Appropriability strategies and policy support: evidence from a representative sample of Italian young innovative companies

1 INTRODUCTION

"*What role do small innovative companies have in emerging innovation ecosystems? Is it possible for them to pursue long-term success without necessarily being acquired?*" These questions, taken from the "Knowledge and Innovation" track of 2019 SMS Conference call for paper, are crucial to the current paper, which investigates to what extent are Young Innovative Companies (YICs) able to take advantage of public policy support in engaging in IP protection strategies.

Corporate R&D is becoming increasingly persistent and, especially in Europe, top performers of yesterday are very much top performers of today (European Commission, 2018). European incumbents are prevailing in the innovation arena and, admittedly, in the recent past, there have been very few tales to tell on largely successful innovative start-ups in the Old Continent. YICs are companies that are knowledge-intensive and research-based, young and independent and devote significant resources to R&D and innovation (Dumont, 2017). According to recent data provided by CB Insights, the list of the so-called *unicorns* is dominated by American (49%) and Chinese (41%) YICs.[1] To that end, even the few European YICs that possibly manage to gain prominence in the market, more and more frequently, end up being acquired by large non-European incumbent firms, typically based in the United States (see Atomico, 2016). These stylized facts reveal an increasingly relevant issue: the limited capacity of Europe to fuel Schumpeter Mark (SM) I dynamics, i.e. the *creative destruction* mechanisms, which are important enablers of the dynamic efficiency of any economic system (Schumpeter, 1911). Namely, especially under the so-called "entrepreneurial society" (Audretsch, 2007), innovative ventures are considered the engine of technological change and economic growth, and are often responsible for the introduction of radical innovations into the market (Henkel et al., 2015; Schneider and Veugelers, 2010). Therefore, the understanding of how Europe can escape this sort of "SM I trap" and re-balance things towards a scenario where YICs are not only producing innovations but are also choosing going-solo strategies, are relevant and timely subjects (Acs et al., 2014). Also, it is equally compelling the analysis of which factors may enable YICs to sell their technologies (and not necessarily the company itself) in flourishing market for technological ideas, where typically European start-ups, except probably for UK, do not abound (Arora et al., 2001; see recent figures by Forrester, 2018).

This difficulty for YICs to emerge as *successful* innovators is likely contingent on their (in)capacity to protect innovation and capturing some of the value they create (Gans et al., 2002). While it seems reasonable to assume that, overall, opting for appropriation mechanisms is inherent to the nature of YICs, these firms encounter two main strategic choices concerning *how* to appropriate the returns of their innovation activities: formal and informal appropriation mechanisms. Formal mechanisms include intellectual property rights (IPRs) like patents, trademarks and copyrights, while informal ones mainly refer to secrecy, exploitation of lead-time and the use of complementary assets. The formal vs. informal choice is not straightforward and depends on a number of barriers and incentives innovative YICs are faced with. On the one hand, formal instruments are often deemed a key pre-requisite to enter into markets for technological ideas (Gans et al., 2002); but at the same time, admittedly, the costs of building an IPRs strategy may simply be beyond the means of the typical start-up, since YICs are inherently subject to resource constraints (Revest and Sapio, 2012). On the other hand, opting for informal intellectual property (IP) strategies could be conducive to a more pro-competitive entry by YICs in product markets (Gans et al., 2002); but even in this case, protection might not be feasible either, since young firms lack the critical scale and resources to control complementary downstream assets necessary to commercialize the innovation (Teece, 1986). Moreover, YICs have a deficit of vested positions and thus reputation capital, which might force them to chase formal protection mechanisms that can function as signals of their capability to stakeholders, financiers and prospective employees (Hsu and Ziedonis, 2013).

Needless to say, the two broad families of IP strategies, i.e. formal or informal, at disposal of YICs are not pursued in an institutional vacuum, but it is legitimate to expect they can be influenced by policy making. Nevertheless, in this respect, while a conspicuous body of research in R&D policy

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[1] *Unicorns* are defined as private companies valued above 1 billion dollars.

literatures has investigated the role of public policies at both national (e.g., Grillitsch et al., 2018) and regional level (e.g., Vecchiato and Roveda, 2014) in affecting R&D in small and resource-constrained firms, the question of whether and to what extent IP protection strategies by YICs can be influenced by different policy instruments remains open and worth investigating.

2   THEORETICAL BACKGROUND

In this paper, we address these questions and test if and how a well-defined and comprehensive set of policy instruments can help YICs overcoming the barriers that often prevent these firms from appropriating the returns of their innovation activities. Specifically, we focus on two sets of policy instruments: financial and labour-driven. The former refers to incentives that reduce the costs and risk of investors and includes: Tax incentives for equity investment, a government-guaranteed bank loan fund, and crowdfunding); the latter refers to granting higher flexibility in hiring and rewarding human capital (employees and collaborators) and includes: Flexible contracts, Dynamic salary, stock option for employees, low tax for highly skilled personnel. We integrate several theoretical lenses and lay down possible mechanisms and directions of the impact that the implemented policies can have on the innovation strategy of YICs. The baseline of our arguments draws on the resource-based view (RBV) of the firm (Barney, 1991), and posits that when an institutional reform manages to alleviate start-ups' (financial) constraints, the freed resources will flow (at least in part) towards protecting innovation. Furthermore, we hypothesize a relationship between "flexibility" of resources (behind policy mechanisms) and the type of appropriability mechanism chosen by the YIC (Chatterjee and Wernerfelt, 1991). In particular, we argue that easing the access to resources through financial mechanisms might support both formal IP protection mechanisms and informal ones, while decreasing barriers to human and knowledge resources through labour mechanisms might be more specific and could only be beneficial for formal mechanisms of protection.

H1. (Financial and labour) Policy instruments increase the probability to adopt appropriability mechanisms by young innovative companies.

H2. Financial policy instruments increase the probability to adopt both informal and formal mechanisms by young innovative companies.

H3. Labour policy instruments increase the probability to adopt formal protection mechanisms by young innovative companies.

3   METHODS

To test our predictions, we take advantage of a unique context, which is a recent policy reform developed in Italy. We focus on Italy as an unexplored and extremely relevant case. In fact, Italy has a structurally weak national innovation system (Nuvolari and Vasta, 2015) and has a lack of the capacity to generate viable and successful start-ups in knowledge-intensive industries (Grilli and Murtinu, 2014). However, an institutional reform introduced by the Italian government in 2012 called the *Italian Startup Act* (the Law 221/2012) was the first to specifically target YICs, and provide a number of benefits for easing their business, and above all, innovative activities. We take advantage of a survey launched 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 Start-ups" and administered by the Italian National Institute of Statistics (ISTAT) in 2016. The survey targeted the population of all registered Italian YICs, which as of December 2015 was equal to 5,150 YICs. The questionnaire was filled with partial information from 2,275 firms, leading to a considerable 44 percent response rate, and with complete information for the variables of interest of this study for 1,668 YICs. The representativeness of the sample with respect to the population is ensured on all relevant dimensions on which ISTAT, including firms' geographic location, industry affiliation, age and legal status. Furthermore, we also check whether a potential survivorship bias could represent a serious concern in our setting as only the start-ups that had survived until the moment of the survey could be sampled. The questionnaire collected information on Italian YICs along a series of dimensions, including information regarding the founding teams and employees, their innovation strategies, firm growth performances and, importantly for our study, adoption of the different public policy measures that were put in place in this domain. As to this latter aspect, entrepreneurs were explicitly asked to declare whether they had used the specific instruments of the implemented reform, which is the central information we exploit in the analysis. While other recent

works have investigated YICs from the Italian Startup Act sample (e.g. Colombelli, 2016; Grilli, 2018; Hahn et al. 2019), our restricted access to the National Committee survey confers us two particular advantages: first, the access to an extensive and highly representative subset of the whole population; second, a satisfying depth of information on the utilized policy mechanisms and their association with appropriation strategies.

We first use a binary dependent variable **IP protection** that equals one if a firm used any of the mechanisms to protect innovation, and zero otherwise. Second, we use two binary dependent variables: **Formal IP protection** (a formal mechanism such as a patent, a license or registered software is used) and **Informal IP protection** (an informal mechanism such as secrecy, lead time, complementary assets in sales, marketing or manufacturing was utilized). We capture the use of the two most important groups of instruments that were introduced by the institutional reform by two binary variables: *Financial policy instruments* variable equals one if the YIC used one of the instruments that facilitate easier access to external finance (equity investors, loans or crowdfunding), and zero otherwise. *Labour policy instruments* variable instead equals one if the YIC used one of the instruments that facilitate easier access to highly skilled labour (less rigid contract requirements, performance-based and equity compensation options, and tax credit for the employment of highly skilled personnel), and zero otherwise. We also adopt several firm level controls.

We first run a probit model to test the impact of the policy on the usage of (any) IP protection mechanisms. Second, we run a binomial probit model that distinguishes between the two types of IP protection mechanisms (formal and informal) to understand the impact of the policy instruments on these two different strategic outcomes.

4   RESULTS

The main results are presented in Table . The first column (model 4a) displays the probit estimates testing H1 that posits that the use of financial and labour policy instruments increases the odds of YICs to use any IP protection mechanisms. While the impact of both financial and labour policy instruments appears to be positive with the marginal effects of 6.15% and 1.48%, we find a statistically significant (at 5% level) effect only for the former one. Nonetheless, when the aggregate of the two groups of instruments is taken into consideration, the overall effect is positive and statistically significant, i.e., the linear combination of the two coefficients equals to 0.267 and it is statistically significant at 5% level, hence confirming the first hypothesis. The next two columns of Table report the results concerning the test of the subsequent set of hypotheses, H2 and H3, based on the estimation of the binominal probit model. The results spell out a positive association between the financial policy instruments introduced by the institutional reform and the use of both formal and informal IP protection mechanisms (significant at 5% and 1% levels, respectively), in support of hypothesis 2. The marginal effects are 6.69% and 7.81%. On the other hand, labour policy instruments of the reform also emerge to be positively associated with both types of IP protection mechanisms (the marginal effects are 5.32% ad 1.67%). However, in line with hypothesis 3, the statistically significant association (at 10% level) can only be observed in the case of formal mechanisms.

Then we perform a series of robustness checks and additional analyses to corroborate and deepen these findings. First, we test the effect of the two groups of reform instruments separately. Financial policy instruments increase the odds to use both types of IP protection for YICs, while labour policy instruments does so significantly for formal IP protection only. Second, we disaggregate the financial policy instrument into its two main components: the equity mechanism and the debt mechanism. The results point to a positive relationship between the reduction in both types of financial barriers and the use of protection mechanisms, in confirmation of the second hypothesis. Third, we disaggregate the labour instrument of the reform into four integral elements: less rigid contract requirements (Flexible contracts), use of performance-based compensation options (Dynamic salary) and equity-based compensation schemes (Stock option) at better terms than all other firms, and finally, tax credit for the employment of highly skilled personnel (Low tax high skills). The results indicate that the positive effect of labour instruments on the use of IP protection mechanisms is driven by the flexible contractual requirements that allow YICs to hire but also lay off employees more easily. Finally, we check whether our results could change, once possible different (formal) appropriability regimes on which YICs are called to operate are taken into consideration. In order to account for the differential

role of appropriability regimes, the sampled industrial sectors are divided according to their ability to appropriate the returns of innovation by relying on patent protection mechanisms. In particular, similarly to Caviggioli et al. (2018), we use worldwide data from ORBIS dataset and construct an index at the industry-level (NACE Rev. 2 classification) based on the average number of patents per firm for each of the sectors considered. Results exposed in Table 8 reveal that our findings hold irrespective of the appropriability regime. Similar findings are also obtained when the index is interacted with the main policy variables of interest, suggesting that no relevant moderating effects are present on the dynamics of interest.

5   CONCLUSIONS

This study takes advantage of a recent institutional reform introduced by the Italian government in 2012 (the *Italian Startup Act*, i.e., the Law 221/2012), specifically targeted to YICs, to analyse if and to what extent different policy mechanisms in the domain of finance and labour can positively affect the appropriability strategies of these firms. At this scope, through the use of survey-based data collected in 2016, we have analysed the behaviour of more than 1,600 YICs. Despite the cross-sectional nature of the data which prevents use to argue in terms of causality, our econometric analyses highlight how financial policy instruments increase the probability to adopt both formal and informal methods of IP protection, while labour policy instruments are only associated to the use of the former ones. Overall, these findings highlight how the so often advocated policy interventions to lessen YIC's burdens in accessing finance and labour resources do exert beneficial effects also to their capacity to protect innovation (and hence produce it, in the first place). In doing so, they also deliver precise policy implications on which policy instrument should be favoured by the policy maker who aims at stimulating the use by YICs of one rather than other protection mechanisms.

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Table 1. Institutional reform and the use of IP protection mechanisms.

Analysis type	Probit models	Bivariate probit model	
Model	**(1a)**	**(1b)**	**(1c)**
Dependent variable	**IP protection**	**Formal IP**	**Informal IP**
Financial policy instruments	0.216**	0.200**	0.255***
	(0.090)	(0.079)	(0.085)
Labour policy instruments	0.052	0.159*	0.055
	(0.102)	(0.089)	(0.096)
No. of founders	0.002	-0.008	0.008
	(0.021)	(0.019)	(0.020)
No. of permanent employees	0.011	-0.007	0.010
	(0.014)	(0.011)	(0.014)
No. of temporary employees	0.056	0.034	0.036
	(0.049)	(0.042)	(0.041)
Firm age	0.068**	0.062**	0.061*
	(0.034)	(0.030)	(0.032)
Human capital of founders	0.009**	0.008**	0.008**
	(0.004)	(0.003)	(0.004)
Motivation profit	0.288***	0.121	0.316***
	(0.080)	(0.075)	(0.077)
Motivation research implement.	0.111	0.028	0.161*
	(0.100)	(0.095)	(0.096)
Motivation innovation	-0.002	-0.221**	0.028
	(0.105)	(0.099)	(0.101)
R&D expenditures	0.360***	0.258**	0.403***
	(0.133)	(0.119)	(0.126)
In-house R&D	0.336***	0.128*	0.285***
	(0.081)	(0.076)	(0.077)
Product innovation	0.341***	0.459***	0.311***
	(0.086)	(0.087)	(0.083)
Process innovation	0.046	0.025	0.099
	(0.078)	(0.072)	(0.075)
International	0.348***	0.351***	0.383***
	(0.076)	(0.072)	(0.073)
Externally funded	0.099	0.076	0.038
	(0.079)	(0.072)	(0.075)
Incubated	-0.112	-0.098	-0.058
	(0.081)	(0.075)	(0.078)
Observations	1612	1668	
Log. likelihood	-816.078	-1834.037	
Pseudo R^2 / Rho	0.141	0.467***	

Notes: Industry (NACE Rev. 2 intermediate aggregation) and regional (Nuts 1 level) controls are included in all models. The number of observations varies between models due to the relatively fine-grained taxonomies of industries, which yields no variation in the dependent variables within some of the groups. Standard errors are reported in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.