various barriers to entrepreneurship (Eberhart et al., 2017; Eesley, 2016). We build on this idea that institutional changes that reduce different types of barriers to entrepreneurship may impact not only entrepreneurial quantity (Branstetter et al., 2014) but also entrepreneurial quality, i.e., the skills and competencies of the individuals who become founders. In doing so, this paper departs from the extant studies in several respects.

First, none of the extant studies has analyzed whether and to what extent a policy change may have an immediate effect on the composition of entrepreneurs in terms of their human capital. Our focus here is not to understand if the policy may alter the number and the mix of innovative vs. non-innovative entrepreneurs in a given economic system (e.g., Darnihamedani et al., 2018), but rather to explore if the policy can modify the pool of innovative entrepreneurs in terms of their human capital, so that after the reform, there is a higher probability that an innovative startup is founded by an entrepreneur with a relatively higher human capital than what occurred before the reform. Given the importance of the creative destruction dynamics brought into the system by innovative risky ventures founded by talented individuals (Audretsch, 1995; Levine & Rubinstein, 2017; Schumpeter, 1912), understanding whether an institutional change may rapidly influence the innovative potential of new

entrepreneurial organizations is a compelling question. In doing so, our research endeavor integrates two different mechanisms through which an ad hoc policy reform can influence the creation of new ventures; i.e., we examine how reduction of entry and growth barriers impact entrepreneurship dynamics. While the effects of institutional changes related to the entry barriers have been widely studied to date, institutional changes that decrease barriers to growth have only recently been investigated (see Eesley, 2016). Nevertheless, extant research tests the two mechanisms (reduction of different barriers) separately, which does not provide conclusive evidence on the relative importance of each of them. We instead confront their impact within the same industrial policy reform.

Second, this study answers the call to deepen our knowledge on how industrial policy may impact the innovativeness of a sector (Bas & Paunov, 2018) by acting as an "external enabler" (Davidsson, 2015) in the pursuit of innovative entrepreneurial opportunities. In doing so, we aim at better elucidating the relationship between industrial policy and high-quality entrepreneurship (Acs et al., 2016; Shane, 2009; Venâncio et al., 2022). On the one hand, we dig into the nature and type of human capital that is most stimulated by the policy reform. In particular, we follow the seminal distinction between specific and generic components of human capital (see Becker, 1975). Generic human capital embraces all the general knowledge that an individual may acquire through education and work experience that, although important, has no direct and exclusive application to a specific domain. In contrast, specific human capital refers to those skills and capabilities that can be immediately and directly applied (and have value only) in a specific context. In our framework, these competences (see Colombo & Grilli, 2005, p. 796) point to "industry-specific human capital obtained by founders through prior work experience in the same industry. They also include knowledge of how to manage a new firm, that is entrepreneur-specific human capital; this is developed by founders through leadership experience (Bruderl et al., 1992)". If both typologies of human capital are deemed important in entrepreneurship (e.g., Ucbasaran et al., 2008), the specific component is typically found to be the most critical in knowledge-intensive sectors (e.g., Kato et al., 2015; Shane, 2000) and new venture growth (e.g., Colombo & Grilli, 2005, 2010; Grilli et al., 2020). Allegedly, it is of particular interest to ascertain if an ad hoc industrial policy reform can be especially capable to increase the attractiveness towards innovative entrepreneurship for individuals endowed with high specific human capital.

The third set of advantages pertain to the nature of our data. We focus on an unexplored (as to the focus of our study), yet extremely relevant institutional context, Italy, that, like most European countries, has been historically unable to generate successful startups in knowledge-intensive industries (Grilli & Murtinu, 2014) and is characterized by a structurally weak national innovation system (Nuvolari & Vasta, 2015). If recent empirical evidence has been produced on both the geographical determinants behind the creation of Italian innovative startups (e.g., Antonietti & Gambarotto, 2020; Colombelli, 2016; Ghio et al., 2016) and their performance's drivers (e.g., Minola et al., 2021), our endeavor complements these works by analyzing the human capital composition of entrepreneurs of such ventures and how industrial policy may alter it.

We conduct our research by relying on the Italian Startup Act (that is, Law no. 221/2012) that was implemented at the end of 2012 to nurture the creation and growth of innovative startups in the Italian economy. The Startup Act envisaged wide bureaucratic and administrative simplification (typical barriers to entry), along with benefits such as tax incentives, more flexible labor regulations (typical barriers to growth), less strict rules on insolvency, and a "fail fast" procedure. By exploiting the retroactive nature of the reform, i.e. also firms created before the end of 2012 could access the envisaged measures provided that they fulfilled the legal requisites for the status of an innovative startup, we are able to compare the human capital characteristics of founders "before" and "after" the reform and so discern the impact of this latter on the quality of created firms in terms of founders' human capital. If the Italian Startup Act has been evaluated looking at several different dimensions in terms of both policy mechanisms and firms outcomes (e.g., Biancalani et al., 2022; Colombelli et al., 2020; Giraudo et al., 2019; Menon et al., 2018), no study has yet investigated if the Italian Startup Act has modified the composition of entrepreneurs of innovative startups in terms of their human capital. To this aim, we pose the following interrelated research questions:

RQ1) Can an ad hoc industrial policy reform towards innovative entrepreneurship increase the quality in terms of human capital of the individuals pursuing an entrepreneurial career in that domain, and will this eventual effect materialize immediately?

RQ2) Which type of human capital, where we distinguish between its generic and specific nature, will be eventually more stimulated by the industrial policy reform?

RQ3) Which specific type of industrial policy measure, where we distinguish between those aiming at the reduction of barriers to entry from those aiming at lowering barriers to growth, will be eventually more capable to stimulate high human capital individuals to pursue the entrepreneurial career as founders of innovative startups?

The rest of the paper is organized as follows. Section 2 gives account of the related literature on the topic of industrial policy and human capital of entrepreneurs and formulate our research hypotheses on the aforementioned questions. Section 3 describes the Italian Startup Act and the data and empirical methodologies we follow in our investigation. Then, in Section 4, we present and discuss the results and the alleged robustness checks, while Section 5 concludes with implications.

2 Theory and hypotheses

It is a well-known fact that entrepreneurial dynamics strongly depend on the "rules of the game" emerging in a given environment in a specific historical moment (Baumol, 1990). If "entrepreneurial spirit" is considered to be relatively constant throughout time, existing institutions (Acemoglu et al., 2002; North, 1990) direct society's entrepreneurial effort toward the most lucrative aims, which may embrace either productive or destructive activities, depending on the institutions in place. Thus, following this institutional view, which specific entrepreneurial ventures will emerge in a given economy will depend on the legal, regulatory, and cultural norms characterizing a society (DiMaggio & Powell, 1983), and this institutional environment will impact both competitiveness and firm behavior (e.g., Berrone et al., 2013; Chung & Beamish, 2005; Delmas et al., 2007). However, entrepreneurial opportunities, including their recognition and exploitation, are entangled with individuals (see Knight, 1921, i.e., the cephalization process in entrepreneurship). Entrepreneurial judgment has an intrinsic idiosyncratic and nontransactional nature (Schumpeter, 1912) that, in many circumstances, makes it difficult for prospective entrepreneurs to pursue a business idea, especially when it is new and complex, without first entering the entrepreneurship arena, i.e., without (co)founding a brand-new venture.

This issue relates to another stream of literature focused on entrepreneurship that has evolved in parallel to the institutional stream and that we can ascribe to a competence-based view of the firm (Grant, 1996). Many studies document a vast array of micro-determinants of entrepreneurial opportunity recognition, business opportunity exploitation through entrepreneurial actions, and outcomes of entrepreneurial activity related to individuals' characteristics (Ardichvili et al., 2003; Choi & Shepherd, 2004; Colombo & Grilli, 2005). In this stream, there is a conspicuous body of evidence that previous experience of founders (e.g., Ardichvili et al., 2003; Åstebro & Thompson, 2011; Gruber et al., 2012; Shane, 2000; Shepherd & DeTienne, 2005; Ucbasaran et al., 2008, 2009), their demographics (e.g., ethnicity, gender, income level), and other personal (e.g., ambition, risk propensity, motivations) traits play significant roles on all the above mentioned dimensions related to entrepreneurship (DeTienne & Chandler, 2007; Douglas & Shepherd, 2002; Lévesque & Minniti, 2007; Van Praag & Cramer, 2001; Waldinger et al., 1990). Nonetheless, apart some notable exceptions (e.g., Eberhart et al., 2017; Eesley, 2016), studies in this realm have typically not considered whether (and eventually how) *changes* in the institutional environment, and in particular the issue of a new specific *formal law*, may impact the relationship between the characteristics of individuals and their decision to become entrepreneurs in the new institutional landscape.

In the following, we adhere to an economically sound logic (Carree et al., 2002), where the choice of becoming an entrepreneur also depends on its opportunity costs (e.g., predicted wage as an employee). Thus, we can argue that the institutional reform will have a particularly profound impact on high human capital (prospective) entrepreneurs, who have a high opportunity cost (relatively high wages as employees) and otherwise might not consider the entrepreneurial

path. In reality, individuals characterized by low levels of human capital have lower opportunity costs in pursuing the entrepreneurial career. That means that an ordinary business idea and a small-scale startup can be sufficient to exceed the benefit they can obtain as employees. In this respect, lowering entry and growth barriers is not expected to make a substantial difference. In contrast, individuals characterized by high human capital command a high salary in the labor market (see e.g., Amit et al., 1995; Buera, 2009), and thus, they have a higher opportunity cost in choosing the entrepreneurial path. To convince these individuals to become entrepreneurs, the realized gains from the startup have to be high. In other words, to induce a highly skilled individual to pursue an entrepreneurial career, she should be ex ante convinced that all the relevant institutional conditions are met so that the newly founded startup can realize its high (i.e., superior) potential. This superior potential value of startups founded by high human capital individuals may stem from their ability to perceive better opportunities (Shane, 2000) and their capacity to run better firms (Colombo & Grilli, 2005), but in either case its realization is triggered by the removal of obstacles that may impede the full deployment of entrepreneurial talent. Taking the argument to the extremes, only for illustrative purposes: if talent is absent, no talent will be released regardless of whether entrepreneurial barriers are low or high. Accordingly, lowering entrepreneurial barriers in this case should have a much more profound effect on high human capital individuals. Thus, we posit the following hypothesis:

Hypothesis (1): A reduction of institutional barriers to innovative entrepreneurship will increase the propensity of individuals endowed with high human capital to found a new innovative venture.

In the context of innovative startups, not all experience can be considered equal (Unger et al., 2011). Indeed, the specific rather than the generic nature of human capital appears to be especially relevant in positively shaping entrepreneurship dynamics (Colombo & Grilli, 2005, 2010; Feeser & Willard, 1990; Ucbasaran et al., 2008).

There are two mechanisms proposed in the literature through which this dichotomy is reflected. First, although the debate on whether entrepreneurial opportunities are created or simply discovered remains open and quite lively (Alvarez et al., 2013), there is general consensus around the fact that *specific* industry, business, and market experience can be crucial determinants of entrepreneurial opportunities exploitation. This may be attributable not only to "Kirznerian alertness" (Kirzner, 1973); i.e., it is the specific knowledge gained in a particular sector that may help individuals identify neglected business opportunities in the same or related areas (Dimov, 2010; Klepper, 2001; Marvel & Lumpkin, 2007; Shane, 2000; Shepherd & DeTienne, 2005; Ucbasaran et al., 2008), but also to the competences that are required to materialize business ideas in knowledge-intensive and high-tech sectors. Once an opportunity is identified, the inherently idiosyncratic and often nontransactional nature of that entrepreneurial idea (Schumpeter, 1912) makes it impervious to being sold to someone else (Zander, 2007): exploitation of that idea must necessarily be pursued by those who are the discoverers (or creators), who allegedly must become entrepreneurs (Knight, 1921). The untested nature of such ideas also makes it hard for prospective entrepreneurs to attract and retain specialized high-skilled workers and providers of complementary assets, with the result that the capabilities of startups very much reflect those of their founders, especially at inception (Cooper & Bruno, 1977; Grilli, 2014). Consequently, and as a second reason, founders with a high level of specific human capital usually also achieve better performance than other entrepreneurs (Bruderl et al., 1992; Colombo & Grilli, 2005, 2010; Cooper et al., 1994; Feeser & Willard, 1990). The meta-analysis conducted by Unger et al. (2011) based on 70 empirical studies over three decades confirms that the influence of entrepreneurial task-related human capital on a young firm's success is positive and significant, especially in high-tech sectors.

Consequently, we expect that removing barriers (especially those that relate to growth see *infra*), will be particularly important, especially for individuals who may generate startups characterized by a greater potential value. Therefore, we posit the following hypothesis:

Hypothesis (2): A reduction of institutional barriers to innovative entrepreneurship will increase the propensity of individuals endowed especially with high specific (rather than generic) human capital to found a new innovative venture.

The two sets of instruments of an institutional change, i.e., reduction of entry versus reduction of growth barriers, influence the choice of potential entrepreneurs in different ways. Implicit or explicit entry costs are one-time lump-sum burdens that are by definition confined to firm creation, while growth costs are continuous charges over the firm life cycle, and they are larger, the higher are the growth prospects of the new firm. Accordingly, we hypothesize that high human capital individuals are particularly sensitive to the alleviation or removal especially of these latter barriers, and this is particularly true for specific human capital. If a firm is inherently incapable to grow, either because its business idea is not particularly innovative or because the founders lack the necessary competencies or ambitions to scale up, lowering or not growth barriers will not make any significant difference. Accordingly, lowering only the cost of entry should have a relatively stronger impact on low human capital individuals as it eases the foundation and not the scale up, which might be sufficient for those who have less lucrative alternatives and therefore face relatively lower opportunity costs to entrepreneurship (Conti & Roche, 2021). In contrast, the decrease of this one-time cost, which is often limited in size, might not provide sufficient incentives for individuals with high (specific) human capital, who have a high opportunity cost, relatively high ambitions, more innovative entrepreneurial ideas to pursue, and more competencies to be deployed in the business. More specifically, the potential value of startups founded by entrepreneurs with high specific human capital is relatively higher (see, e.g., Colombo & Grilli, 2005, Eisenhardt & Schoonhoven, 1990, Feeser & Willard, 1990). However, this potential can effectively translate into superior performance only if access to financial and labor resources is not made impervious by the existing institutional environment and regulatory framework. In this respect, structurally lowering the typology of costs that are more relevant to facilitating the growth of startups should, in relative terms, confer a greater benefit on individuals who have higher growth potential in the first place. Hence, we posit that lowering barriers to growth will have a stronger effect on attracting individuals with high (specific) human capital to entrepreneurship than lowering barriers to entry:

Hypothesis (3): The growth (rather than the entry) barrier removal engendered by the institutional reform will particularly increase the propensity of individuals endowed with high (specific) human capital to found a new innovative venture.

3 Methodology

3.1 Empirical setting: the Italian Startup Act

Our analysis is based on the Italian institutional environment that encountered a regulatory change directed at innovative entrepreneurship. More specifically, the Italian Government issued a law in November 2012 (the Law 221/2012, modified by further amendments, the so-called *Italian Startup Act*) intended to spark the national innovation ecosystem by providing an opportunity for innovative startups to access a range of benefits. We take advantage of the retroactive nature of the mechanism introduced by the reform to discern the impact of this policy reform on the quality of the created firms.

The targeted companies of the reform are innovative startups, also known as Young Innovative Companies (YICs). To be considered an innovative startup, a company must satisfy an assortment of basic criteria. First, it must be 5 years old or younger, it cannot distribute dividends (or it must not have distributed dividends in the past), and it cannot be listed on a stock market. It also needs to have annual revenues not higher than 5 million euros, and it cannot be created as a divestiture of an existing company. Furthermore, a startup needs to comply with specific innovation standards. The relevant innovative criteria have at least one of the following three features: (*i*) the startup (or its founders) should be in possession of tangible intellectual property rights, such as a patent or a license; (*ii*) startups' investments in R&D should account for at least 15% of the revenues (or operating costs if they exceed the revenues); or (*iii*) at least one-third of the employees (including founders) must hold a PhD or a research tenure or at least two-thirds must have obtained a master's degree.

If a startup qualifies as a YIC, it can take advantage of several types of incentives and enjoy access to privileged services at a discount (full details of the reform are provided by, e.g., MISE, 2016). The benefits are mainly created to remove the usual barriers to innovative entrepreneurship, which should make entrepreneurial activity less costly and uncertain

(Hiatt & Sine, 2014). In particular, Table 1 reports in detail the series of instruments for the removal of entry and growth barriers to entrepreneurship envisaged by the Startup Act. The first batch of regulations is related to the decrease of entry barriers for Italian innovative startups and includes waivers of fees and running costs and simplification of procedures for company registration that can be done digitally. The second group integrates instruments that reduce the barriers that typically impede the growth of new innovative ventures. It includes more flexible and beneficial labor regulations, tax incentives for equity investments by professional private investors (business angels or venture capital firms), government-guaranteed (GG) bank loans, and eligibility to report losses for an extended time period and support in internationalization activities.

Finally, for the design of our study, it is critical to note that the retroactive nature of the policy has also allowed access to these measures not only to new ventures but also to firms that existed before the promulgation of the Startup Act, provided that these firms fulfilled the prescribed requirements (including the requirement of being less than 5 years old).

3.2 Data

This study is based on data collected in a survey taken by the National Committee of the Italian Ministry for Economic Development on the "Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Startups" and administered by the Italian National Institute of Statistics (ISTAT) in April and May 2016. The questionnaire aimed at collecting information on Italian innovative startups along a series of dimensions, including the human capital endowment of the founding teams, their innovation strategies, firm growth performance, and entrepreneurs' assessment of public policy measures implemented in this domain. As to this latter aspect, entrepreneurs were explicitly asked to declare whether they had already used or intend to use the specific instruments of the implemented reform.

The questionnaire targeted the population of all registered Italian innovative startups (including few that ceased their status because of their age), which was equal to 5150 YICs as of December 2015. At that time, no startup (previously YIC) had yet ceased its YIC status because of an IPO or the exceeding of the limit of 5 million euros in terms of annual revenues.

The questionnaire was filled with partial information from 2275 firms, leading to a considerable 44% response rate, and with complete information for the variables of interest of this study for 1769 YICs. The sample is ensured to be representative of the population on all dimensions on which ISTAT has information on both sides, i.e., population and sample, including firms' geographic location, industry affiliation, age and legal status (see the Online Supplemental Material – Appendix for more details). Another concern about the dataset is a possible survivorship bias since the companies are not sampled at their birth, but we can include in the survey only the startups that survived until the moment of the survey. We elaborately address the potential survivorship bias issue in the Appendix, in which we both conceptually and

Table 1 Description and taxonomy of the Startup Act instruments for the removal of entry and growth barriers to facilitate the creation of YICs in the Italian economy

Instrument group	Instrument definition
Entry instruments	• Decrease of startup costs (exemption from payment of stamp duties and other fees)
	• Decrease of startup time (incorporation procedure simplification)
Growth instruments	• Flexible labor regulations (less rigid contract requirements)
	• Dynamic salary (enhanced possibilities to activate performance-based compensation options)
	• Stock/equity compensation option (enhanced possibilities to use capital shares as remuneration)
	• Tax savings for the employment of highly skilled personnel
	• Incentives for equity investors (fiscal deductions on income taxes)
	• Incentives for debt providers (privileged access to government-guaranteed bank loans)
	•Internationalization support (ad hoc consultancy soft services of the Italian Trade Agency)
	• Incentives for equity crowdfunding (possibility to collect capital through authorized online portals)

empirically show that this should not exert a severe confounding effect on the findings of our analysis.

3.3 Estimation methods and variables

3.3.1 Models specifications for tests of Hypotheses 1 and 2

To investigate RQ1 (H1) and RQ2 (H2), we initially estimate a logit model in which the dependent variable is an indicator that separates entrepreneurs depending on whether they founded the company before or after the reform:

$$Founded\ after\ reform_i = \alpha + \beta' Human\ capital_i + \gamma' Controls_i + \varepsilon_i \quad (1)$$

Founded after reform equals 1 if an entrepreneur started the company after the reform (and zero otherwise). The main interest is to understand the impact of the founders' human capital variables, which in turn will explain whether the industrial policy reform has attracted founders endowed with relatively higher human capital. In particular, the explanatory variables are built on the same principles extensively used in previous studies to describe the human capital endowments of entrepreneurs (e.g., see Colombo & Grilli, 2005, 2010). In particular, we create the variable *Human capital* that comprises total years of university education and work experience prior to foundation (see, e.g., Beckman et al., 2007; Eisenhardt & Schoonhoven, 1990). In separate regressions, we also break down this measure into two components—*generic* and *specific* human capital. The measure of *Generic human capital* sums years of university education, freelance work experience, and employment in other sectors from the sector in which the founded company operates. On the other hand, *Specific human capital* is a measure of total years of entrepreneurial and managerial experience and years of employment in the same sectors of founded company's activity. The operationalization of the two variables closely follows previous studies in the field (e.g., Colombo & Grilli, 2005, 2010; Garrone et al., 2018).[1]

The vector *Controls* include variables that literature found relevant as founding determinants. More specifically, the international experience of founders is likely to affect entrepreneurial decision-making processes (e.g., Reuber & Fischer, 1997), so we include an *International experience* index that is built on student, work, and entrepreneurial experience abroad gained by entrepreneurs in the past (the value range is [0–3], given by the sum of the international experiences; the higher the value, the greater the international experience). Then, female entrepreneurs are less common when compared to male entrepreneurs (e.g., Minniti & Nardone, 2007), so we include a dichotomous gender variable *Gender male*, which equals 1 if the entrepreneur is male and 0 otherwise. Another stream of literature has argued that parents' experience impact entrepreneurial entry and behavior (e.g., Greve & Salaff, 2003). Hence, we control for whether one of the founders' parents has had any entrepreneurial experience (dummy variable *Parent entrepreneur* equals 1 if one of the parents was an entrepreneur, and 0 otherwise). Founding team size is also accounted for by including a continuous variable *Founding team size* that equals the number of operative cofounders. Finally, apart from the firm-level controls, we also add to the model relevant macro-environmental variables. Namely, we control for total entrepreneurship rate on a NUTS2 regional level (*TEA*), which should corroborate our analysis in line with the formulated hypotheses that are intended to understand if the reform changes the quality and not the quantity of the national entrepreneurial ecosystem. *TEA* is sourced from the Regional Global Entrepreneurship Monitor (GEM), and is time-invariant in the cross-sectional analysis (fixed to the value in the year of company foundation) and time-varying in the panel structure. In longitudinal settings, we also control for annual gross domestic product (GDP) per capita rate.

We estimate Eq. (1) on the whole sample of founders and also on a series of subsamples of founders who created their startups in different time windows centered around the implementation of the industrial policy. This further before-and-after analysis allows us to estimate the (local) average treatment effect of the industrial policy and be sure that our findings are not driven by the potential presence of other contextual facts beside the reform here analyzed.

Then, as a further preliminary robustness check, we move to a longitudinal setting (from year 2009

[1] The survey questionnaire asked respondents to categorize their previous professional conditions in several ways, including position, function, and sector experience. The human capital variables were operationalized as continuous by taking into account the age of the entrepreneurs at founding time and considering the time of their entry into the labor market.

to 2015, i.e., our time window based on the potential interval of YICs' population birth dates) and apply the following estimation framework (for a similar specification see Eesley, 2016):

$$Foundation_{it} = \alpha + \beta' Human\ capital_i + \delta' Post\ reform_{it} + \rho' Human\ capital * Post\ reform_{it} + \gamma' Controls_{it} + \varepsilon_{it} \quad (2)$$

In fact, *Foundation* is a dichotomous variable that equals 1 if an entrepreneur founded the company in the given year (and zero otherwise) and *Post reform* is a variable that equals 1 in the years after the reform (and 0 before the reform). All other (vectors of) variables have been already defined.

More specifically, we carry out both a pooled logit model and a Cox survival model. The advantage of the Cox (proportional-hazards) model is that it allows for a fairly flexible specification as it uses a semi-parametric estimation. As specified in Eq. (2), we define a "failure" event as the year when the entrepreneur starts a company (by the nature of our dataset, we have no censored data). In both cases, the interest lies in the interaction between the human capital variables and a dummy variable that indicates the time period after the policy.[2]

3.3.2 Models specifications for tests of Hypothesis 3

In order to dig into RQ3 (and explore H3), we use a similar approach as the one previously presented. We first estimate the logit model with a reform variable adjusted for the specific instruments it implemented related to the growth of the startups. Namely, *Founded after growth reform* in Eq. (3) equals 1 if an entrepreneur started the company after the reform and has used or intends to use its growth instruments (and zero otherwise). In this case, the baseline case identifies entrepreneurs who founded the startup before the reform and those who founded it after but did not use any instrument or used only entry-related measures:

$$Founded\ after\ growth\ reform_i = \alpha + \beta' Human\ capital_i + \gamma' Controls_i + \varepsilon_i \quad (3)$$

Again, as a robustness check, we repeat the pooled logit model and Cox survival model estimations.

Moreover, in order to conduct an even more rigorous test and better understand the importance of the industrial policy measures, we estimate another pooled logit model and Cox event-history analysis, with more precise explanatory variables related to the reform. We create two binary variables: specifically, *Post entry reform* equals 1 in the years after the reform for the firms that have used only the entry instruments of the reform (and 0 otherwise), while *Post growth reform* equals 1 in the years after the reform for the firms that have used also the growth instruments of the reform (and 0 otherwise). Therefore, the baseline case is represented by founders who created their company before the reform and did not use any measures:

$$Foundation_{it} = \alpha + \beta' Human\ capital_i + \delta' Post\ entry\ reform_{it} + \rho' Human\ capital * Post\ entry\ reform_{it} + \theta' Post\ growth\ reform_{it} + \vartheta' Human\ capital * Post\ growth\ reform_{it} + \gamma' Controls_{it} + \varepsilon_{it} \quad (4)$$

Again, the major interest resides in the interaction between the human capital variables and the two created dummy variables.

Finally, it is worth noting that in all the models' specification of (1)–(4), we inserted a set of industry dummies to capture the unobservable structural variance between different areas of Italy at the NUTS 2 level. We also introduce a vector of dummies for industrial sectors based on NACE classification, with the aim of controlling for intrinsic yet unobservable differences between industrial sectors to which startups belong. As our data are available on the individual-level, i.e., founder-level, we estimate the models allowing for company-level clustering of the errors—that is, allowing for correlation in the error terms between the cofounders.

4 Results

4.1 Descriptive statistics

Table 2 presents descriptive statistics among the key variables used in the study, along with their correlation matrix based on 4055 founders of 1769 YICs. As

[2] While Ai and Norton (2003) suggest that the magnitude of the interaction effect in non-linear models does not necessarily reflect its marginal effect, in the non-linear analyses described here, it is shown by Puhani (2012) and further extended by Eesley (2016, see his Appendix) that the coefficient of the interaction term fully accounts for the treatment effect of interest, provided that the two-way interaction term is formed by a treatment dummy (which is the case here).

Table 2 Means, standard deviations, and mutual correlation among the key variables

Variable	Mean	St. Dev.	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
(1) Founded after reform	0.867	0.339	1										
(2) Founded after growth reform	0.736	0.441	0.653	1									
(3) Human capital	19.386	11.907	0.043	0.054	1								
(4) Generic human capital	9.470	9.896	0.009	0.003	0.347	1							
(5) Specific human capital	9.915	12.558	0.034	0.049	0.674	− 0.459	1						
(6) International experience	0.321	0.588	0.001	0.036	0.111	− 0.015	0.117	1					
(7) Gender male	0.818	0.385	− 0.037	− 0.034	0.088	− 0.028	0.106	0.067	1				
(8) Parent entrepreneur	0.194	0.395	0.006	0.037	− 0.006	0.032	− 0.030	0.016	− 0.014	1			
(9) Founding team size	2.911	2.069	0.040	0.080	− 0.026	0.039	− 0.055	− 0.033	− 0.039	− 0.108	1		
(10) GDP per capita	35.379	639.377	0.001	0.001	0.001	0.001	0.001	− 0.001	− 0.001	0.001	− 0.001	1	
(11) TEA	0.040	0.021	0.106	0.063	− 0.092	− 0.046	− 0.051	0.002	− 0.036	0.033	− 0.018	0.001	1

Statistics are based on 4,055 founders (of 1,769 YICs created before and after the reform in the potential interval between the year 2009 and 2015, yielding 28,381 observations in longitudinal terms)

anticipated, most of the founders are based in large urban areas (12.93% in Milan, 7.9% in Rome, 6.1% in Turin) and are active in information technology (31.47%) and scientific research and development (17.54%) sectors. One may notice interestingly similar means of the two types of human capital (on average, a single founder has approximately 9.4 years of generic and 9.9 years of specific experience). Furthermore, the high ratio of male representation reflects the strikingly low engagement of women in entrepreneurship (approximately 18%). A remarkably high percentage of founders (close to 20%) have at least one parent with entrepreneurial experience. No particular correlations are large in magnitude, eliminating concerns of potential multicollinearity that might affect our results. Additional descriptive statistics are presented in the Appendix.

4.2 Policy reform and founders' human capital: the econometric evidence

4.2.1 Results on tests of Hypotheses 1 and 2

The first set of econometric results concerning RQ1 (H1) and RQ2 (H2), i.e., the ability of the industrial policy reform as a whole to increase the propensity of individuals endowed with high (generic vs. specific) human capital to found a new innovative venture, is presented in Table 3. The first two columns (Models 3a and 3b) report estimates of two logit models based on Eq. (1), where specification of Model (3a) includes *Human capital* as a whole, while the specification of Model (3b) distinguishes *Generic human capital* and *Specific human capital*. The coefficients of the variables explain which characteristics of the founders (or the external environment) impact the probability of foundation after the reform. Results show that high human capital founders are more prone to found a new venture after the Startup Act: the *Human capital* variable in Model 3a has a positive and statistically significant (at the 1% level) coefficient. However, when the more detailed measures of human capital are used, the results display that the industrial policy has managed to impact particularly founders with high specific human capital (likewise at the 1% level), while no particularly significant influence ($p = 0.131$) is found for the ones with high generic human capital. The effect of (specific) human capital is not only significant from a statistical point of view, but it is also remarkable in economic terms. Looking at Model (3b), ceteris paribus (i.e., other independent variables at the median or mean value), an individual entrepreneur located near Rome and active in the information technology services sector (the benchmark case in our estimates) and characterized by high specific human capital (90th percentile of the corresponding variable) is +49.65% more likely than the same individual characterized by low specific human capital (10th percentile of the corresponding variable) to have become an entrepreneur after the reform. The next four columns of Table 3 report robustness checks performed on a longitudinal structure of the data, by the estimation of the pooled logit and Cox models (see Eq. 2). In this case, as the dependent variable is a dummy which equals one if the firms were founded in the given year, and zero otherwise, and the model specification includes the *Post reform* variable, coefficients related to human capital have a distinctive interpretation. Specifically, the primary interest does not lie in the direct effect of human capital variables, where the associated coefficient reflects the human capital endowment of pre-reform entrepreneurs compared to post-reform ones, but it rather resides in their interactions with the *Post reform* variable (see Eesley, 2016). To confirm the evidence provided above, by the means of this specification, we expect a negative sign for the direct effect of human capital and a positive one for the interaction terms of the human capital variables with the *Post reform* variable. The findings fully comply with this pattern, and, therefore, they are totally in line with the findings of the logit model estimations. Repeating a similar simulation exercise as the one exposed before, the difference in the (yearly) probabilities "before" and "after" the reform of becoming an entrepreneur is +13.67% higher for an individual with high specific human capital (90th percentile) than the same individual with low specific human capital (10th percentile).

Table 4 reports the results concerning the before-and-after analysis with different time windows which enables us to verify that no other contextual factors rather than the promulgation of the Startup Act may have interfered on the above highlighted results. Regressions of Eq. (1), based only on the founders of

Table 3 Policy reform and human capital of founders

Analysis type	Logit models		Pooled logit models		Cox models	
Model	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)
Dep. variable	*Founded after reform*		*Foundation*		*Foundation*	
Human capital	0.015***		−0.010**		−0.010**	
	(0.005)		(0.004)		(0.004)	
	[0.005]		[0.014]		[0.024]	
Generic human capital		0.011		−0.009		−0.008
		(0.007)		(0.006)		(0.006)
		[0.131]		[0.133]		[0.192]
Specific human capital		0.017***		−0.011**		−0.010**
		(0.006)		(0.004)		(0.004)
		[0.003]		[0.013]		[0.020]
Post reform			1.741***	1.749***	1.470	-2.425
			(0.135)	(0.139)	/	/
			[0.000]	[0.000]	/	/
Post reform x Human capital			0.013**		0.007*	
			(0.005)		(0.004)	
			[0.012]		[0.089]	
Post reform x Generic human capital				0.011		0.005
				(0.007)		(0.006)
				[0.123]		[0.436]
Post reform x Specific human capital				0.014**		0.008*
				(0.005)		(0.005)
				[0.011]		[0.062]
International experience	−0.071	−0.076	0.001	0.001	−0.020	−0.021
	(0.110)	(0.110)	(0.001)	(0.001)	(0.025)	(0.025)
	[0.520]	[0.495]	[0.440]	[0.415]	[0.409]	[0.401]
Gender male	−0.373**	−0.380**	-0.002	-0.002	0.047	0.046
	(0.159)	(0.159)	(0.001)	(0.001)	(0.032)	(0.032)
	[0.019]	[0.017]	[0.234]	[0.256]	[0.141]	[0.153]
Parent entrepreneur	−0.009	−0.003	0.001	0.001	0.019	0.020
	(0.151)	(0.152)	(0.001)	(0.001)	(0.033)	(0.033)
	[0.952]	[0.986]	[0.195]	[0.209]	[0.554]	[0.541]
Founding team size	0.085*	0.087*	-0.001	-0.001	−0.014	−0.014
	(0.046)	(0.046)	(0.001)	(0.001)	(0.011)	(0.011)
	[0.067]	[0.063]	[0.897]	[0.873]	[0.188]	[0.196]
GDP per capita			0.001***	0.001***	0.000	-0.001***
			(0.000)	(0.000)	/	(0.000)
			[0.000]	[0.000]	/	[0.000]
TEA	27.466***	27.428***	13.858***	13.861***	4.425**	4.432**
	(9.486)	(9.488)	(2.798)	(2.797)	(1.953)	(1.952)
	[0.004]	[0.004]	[0.000]	[0.000]	[0.023]	[0.023]
Const.	−2.862	−2.814	−44.012***	−44.020***		
	(2.275)	(2.294)	(3.556)	(3.556)		
	[0.208]	[0.220]	[0.000]	[0.000]		
Industry dummies	Included	Included	Included	Included	Included	Included

Table 3 (continued)

Analysis type	Logit models		Pooled logit models		Cox models	
Model	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)
Dep. variable	*Founded after reform*		*Foundation*		*Foundation*	
Regional dummies	Included	Included	Included	Included	Included	Included
Observations	3420	3420	28381	28381	15514	15514
Founders	3420	3420	4055	4055	4051	4051
Companies	1497	1497	1769	1769	1766	1766
Log. likelihood	−1311.988	−1311.527	−9512.484	−9512.397	−31317.676	−31317.336
Pseudo R^2/Wald Chi^2	0.114	0.114	0.182	0.182	1.30e+13	9.47e+13

GDP per capita in longitudinal models are included as a time-varying control. The reported standard errors (in parenthesis) are robust standard errors clustered by company. The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. Standard errors for (some) time-varying variables in the Cox model are not estimated due to collinearity. *p* values are shown in square brackets. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels

companies founded closely around the introduction of the policy reform, using different time windows (3 months before and after, 6 months before and after, 12 months before and after, 18 month before and after, 24 months before and after), confirm that the reform indeed does positively impact the entry of high (specific) human capital founders and this effect materializes quite rapidly. Overall, the findings speak in favor of hypotheses H1 and H2.

4.2.2 Results on tests of Hypothesis 3

We now turn to the enquire represented by RQ3 (H3), where we investigate whether the propensity of high (specific) human capital founders will increase as a consequence of reduction of growth rather than entry barriers by the reform. To investigate this, the same set of analyses was repeated, with the only difference that now *Post reform* variable is substituted with the variable *Post growth reform* (see Eq. 3). The latter variable is a dummy that equals one only if a founder founded the firm after the policy and has used or plans to use growth-related instruments of the reform. Otherwise, this dummy variable equals zero for a founder who founded the firm before the policy or after the policy but has not used and plans not to use the growth-related measures. Results reported in Table 5 indicate that individuals endowed with high levels of human capital, and especially with the *specific* type, are more prone to become entrepreneurs after the growth reform was introduced. The coefficient of the specific human capital variable is significant at the 1% level. Additionally, by mimicking the same simulation exercise exposed before, we can again gauge the economic impact that the reduction of growth barriers may produce on individuals with high specific human capital. In fact, by the means of Model (5b), the increase in the probability to opt for the entrepreneurial career after the reform and thanks to the decrease in growth barriers for this typology of individuals (with respect to individuals with low specific human capital) is estimated to be equal to +32.25%. All results are confirmed by looking at the interaction terms of the pooled logit model and (to a lesser extent in terms of statistical significance) of the Cox model.

To provide further evidence on this aspect and compare the relative power of the entry and growth instruments of the industrial policy to drive high human capital individuals towards entrepreneurship, we estimate Eq. (4). Table 6 reports the results of the pooled logit and Cox models, with the main coefficients of interest being those of the interaction terms. The results corroborate the idea that reduction of both type of barriers was important, but that the lessening of growth barriers was particularly effective in stimulating individuals with high specific human capital to enter into the entrepreneurial arena. As a matter of fact, on top of the

Table 4 Before-and-after analysis for different time windows

Analysis type	Logit	Logit	Logit	Logit	Logit
Time window [months]	3	6	12	18	24
Dep. variable	*Founded after reform*	*Founded after reform*	*Founded after reform*	*Founded after reform*	*Founded after reform*
Generic human capital	0.103***	0.003	0.001	0.009	0.008
	(0.028)	(0.027)	(0.015)	(0.009)	(0.008)
	[0.000]	[0.922]	[0.925]	[0.311]	[0.332]
Specific human capital	0.079**	0.042**	0.021*	0.014*	0.017***
	(0.029)	(0.017)	(0.012)	(0.008)	(0.006)
	[0.008]	[0.013]	[0.079]	[0.082]	[0.005]
International experience	0.750	−0.512	−0.411*	0.067	−0.066
	(0.507)	(0.395)	(0.219)	(0.145)	(0.121)
	[0.139]	[0.195]	[0.061]	[0.640]	[0.581]
Gender male	−0.846**	0.201	−0.052	−0.134	−0.302*
	(0.377)	(0.409)	(0.249)	(0.193)	(0.170)
	[0.025]	[0.623]	[0.835]	[0.485]	[0.076]
Parent entrepreneur	0.611	0.082	−0.075	0.241	0.092
	(0.465)	(0.458)	(0.262)	(0.182)	(0.156)
	[0.189]	[0.857]	[0.774]	[0.186]	[0.552]
Founding team size	−0.600**	0.355	−0.111	0.027	0.039
	(0.276)	(0.257)	(0.099)	(0.070)	(0.057)
	[0.030]	[0.167]	[0.265]	[0.700]	[0.487]
TEA	−800.05***	−122.11***	−94.640***	−1.143	18.941***
	(284.82)	(36.975)	(16.829)	(7.807)	(6.970)
	[0.005]	[0.001]	[0.000]	[0.884]	[0.007]
Const.	−24.947***	3.860***	5.614***	0.014	−2.037
	(9.507)	(1.483)	(1.942)	(1.987)	(2.157)
	[0.009]	[0.009]	[0.004]	[0.995]	[0.345]
Industry dummies	Included	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included	Included
Observations	116	283	731	1400	2110
Log. likelihood	−10.7471	−102.5692	−328.3464	−740.5903	−1034.6319
Pseudo R^2/Wald Chi^2	0.866	0.476	0.330	0.133	0.118

The reported standard errors (in parenthesis) are robust standard errors clustered by company. p values are shown in square brackets. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

positive coefficients corresponding to both entry and growth instruments, only growth-related instruments appear to have a strongly statistically significant effect on the foundation decision of high specific human capital founders in both models (at the 1% and 10% levels on the pooled logit and Cox models, respectively); with a Wald test in pooled logit estimates (Model 6b), that rejects the hypothesis of null difference between the positive coefficients of *Specific human capital * Post growth reform* and *Specific human capital * Post entry reform* ($\chi^2_{(1)} = 8.95$ ($p - value = 0.003$)). Thus, hypothesis H3 is confirmed.

We subjected all results to a large battery of robustness checks which also provide additional evidence on these findings (see the dedicated session in the Appendix).

Table 5 Reduction of growth barriers and specific human capital of founders

Analysis type	Logit models		Pooled logit models		Cox models	
Model	(5a)	(5b)	(5c)	(5d)	(5e)	(5f)
Dep. variable	*Founded after growth reform*		*Foundation*		*Foundation*	
Human capital	0.013***		−0.008***		−0.007**	
	(0.004)		(0.002)		(0.003)	
	[0.002]		[0.001]		[0.011]	
Generic human capital		0.007		−0.005		−0.008**
		(0.006)		(0.003)		(0.004)
		[0.223]		[0.122]		[0.038]
Specific human capital		0.015***		−0.009***		−0.007**
		(0.005)		(0.003)		(0.003)
		[0.001]		[0.001]		[0.021]
Post growth reform			1.701***	1.713***	−0.074	−0.075
			(0.060)	(0.061)	(0.078)	(0.080)
			[0.000]	[0.000]	[0.348]	[0.347]
Post growth reform x Human capital			0.008***		0.005*	
			(0.002)		(0.003)	
			[0.001]		[0.093]	
Post growth reform x Generic human capital				0.006*		0.005
				(0.003)		(0.004)
				[0.075]		[0.186]
Post growth reform x Specific human capital				0.009***		0.005
				(0.003)		(0.003)
				[0.001]		[0.126]
International experience	0.108	0.100	−0.019	−0.018	−0.020	−0.021
	(0.092)	(0.092)	(0.017)	(0.017)	(0.025)	(0.024)
	[0.243]	[0.278]	[0.262]	[0.304]	[0.409]	[0.401]
Gender male	−0.310***	−0.323***	0.059***	0.061***	0.048	0.047
	(0.118)	(0.118)	(0.021)	(0.021)	(0.032)	(0.032)
	[0.008]	[0.006]	[0.006]	[0.004]	[0.136]	[0.147]
Parent entrepreneur	0.272**	0.280**	−0.048**	−0.050**	0.019	0.020
	(0.115)	(0.115)	(0.021)	(0.021)	(0.032)	(0.032)
	[0.018]	[0.015]	[0.022]	[0.018]	[0.549]	[0.537]
Founding team size	0.146***	0.149***	−0.023***	−0.023***	−0.014	−0.014
	(0.041)	(0.042)	(0.006)	(0.007)	(0.011)	(0.011)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.183]	[0.190]
GDP per capita			0.001***	0.001***	0.001***	0.001
			(0.000)	(0.000)	(0.000)	/
			[0.000]	[0.000]	[0.000]	/
TEA	15.122**	15.034**	15.364***	15.370***	4.377**	4.375**
	(6.717)	(6.743)	(2.497)	(2.497)	(1.956)	(1.956)
	[0.024]	[0.026]	[0.000]	[0.000]	[0.025]	[0.025]
Const.	−1.599	−1.548	−46.094***	−46.110***		
	(1.591)	(1.585)	(2.993)	(2.994)		
	[0.315]	[0.329]	[0.000]	[0.000]		

Table 5 (continued)

Analysis type	Logit models		Pooled logit models		Cox models	
Model	(5a)	(5b)	(5c)	(5d)	(5e)	(5f)
Dep. variable	*Founded after growth reform*		*Foundation*		*Foundation*	
Industry dummies	Included	Included	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included	Included	Included
Observations	3850	3850	28381	28381	15514	15514
Founders	3850	3850	4055	4055	4051	4051
Companies	1671	1671	1769	1769	1766	1766
Log. likelihood	−2035.747	−2033.899	−9472.749	−9472.087	−31318.198	−31318.13
Pseudo R^2/Wald Chi^2	0.102	0.102	0.186	0.186	3.96e+07	2.13e+14

GDP per capita in longitudinal models are included as a time-varying control. The reported standard errors (in parenthesis) are robust standard errors clustered by company. The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. Standard errors for (some) time-varying variables in the Cox model are not estimated due to collinearity. *p* values are shown in square brackets. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels

Table 6 Reduction of entry and growth barriers and human capital of founders

Analysis type	Pooled logit models		Cox models	
Model	(6a)	(6b)	(6c)	(6d)
Dep. variable	*Foundation*		*Foundation*	
Human capital	−0.010**		−0.010**	
	(0.004)		(0.004)	
	[0.013]		[0.024]	
Generic human capital		−0.009		−0.008
		(0.006)		(0.006)
		[0.140]		[0.193]
Specific human capital		−0.011**		−0.010**
		(0.004)		(0.004)
		[0.011]		[0.020]
Post entry reform	2.049***	2.053***	0.006	0.025
	(0.112)	(0.118)	(0.085)	/
	[0.000]	[0.000]	[0.939]	/
Post growth reform	1.767***	1.776***	−0.006	−0.001
	(0.133)	(0.137)	/	(0.086)
	[0.000]	[0.000]	/	[0.996]
Post entry reform x Human capital	0.009**		0.006	
	(0.004)		(0.005)	
	[0.049]		[0.246]	
Post growth reform x Human capital	0.013***		0.008*	
	(0.005)		(0.004)	
	[0.009]		[0.082]	

Table 6 (continued)

Analysis type	Pooled logit models		Cox models	
Model	(6a)	(6b)	(6c)	(6d)
Dep. variable	*Foundation*		*Foundation*	
Post entry reform x Generic human capital		0.008		0.001
		(0.006)		(0.007)
		[0.202]		[0.876]
Post growth reform x Generic human capital		0.011		0.006
		(0.007)		(0.006)
		[0.117]		[0.377]
Post entry reform x Specific human capital		0.009*		0.009
		(0.005)		(0.006)
		[0.060]		[0.115]
Post growth reform x Specific human capital		0.014***		0.008*
		(0.005)		(0.005)
		[0.008]		[0.064]
International experience	0.010	0.010	−0.021	−0.021
	(0.007)	(0.007)	(0.025)	(0.025)
	[0.169]	[0.161]	[0.403]	[0.401]
Gender male	0.003	0.004	0.048	0.046
	(0.007)	(0.007)	(0.032)	(0.032)
	[0.670]	[0.613]	[0.138]	[0.153]
Parent entrepreneur	−0.007	−0.007	0.019	0.019
	(0.008)	(0.008)	(0.033)	(0.032)
	[0.391]	[0.367]	[0.560]	[0.555]
Founding team size	−0.002	−0.002	−0.014	−0.014
	(0.002)	(0.002)	(0.011)	(0.011)
	[0.362]	[0.344]	[0.182]	[0.190]
GDP per capita	0.001***	0.001***	0.001	0.001
	(0.000)	(0.000)	/	/
	[0.000]	[0.000]	/	/
TEA	13.801***	13.803***	4.420**	4.439**
	(2.820)	(2.819)	(1.953)	(1.952)
	[0.000]	[0.000]	[0.024]	[0.023]
Const.	−44.101***	−44.109***		
	(3.611)	(3.611)		
	[0.000]	[0.000]		
Industry dummies	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included
Observations	28381	28381	15514	15514
Founders	4055	4055	4051	4051
Companies	1769	1769	1766	1766
Log. likelihood	−9434.2703	−9434.1491	−31317.557	−31316.846
Pseudo R^2/Wald Chi^2	0.189	0.189	4.39e+07	7.91e+13

The reported standard errors (in parenthesis) are robust standard errors clustered by company. Standard errors for (some) time-varying variables in the Cox model are not estimated due to collinearity. *p* values are shown in square brackets. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels

5 Conclusions

It is well-known that industrial policy can impact firm entry and thus influence the *quantity* of entrepreneurs (e.g., Branstetter et al., 2014). With this study, we instead focus on *quality* and investigate the extent to which an ad hoc industrial policy reform directed towards innovative entrepreneurship can act as an "external enabler" (Davidsson, 2015) of virtuous dynamics by pushing towards innovative entrepreneurship founders equipped with more advanced human capital. Our analysis focuses on the Italian Startup Act and uses data on a comprehensive sample of founders of new Italian innovative startups created before and after this milestone reform. We found that (a) an industrial policy that reduces barriers to entrepreneurship increases propensity of high human capital individuals to become entrepreneurs, (b) it is the *specific* rather than the *generic* human capital component which appears to be the most incentivized, and (c) the policy instruments that reduce *growth barriers* seem to be particularly impactful in stimulating individuals with high specific human capital in choosing the entrepreneurial path rather than those instruments which are simply directed to lower *entry barriers*.

Our findings provide several contributions to the literature and provide interesting policy implications.

First, we add to the intersection of the institutional theory and the firm entry literature by shedding light on how a comprehensive industrial policy can impact entrepreneurship, and how different policy instruments may model the human capital of the entrepreneurs operating in markets. Previous studies highlight entry barriers as a pivotal mechanism influencing founding rates (Klapper et al., 2006; Sine & Lee, 2009). Eesley (2016) and Eberhart et al. (2017) do introduce and test alternative mechanisms (growth and exit barriers, respectively). However, they do not confront these mechanisms within the same policy reform. We do exactly that, and show that if lowering both entry and growth barriers seem important, if a priority should be set, it could probably be put on the latter type of measures which are the most capable to stimulate individuals with high specific human capital to found a new venture, where this specific component of founders' human capital is considered an essential ingredient for a successful venture in knowledge-intensive sectors (e.g., Colombo & Grilli, 2005, 2010; Grilli et al., 2020). In particular our analysis suggests that growth-related benefits, such as flexible labor regulations, beneficial tax credit for the employment of highly skilled personnel, and incentives for equity investors and debt providers, are the most effective industrial policy measures for pushing talented individuals towards the innovative entrepreneurship career's path; and accordingly, they should be preferred with respect to entry facilitating measures such as the lowering of (explicit and opportunity) startup costs or the easing of incorporation procedures.

Second, we also shed new light on the links between industrial policy and industrial organization. In fact, if we already know that policy changes may immediately affect the (innovative) performance of industries (see, e.g., India's liberalization reform and its impacts on firms' R&D investments, analyzed by Bas & Paunov, 2018), we hereby highlight that institutional changes brought in by new industrial policies may indeed produce rapid changes on sectors, not only by modifying behaviors of incumbent firms, but also through the *entrepreneurship* channel, i.e., by enhancing the human capital of entrepreneurs. In this respect, especially if we refer to the organization imprinting and population ecology perspectives (Hannan et al., 1996; Hannan & Freeman, 1977), an industrial policy of the type here analyzed may indeed reverberate its effects for a long time, since a firm's inception represents a key *sensitive moment* of an organization's existence (e.g., Geroski et al., 2010; Shinkle & Kriauciunas, 2012; Stinchcombe, 1965). Thus, new industrial policies appear capable of immediately affecting the nature of the firms in the pool, and again through imprinting effects (e.g., Grilli et al., 2020), they may have persistent effects on a population's subsequent dynamics. In this respect, if extant firms' characteristics may evolve slowly and path-dependently from an initial imprinting, we can also claim, on the basis of the results of this study, that industrial sectors could not necessarily be subject to the same inertia and might instead experience swifter (positive) changes driven by appropriate industrial policies. Needless to say, further research is necessary to substantiate this latter implication.

Relatedly, due to the single country focus of our study, a question on the generalizability of the findings here exposed arises. To the best of our knowledge, this is the first study of its type on Western countries analyzing the effect of a Startup Act on

the human capital of entrepreneurs. Recently there has been an upsurge of this type of policy interventions around the world (see Audretsch et al., 2020 for a recent survey), and it would surely be important to replicate the analysis in other institutional contexts. If it is not unconceivable that similar effects on the quality of entrepreneurs could be exerted by other industrial policy measures, a comparison of results across different settings would greatly increase our knowledge on the best mechanisms aimed at stimulating virtuous dynamics in innovative entrepreneurship. Finally, our investigation is intrinsically unable to assess (reallocative) general economic equilibrium effects. In other words, the change in the composition of founders of innovative startups brought by the policy reform could have potentially produced spillover effects on the whole economic system that we are unable to trace. Needless to say, the analysis of possible crowding out effects of this sort, and their eventual quantification, would enable us to better gauge the general validity of the policy mechanisms here considered.

Despite these unavoidable caveats, our study shows how industrial policy can quite rapidly and favorably influence who is becoming an innovative entrepreneur, where the typology of players—whether they have high human capital or not—may greatly impact on the prosperity of the innovative entrepreneurship segment. This finding is clearly an important element to be considered by makers of entrepreneurship and innovation policies.

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