UNIVERSITY OF CASTILLA-LA MANCHA
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ENVIRONMENTAL AND EMPLOYMENT RESPONSIBLE INNOVATION: EMPIRICAL EVIDENCE FOR SPANISH FIRMS

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Introduction

AIMS:

- What are the explanatory determinants of being "environmental-oriented" and "employment-oriented" innovators in Spanish firms?
- Are the drivers of both types of innovation similar?
- Do the environmental innovators show high awareness about the employment?

MAIN CONTRIBUTION:

- We distinguish innovation with environmental benefits and innovation with social benefits
  - Most of papers analyse the relationship between employment and eco-innovations

Contents

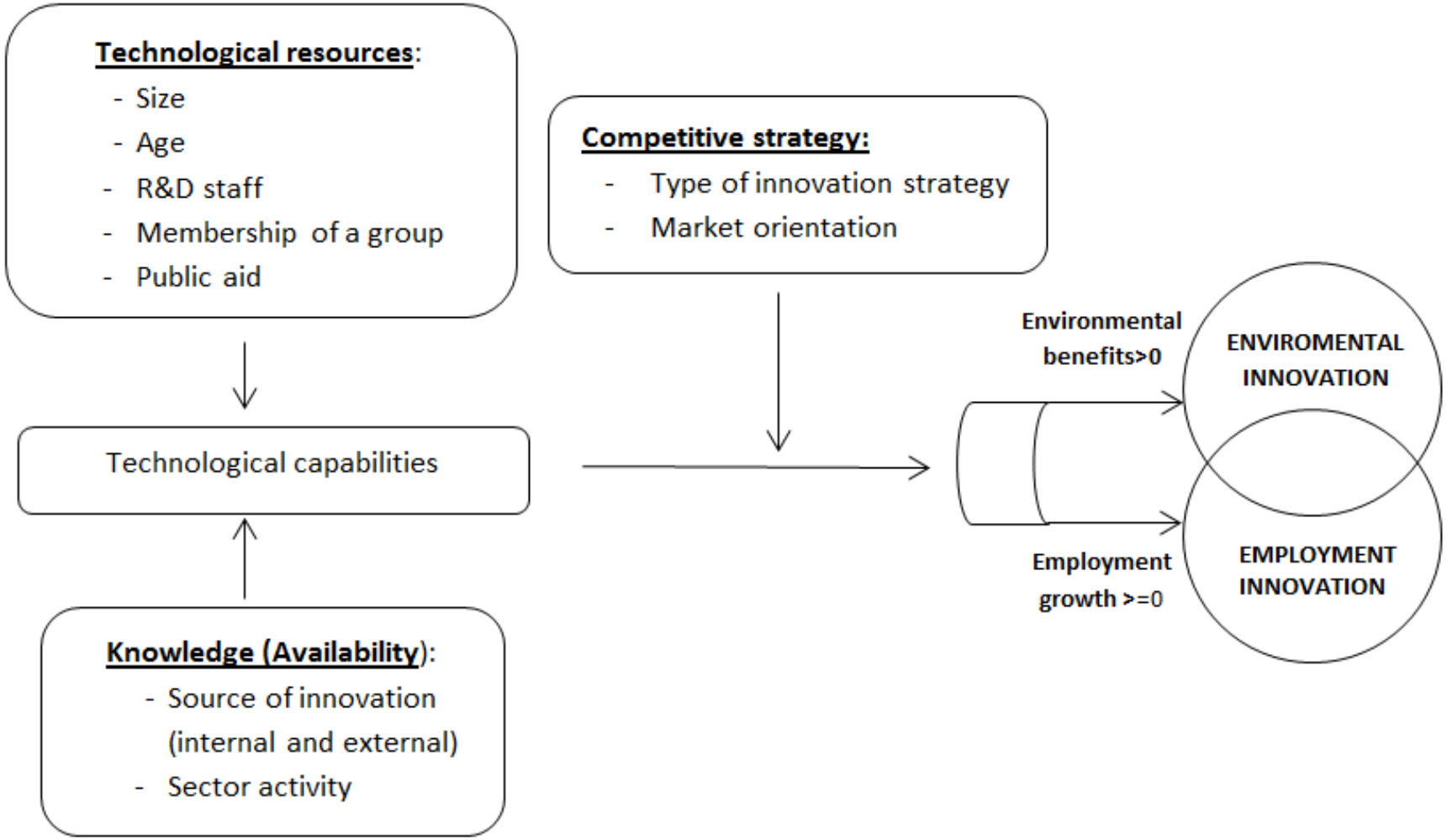
Theoretical framework

- Eco-innovation is an important topic in the literature during the last years
  - A large number of previous works focus on the specific determinant at firm-level (Horbach et al., 2012; Kesidou and Demirel, 2012; Rennings, 2000)
  - Only few studies consider the correlation beetwen eco-innovation and employment (Horbach and Rennings, 2013; Rennings et al. 2004; Getzner, 2002)
    - In general, eco-innovation has a neutral or small effect on employment
  - But little is know about the differences in the determinants and sinergies of eco-innovation and employment- oriented innovation
    - It is needed a better understanding of responsible innovation with natural resources and human resources

Theoretical framework

- We integrate the Resource-Based View (RBV) and competitive dynamics perspectives
  - Firm resources, capabilities and competitive actions as drivers of superior performance (Ndofor et al., 2011)
    - This framework allow us to analyse the influence of internal and external factors considering the diversity of innovation and other competitive strategies as mediator factors

Theoretical framework



Data

- Information comes from the last wave of Spanish CIS (PITEC, 2011)
  - Total firms of all sector: 12,828
  - Our sample of innovative firms: 6,553
- Dependent variables:
  - Eco-innovation
    - ECO-inn = 1 if firm reports high or medium importance in the question on "reducing environmental impact" as an aim of innovation in 2009-2011
  - Employment-innovation
    - EMP-inn = 1 if firm reports high or medium importance in the question on "increasing and/or maintaining employment" as an aim of innovation in 2009-2011

Data

	Increase or maintain employment	Without employment benefits
With environmental benefits	1,321 (20.16%)	1,794 (27.38%)
Without environmental benefits	379 (5.78%)	3.059 (46.68%)
Total innovative firms	6,553	
Total Environmental responsible innovative firms	3,115 (47.54%)	
Total Employment responsible innovative firms	1,700 (25.95%)	

Data

Explanatory variables:

Technological capabilities	
Resources	
Size	Dummy variable: 1 if firm has 200 or more employees 0 if firm has less than 200 employees
Age	Year of constitution of the firm
Ownership	Dummy variable: 1 if firm is membership of a group of firms 0 if not
Public aid	Dummy variable: 1 if firm receives public financing for its internal R&D activity from local, national or regional administration and European Union 0 if not
R&D staff	Percentage of researchers over the R&D staff
Knowledge	
Internal	Dummy variable: 1 if firm considers that information within the firm has been very relevant for its innovative activity 0 otherwise
Vertical cooperation	Dummy variable: 1 if firm considers that information from providers and clients has been very relevant for its innovative activity 0 otherwise
Competitors	Dummy variable: 1 if firm considers that information from competitors has been very relevant for its innovative activity 0 otherwise
Private research centers	Dummy variable: 1 if firm considers that information from private research centers has been very relevant for its innovative activity 0 otherwise
Universities	Dummy variable: 1 if firm considers that information from universities has been very relevant for its innovative activity 0 otherwise
Public research centers	Dummy variable: 1 if firm considers that information from public research centers has been very relevant for its innovative activity 0 otherwise
Sector activity	One dummy for each sector

Data

Explanatory variables:

Competitive strategy	
Type of innovation	
Product innovation	Dummy variable: 1 if firm has carried out product innovation during 2009-2011 0 if not
Process innovation	Dummy variable: 1 if firm has carried out process innovation during 2009-2011 0 if not
Organizational innovation	Dummy variable: 1 if firm has carried out organizational innovation during 2009-2011 0 if not
Market orientation	Dummy variable: 1 if firm is exporter 0 if not

Methodology

- A **bivariate probit regression,** that allows to estimate the probability of two different but correlated processes
  - Following Greene's (2003) notation:

$$ECO\text{-}inn_s(t)^* = \alpha_1 X_1 + \varepsilon_{i1} \; ; ECO\text{-}inn_s(t) = 1 \text{ if } ECO\text{-}inn_s(t)^* > 0; \; 0 \text{ otherwise}$$

$$EMP\text{-}inn_s(t)^* = \alpha_2 X_2 + \varepsilon_{i2} \; ; EMP\text{-}inn_s(t) = 1 \text{ if } EMP\text{-}inn_s(t)^* > 0; \; 0 \text{ otherwise}$$

where ε_{i1} and ε_{i2} *are* assumed to follow a normal distribution; and X_1 and X_2 are the set of explanatory variables

- A **probit regression** is considered to analyze the effect of being eco-innovation over the probability to carry out employment-oriented innovation

Results

Estimation results of the biprobit regression (marginal effects)

			ECO-inno	EMP-inno	ECO-inno	EMP-inno
Technological Capabilities	Technological resources	Size	0.06567***	0.0171	0.0468***	0.0007
		Age	-0.0008***	0.0009***	-0.0006**	0.0010***
		Ownership	0.01921	-0.0160	0.0109	-0.0223*
		R&D personal	0.0007***	0.0005***	0.0006***	0.0005***
		Public financing	0.1146***	0.0800***	0.1017***	0.0685***
Knowledge-(Availability)	Internal innovation sources	Within the firm	0.1270***	0.0787***	0.1108***	0.0657***
	External innovation sources	Vertical cooperation	0.1231***	0.0786***	0.1038***	0.0628***
		Competitors	0.0584***	0.0841***	0.0506***	0.0778***
		Private research centers	0.08247***	0.0713***	0.0798***	0.0716***
		Universities	0.03548***	0.0542***	0.0360***	0.0553***
		Public research centers	0.0749***	0.0469**	0.0804***	0.0498**
Competitive strategies	Market orientation	Export	0.01189	0.0299**	0.0016	0.0210
	Type of innovation	Process innovators			0.0413***	0.0457***
		Product innovators			0.0547***	0.0516***
		Organizational innovators			0.1340***	0.0781***
	Number of firms		6,553			
	Wald-test		1394.67 (0.000)		1557.36 (0.000)	
	Rho		0.5499***		0.5343***	

*p <0.10; **p<0.05; *** p<0.01. Estimations controlled by sector dummies

Results

Estimation results of the probit regression (marginal effects)

			EMP-inno
Innovation benefits	Environmental benefits	ECO-inno	0.2599***
Technological Capabilities	Technological resources	Size	-0.0118
		Age	0.0011***
		Ownership	-0.0257**
		R&D personal	0.0003**
		Public financing	0.0402***
Knowledge-(Availability)	Internal innovation sources	Within the firm	0.0344***
	External innovation sources	Vertical cooperation	0.0332***
		Competitors	0.0646***
		Private research centers	0.0498***
		Universities	0.0449***
		Public research centers	0.0281
Competitive strategies	Market orientation	Export	0.0201*
	Type of innovation	Process innovators	0.0333***
		Product innovators	0.0381***
		Organizational innovators	0.0427***
	Number of firms		6,551
	Wald-test		1926.73 (0.000)

*p <0.10; **p<0.05; *** p<0.01. Estimations controlled by sector dummies

Main conclusions

- In a knowledge-based economy, the environmental and social benefits of innovation must be considered
- This paper explore the differences between factors influencing the adoption of “eco-innovation” and “employment-oriented innovation” for Spanish firms
- In general, drivers related to technological capabilities are very similar for both types of innovation
- Nevertheless, “size” is only significant for eco-innovation while “age” decreases the probability of eco-innovating
- The effect of R&D resources, public support, internal knowledge source and external sources of information from clients, suppliers and public and private centers is higher for eco-innovations

Main conclusions

- Organizational innovators have more stimuli than other innovators to adopt eco-innovation and employment oriented innovation, in particular, for eco-innovation
- It is possible for firms to cope with climate change, pollution or sustainable use of scarce resources and employment
  - In fact, the probability of doing eco-innovation increases notably when firms take into account employment concerns in their innovation process
- From the point of view of policy makers, is crucial a sound public financial support to incentivize green and social capabilities :
  - Foster cooperation with external agents
  - Develop organizational innovations linked to the management of knowledge, development of human resources, organization of work or management of quality and environmental systems

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