RELATIONS BETWEEN INNOVATION ACTIVITIES AND EXPORTS IN FOOD AND AGRICULTURE FIRMS

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Abstract

The paper examines the innovation and export strategies of Spanish food and agriculture firms. It is based on a sample of these firms selected by PITEC for the period 2003-2010. The results show the key role of internal innovation efforts in international commercial activity. This highlights the importance of the capacity to absorb internal innovation efforts. Furthermore, process innovation has a greater effect than product innovation on the internationalization strategy, both for the agricultural and the food firms.

Key Words: R&D, product innovation, process innovation, internationalization, agri-food firms.

1. Introduction

Food and agriculture businesses play a fundamental role in the European and Spanish production systems. Agriculture accounted for 2.3% of Spanish GDP in 2011 while the agri-food business accounted for 18.3% of sales and 16.7% of employment in Spanish industry (INE, 2012). The importance of the sector becomes even greater when the contribution it makes to the rural population in disadvantaged areas of rural Spain is taken into consideration. It is thus of the greatest importance that agri-business firms increase their competiveness in order to continue to contribute to the economic growth of the country.

The entry of these firms into international markets and the increase of their commercial activities in relation to countries abroad involve considerable effort but they allow them to make progress with their strategies of growth and competitiveness. Furthermore, during this current period of economic crisis, which has depressed domestic consumption, exports represent one of the few possibilities for growth for these firms, and even for their survival in some cases (Benito-Hernández et al, 2014). Bearing in mind that the market for food products has characteristics that make it particularly vulnerable to globalization due to its dependence on factors in the external environment, both those related to production and the role of governments, the Spanish agri-business sector has been successfully responding to the challenges of internationalization that it faces. Thus, according to the Informe de Exportaciones [Exports Report] of the FIAB (FIAB, 2012) sales outside Spain have increased by more than 60% in the last 10 years, from 19,398.63 million Euro in 2001 to 31,284.09 million Euro in 2011.

Along with their efforts to develop foreign markets, these firms can use other strategies to help improve their competiveness, among these are innovation activities and, indeed, these have become one of their main tools for this purpose. The basic idea is that innovation resources allow for the improvement of certain aspects of productivity which in turn has an effect on the firm's results, in terms of growth, profitability etc., as well as on the internationalization of the firm. And this in turn opens ways to find new markets and opportunities to increase production. Innovation and exports thus interact and can create a virtuous circle for the firm, the sector or the country in question.

This paper's main contributions are a study of both food and agricultural firms, an analysis of innovation both in terms of the inputs that are used (total expenditure on innovation, internal expenditure on R&D, external expenditure on R&D) and the innovation outputs obtained (product innovation, process innovation) and, finally, the behavior of agricultural and food firms regarding innovation and internationalization.

3. Methodology

3.1. Data

This study used the PITEC data base (http://icono.fecyt.es/PITEC) following the guidelines in the Oslo Manual. Its ultimate goal is to provide statistical information regarding

businesses' technological activities and to analyze their evolution over time so as to identify the different innovation strategies they adopt.

We have extracted 2 samples from PITEC, which we have called Agricultural and Food. The Agricultural sample includes agricultural, livestock, forestry and fishing companies (codes CNAE-93 01, 02 and 05, and codes CNAE-2009 01, 02 and 03) and the Food sample includes information regarding food, beverages and tobacco companies (codes CNAE-93 15 and 16, and codes CNAE-2009 10, 11 and 12). Both panels are incomplete. The Agricultural subsample includes 179 different companies which present information for some of the 8 years in the period 2003-2010, mainly SMEs[1], 85.4%. The Food subsample has 821 companies, 70.0% of which are SMEs and 30.0% large companies.

The variables used in this study are defined in Table 1. Innovation has been characterized through input measures such as total innovation cost, external R+D expenditure and internal R+D expenditure and output variables such as process innovation and product innovation.

Table 1 also collects the average values of the selected variables in both subsamples. The mean values of the *export* variable indicate that the proportion of Food exporting companies (73.5%) is higher than in the Agricultural subsample (62.9%). These percentages indicate that the bulk of the most innovative agricultural and food companies tend to export. This gives an initial idea of the positive relationship between internationalization and innovation activities also in the agri-food sector. As to innovation variables, the fact that Agricultural companies show higher values in innovation inputs in relation to Food companies is striking, but the latter achieve higher percentages in innovation outputs. Thus, *inn*, *exRD* and *inRD* mean values are higher for Agricultural companies, which reflects higher innovation and external and internal R+D expenditure, but Food companies show higher percentages in product and process innovation. A possible explanation would be that the different productive processes of these two kind of companies and their differences in company structure means that in Agricultural firms successful innovation requires, on average, higher efforts in terms of resources. Moreover, the *k* and *l* values show higher mean sizes in Food firms, which would be a possible explanation of the previous point: larger size in Food companies implies economies of scale in innovation and internationalization processes, or transmission along the food chain (Ghazalian & Furtan, 2007).

Table 1. Defintion of variables and average values

		Agriculture	Food
Ex	takes value 1 if the company exports and 0 otherwise	0.6294	0.7345
inn	logarithm of deflated total innovation cost (€)	5.9813	5.6189
exRD	logarithm of external R+D total deflated expenditures (€)	0.9370	0.2221
inRD	logarithm of internal R+D total deflated expenditures (€)	4.9156	3.8231
INNPROD	takes value 1 if the company is innovating in products	0.4477	0.5358
INNPROC	takes value 1 if the company is innovating in process	0.5447	0.6347
k	logarithm of deflated and accumulated capital (€)	11.5670	11.9620
l	logarithm of number of employees	3.6431	4.3519

[1] In PITEC the SME-Large company classification is carried out by means of the number of employees indicator, the limit between categories being 200.

3.2. Econometric model

According to Bernard & Jensen (2004), the empirical model proposed aims at identifying and quantifying the factors which increase the probability of a company deciding to export by means of a binary election model:

$$Prob(export_{it} = 1) = \Phi(\beta I_{it-1} + \gamma Z_{it-1} + \theta export_{it-1} + \epsilon_{it})$$
$$Prob(export_{it} = 0) = 1 - \Phi(.) \quad (1)$$

Sub-indices i and t indicate company and year respectively. Φ represents the normal standard distribution function. All the variables are one year delayed in order to avoid simultaneity problems. The variables of interest are the innovation ones (I) and both inputs ($inn, exRD, inRD$) and outputs ($INNPRO, INNPROC$) have been measured. Control variables (Z) include productive factors such as capital (k) and work (l) as well as other elements which can impact on the decision to export, such as passing of time ($temporal\ dummies$). Furthermore, the dependent variable delayed one year ($export_{it-1}$) has been introduced as a regressor to control exporting persistence. β, γ, θ are the coefficients estimated in each group of variables.

4. Results and discussion

The estimations are shown in Tables 2 (Agricultural) and 3 (Food). The models are very similar and they differ only in the innovation variable considered. The high similarity in terms of R^2 indicates the high correlation existing between innovation variables. However, the models including the total innovation expenditure variable, *inn_1*, column (1), provide slightly better fits.

Table 2. Probit estimations in the Agricultural companies panel

Dependent variable: *export_t*					
	(1)	(2)	(3)	(4)	(5)
inn_t-1	0.0271**				
	(0.0081)				
exRD_ t-1		-0.0031			
		(0.0086)			
inRD_ t-1			0.0233**		
			(0.0081)		
INNPROD_ t-1				0.2417*	
				(0.1269)	
INNPROC_ t-1					0.3401**
					(0.1218)
k_ t-1	0.0067	0.0137	0.0088	0.008455	0.003368
	(0.0140)	(0.0130)	(0.0138)	(0.0136)	(0.0136)
l_ t-1	-0.0003	0.0259	0.008021	0.03104	0.02544
	(0.0451)	(0.0441)	(0.0453)	(0.0447)	(0.0441)
export_ t-1	2.400**	2.389**	2.404**	2.374**	2.381**
	(0.1265)	(0.1230)	(0.1265)	(0.1240)	(0.1240)
Observations	841	841	841	841	841
R^2	0.5056	0.4956	0.5034	0.4990	0.5024

Standard deviation between brackets; * indicates significant at the 10 per cent level,** indicates significant at the 5 per cent level; R^2 is McFadden's pseudo R^2. Time dummies are included in all estimations.

The capital and work variables produce positive values in most of the regressions, but they are significant only in the case of Food companies. This result might also indicate the effect of size on the relationships between innovation and internationalization. The delayed

dependent variable, *export_t-1*, is in all cases positive and highly significant; it shows coefficient values higher than all the other variables. This reveals the inertia generated by exports: once exporting activity is launched the odds of continuing exports in successive years are much higher.

Table 3. Probit estimations in the Food companies panel

Dependent Variable : *export_t*					
	(1)	(2)	(3)	(4)	(5)
inn_t-1	0.0200**				
	(0.0043)				
exRD_ t-1		0.0120**			
		(0.0055)			
inRD_ t-1			0.0192**		
			(0.0042)		
INNPROD_ t-1				0.1700**	
				(0.0632)	
INNPROC_ t-1					0.2026**
					(0.0645)
k_ t-1	0.0134*	0.0178**	0.0157**	0.0168**	0.0149**
	(0.0075)	(0.0073)	(0.0072)	(0.0074)	(0.0073)
l_ t-1	0.0405	0.0516**	0.0442*	0.0483*	0.0521**
	(0.0250)	(0.0248)	(0.0248)	(0.0250)	(0.0249)
export_ t-1	2.677**	2.696**	2.678**	2.697**	2.690**
	(0.0645)	(0.0642)	(0.0645)	(0.0642)	(0.0642)
Observations	4069	4069	4069	4069	4069
R^2	0.5827	0.5790	0.5823	0.5795	0.5800

Once the good behavior of the control variables is confirmed we analyze the innovation variables. All of them are positive except for external R+D expenditure, *exRD_t-1*, in agricultural companies. Significance is high in both categories but it is higher in Food companies whereas coefficients and marginal effects are higher in Agricultural companies. Therefore, there is evidence of a positive relationship between innovation and exports as expected based on previous studies.

External R+D expenditure is negative in Agricultural companies but it is not significant. In Food companies *exRD_t-1* is positive and significant but to a lesser extent than internal R+D expenditure. Therefore, internal efforts in R+D are more important than external ones i.e. those hired or bought from other companies both in Agricultural and Food companies, although they should not be discarded in the case of Food companies. The marginal effects of these input innovation variables are very small, though slightly higher in Agricultural companies, *inn* 0.99% versus 0.49% in Food companies. This result might be showing the importance of making internal innovation efforts to support other business activities such as exporting, or it could be related to the absorption capacity generated by internal innovation efforts when it comes to the possibility of transferring innovation efforts to the company's activities and results (Cohen & Levinthal, 1990).

The innovation output variables are positive and significant in both groups but more significant in the case of Food companies. The marginal effects in the latter group are 4.20% in product innovation and 5.11% in process innovation. Marginal effects in Agricultural companies are slightly higher, 8.72% and 12.39% respectively but not as significant. As expected, inputs' marginal effects are much lower than outputs' marginal effects given that the former measure the innovation efforts carried out by companies whereas the latter collect

successful results. Therefore, innovation outputs collect to a larger extent the potential effects on national and international sales. On the other hand, the marginal effects of process innovation are higher than those of product innovation both in Agricultural and Food companies. This result is relevant given that in percentage terms process innovations are more important than product innovation in both these economic activity subsectors (Bayona et al., 2013). This suggests a trend to provide more incremental than radical innovations as a result of the competitive structure of the sector, which features an important proportion of SMEs, and of the occasional dependence on the conditioning factors of food distribution (Galizzi & Venturini, 1996 Capitanio et al., 2010).

5. Conclusions

The results show that internal R+D expenditure plays a more decisive role than external R+D expenditure in the innovation-exporting strategy of agri-food companies; this result has an impact on the importance of the absorption capacity generated by internal innovation efforts. Both product and process innovation are essential in internationalization, but process innovation is rather more frequent and has stronger effects in this activity sector.

Furthermore, internal and external R+D expenditure is proportionally higher in the agricultural sector, but in terms of innovation outputs the agri-food industry obtains better market results in terms of products and productive processes. Besides, size has a positive effect on these two business strategies, internationalization and innovation.

Moreover, even though a higher impact of innovation outputs on exporting is detected, it would be advisable to go further into this analysis in order to detect the impact of other types of outputs such as incremental or radical innovations. It would be interesting to carry out this analysis taking into account business results measurements such as sales, margin, productivity, etc.

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