

## **Supplemental Data**

**for**

### **There must be an angel? Local financial markets, business angels and the financing of innovative start-ups**

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## **Appendix A. The Italian Startup Act**

As reported in the main text, the YIC status was and still is reserved to limited companies (either Italian companies or branches of EU companies registered in Italy), which are younger than 5 years (at the end of the fifth year their status as YIC ceases along with the possibility to obtain benefits), operate in high and medium technology-related businesses, and have an innovative content. Specifically, at least one of the following three requirements have to be fulfilled by an innovative start-up in order to gain the status of a YIC: (i) owner or licensee of a patent or a registered software or a generic intellectual right, (ii) at least one third of employees should hold a Ph.D. or a research tenure (or at least 66% of the employees should possess a M.Sc. degree), (iii) investments in R&D should account for at least 15% of the revenues (or operating costs if they exceed the revenues). A company that qualifies as a YIC cannot distribute dividends and cannot be listed on a stock exchange. The annual revenues must be lower than €5 million and the company must not be originated from a spin-off or a merger of pre-existing operations.

YICs (as identified by the Law) are granted specific incentives, exemptions and access to privileged (and discounted) services. The retroactive nature of the policy has also allowed access to these support measures not only to the ventures created after the promulgation of the Law, but also to those already existing before, provided that these firms fulfilled the prescribed requirements (including the requirement to be less than 5 years old). Measures span over different areas. For example, Italian YICs can be incorporated on the Internet through digital identification almost for free and they are exempted from any significant entry fee otherwise due to the Chambers of Commerce. Then, employees and consultants can be remunerated with stock options and “work for equity” tools enjoying particular reliefs. Moreover, Italian YICs may benefit from fail-fast mechanisms in case of liquidation, so to allow fresh new starts to entrepreneurs. Most notably for the domain of this study, the Law also contemplates benefits in the form of robust tax reliefs on equity investments made by legal entities and individuals: until 2016, a 20% fiscal deduction up to a maximum investment of €1.8 million for legal entities, and a 19% deduction up to a maximum

investment of €0.5 million for individual investors. This provision aims at supporting VCs and BAs for the benefit of those YICs that receive this type of financing. A brief synopsis of the Law (and a comparison with similar legislations in other EU Member States) is provided by the European Digital Forum (2016). A complete description of the eligibility criteria and all support measures are available on the governmental website of MISE (<http://www.mise.gov.it>).

### ***Reference***

European Digital Forum (2016) The 2016 Startup Nation Scoreboard (London, U.K.).

## Appendix B. Descriptive statistics and explanatory variables

**Table B1. Geographical distribution of Italian BA-backed start-ups**

Region	At foundation			At survey time	
	N. firms	N. of BA-backed firms	%	N. of BA-backed firms	%
Abruzzo	44	0	0.00	1	2.27
Basilicata	16	1	6.25	1	6.25
Calabria	53	0	0.00	1	1.89
Campania	121	2	1.65	3	2.48
Emilia-Romagna	249	11	4.42	17	6.83
Friuli Venezia Giulia	66	1	1.52	4	6.06
Lazio	192	8	4.17	17	8.85
Liguria	32	0	0.00	0	0.00
Lombardia	480	29	6.04	45	9.38
Marche	85	0	0.00	0	0.00
Molise	8	0	0.00	0	0.00
Piemonte	163	8	4.91	11	6.75
Puglia	80	2	2.50	2	2.50
Sardegna	60	0	0.00	2	3.33
Sicilia	93	0	0.00	1	1.08
Toscana	129	3	2.33	7	5.43
Trentino Alto Adige	99	5	5.05	10	10.10
Umbria	32	0	0.00	0	0.00
Valle d'Aosta	5	1	20.00	1	20.00
Veneto	177	2	1.13	3	1.69
<b>Total</b>	<b>2184</b>	<b>73</b>	<b>3.34</b>	<b>126</b>	<b>5.77</b>

**Table B2. Definition of explanatory variables**

<b>Variable</b>	<b>Description</b>
<i>Local Bank System Development</i>	Yearly average of the amount of bank credit loans over GDP granted to firms in the region (NUTS-2 level) over the time window 2008-2011 (source: ISTAT).
<i>Local VC Development</i>	Yearly average of the amount of venture capital investments over GDP flown in the region (NUTS-2 level) over the time window 2008-2011 (source: ISTAT).
<i>High-tech Industry</i>	Average number of residents employed in high-tech and knowledge-intensive manufacturing sectors as a percentage of the total workforce of the region (NUTS-2 level) over the time window 2008-2011 (source: ISTAT).
<i>TEA</i>	Value of the Total Entrepreneurship Rate at regional (NUTS-2) level in the year of foundation of the firm (source: GEM).
<i>Generic Human Capital</i>	Average number of years of experience among co-founders of the firm gained through education and work experience in other sectors with respect to the activity of the start-up, before firm's foundation.
<i>Specific Human Capital</i>	Average number of years of experience among co-founders of the firm gained through work experience in the same sector of the start-up before firm's foundation and previous managerial and entrepreneurial experiences.
<i>Parent Entrepreneur</i>	Average number of co-founders in the firm with parents who are (or were) entrepreneurs.
<i>International Experience</i>	Averaged index across co-founders of the firm that ranges from 0 to 3 and counts if the entrepreneurs have matured any experience in a foreign country as an enrolled student, a pay-roll employee and an entrepreneur.
<i>Male Founders</i>	Percentage of male individuals among co-founders of the firm.
<i>Team Size</i>	Number of co-founders of the firm.
<i>Incubation</i>	Dummy that equals one if the firm has ever been located in a certified business incubator, zero otherwise.
<i>SRL</i>	Dummy that equals one for limited liability companies (i.e., Società a Responsabilità Limitata), zero otherwise.
<i>GDP per capita</i>	National gross domestic product converted to dollars using purchasing power parity rates and divided by total population in the year of foundation of the firm (source: World Bank).

*Legend.* If not otherwise specified, the source of the variable is the *Startup Survey*.

**Table B3. Descriptive statistics and correlation matrix**

<b>Variable</b>	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) <i>Local Bank System Development</i>	61.001	15.914	1.000											
(2) <i>Local VC Development</i>	0.005	0.004	-0.0254	1.000										
(3) <i>High-tech Industry</i>	3.350	1.530	0.3996	0.6705	1.000									
(4) <i>TEA</i>	0.040	0.021	-0.3372	-0.2620	-0.3546	1.000								
(5) <i>Generic Human Capital</i>	10.543	10.835	0.0647	0.0610	0.0903	-0.0516	1.000							
(6) <i>Specific Human Capital</i>	9.185	8.075	0.0385	-0.0070	-0.0220	-0.0434	-0.4685	1.000						
(7) <i>Parent Entrepreneur</i>	0.221	0.353	0.0288	-0.0467	-0.0048	0.0190	-0.0807	0.0680	1.000					
(8) <i>International Experience</i>	0.348	0.538	0.0225	0.0336	0.0557	-0.0176	0.1432	-0.0468	0.0094	1.000				
(9) <i>Male Founders</i>	0.828	0.302	0.0418	-0.0001	0.0242	-0.0448	0.0801	-0.0469	-0.0119	0.1094	1.000			
(10) <i>Team Size</i>	3.571	3.048	0.0153	-0.0270	0.0007	-0.0685	-0.0502	0.0458	-0.0787	-0.0196	0.0027	1.000		
(11) <i>Incubation</i>	0.279	0.448	-0.0243	-0.0190	-0.0309	-0.0508	-0.0740	-0.0198	0.0116	0.0207	-0.0157	0.0387	1.000	
(12) <i>SRL</i>	0.960	0.196	0.0147	-0.0076	0.0097	0.0163	0.0217	0.0095	0.0452	0.0224	0.0599	-0.2092	0.0213	1.000
(13) <i>GDP per capita</i>	35,696	218.23	0.0378	0.0536	0.0413	-0.0861	-0.0324	0.0443	-0.0389	-0.0060	0.0306	0.0114	0.0525	-0.0164

*Legend.* Descriptive statistics on the main independent variables computed on 2184 firms. Descriptive statistics on control variables and correlation matrix based on 1726 firms.

## Appendix C. Size effects

**Table C1. Marginal effects and semi-elasticities of variables of interest**

	At foundation		At survey time	
	I	II	III	IV
Model	Probit	Tobit	Probit	Tobit
<i>Local Bank System Development</i>	0.001 (0.000)***	67.970 (20.705)***	0.002 (0.000)***	48.475 (11.992)***
<i>Local VC Development</i>	1.645 (0.925)*	9.360 (5.575)*	3.768 (1.159)***	9.509 (3.297)***

*Legend.* Marginal effects (for probit) and semi-elasticities (for tobit) computed from models of Table 1. Standard errors are shown in parentheses. \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

## Appendix D. Robustness checks

As we say in the main text, results have been subjected to several tests in order to gauge the reliability of the findings and they are exposed in the Table D1 below reported. We present results of these robustness tests on the probit models at survey time, but it is worthwhile to note that all the other models estimated (probit or tobit) at different moments (foundation or survey time) comply with these checks. First, we excluded from the sample the YICs that were born before the implementation of the *Startup Act* (column I). In fact, one may suspect that these firms are particularly unlikely to receive the attention of BAs, given that they have self-selected themselves for the public support and this might be revealing of the lack of (already explored) alternative options to finance firms' operations. The exclusion of the innovative start-ups created in the year 2012 or before does not lead to any remarkable change in the findings. Secondly, we included the eventual use of alternative sources of financing by the innovative start-ups as additional regressors into the model specification (column II). More specifically, through the use of the questionnaire, entrepreneurs were asked to indicate the percentage through which they finance operations of their firms across the following different financing modes: own resources, resources from family, fools and friends (3Fs), public subsidies granted at national level, public subsidies granted at regional level, equity financing provided by third parties (including VC), bank debt. Despite of the probable endogeneity of these regressors since they are likely to depend on whether or not YICs effectively get access to angel

financing, a further (indirect) confirmation of our findings would be represented by the absence of any strong negative correlation between these alternative financing modes and BA financing. Results meet this expectation: the impact of the two variables of interest is still positive and strongly significant, while the existing correlations between these firm-specific financing modes and the probability of obtaining BA financing for an innovative start-up are always positive, and in most cases statistically significant, including the coefficients that refer to VC and bank debt. Then, findings do not appear to be driven by the North-South divide, since they are totally confirmed once southern regions are excluded from the estimations (column III). They also hold in other three regressions where YICs located in Northwest, Northeast and the Centre of Italy are sequentially excluded from estimation. Analogously, results are unchanged if YICs located in Lombardia or in Milan (which represents the financial capital city of Italy and a pole of attraction for potential innovative entrepreneurs) are dropped (column IV). Furthermore, following Dale and Fortin (2002), we used a plethora of different methods to check if our findings could be driven by the presence of spatial correlation in the structure of data. Accordingly, we re-run the main regression analysis by subsampling our data (by randomly picking some NUTS-2 regions and excluding the closest neighbour regions) and by using other recommended randomization or permutation techniques (i.e. bootstrapping and jack-knifing). Our main results are totally confirmed (see column V for what concerns estimates of the model on a random sub-sample of 761 innovative start-ups located in 7 different non-neighbour regions; different combinations among non-neighbour regions lead to similar findings). In column VI, we also tested if a generic availability at local level of business angel financing can be positively related to the probability for an innovative start-up to get a professional BA investment (as our definition implies). For this purpose, we resorted to the Global Entrepreneurship Monitor (GEM) data and created a brand new variable that captures the generic business angel activity in NUTS-2 regions as measured by the GEM survey, averaged over the same time window 2008-2011 used for the independent variables of interest. Findings about the main regressors are totally unaffected and the new variable shows a negative and largely insignificant

impact. This is largely unsurprising given both the narrow definition of BAs which our study adopts (that point to “professionals”) and, conversely, the general concept of BA financing which applies to GEM (where the survey item used is: “Have you, in the past three years, personally provided funds for a new business started by someone else, excluding any purchases of stocks or mutual funds?”). At the same time, this negligible impact can also be viewed as another indirect confirmation that external equity investments in innovative start-ups are especially enabled only by strong and professionalized local financial markets. Finally, despite of the fact that clustering standard errors in non-linear settings is not immune from critiques, especially when the number of clusters is limited (e.g. Angrist and Pischke, 2008, p. 319), we checked whether clustering standard errors at the regional level could make any difference on our findings. As shown in column VII, the results (and their significance) are largely unaffected by the choice.

Then, in unreported (but available upon request) regressions we checked for several other potential empirical issues. For example, we also inspected whether our results could be driven by the specific time-window (2008-2011) we chose for the main independent variables. Therefore, we both re-run regressions using different time-spans for both *Local Bank System Development* and *Local VC Development*, and results again do not remarkably change from those already commented. In the same vein, we inspected whether the inclusion into the regressions (whether probit or tobit) of a series of year dummies that capture possible time-varying idiosyncratic shocks at YICs’ foundation time could affect our findings and exclude this possibility. Then, we also verified if the substitution of the regional-specific controls we used with other equally possible alternatives could lead to significant changes. For instance, we substituted the covariate *High-tech Industry* with the variable *Science and Technology Education* that represents the number of graduates in science and technology subjects per thousand of inhabitants with an age in-between 20 and 29 years old (source: ISTAT). The two variables are highly correlated, albeit not perfectly collinear (pairwise correlation equal to 0.65) and perform rather similarly. Additionally, we used *GDP per capita at regional level* and *Number of active firms* in a region as proxies for regional economic development. Results as to the main

independent variables remain unchanged and again confirm the weak statistical influence of these controls on the dynamics of interest. We also decomposed the TEA index into its opportunity and necessity components, to discover that again findings remain unaltered, with the opportunity component that leads to a positive impact and the necessity component to a negative one, but in both cases, the effects are largely statistically insignificant. Finally, both the use of the current value of the TEA index in place of the value anchored to the start-up foundation year and the omission of the variable *GDP per capita* in the regressions at survey time, do not change the findings exposed here.

### ***References***

Angrist, J. D., & Pischke, J. (2008). *Mostly Harmless Econometrics; an Empiricist's Companion*, 1st ed. Princeton University Press. Princeton.

Dale, M. R., & Fortin, M. J. (2002). Spatial autocorrelation and statistical tests in ecology. *Ecoscience*, 9(2), 162-167.

**Table D1. Robustness checks**

Check	I	II	III	IV	V	VI	VII
	Excluding YICs born before 2013	Alternative sources of financing	Excluding southern YICs	Excluding YICs from Milan	YICs in non-neighbour regions	Controlling for generic BAs at local level	Clustered standard errors at regional level
<i>Local Bank System Development</i>	0.013 (0.004)***	0.013 (0.004)***	0.012 (0.005)**	0.009 (0.003)***	0.016 (0.007)**	0.012 (0.003)***	0.013 (0.003)***
<i>Local VC Development</i>	35.519 (11.408)***	40.212 (11.504)***	30.034 (11.583)***	34.196 (10.282)***	48.039 (15.322)***	38.894 (10.956)***	33.447 (9.542)***
<i>Own personal funds</i>		0.002 (0.003)					
<i>3Fs</i>		0.014 (0.005)***					
<i>National Subsidies</i>		0.008 (0.005)*					
<i>Regional Subsidies</i>		0.011 (0.004)**					
<i>VC</i>		0.021 (0.003)***					
<i>Bank debt</i>		0.005 (0.003)*					
<i>Local availability of generic BA financing</i>						-4.666 (3.250)	
<i>Constant</i>	-2.693 (0.261)***	-3.288 (0.392)***	-2.503 (0.395)***	-2.414 (0.237)***	-2.986 (0.524)***	-2.429 (0.264)***	-2.615 (0.230)***
<i>No of Obs.</i>	1857	2184	1709	1913	761	2184	2184
<i>Log-likelihood</i>	-360.704	-365.400	-416.898	-360.704	-156.02	-467.17	-468.22

*Legend.* Standard errors are shown in parentheses. \* p < 0.10; \*\* p < 0.05; \*\*\* p < 0.01. All probit models refer to survey time.