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Vertical and Horizontal Networks and Export Performance in the Spanish Wine Industry

Juan-Ramón Ferrer [a], **Silvia Abella-Garcés** [b] **and Raúl Serrano** [c]

Abstract

Wineries in the "old world" export almost 40% of their production. This study analyzes the influence of vertical and horizontal networks on export performance. We draw on a sample of 183 Spanish wineries and examine the main independent variables using a two-step Heckman model. We find positive effects of horizontal networks and—at a somewhat lower level—downstream vertical networks on export performance. (JEL Classifications: L66, M16, Q13)

Keywords: export performance, networks, Spanish wine sector.

I. Introduction

Spanish wineries focus on internationalization, as local markets do not have the capacity to absorb their production. But only larger firms with higher productivity can cover the fixed costs necessary to enter export markets. Network theory suggests that firms can overcome their resource and ability limitations by cooperating with other firms. Belonging to a network may allow businesses to acquire the knowledge they need

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[a] Universidad Politécnica de Madrid, Escuela Técnica Superior de Ingeniería Agronómica, Alimentaria y de Biosistemas. Departamento de Economía Agraria, Estadística y Gestión de Empresas. Campus Ciudad Universitaria, Avenida Puerta de Hierro, 2-4–28040 Madrid, Spain; e-mail: juanramon.ferrer@upm.es (corresponding author).
[b] Universidad de Zaragoza, Facultad de Empresa y Gestión Pública. Departamento de Dirección y Organización de Empresas. Plaza de la Constitución s/n – 22001 Huesca, Spain; e-mail: sabella@unizar.es.
[c] Universidad de Zaragoza, Facultad de Economía y Empresa. Departamento de Dirección y Organización de Empresas. Paseo de la Gran Vía, 2–50005 Zaragoza, Spain; e-mail: raser@unizar.es.

about potential international markets, to obtain the resources needed to penetrate them, and to achieve synergies through costs and risk (Vahlne and Johanson, 2017).

This study seeks to determine which kind of network (vertical or horizontal) has a greater impact on the firm's international success. We draw on a sample of 183 Spanish wineries and examine the main independent variables using a Heckman model. We find that participating in networks, in general, exerts positive effects on export intensity; horizontal networks and—at a lower level—downstream vertical marketing networks seem to have particularly beneficial effects.

II. Hypothesis Development

This study considers a network as a set of two or more connected relationships that can arise between the company and other entities involved in the development of its business. One methodology for classifying networks consists in observing the position held by the collaborators within the value chain, differentiating between vertical and horizontal networks (Möller, Rajala, and Svahn, 2005).

Horizontal networks refer to firms in the same market sharing capacities to jointly (or as a consortium) develop new markets, improve products, and present product innovations (Sellers-Rubio, Mas-Ruiz, and Sancho-Esper, 2021). One domain of horizontal cooperation is within a European Designation of Origin (DO) region. Companies develop markets and run advertising campaigns together; they lobby for their region and develop newly-regulated products. Various studies suggest that the more frequent and stronger the ties among the collaborators and the more efficient the networks, the greater the likelihood that participating firms will export (Escolá, Serrano, and Ferrer, 2021). However, some studies show that belonging to a horizontal network is not necessarily beneficial (Ryan et al., 2019).

Vertical networks denote cooperations along the supply chain and include suppliers (upstream) and/or customers/marketing (downstream). Some studies show that vertical networks improve export performance more than horizontal networks do (Easmon et al., 2019).

It is *a priori* unclear which form of network, that is, horizontal or vertical, yields the strongest export effects (Easmon et al., 2019).

Based on a literature review, we examine the following hypotheses:

Hypothesis 1a (H1a): Involvement in horizontal networks has a positive impact on the export status of small and medium-sized enterprises (SMEs).

Hypothesis 1b (H1b): Involvement in vertical networks has a positive impact on the export status of SMEs.

Hypothesis 2a (H2a): Involvement in horizontal networks has a positive impact on the export intensity of SMEs.

Hypothesis 2b (H2b): Involvement in vertical networks has a positive impact on the export intensity of SMEs.

III. Methodology

Since our sample is unlikely to be random, that is, mainly successful wineries or wineries with certain characteristics are likely to export and *vice versa*, we need to correct for selection bias and employ a two-step Heckman correction model (Heckman, 1976). The first stage examines the influence of various determinants on the firm's decision to export. The second stage analyses the effect of cooperation mechanisms on export intensity.

A. Sample and Data

Our analysis draws on panel micro-data of a sample of the population of all Spanish wineries. For all Spanish wineries, we refer to Protected Designation of Origin (PDO) data compiled by the Ministry of Agriculture, Fishing and Food (MAGRAMA) as well as the Iberian Balance Sheet Analysis System (SABI) and include firms belonging to Section 11.02 of the Classification of Economic Activities (CNAE). All data refer to the year 2015. The population size is 2,413 wineries. In February and March 2016, we sent a questionnaire to the managers of these firms requesting firm-related information for December 2015. There were a total of 264 valid questionnaires (of which 183 answered the export-related questions). The sampling error for a confidence level of 95% was 5%. The final sample adequately reflects the structure of the sector in terms of company size and the sector's reality, as shown in Table 1. The sample represents approximately 13% of all wine produced in Spain in 2015.

B. Variables

(1) Dependent Variables

As a first step of the Heckman procedure, we analyze whether a firm exports or not. The dependent variable is the dummy D_i^{exp}, which takes on the value 1 if firm i exports and 0 otherwise. At the second stage, we examine export intensity (of

Table 1
Composition of Sample and All Wineries in Spain
by Number of Employees (December 2015)

Type of Firm Employees	*Micro < 10*	*Small 10–49*	*Medium 50–249*	*SMEs 0–250*	*Larger Than 250*	*Total*
SABI data % of total	83.2	14.5	2.3	99.8	0.2	100
Sample data % of total	71.3	26.5	2.2	100	0	100

exporting wineries), measured as the export share of all sales. In our model, we include the logarithm of this ratio (*L_Export*).

(2) Independent Network Variables

As independent variables, we include four different types of networks that the company could belong to, two horizontal networks and two vertical networks (Möller, Rajala, and Svahn, 2005; Escolá, Serrano, and Ferrer, 2021). Note, involvements in these networks are not mutually exclusive.

The *Horizontal Innovation Network* variable is measured by the sum of two Likert-scale questions. (1) Does the firm participate in R&D projects, and (2) does it collaborate with public research bodies or other companies. The managers of the wineries evaluate their firm's position with respect to their competitors on a 5-point Likert scale where 1 is "much weaker than competitors" and 5 is "much stronger than competitors."

The *Horizontal Commercial Network* variable indicates whether a firm collaborates with other competitors within a Designation of Origin (DO). This variable is measured by the number of DOs the winery participates in.

The *Vertical Upstream Network* variable quantifies the upstream relationships and collaborations and is calculated through one Likert question, "do you enter into agreements and alliances with suppliers." The managers of the wineries evaluate their firm's position with respect to their competitors on a 5-point Likert scale where 1 is "much weaker than competitors" and 5 is "much stronger than competitors."

Finally, we include a *Vertical Downstream Network* variable, measured as the sum of the two Likert-scale questions: (1) "do you enter into agreements and alliances with conventional distributors," and (2) "do you enter into agreements and alliances with large-scale distributors." The managers of the wineries evaluate their firm's position with respect to their competitors on a 5-point Likert scale where 1 is "much weaker than competitors" and 5 is "much stronger than competitors."

(3) Firm Control Variables

We include eight control variables. The first one is the size of the company (*Size*), which is determined by the number of assets, measured on a 7-point scale from 1 "less than 50,000 euros" to 7 "more than 20 million euros." The second one is the company's *Age*, calculated as the number of years plus one at the time of the survey.

For the next six control variables, we employ principal component analysis (PCA). For each of these five variables, the managers of the wineries evaluate their firm's relative position, compared with their competitors on a 5-point Likert scale where 1 is "much weaker than competitors" and 5 is "much stronger than competitors." These PCA-based control variables measure the firm's technological resources and

capabilities (*Techno R&C*), innovational resources and capabilities (*Inno R&C*), human resources and capabilities (*Human R&C*), managerial resources and capabilities (*Manag R&C*), marketing resources and capabilities (*Market R&C*), and financial resources and capabilities (*Finan R&C*).

The technological resources and capabilities variable (*Techno R&C*) is derived from four questions that seek to evaluate the firm's relative position in terms of (1) access to technological capabilities and equipment, (2) the possession of an efficient and effective production department, (3) economies of scale, and (4) economies of experience.

The variable innovational resources and capabilities (*Inno R&C*) is based on two questions, that is, whether the firm has been involved in (1) the development of new products and (2) the development of process innovations.

Human resources and capabilities (*Human R&C*) draws on the answers to five questions, (1) employee evaluation system, (2) occupational training and personnel qualification, (3) plans for growth and promotion of staff, (4) recruitment and staff selection, and (5) monetary reward system.

The managerial resources and capabilities variable (*Manag R&C*) is based on seven questions, (1) strategic planning, (2) efficient organizational structure, (3) coordination, (4) ability to attract creative employees, (5) work climate, and (6) knowledge and skills of employees.

Marketing resources and capabilities (*Market R&C*) are measured by referring to four questions, (1) advantageous relationships with distributors, (2) control and access to distribution channels, (3) market and customer knowledge, and (4) size of customer base.

The last variable, financial resources and capabilities (*Finan R&C*), indicates a firm's equity ratio defined as equity over assets. The variable is ordinal and ranges from 1 to 5. The ranks denote equity ratios of 0% (1), between >0% and 25% (2), between >25% and 50% (3), between >50% and 75% (4), and more than 75% (5). We employ this variable as an instrument for the first-stage Heckman equations.

C. Heckman-Probit Model

We employ a two-stage Heckman-Probit model to correct for potential selection biases between exporting and non-exporting firms within our sample (Heckman, 1976). In our case, the first stage of the model includes all firms that filled out the questionnaire, 183 firms (i.e., 160 exporters and 23 non-exporters). The second stage only includes exporting firms. In addition to similar firm size compositions of the sample and all wineries as reported in Table 1, Table 2 reports the sample's share. Overall, our sample represents 8% of firms, 10% of employment, 13% of production, and 9% of total sales.

Table 2
Winery Sample Compared to All Spanish Wineries

	Universe	*Sample*	*Sample (%)*
Number of firms	2,337	183	8
Number of employees	21,033	2,013	10
Volume produced (in '000 liters)	3,770,000	502,600	13
Total sales (in '000 €)	6,875.785	627,573	9

The first Heckman equation estimates a probability model (Probit) analyzing the factors affecting a firm's export probability and provides the inverse Mills ratio[1] for each company. The inverse Mills ratio is then included as an additional explanatory variable in the subsequent second-stage estimation

$$D_i^{exp} = \begin{cases} 1 & (exports) \rightarrow f(\ network\ type,\ control\ variables) \\ 0 & (does\ not\ export) \end{cases} \quad (1)$$

where the dependent variable (D_i^{exp}) is a dummy variable taking on the value 1 if firm i exports and 0 otherwise.

The second stage, Equation (2), analyzes the determinants of export intensity.

$$\begin{aligned} L\_Export_{,t} = {} & \beta_1 Network\ type_i + \beta_2\ Size_i + \beta_3\ lnAge_i + \beta_4\ Techno\ R\&C_i \\ & + \beta_5\ Inno\ R\&C_i\ + \beta_6\ Human\ R\&C_i + \beta_7\ Manag\ R\&C_i \\ & + \beta_8\ Market\ R\&C_i + \beta_9\ Finan\ R\&C_i + \beta_{10}\ inverse\ Mills\ ratio_i + u_{ij} \end{aligned} \quad (2)$$

IV. Results

Table 3 reports selected descriptive statistics and pairwise correlations for the dependent and all independent variables. Accordingly, our export intensity variable appears to be closest correlated with the firm's size ($r = 0.57$). Among the various network types, we find particularly close correlations between vertical upstream and downstream cooperations ($r = 0.65$). In contrast, there seems to be little to no correlation between the two horizontal networks (innovation and commercial).

The results of the two-step Heckman model estimates are reported in Tables 4 and 5. Table 4 shows the first-stage results for each of the four network types, separately (Columns 1–4) and combined (Column 5). Independent of specification, firm size exerts a significantly positive effect on a firm's export likelihood. In contrast,

[1] The inverse Mills ratio is the probability density function divided by the cumulative distribution function of a distribution. In the first step, a regression for observing a positive outcome of the dependent variable is modeled with a probit model. The estimated parameters are used to calculate the inverse Mills ratio, which is then included as an additional explanatory variable in the second-stage estimation.

Table 3
Descriptive Statistics and Spearman Correlation Matrix

						Correlation Coefficients												
Variable	*n*	*Mean*	*Min.*	*Max.*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
(1) *L_Exports*	160	1.73	0.70	1.94	0.59	1.00												
(2) D_i^{exp}	183	0.86	0	1	0.34	0.59	1.00											
(3) Vertical upstream network	182	2.79	1	5	0.86	0.31	0.12	1.00										
(4) Vertical downstream network	178	5.05	2	10	1.73	0.35	0.13	0.67	1.00									
(5) Horizontal innovation network	181	4.63	2	10	1.95	0.19	0.07	0.43	0.47	1.00								
(6) Horizontal commercial network	183	1.32	1	8	1.05	0.25	0.12	0.05	0.10	0.10	1.00							
(7) *Size*	174	2.55	1	7	1.32	0.57	0.24	0.21	0.30	0.21	0.26	1.00						
(8) *Age*	178	35.01	3	186	32.92	0.28	–0.11	0.14	0.19	0.03	0.13	0.26	1.00					
(9) *Techno R&C*	180	0.07	–2.25	2.65	0.98	0.34	0.17	0.44	0.41	0.38	0.05	0.34	0.10	1.00				
(10) *Inno R&C*	179	0.07	–1.97	3.04	0.96	0.38	0.16	0.52	0.52	0.65	0.09	0.29	0.05	0.63	1.00			
(11) *Human R&C*	182	–0.01	–2.93	2.27	0.91	0.19	0.09	0.45	0.41	0.27	0.02	0.12	–0.09	0.39	0.44	1.00		
(12) *Manag R&C*	178	0.01	–3.46	2.68	0.93	0.27	0.09	0.27	0.30	0.27	0.04	0.23	–0.04	0.40	0.46	0.57	1.00	
(13) *Market R&C*	181	0.03	–2.18	2.56	1.01	0.31	0.18	0.54	0.58	0.38	0.12	0.29	0.09	0.47	0.54	0.45	0.39	1.00
(14) *Finan R&C*	180	4.13	1	5	1.05	–0.21	–0.22	–0.05	–0.12	–0.06	–0.17	–0.13	0.00	–0.13	–0.10	–0.16	–0.02	–0.07

Table 4

Heckman First Stage: Export Probit Equations

Dependent Variable: export ∈{0,1}

	(1) *Heckman*	*(2)* *Heckman*	*(3)* *Heckman*	*(4)* *Heckman*	*(5)* *Heckman*
Vertical upstream network	0.092				0.225
	(0.198)				(0.253)
Vertical downstream network		–0.053			–0.056
		(0.110)			(0.134)
Horizontal innovation network			–0.103		–0.136
			(0.096)		(0.104)
Horizontal commercial network				0.392	0.410
				(0.296)	(0.302)
Size	0.367**	0.368**	0.363**	0.345**	0.356**
	(0.198)	(0.134)	(0.138)	(0.137)	(0.144)
Ln (Age)	–0.332**	–0.302**	–0.393**	–0.327**	−0.312*
	(0.156)	(0.154)	(0.154)	(0.153)	(0.161)
Techno R&C	0.052	0.072	0.053	0.081	0.041
	(0.199)	(0.199)	(0.201)	(0.201)	(0.204)
Inno R&C	0.077	0.123	0.175	0.140	0.221
	(0.215)	(0.214)	(0.249)	(0.214)	(0.263)
Human R&C	–0.189	–0.130	–0.119	–0.140	–0.145
	(0.234)	(0.233)	(0.225)	(0.230)	(0.239)
Manag R&C	0.139	0.084	0.122	0.097	0.161
	(0.214)	(0.211)	(0.209)	(0.208)	(0.222)
Market R&C	0.277	0.331*	0.320	0.261	0.245
	(0.192)	(0.198)	(0.183)	(0.183)	(0.207)
Finan R&C	–0.380**	–0.377**	–0.390**	–0.331**	–0.380**
	(0.164)	(0.164)	(0.167)	(0.162)	(0.171)
Constant	2.742***	3.156***	3.424***	2.384**	2.779**
	(0.987)	(1.030)	(1.021)	(0.946)	(1.187)
Observations	181	179	181	182	177

Notes: Standard errors in parentheses. Statistical significance *** (1%), ** (5%), and * (10%), respectively.

Table 5

Heckman Second Stage Equations: Export Intensity

Dependent Variable: ln(export share)

	(1) *Heckman*	*(2)* *Heckman*	*(3)* *Heckman*	*(4)* *Heckman*	*(5)* *Heckman*	*(6)* *OLS*
Vertical upstream network	0.194				0.095	0.103
	(0.182)				(0.194)	(0.164)
Vertical downstream network		0.154			0.171	0.167
		(0.102)			(0.112)	(0.133)
Horizontal innovation network			–0.057		–0.124	–0.123
			(0.083)		(0.084)	(0.110)
Horizontal commercial network				0.256**	0.286**	0.285***
				(0.104)	(0.104)	(0.073)
Size	0.507***	0.506***	0.565***	0.537***	0.512***	0.538***
	(0.134)	(0.133)	(0.131)	(0.124)	(0.125)	(0.137)
Ln (Age)	0.650***	0.631***	0.619***	0.635***	0.577***	0.570**
	(0.170)	(0.166)	(0.162)	(0.159)	(0.158)	(0.199)
Techno R&C	–0.038	–0.013	–0.001	0.053	0.041	0.048
	(0.176)	(0.1752)	(0.168)	(0.165)	(0.165)	(0.161)
Inno R&C	0.192	0.164	0.336	0.186	0.241	0.229
	(0.200)	(0.198)	(0.222)	(0.188)	(0.218)	(0.266)
Human R&C	0.111	0.164	0.173	0.207	0.159	0.169
	(0.205)	(0.196)	(0.193)	(0.188)	(0.192)	(0.194)
Manag R&C	0.194	0.157	0.171	0.170	0.166	0.156
	(0.209)	(0.203)	(0.201)	(0.197)	(0.197)	(0.198)
Market R&C	–0.231	–0.284	–0.130	–0.168	–0.312*	–0.305
	(0.188)	(0.198)	(0.177)	(0.169)	(0.184)	(0.263)
Constant	13.396***	13.145***	13.977***	13.352***	12.966***	12.889***
	(0.723)	(0.675)	(0.660)	(0.570)	(0.759)	(0.787)
Observations	153	151	154	154	150	152
Mills lambda	–0.979	–0.674	–0.302	–0.154	–0.112	
	(0.978)	(0.954)	(0.989)	(0.946)	(0.943)	
Wald chi2	58.60	65.77	62.53	73.74	76.46	
R2						0.43

Notes: Standard errors in parentheses. Statistical significance *** (1%), ** (5%), and * (10%), respectively.

financial resources and capabilities (*Finan R&C*) and firm age appear to negatively affect a firm's export likelihood.

We do not find any support for hypotheses H1a and H1b, that is, neither vertical nor horizontal network involvement appears to be conducive to a firm's export likelihood.

Table 5 reports the second-stage regression results for each of the four network types, separately (Columns 1–4) and combined (Column 5). Given that the inverse Mills ratio is statistically insignificant in all specifications, we find little evidence for an exporting winery selection bias. For the sake of comparison, in Column (6), we, therefore, also report OLS results. All specifications suggest significant support for Hypothesis H2a. In particular, participation in commercial horizontal networks, measured by the number of DOs in which the winery participates, appears to provide positive effects on export intensity.

In contrast, we find only scant support for vertical network impacts on a firm's export share (H2b). This may be due to the close correlation of upstream and downstream. When only including vertical downstream networks (Column (2) in Table 5), we find a somewhat positive effect, however, at a low significance level.

Similar to the first-stage results in Table 5, both *Size* and *Age* variables are statistically significant. However, in contrast to the first-stage results, both *Size* and *Age* variables exert a positive impact on export intensity. None of the winery resource and capability (R&C) variables displays consistent significance. Only in the specification including all networks (Column 5), *Market R&C* show a positive effect—albeit at a low significance level.

Given the insignificance of the inverse Mills ratio, we also ran a simple OLS regression (Column (6), Table 5). As expected, the coefficients are almost identical to the ones reported in the full Heckman model (Column (5), Table 5).

V. Discussion and Conclusions

This paper analyzes the relationship between different types of networks and export performance. We present new empirical evidence of the positive network effects on the export intensity of companies. Our analysis highlights the positive effects of commercial horizontal collaborations with competitors, measured as belonging to one or several DOs. This is a novel point since previous studies have highlighted the greater importance of vertical networks. We also found positive effects of downstream vertical marketing networks—although at a somewhat lower level.

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