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RESEARCH PAPER

A characterization of Chilean farmers based on their market-production orientation

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Abstract

R. Echeverría, V. Moreira, J. Barrena, and M. Gopinath. 2012. A characterization of Chilean farmers based on their market-production orientation. Cien. Inv. Agr. 39(2): 255-264. Chile's open trade policy, implemented during the last few decades, has greatly transformed Chilean farmers and their production systems. As a result, farmers can be grouped into three categories based on their market-production orientation: domestic, transitional or export producers. The objective of this paper is to analyze the factors underlying the decision to produce for a particular market and compare the three groups of farmers based on data from the 2007 agricultural census. A generalized ordered logit model was used to analyze different methods of production, and non-parametric methods were used to compare the groups. Results show that some farmers change categories in sequence; farmers that produce for the domestic market can later produce for the foreign market and eventually specialize further in the production of exports. The three types of farmers differ in several aspects. Beyond the indisputable role of geographic attributes and irrigation in producing exportable species, export-oriented producers have more modern characteristics than those producing for the internal market: they are more educated, have access to various financial resources, benefit from state-funded programs, have better managerial skills and are active users of technology.

Key words: Agricultural trade, export production, generalized ordered logit model, market.

Introduction

Chilean agricultural exports have shown solid and remarkable growth in recent decades, increasing from US$ 97 million in 1974 to more than US$ 12,500 million in 2008 (ODEPA, 2009); however, this growth has been uneven. Fresh fruits, processed fruits and wines have successfully reached foreign markets. As shown in Table 1, these products accounted for 73.8% of total agricultural exports in the year 2007. Products such as cereals, seed oils and sugar beets are produced in Chile mainly for the internal market and accounted for more than 60% of total Chilean imports that year. These products are grown by farmers considered to be traditional producers; in contrast, fruit and wine producers

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are considered to be modern farmers (OECD, 2008). This duality of production is also linked to geographical location: export-oriented farmers are located mainly in central Chile, while the domestic-oriented farmers are often located in the south.

Although the differences between exporters and non-exporters in the manufacturing industry have been analyzed previously (Bernard *et al.*, 2007; Kox and Rojas-Romagosa, 2010; Wagner, 2007), study of this divide in the agricultural sector has been limited (Echeverria *et al.*, 2009). Lack of information regarding agriculture can limit growth in countries such as Chile, where the agri-food sector is an important component of the economy. Chile currently benefits from off-season fruit production for export to the northern hemisphere. By studying the factors behind the shift to export production and the characteristics of export producers, the country can direct resources towards transitioning import producers that have the greatest chance of success to export production.

An important aspect of Chilean agriculture is that most farmers wish to produce exportables because of their higher returns. This implies that many internal-market producers will eventually become producers of exportables. The objective of this paper is to analyze the factors underlying the decision to produce for the internal or external markets, as well as compare farmers as they shift in production from the internal-market to exportables to specialization in export-oriented products. Here, we present a simple model explaining why farmers choose one of the three types of production. We also outline the econometric specification and the statistical framework for comparing farmers, followed by a description of the data used in this work, the results and our conclusions.

Table 1. Chilean agricultural balance of trade (thousands of dollars) in 2007.

	Products	Exports	Share, %	Imports	Share, %
Primary	Fresh fruits	2,781,238	42.9	58,040	2.0
	Fresh vegetables	116,352	1.8	24,988	0.8
	Total livestock	68,777	1.1	42,430	1.4
	Legumes	5,054	0.1	14,156	0.5
	Seed oils	14,612	0.2	98,241	3.3
	Other products	16,720	0.3	100,193	3.4
	Cereals	126,632	2.0	707,312	24.0
	Flowers	69,537	1.1	n/a	
Processed	Wines and liquors	1,273,773	19.6	102,419	3.5
	Fruits	731,927	11.3	80,974	2.7
	Meat	581,790	9.0	400,081	13.6
	Processed vegetables	157,327	2.4	n/a	
	Dairy products	173,326	2.7	62,710	2.1
	Leather and fur	24,895	0.4	18,052	0.6
	Other livestock	49,438	0.8	47,443	1.6
	Legumes	2	0.0	n/a	0.0
	Cereals	36,716	0.6	79,339	2.7
	Other industrial (sugar)	235,155	3.6	498,458	16.9
	Seed oils	12,046	0.2	615,723	20.9
	Wool and fiber	7,549	0.1	n/a	0.0
	Total	6,482,866	100	2,950,559	100

Source: ODEPA (2009).
n/a: not available.

Materials and methods

The theoretical framework

We present a formal model of export behavior based on the work of Aitken, Hanson and Harrison (1997). We assume that farmers maximize their profits by choosing a mix of internal- and external-market oriented products. In general, production for the external market takes place when prices are higher in foreign countries than in the internal market, or when the size of the domestic market is small. Firms benefit from exporting by increasing their profits, even though exporting also involves extra costs. Thus, we assume that production for the internal and external market differs in both price and cost. Although the production of exportables is desirable, domestic and exportable production are constrained by different cost functions that are determined by socio-geographic characteristics of farms and specific attributes of farmers (Edward-Jones, 2006). To make a decision on production, a profit maximizing farm *i* will solve the following:

$$\max_{q_d^i, q_e^i} \{[p_d q_d^i - c_d^i(q_d^i, S, G)] + [p_e q_e^i - c_e^i(q_e^i, S, G)]\} \qquad (1)$$
$$s.t. \quad q_d^i, q_e^i \geq 0$$

where *d* and *e* indicate domestic and exportable production, respectively; *p* represents product prices (not necessarily specific to the farm); *q* represents the quantity of production; *c(·)* are the production cost functions; *S* represents producer-specific attributes; and *G* represents farm socio-geographic characteristics. It is assumed that production cost functions are increasing and convex in their respective arguments. The optimal output choice may be positive or zero for either type of production (domestic or exportable). As a result, three types of farmers can exist based on the market orientation: those that produce only for the internal market, those that produce a mix of internal and external oriented products, and those that produce only exportable products.

Farmers that produce only for the internal market have an incentive to add exportable products. Over time, the higher profits derived from the production of exportables stimulate farmers to produce more of these products, eventually reaching complete specialization. Thus, the categorization of farmers exists in a sequence: internal-market production is followed by production aimed to both the internal and external market, and finally production is specialized in exportables. To simplify notation, in this paper we refer to farmers who fit into the first category as "domestic producers," those who fit into the second category as "transitional producers" and those of the third category as "exporting producers."

A discrete model for production choice

Despite the above theoretical framework, we allow the possibility that farmers could choose a production category without following a particular sequence. A multinomial logit model, MNL, would be a suitable in this case. This can be stated as:

$$P(Y_i = m | x_i) = \frac{\exp(X_i \beta_m)}{1 + \sum_{j=2}^{J} \exp(X_i \beta_j)}, \qquad for\ m > 1 \qquad (2)$$

where *m* represents a category that a farmer could choose among *j* alternatives (note that a category *J* is dropped from the equation in order to identify the model). A Hausman test is typically used for verifying the independence of irrelevant alternatives (IIA) assumption. If the alternatives are not independent is likely that they are ordered. This would require use of an ordered model, as described below.

Let y^* denote a latent (unobserved) variable that represents the decision to produce any of the production alternatives, *y* denote the observable variable (the market-production orientation), and τ denote the thresholds for the market-production orientation, such that the following must hold in an ordered model:

$$y_i = \begin{cases} \text{Domestic Producer} & if & y^* < \tau_1 & (q_d^i > 0 \ and \ q_e^i = 0) \\ \text{Transitional Producer} & if & \tau_1 \leq y^* \leq \tau_2 & (q_d^i > 0 \ and \ q_e^i > 0) \\ \text{Exporting producer} & if & y^* > \tau_2 & (q_d^i = 0 \ and \ q_e^i > 0) \end{cases} \qquad (3)$$

This latent variable y^* can be estimated using the structural model:

$$y_i^* = x_i\beta + \varepsilon_i \quad (4)$$

where x is a vector of variables explaining y^*, β is the associated vector of coefficients, and ε is the error term for each farm i.

If the error terms of equation (4) are assumed to have a logistic distribution, the probability that a producer i will choose one of the categories j (the three production options) can be expressed as an ordered logit model:

$$P(y_i > j) = \frac{\exp(\alpha_j + X_i\beta)}{1+[\exp(\alpha_j + X_i\beta)]}, \qquad j = 1,2,3 \quad (5)$$

where α is the constant term, and β corresponds to the coefficients of a vector of variables X.

An ordered logit model assumes that the coefficients are similar for each alternative, meaning that the regression lines are parallel to each other (parallel regression assumption). A Brant test is usually used to verify that this assumption is satisfied. If not, a generalized ordered logit (GOL) model allows the coefficients to differ between categories. The GOL model used in this paper can be expressed as:

$$P(y_i > j) = \frac{\exp(\alpha_j + X_i\beta_j)}{1+[\exp(\alpha_j + X_i\beta_j)]}, \qquad j = 1,2,3. \quad (6)$$

Note that this model differs from the ordered logit in that β can be specific for each category j.

Nonparametric analysis for comparing the three groups

The previous model allows analysis even if farmers change categories sequentially. However, this model imposes restrictions; only some variables can be included. The latent farmers' market production choice, y^*, cannot exist simultaneously with the observable choice, y, because farmers that produce exportable fruits would have established their orchards several years ago. The only variables that can be included in the model are those that were likely present when farmers made the decision to transition. Nonparametric analyses were conducted to compare farmers using the variables that were not included in the generalized ordered logit model. In the case of binary variables, the association between the groups was analyzed through a Pearson Chi-squared test. A Cochran-Armitage test was used to analyze a potential trend between groups. A Kruskal-Wallis analysis was performed to test the equality of the group means for ordinal or numeric variables, and a Mann-Whitney U test is used to pairwise comparisons between groups.

Data

Producers were characterized as domestic, transitional or exporting. Data used for comparing these three groups were obtained from the VII Chilean Agricultural Census of 2007. However, the market-production identification of farms was derived from the 2007 Chilean balance of trade (ODEPA, 2009). According to this report, fresh/processed fruits and wines/liquors represented nearly 75% of total agricultural exports. Among the exported fruits, the following 19 products accounted for 90% of total exports: almond, blueberry, plum, apricot, peach, kiwi, raspberry, red apple, green apple, orange, nectarine, walnut, avocado, pear, table grape, blackberry, cherry, lemon and tangerine. The 2007 census specifies whether a farm exported directly or indirectly through an exporting company, though there was no information regarding the type of product exported. Therefore, a farm producing these 19 fruits and/or wine grapes with reported export activity was considered to be a producer of exportable products. Following the same procedure, we found that wheat, durum wheat, barley, corn, rice, rape, lupine and sugar beet accounted for 61% of agricultural imports. A farm that produced

any of these products that did not report export activity was considered to be a domestic-oriented producer. Transitional producers were those that produced both traditional and exportable products.

The aim of the study is to compare producers based on their market orientation. Farms that have an area of less than 0.5 hectare of the products listed above are assumed to produce for self-consumption and are excluded from our analysis. The census dataset also includes units that produce forestry products; farms consisting of more than 25% forest plantations are excluded. After filtering the dataset and adjusting for missing data and inconsistencies, we obtain a final sample of 50,433 farmers. This number includes 40,920 domestic, 4,571 transitional and 4,942 exporting producers.

A farm's observed production would be the result of a decision made previously; therefore, the discrete choice analysis is analyzed using only exogenous variables. Among these variables we identified gender, education, completion of studies and irrigation. Although the decision to produce exportables could be made prior to having access or rights to water, most farmers decide to produce fruits when have water for irrigation. Fruit production varies from region to region, so we also control for the geographic location of farms by assigning them one of three zones (northern, central and southern). The northern zone includes all regions located north of Maule region, the central zone includes Maule and Bio-Bio regions and the southern zone includes all regions located south of Bio-Bio.

The remaining variables did not satisfy normality or homoscedasticity; therefore nonparametric methods were used for comparing the three groups of farmers. Table 2 describes all of the variables used in this study.

Results and discussion

First, we present the results from the production-market orientation analysis based on the discrete choice model, followed by the comparison of the three groups using non-parametric methods.

Production-market orientation

A Hausman test following the MNL model (equation 2) rejects the independent of irrelevant alternatives assumption that the three production-market categories are independent. As a consequence, the ordered logit model would be the appropriate approach to evaluate the farmers' production-market orientation. Other models, such as the nested MNL model, are not possible in this case given the reduced number of categories. A Brand test rejects the null hypothesis that the coefficients are the same for all alternatives (the parallel regression assumption) in the ordered logit model (equation 5). Therefore, the GOL model (equation 6) was chosen for modeling the farmers' production-market orientation. Estimation results are in Table 3.

Estimates from the GOL model are presented as odds ratios in two panels: panel 1 contrasts domestic producers with combined transitional and exporting producers, and panel 2 contrasts combined domestic and transitional producers with exporting producers. Odds ratios greater than one in any of the two panels suggests that the farmer will likely choose the next category. Odds ratios lower than one suggest that the farmer is more likely to choose the previous category.

Among the farmers' characteristics analyzed, gender is not a statistically significant factor in the first panel, though it is statistically significant at a 1% level in the second panel. The odds that males will produce only exportable products is lower for males rather than for females (0.885). Age as a variable has positive and statistically significant odds ratios in both panels. It does not show an important role in the choice of any of the categories, given that the odds ratios are close to 1. Education and completion of studies are relevant variables in the market-production

Table 2. Description of variables.

Variable	Description
Age	Farmer's age
Gender	1 if farmer is male, 0 otherwise
Education	Years of education of farmer
Studies	Farmer completed his/her studies; 1 if yes, 0 otherwise
Manager	Farm has a manager; 1 if yes, 0 otherwise
Live in farm	Farmer lives on the farm; 1 if yes, 0 otherwise
Farm area	Area of the farm in hectares
Soil subsidy	Use of subsidies to fertilize soils; 1 is yes, 0 otherwise
Irrigation subsidy	Use of subsidies for irrigation (law 18450); 1 is yes, 0 otherwise
ProChile subsidy	Use of the Dirección de Promoción de Exportaciones (ProChile) subsidy; 1 is yes, 0 otherwise
INDAP loans	Use of loans provided by the Instituto de Desarrollo Agropecuario (INDAP); 1 is yes, 0 otherwise
State bank loans	Use of loans provided by the major state bank BancoEstado; 1 is yes, 0 otherwise
Private bank loans	Use of loans provided by private banks; 1 is yes, 0 otherwise
Supplier loans	Use of loans provided by suppliers; 1 is yes, 0 otherwise
INDAP programs	Participation in INDAP technical assistance programs; 1 is yes, 0 otherwise
Technological Programs (GTT)	Participation in Technological Transfer Programs; 1 is yes, 0 otherwise
CORFO programs	Participation in Corporación de Fomento de la Producción (CORFO) assistance programs; 1 is yes, 0 otherwise
FIA programs	Participation in Fundación para la Innovación Agraria (FIA) assistance programs; 1 is yes, 0 otherwise
Good agricultural practices	Adoption of good agricultural practices; 1 is yes, 0 otherwise
Training subsidy	Use of the Servicio Nacional de Capacitación y Empleo (SENCE); 1 is yes, 0 otherwise
Agricultural insurance	Use of agricultural insurance; 1 is yes, 0 otherwise
Irrigation	Farm has irrigation for production; 1 is yes, 0 otherwise
Belongs to association	Farmer is a member of an agricultural association; 1 is yes, 0 otherwise.
Use of computer	Use of computer in farm activities; 1 is yes, 0 otherwise
Use of Internet	Use of internet in farm activities; 1 is yes, 0 otherwise
Tax declaration (presumption)	Farmer makes tax declaration by presumption income method; 1 is yes, 0 otherwise
Tax declaration (complete)	Farmer makes tax declaration by complete real income method; 1 is yes, 0 otherwise
No tax declaration	Farmer makes no tax declaration; 1 is yes, 0 otherwise
Agribusiness sales	Sales to agribusiness companies; 1 yes, 0 no
Contract farming	Contract farming sales; 1 yes, 0 no
Permanent household labor	Number of household members that work permanently on the farm
Temporary household labor	Number of household members that work temporally on the farm
Permanent external employment	Number of people that work permanently on the farm
Temporary external employment	Number of people that work temporally on the farm.
Farm's income share	Share of total farmer's income that comes from farm activity

choice. Education as a factor is statistically significant at a 1% level. Each additional year of education raises the odds of producing transitional and exportable products or only exportable products versus producing only domestic products 1.151 times, when all other variables are constant. The role of education is slightly greater when farmers decide to specialize in the production of exportables (odds ratio of 1.171 in the second panel). Despite the important role of farmers' educational levels, the completion of their studies is even more relevant. The odds that a farmer produces a mix of domestic and exportable products or only exportable products versus

Table 3. Generalized ordered logit results.

Number of observations	50,433	
Wald chi^2(13)	8,548.75	
Log pseudolikelihood	-24,494.533	
Pseudo R^2	0.2100	
	Panel 1	Panel 2
Gender	0.978	0.885***
	(0.029)	(0.032)
Age	1.014***	1.007***
	(0.001)	(0.001)
Years of education	1.151 ***	1.171***
	(0.005)	(0.006)
Completion of studies	1.315 ***	1.597***
	(0.037)	(0.058)
Irrigation	1.730***	6.965***
	(0.061)	(0.552)
Central zone	8.097 ***	8.097***
	(0.435)	(0.435)
Northern zone	14.139***	21.273***
	(0.825)	(1.308)

Numbers in parentheses are standard errors.
***Significant at 1%.

producing only domestic products (first panel) are 1.315 times higher when he/she completes his/her studies at any educational level. These odds increase by 59.7% in the second panel, when the specialization in exportable products is compared with the production of domestic products or a mix of domestic and exportable products.

Among the characteristics of farms, irrigation is a positive and statistically significant variable at a 1% level. The odds of producing domestic and exportable products or only exportable products versus producing only domestic products are 1.73 times greater if irrigation is present. If the farm has irrigation capabilities, the odds are 6.9 times greater that a farm specializes in exportable products versus domestic products or both.

When analyzing the location variables, we arbitrarily drop the southern zone variable to avoid the dummy variable trap. As expected, farms located in the central zone are more likely to produce some or specialize in exportables compared to farms located in the southern zone; the odds are 8.1 times higher in each panel. Farms located in the northern zone have higher odds of producing some or all exportables than farms located in the southern zone (odd ratio of 14.139 of panel 1). These odds increase to 21.273 when the exclusive production of exportable products is compared with the domestic and transitional categories (panel 2).

Differences between the three groups

A comparison of the three groups based on binary variables is presented in Table 4. The values represent the proportions (as coefficients) of positive answers to yes or no questions. For example, for domestic producers, the proportion of farms that reported having a manager was 2.68%. The results show that the null hypothesis was rejected for most variables analyzed, suggesting that farmers' market-production orientation is ordered rather than random (the Pearson Chi-squared test of groups' associations). The last column of the table shows the ordering that results from the Cochran-Armitage test. For example, the manager variable shows that exporting producers have a higher proportion of managers than transitional producers, and the transitional producers have a higher proportion of managers than domestic producers.

Table 4. Variables' proportions (means) and their ordering.

Variable	Domestic (1)	Transitional (2)	Exporter (3)	Ordering
Groups' association: Pearson Chi-squared Test Trend: Cochran-Armitage Test				
Manager	0.0268	0.0859	0.2843	1<2<3
Live in farm	0.7379	0.7115	0.4571	3<2<1
Irrigation subsidy (18450)	0.0090	0.0498	0.0861	1<2<3
INDAP loans	0.1953	0.2708	0.1621	Mixed
State bank loans	0.0407	0.1000	0.1297	1<2<3
Private bank loans	0.0353	0.1057	0.1942	1<2<3
Suppliers loans	0.0555	0.1329	0.1905	1<2<3
INDAP assistance programs	0.1987	0.2901	0.2065	Mixed
Technological Programs	0.0117	0.0353	0.0515	1<2<3
CORFO programs	0.0033	0.0182	0.0521	1<2<3
FIA programs	0.0005	0.0026	0.0054	1<2<3
Good agricultural practices	0.0073	0.0921	0.2743	1<2<3
Training subsidy	0.0030	0.0232	0.1050	1<2<3
Belongs to association	0.2296	0.3473	0.5825	1<2<3
Use of computer	0.0311	0.1081	0.3546	1<2<3
Use of Internet	0.0284	0.0925	0.3032	1<2<3
Estimated income tax declaration	0.2496	0.5109	0.7101	1<2<3
Real income tax declaration	0.0303	0.0772	0.1419	1<2<3
No tax declaration	0.7073	0.3920	0.1179	3<2<1
Agribusiness sales	0.1461	0.4051	0.6764	1<2<3
Contract farming	0.0456	0.1918	0.4182	1<2<3
Groups' comparison: Kruskal-Wallis Test Trend: Mann-Whitney U Test				
Farm area	26.614	57.551	44.727	Mixed
Permanent household labor	0.7147	0.7628	0.4724	Mixed
Temporary household labor	0.8845	0.7007	0.3269	3<2<1
Permanent external employment	0.2276	1.3113	3.2756	1<2<3
Temporary external employment	0.3074	2.6151	7.5192	1<2<3
Farm's income share	2.4048	2.5845	2.6095	1<2<3

Farmers' attributes show that exporting producers have several characteristics related to modern farms, while domestic producers show a more traditional production structure. Exporting producers are more likely to live outside the farm and hire managers. Domestic producers live on the farms and manage them. Exporting producers make intensive use of financing alternatives, such as loans from state, private banks and suppliers. They also exhibit greater utilization of programs and subsidies provided by the state, such as irrigation and training subsidies, technological transfer programs, and other innovation and improvement programs such as CORFO and FIA. It is important to note that the variables that show mixed results are related to INDAP, the state institution that promote the development of small farmers. A possible explanation is that the internal-market

oriented producers are stimulated by INDAP to produce exportables but are unable to specialize in these products because of technical and economic constraints. For example, these farmers can hardly make economies of scale, and have problems to satisfy the quality requirements of foreign markets.

Exporting producers have more managerial skills than transitional and domestic producers, in that order. Exporting producers are often users of computers and the internet (35.46% and 30.32%, respectively), and many exporters (58%) belong to farmers' associations, where they likely benefit from provided technical and market information. Exporting producers also have close relations with agribusiness firms (most fruit is exported through marketing firms). Exporters extensively use contract farming and advanced production techniques such as good agricultural practices. The share of exporting producers that declare taxes by the presumptive or complete real income method is higher than that of the other two groups.

A comparison of groups based on ordinal variables is also shown in Table 4. Because homoscedasticity and normality were violated for all ordinal variables, a Kruskal-Wallis one-way analysis of variance by ranks was used to compare the groups. The ordering of the last column is based on the results of the Mann-Whitney U test. Results show that the production of exportables is related to more external employment, both permanent and temporary (3.2 and 7.5 employees per farm in average, respectively). This is consistent with fruit production, which is a labor-intensive activity. The use of permanent household labor was greater for domestic producers than exporting producers and highest for transitional producers. It is possible that many small producers that were motivated by INDAP to produce exportables use household labor. The share of farmer's income that comes from the farm is higher for exporting producers. This is consistent with the higher returns in exportable production. An interesting result is that producers' categories are not directly correlated with farm size; the average size was 26.6 ha for domestic producers, 57.5 ha for transitional producers, and 44.7 ha for exporting producers. It is likely that the production of exportables does not require a large farm size because it involves an intensive production system.

The present study shows that Chilean farmers can be divided into three categories based on their market orientation: producers oriented to the internal market, producers oriented to foreign markets, and those that produce for both markets. Remarkably, these categories exist in a sequence, wherein farmers that produce for the domestic market can begin to produce for the foreign market until they eventually specialize in the production of exportables. This sequence has not been reported previously and constitutes an important aspect to formulate policies that intend to promote agricultural export activity. The three categories of farmers differ in several aspects. In addition to the indisputable role of geographic attributes and irrigation in the production of exportable species, export-oriented producers have more modern characteristics than those producing for the internal market. Those that produce for foreign markets are more educated, have access to different financial resources, use widely state-based programs, are labor-intensive units and are users of hard and soft managerial tools.

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Resumen

R. Echeverría, V. Moreira, J. Barrena y M. Gopinath. 2012. Caracterización de los agricultores chilenos de acuerdo a su orientación de producción y mercado. Cien. Inv. Agr. 39(2): 255-264. La apertura comercial de Chile implementada durante las últimas décadas ha causado una importante transformación de los agricultores y sus sistemas de producción. Como resultado de esto, los agricultores pueden ser agrupados en tres categorías de acuerdo a su orientación de producción y mercado: productores domésticos, de transición y de exportación. El objetivo de este trabajo es analizar los factores subyacentes a la decisión de producción para cada mercado, así como comparar los tres grupos de agricultores. En base a datos del censo agropecuario del año 2007, un modelo logístico ordenado generalizado fue utilizado para analizar la decisión de producción, y métodos no paramétricos fueron usados para comparar los tres grupos. Los resultados indican que las tres categorías de agricultores presentan un ordenamiento, es decir, los agricultores que producen para el mercado doméstico pueden comenzar a producir para el mercado externo hasta que eventualmente podrían llegar a especializarse en la producción de exportables. Más aún, los tres tipos de agricultores difieren en varios aspectos, exhibiendo un orden muy claro. Además del rol indiscutible que los atributos geográficos y el riego tienen en la producción de las especies exportables, los productores orientados al mercado externo tienen características asociadas a productores más modernos que aquellos que producen para el mercado interno: presentan un mayor nivel educacional, tienen acceso a distintas fuentes de financiamiento, aprovechan los programas con financiamiento estatal, tiene mejores capacidades de gestión y utilizan activamente las herramientas tecnológicas.

Palabras clave: Comercio agrícola internacional, mercado, modelo logístico ordenado generalizado, producción de exportación.

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