

Entrepreneurs' Preferences and Industry 4.0 Technologies: Evidence from Italian firms

Stefania Basiglio ¹ Andrea Ricci ² Mariacristina Rossi ¹

¹Università degli Studi di Torino

²National Institute for the Analysis of Public Policies (INAPP)

III International Triple Helix Summit 2020
24-26th November 2020

- This paper documents the role of entrepreneurs' preferences on firms' propensity to invest in industry 4.0 technologies.
- We use responses to questions intended to elicit risk taking and patience included in the RIL survey conducted by INAPP in 2018 on a representative sample of Italian firms.
- Preliminary results suggest that impatience plays a role in investing in industry 4.0 technologies.

Motivation 1/2

- Personality traits of entrepreneurs are important to explain the investment performance of small and medium enterprises (Parker, 2009).
- In this paper, we document the role of businesspersons' (self-declared) risk, time preferences and reciprocity for choices made under uncertainty that affect the present as well as the future.
- We focus on investments in industry 4.0 technologies, activities where patience and risk taking are crucial (Andersen et al., 2008).
- Previous empirical evidence is scant or even inexistent. As for risk attitude, the studies referring to its impact on firm performance have proven to be quite inconclusive (see, for instance, Guiso et al., 2016).

Motivation 2/2

- Recent cross-country evidence (Falk et al., 2015) shows that patience is strongly correlated with the degree of economic development, as measured at the macro level.
- Psychological traits traditionally associated with successful entrepreneurs (Mc Clelland, 1961; Schiller and Crewson, 1997; van Praag and van Ophen, 1995; Ciavarella et al., 2004; Braum and Locke, 2004) might deal with the degree of time preference.
- Hence, previous empirical analyses have been limited by the paucity of data available. In the RIL conducted by INAPP, two questions have been included in the year 2018 on a representative sample of Italian firms.

- The empirical analysis is based on information obtained by the Rilevazione su Imprese e Lavoro (RIL) conducted by the INAPP on a representative sample of 30,000 partnerships and limited liability firms operating in the non-agricultural private sector.
- The RIL gathers a unique set of information about employment composition, personnel organisation, industrial relations and other firms' characteristics.
- In particular, in the 2018 wave two questions regarding the entrepreneur's psychological attitudes in term of time preferences and risk attitudes have been included.

Data - Main Variables

- Impatience ▶ Impatience question
- Risk taking ▶ Risk question
- Positive reciprocity ▶ Reciprocity question
- Industry 4.0 technologies ▶ Investment in 4.0 question

As for sample selection,

- we consider only firms for which the respondent is an entrepreneur;
- we keep firms with at least one employee;
- the final sample used for empirical analysis counts more than 5,000 firms.

Data - Descriptive Statistics 1/3

Table 1 reports the average incidence of firms investing in industry 4.0 technologies by their size, sector of activity and geographical location.

Table 1: Average Values of Investment and Industry 4.0

	investment	industry 4.0	n° of industry 4.0
	n° of employees		
0-9	0.236	0.227	0.288
10-49	0.510	0.355	0.501
50-249	0.703	0.600	0.984
>250	0.836	0.743	1.519
	macro-sector		
Services	0.283	0.254	0.334
Industry	0.332	0.274	0.373
	macro-region		
North West	0.309	0.289	0.386
North East	0.362	0.296	0.416
Centre	0.279	0.278	0.358
South	0.254	0.188	0.241
Total	0.298	0.260	0.346

Source: our elaborations on RIL 2018 data. Note: sampling weights applied

Each column corresponds to: i) probability of investment, ii) probability of investment in at least one industry 4.0 technologies and iii) the number of industry 4.0 technologies.

The responses to the questions about time preferences, risk behaviour and positive reciprocity are reported in Table 2.

Table 2: Descriptive Statistics on Preferences

time preferences		risk attitude		positive reciprocity	
values	percent	values	percent	values	percent
0.01	13.69	0.05	14.65	1	4.45
0.05	11.5	0.10	5.88	2	1.50
0.1	16.18	0.25	9.46	3	9.12
0.5	24.79	0.5	23.00	4	10.18
1	15.26	0.8	15.09	5	74.76
3	18.57	1	31.92		
N of obs. =5,150		N of obs. = 6,830		N of obs. = 6,830	

Source: our elaborations on RIL 2018 data. Note: sampling weights applied

The distribution across categories of responses seems similar to that provided by the studies focusing on households (Vischer et al. 2013).

Table 3 shows the average values of our measure of entrepreneurs' preferences by firms size, sectorial specialisation and geographical location.

Table 3: Average Values of Entrepreneurs' Preferences

	time preferences	risk attitude	positive reciprocity
	n° of employees		
0-9	0.86	0.59	4.49
10-49	0.82	0.60	4.53
50-249	0.80	0.62	4.52
>250	0.76	0.64	4.46
	macro-sector		
Services	0.92	0.59	4.48
Industry	0.67	0.60	4.52
	macro-region		
North West	0.78	0.56	4.60
North East	0.88	0.60	4.42
Centre	0.79	0.59	4.42
South	0.97	0.61	4.51
Total	0.86	0.59	4.49

Source: our elaborations on RIL 2018 data. Note: sampling weights applied

To investigate the role of entrepreneurs' preferences for firm's investment in industry 4.0 technologies, we perform a linear and non-linear (Probit) regression models on the following equation:

$$Y_{i,s,l} = \alpha_0 + \alpha_1 \text{Impatience}_i + \alpha_2 \text{RiskTaking}_i + \alpha_3 \text{PositiveReciprocity}_i + \\ + \alpha_4 X_i + FE_s + FE_l + \epsilon_{i,s,l}$$

where i indexes firms, s denotes sector and l the Italian regions. We also include area fixed effects and sector fixed effects.

In Table 4, we mainly focus on three dependent variables:

- i) the probability of investment;
- ii) the probability of investment in at least one industry 4.0 technologies;
- iii) the number of industry 4.0 technologies.

Investing in new technologies involves probabilities of yield and loss and entails weighting future benefits against present costs.

Empirical Analysis - Preliminary Results 2/2

Table 4: Main Estimates

	investment*	industry 4.0*	n° of industry 4.0
time preference	-0.006 (0.007)	-0.020*** (0.007)	-0.033*** (0.012)
risk attitude	-0.017 (0.023)	0.025 (0.023)	0.029 (0.037)
positive reciprocity	0.020** (0.009)	0.029*** (0.008)	0.038*** (0.012)
tertiary educ	0.074*** (0.024)	0.064*** (0.023)	0.119*** (0.038)
upper secondary educ	0.045** (0.019)	0.041** (0.019)	0.064** (0.026)
age (in ys)	-0.002*** (0.001)	0.000 (0.001)	-0.003** (0.001)
female	-0.055*** (0.018)	-0.052*** (0.017)	-0.095*** (0.026)
managerial tenure (in ys)	-0.001* (0.001)	-0.002** (0.001)	-0.001 (0.001)
other controls	Yes	Yes	Yes
N	4306	4337	4337

Source: our elaborations on RIL 2018 data. Note: other controls include workforce characteristics (education, age, female, contractual arrangements, professions etc.), firms' characteristics (public procurement, foreign markets, log of sales per employee, firms' size in classes, second level bargaining, multinationals). All regressions controls for sectors of activity and regions fixed effects. Standard errors (in parentheses). * Probit estimates of average marginal effects.

Final Remarks

- This paper investigates the role of entrepreneurs' preferences on firms' propensity to invest in industry 4.0 technologies.
- Using RIL data, we find that impatience has a negative association with investment in industry 4.0, while the propensity to undertake risk plays no significant role.
- A nice feature of our data is that they are collected for a relatively large number of firms.
- A limitation is that our survey refers to Italy, a country where the degree of innovative activities carried out by the firms is quite low and the sector specialisation is tilted towards traditional productions. This could imply that the association we found is a sort of lower bound.

Thank you for your attention!

stefania.basiglio@unito.it

Impatience.

Suppose you were given the choice between a payment (say $\text{€}x$, equal to your current annual income) today and a higher payment ($\text{€}x +$ a given percentage, as clarified below) in 12 months. We will now present to you six situations. The payment today is the same in every situation. The payment in 12 months is different in every situation. For each of these situations we would like to know which one you would choose. Please assume there is no inflation, i.e., future prices are the same as today's prices.

Would you rather receive $\text{€}x$ today or $\text{€}x +$ the following premia in 12 months:

1) 1%; 2) 5%; 3) 10%; 4) 50%; 5) 100%; 6) 300%; 7) none of the previous.

Risk taking.

Please imagine the following situation. You have a lottery ticket that gives you a 50 percent chance of receiving an amount equal to your current annual income and the same 50 percent of receiving nothing. Would you give away your lottery ticket in exchange of a percentage of your current annual income?

What percentage it will be:

1) 5%; 2) 10%; 3) 25%; 4) 50%; 5) 80%; 6) none of the previous.

Positive reciprocity.

How much do you recognise in the following statements? Please indicate your answer on a scale of 1 to 5, where 1 means "I don't recognise myself at all" and 5 "I recognise myself perfectly":

1. If someone does me a favour, I am ready to return it.
2. If I suffer a grave injustice, I take my revenge at the first opportunity, regardless of how much it costs me to do it.
3. If someone treats me unfairly I am willing to punish him/her, regardless of how much it costs me to do it.
4. If someone treats others unfairly, I am willing to punish him/her, regardless of how much it costs me to do it.

Industry 4.0 technologies.

We firstly exploit the RIL data investment tout court. In particular, RIL offer a very rich information about industry 4.0 technologies. More specifically: Did the company invest in new technologies in the 2015-2017 period?:

- a. "Internet of Things" solutions (e.g., RFID, sensors, connected objects)
- b. Robotics (industrial robots, interconnected and programmable collaborative robots)
- c. Big Data Analytics (use of technologies and software for analysing large amounts of data)
- d. Augmented reality and virtual reality
- e. IT security
- f. Update of existing devices (PCs, printers, etc.)
- g. Other: Please specify