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Causal Factors Affecting Export Intensity of U.S. Agricultural Firms

Hilde vanVoorthuizen and A. Desmond O'Rourke

A nationwide survey of exporters of high-value products was conducted in the summer of 1998. The purpose of the survey was to ascertain the extent of activity by U.S. exporters in offshore markets and to identify which firms were most likely to benefit from targeted government assistance programs to firms with different levels of export intensity. Government and private agencies can use this information to plan and monitor government export assistance on a more targeted basis to advance the national goal of expanding value-added agricultural exports.

Results revealed that the majority of the firms had export intensities (percent of total sales derived from exports) below 40 percent with respect to their total sales. Firms that were more likely to have low-export intensity included growers, processors, retailers, firms exporting dairy products, and firms exporting to Canada and Mexico. Conversely, among commodity specializations, firms exporting almonds, nuts, pecans, and specialty products, wood products, and seafood were more likely to have high-export intensity.

Introduction

Adding value to agricultural commodities has become fundamental to maintaining the competitive advantage of the U.S. food industry in global markets. Since 1975, exports of high-value or value-added products (including all semi-processed and processed agricultural commodities) have increased substantially in dollar value and as a proportion of total U.S. agricultural exports. In 1975, the value of these exports was 27 percent of total exports. By 1998, they represented 63 percent of total U.S. agricultural exports. Effective export assistance can help the food industry strengthen its competitive advantage in global markets and stimulate the creation of new jobs in the agricultural and nonagricultural sectors.

Even though the government provides a wide array of export assistance programs to help firms expand their operations in international markets, it might be possible for export growth to be stimulated further if more targeted assistance was directed toward different types of firms based on their export intensity level (percent of total sales derived from exports). However, in order to design appropriate targeting assistance, it is important to detect which firms tend to have low export intensity and which firms tend to have high export intensity and to determine the reason for such be-

haviors. Firms with low export intensity benefit from an export assistance program to motivate their participation in offshore markets. In contrast, firms with high export intensity are more committed to international marketing. Thus, a different sort of assistance program is needed to help such firms boost their export sales.

By identifying which firms have low or high export intensity and exploring the reasons why firms have a certain level of export intensity, the planning and monitoring of government export assistance is facilitated on a more targeted basis.

The approach in previous studies has been to determine the kind of assistance needed by a firm according to its size, without taking into account the effects of export intensity on the firm's assistance needs. Export intensity should be included in such an analysis because a firm's assistance needs may not be proportional to its size. For example, a small firm may be exporting all that it produces. Therefore, this firm may need capital to expand productive capacity but not need training in market development and export procedures through seminars and workshops. Conversely, a large firm with export intensity of 20 percent may benefit from some type of motivational assistance to increase its export share of total sales.

In January 1998, the Agricultural Marketing Service of the U.S. Department of Agriculture (USDA) signed a cooperative agreement that required the authors to conduct a nationwide survey of agricultural exporters. The report of that survey addressed challenges faced by agricultural export-

Hilde vanVoorthuizen is graduate student, and A. Desmond O'Rourke is director, IMPACT Center, and professor in agricultural economics, Washington State University.

ers of high-value and value-added products, evaluated the USDA export assistance programs oriented to this sector of the U.S. economy, and identified firms that were most likely to have high or low export sales for targeting assistance purposes. As a follow-up study, the identification of the type of firm most likely to have high or low export intensity was an important component in the overall analysis. This paper presents results relating to these research objectives.

Previous Studies

The 1998 study conducted by the authors identified a number of factors that appeared to be related to export sales. One of the major findings was that the size of the firm appeared to have a significant influence on the level of the firm's export sales. Certain types of firms were less likely to have high export sales, including firms who characterized themselves as growers and/or ranchers, and/or wholesalers, and firms that were exporting dairy products and fresh and/or processed fruits and vegetables. On the other hand, the study revealed higher export sales among firms exporting almonds, nuts, pecans, specialty crops, and seafood, and exporters of other miscellaneous commodities, such as noodles and ethnic foods. The study also showed that firms who assigned importance to export activities had a higher probability of increased levels of export sales.

Jensen and Hollis (1998) conducted a study that identified the characteristics of firms that were negatively or positively correlated to a firm's export involvement. Export involvement was defined as the number of years of experience a firm had in offshore markets, when at least 10 percent of its total sales were exported. The major finding from a survey of 264 firms was that export involvement was influenced by firm size, location, and type of product sold. Firms that had a single location were less likely to have high export involvement. Firms that sold bakery products were also less likely to be highly involved in exporting than were firms selling other types of products.

In 1995, a survey of agricultural export programs was conducted by the Department of Agricultural, Resources, and Managerial Economics at Cornell University and the USDA. The responding firms indicated that major export obstacles were (1) competition in foreign arenas, (2) new customer recruitment and (3) market information re-

trieval. Two-thirds of the firms surveyed at the time indicated that they obtained information directly through the USDA. However, 40 percent of the respondents appeared to have been unaware of the USDA export assistance program.

Methodology

Survey Procedure

The data used in this study was collected through a 1998 Survey of Agricultural Exporters conducted by the authors. In conducting the survey, the method suggested by Salant and Dillman (1994) was followed closely.

Firms to be interviewed in the survey were selected by random sampling from a comprehensive list of agricultural commodity exporters. The list used to select the random sample was built from several sources, including the USDA Supplier List, The Red Book, and Dun & Bradstreet's exporter list. Other sources—such as supplier directories of the states of Washington, Oregon, California, Iowa, Georgia, Texas, New York, New Jersey, Florida, Arkansas, and Virginia provided by their respective Departments of Agriculture—were also used. All the lists were merged into a single list, and duplicates were removed. The final list contained 6,831 records. Each record included the name of the company, a person to contact, and the address. The targeted random sample size was 1,075 records, which represented 15.7 percent of the total records available. Every record in the population had an equal chance of being selected.

The questionnaire was sent in May 1998 to all 1,075 firms in the previously selected random sample. Thirty days later, a second mailing was sent to those who did not respond to the first mailing. A final follow-up letter was sent 30 days after that to firms who did not respond to either of the first two mailings. A total of 195 usable responses, 18 percent of the sample, were received.

Statistical Procedure

The statistical analysis in this study was divided into two types. The first type involved general descriptive statistics and model specifications. The second type investigated which characteristics of the firm were related to low or high export intensity. An ordered Logit model was used to test the hypothesis that a firm level

of export intensity depended on the characteristics of the individual firm and on the external resources available to it. In specifying the Logit model, export intensity was defined as the proportion of the firm's total sales made to export markets. The probability that a firm had export intensity within one of the ten levels (Table 1) was hypothesized to be a function of the variables presented in Table 2. Such an ordered Logit model was first considered by Aitchinson and Silvey in 1957 and Ashford in 1959 (Maddala, 1983), who used the cumulative normal distribution for Φ . In 1960, Gurland et al. discussed a more general functional form for the cumulative distribution function—the logistic distribution function (Equation 2) (Maddala, 1983). The model is specified as follows: The probability of observing the *i*th level of export sales:

$$\begin{aligned} & \Phi(\alpha_1 + \beta'x_j) && i = 1 \\ (1) \Pr(Y_j = i/X) &= \Phi(\alpha_i + \beta'x_j) - \Phi(\alpha_{i-1} + \beta'x_j) && 1 < i \leq k \\ & 1 - \Phi(\alpha_k + \beta'x_j) && i = k+1 \end{aligned}$$

where Y_j ' *i* denotes export intensity at the category level *i* for firm *j* (Table 1) and *X* is a general notation for the firm characteristics listed in Table 2. Because the data represented ordinal rankings, an ordinal Logit model was used to estimate the coefficients (β). Therefore, the cumulative distribution function is:

$$(2) \Phi = (\exp(\alpha + \beta'x_j)) / (1 + \exp(\alpha + \beta'x_j)).$$

Table 1. Level of Export Intensity.

Level of Export Intensity	Range of Export Intensity	Frequency Response
1	0–10%	45
2	11–20%	29
3	21–30%	23
4	31–40%	10
5	41–50%	4
6	51–60%	7
7	61–70%	1
8	71–80%	5
9	81–90%	10
10	91–100%	16
No data		6
Total		156

Indicator variables were used to introduce firm size, export experience, and the importance that a firm gave to export activities. Indicator variables were appropriate because the categories within each of these characteristics (for example, firm size) were mutually exclusive. The firm was either a small firm, a medium-sized firm, or a large firm, and the firm could not be in more than one category at the same time. Thus, for each firm, the sum of the different categories was one.

Since the number of potential explanatory variables was relatively large (67), a step-wise algorithm was used to identify significant variables for inclusion in the model. When using variable selection methods, such as the step-wise method, a significant level at which variables are entered and left in the model can be chosen. The significance level of 0.40 was used to allow variables to enter the model. The step-wise procedure removed any variable exceeding the 0.15 significant level. This step-wise selection criteria has been suggested in literature related to multivariate analysis (Johnson, 1998) and logistic models when the number of explanatory variables are greater than 15 variables.

One of the variables taken into account in the model was firm size. The measure used to classify firm size was total sales. Small firms were those which had total sales less than \$5 million; medium-sized firms were firms with total sales between \$5 million and \$10 million; and large firms were firms whose total sales were higher than \$10 million. This categorization was based on the article by Flemings, Jensen, and Davis (1997). It was tentatively hypothesized that firm size would have no effect on export intensity on the grounds that firm size is most likely to affect the probability of export sales but not the level of export intensity. Thus, the bigger the firm, the more likely that firm would have high export sales, but the level of export intensity could be either high or low.

Exporters or export agents are expected to have expertise in conducting international business; therefore, such firms were hypothesized to have a positive influence on export intensity. Those firms that did not specialize in exports—such as growers, processors, wholesalers, and retailers—would be expected to report lower levels of export intensity.

Fresh fruits and fresh vegetables usually have a much shorter shelf life. Thus, exporting these kinds of products may generate all sorts of prob-

Table 2. Variables Used in the Logistic Model and Their Frequency Responses—Firm Characteristics.

Variable	% Response	Variable	% Response
<i>Firm Size (sales)</i>		<i>Commodity Exported</i>	
-Small (<\$5 m.)	36.2	Meat, Poultry, or Related	9.0
-Medium (\$5–10 m.)	16.1	Grain, Seed, Hay	7.0
-Large (>\$10 m.)	<u>47.7</u>	Dairy Products, Eggs, Honey	4.0
Total	100.0	Fresh Fruits and/or Vegetables	24.0
<i>Firm Category</i>		Processed Fruits/Vegetables	11.0
Grower and/or Rancher	13.8	Almonds, Nuts, Pecans, Specialty	6.0
Processor	17.6	Tobacco	2.0
Packer	12.6	Cotton	1.0
Wholesaler	8.5	Sugar	1.0
Retailer	3.8	Wood Products	5.0
Broker	6.4	Snack Foods	4.0
Shipper	13.8	Seafood	4.0
Exporter	16.4	Livestock	3.0
Export Agent	5.0	Other Miscellaneous	<u>21.0</u>
Other	<u>2.1</u>	Total*	102.0
Total	100.0		
<i>Export Experience</i>		<i>Market Orientation</i>	
Less than 2 years	1.3	Africa	3.6
Between 2 and 5 years	11.9	Asia	21.5
More than 5 years	<u>86.8</u>	Canada and Mexico	17.0
Total	100.0	The Caribbean	8.1
		Central and South America	12.7
		Eastern Europe	5.1
		Western Europe	16.8
		Australia and New Zealand	5.3
		Middle East	9.4
		No Data	<u>0.05</u>
		Total	100.0

*Frequency responses add to more than 100% because of rounding.

lems, such as spoilage in the marketing process and sanitary and phytosanitary conflicts when the product crosses international borders. These problems can be avoided by supplying strategically to markets that are closer to the produce's origin. Therefore, it was also hypothesized that firms who export highly perishable value-added products, such as fresh fruits and vegetables, would have increased probability of lower levels of export intensity when compared to firms who export processed products.

Firms that are exporting to Western Europe would have increased probability of low export intensity because Western Europe is a challenging

market, which is difficult to penetrate and to remain in. Firms exporting to Africa were also hypothesized to have increased probability of low export intensity. Firms that are exporting to Canada, Mexico, Eastern Europe, and Asia would tend to have increased probability of high export intensity as those markets are considered to be growing markets with significant opportunities.

From the perspective of how export sales are made, it was theorized that a firm that sells primarily through U.S. or foreign-based brokers or that sells directly to international customers would have a higher probability of high export intensity. Firms who sell primarily to domestic customers,

some of whom in turn sell internationally, were hypothesized to have lower export intensity. Export experience was expected to be positively correlated with export intensity as was the importance that a firm gives to export activities. Commitment to electronic devices—such as e-mail, Internet surfing, and electronic data interchange—was hypothesized to have a positive effect on export intensity. This hypothesis was formulated because firms might use electronic commerce as an alternative channel to make their exporting practices more efficient. Assistance from different private institutions, other exporters, and government agencies was also theorized to have a positive effect on export sales.

Results

Descriptive Statistics on Survey Response

Of the 195 questionnaires returned, 158 were agricultural exporters, and 37 were non-exporters. Most of the non-exporter questionnaires were received from the state of Oregon. For the purposes of this analysis, only exporters were taken into account.

Tables 2 and 3 show the frequency responses for all variables used in the logistic model. The most frequently represented firms in the sample were processors, exporters, growers, and shippers. Firms exporting fresh fruits and vegetables, processed fruits and vegetables, and other miscellaneous commodities were also heavily represented.

The frequency response of firms at different levels of export intensity is shown in Table 1. There were 107 firms that were exporting less than 40 percent. Thirty-one firms were exporting more than 71 percent. Of the total responses, 54 were small firms, most of which were exporting less than \$5 million annually. Seventy-one firms were large firms, of which 27 were exporting more than \$10 million per year; 21 firms were exporting between \$1 million and \$10 million; and 23 were exporting less than \$1 million. Analyzing export intensity by firm size (Figure 1), most of the firms surveyed, particularly large firms, were exporting less than 40 percent. However, those firms most likely to have low or high export intensity were assessed using logistic regression.

Factors Affecting Export Intensity

Results for the parameter estimates and the Wald test statistic of parameter significance, based on the estimated ordered Logit model, are shown in Table 4. The interpretation of the parameter estimates is that negative coefficients increase the probability of low export intensity, and conversely, positive coefficients increase the probability of high export intensity. The parameter estimates presented in Table 4 correspond to those that were significant at the 0.05 and 0.01 levels. The parameter estimates were obtained using the descendant logistic procedure with a step-wise algorithm built in SAS software. To assess the fitness of the model, the -2 log likelihood test and the chi-square test were used. Both p-value for -2 log likelihood and the Pearson Chi-square statistic had values of 0.0001, which indicates that the predictor variables being used in the model were statistically significant predictors of export intensity.¹

To test whether the ordered Logit model was adequate for the data analyzed, the odd assumption test was used. That is, common β s prevail across the different levels of export intensity while α_s change (see Equation 1 of the model specification). The p-value for the odd assumption was 0.657, which supported the null hypothesis that, in fact, the ordered Logit model was adequate in this case. The logistic model correctly forecasted 81.9 percent of the export intensity levels.

The size of the firm did not influence the probability of high or low export intensity. This result agrees with what was hypothesized earlier. Firm-sized parameter estimates were eliminated from the model due to insignificance. A firm that is primarily an export agent had a stronger probability of high export intensity. On the other hand, a firm that was a grower and/or a rancher, a processor, a wholesaler, and/or a retailer was more likely to have a low level of export intensity. The validity of these conclusions is statistically supported by the low p-values obtained in the results and agree with what was hypothesized.

Given the significance of the parameter estimates, firms that were exporting dairy products and fresh fruits and vegetables were more likely to have low export intensity. Only firms that export

¹These tests consider all predictor variables simultaneously.

Table 3. Variables Used in the Logistic Model and Their Frequency Responses—Firm Activities.

Variable	% Response
<i>How Export Sales are Made**</i>	
Sales to domestic customers some of whom sell internationally	24.6
Sales directly to international customers	38.6
Sales through foreign-based brokers or agents in target markets	22.4
Sales through U.S.-based foreign trading companies	14.4
<i>Importance the Firm Gives to Export Activities</i>	
Very Important	52.9
Important	38.1
Not Very Important	9.0
Total	100.0
<i>Assistance Received from Different Export Entities**</i>	
Other exporters	62.7
USDA Foreign Agricultural Service	54.7
USDA Agricultural Marketing Service	51.7
U.S. Agency for International Development	19.2
U.S. Department of Commerce	30.6
Export agents and trading companies	76.0
Paid consultants	14.1
Trade associations	61.1
EX-IM Bank	18.0
Chamber of Commerce	24.3
Universities or community colleges	17.7
<i>Firm's Commitment to Electronic Devices**</i>	
Use of E-mail regularly for business	63.0
Surf the Internet for information and business leads	55.6
Have own web page	47.4
Have electric data interchange with one or more customers	36.3
<i>Publications the Firms Use as Sources of Information**</i>	
International Trade Administration	7.4
U.S. Agency for International Development	9.5
Small Business Administration	3.4
EX-IM Bank/Foreign Credit Insurance Association	12.8
USDA Foreign Agricultural Service	48.0
USDA Agricultural Marketing Service	40.9

* Frequency responses add to more than 100% because of rounding.

** Frequency responses add to more than 100% because respondents had more than one choice.

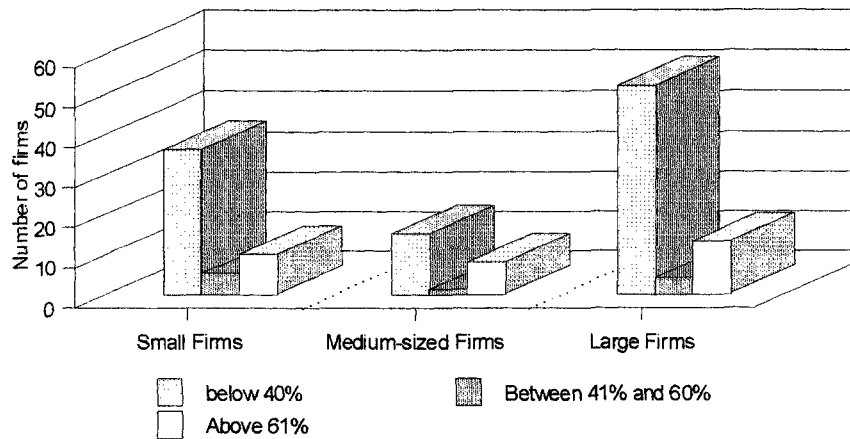


Figure 1. Export Intensity Categorized by Firm Size.

Table 4. Parameter Estimates and Test Statistics.

Firm Characteristics	Estimated Coefficient	Wald Test Statistic
α	-8.1711*	33.278
α_2	-6.9932*	26.780
α_3	-6.3580*	22.978
α_4	-6.2302*	22.209
α_5	-5.7893*	19.582
α_6	-5.6917*	19.009
α_7	-5.1283*	15.786
α_8	-3.745*	8.844
α_9	-1.4452	1.447
βs:		
<i>Firm Category</i>		
Grower/rancher	-1.1707*	6.139
Processor	-1.6956*	9.952
Retailer	-2.4871**	5.6726
Export Agent	2.473*	10.135
<i>Commodity Exported</i>		
Dairy Products,		
Eggs, Honey	-3.5042*	8.051
Almonds, Pecans	4.612*	15.536
Wood Products	1.3752*	2.953
Seafood	4.173*	8.372
Other Misc.	1.1232**	5.041
<i>Market Orientation</i>		
Canada and Mexico	-2.093*	16.609
<i>Importance That a Firm Gives to Export Activities</i>		
Very important	5.712*	19.653
Important	2.878	5.4511
<i>Publication Firms Uses for Export Assistance</i>		
EX-IM Bank	2.380*	11.896
Foreign Agric. Service	1.137*	5.255

*Significant at 0.01 level.

**Significant at 0.05 level.

almonds, pecans, wood products, seafood, and other nontraditional agricultural commodities had a high probability of high-level export intensity.

From the market orientation perspective, a firm that is exporting to Canada and Mexico had a greater probability of having low export intensity. This contradicts our initial hypothesis. It may be easier to make occasional export sales to neighboring countries, such as Canada and Mexico, that require lower expertise in exporting. Statistical evidence shows that firms whose management considers export activities important to the profits of the firm were more likely to have higher export intensity than those that consider export activities not important at all.

Regarding firms' commitment to electronic commerce, statistical evidence indicated that the fact that firms surfed the Internet for information or business, used e-mail regularly, or had their own web-page did not affect the level of export intensity. These results contradict the initial hypothesis, and nothing can be ascertained about the causes for this outcome without further research.

Firms using EX-IM Bank and Foreign Agriculture Service (USDA, various issues) publications had a higher probability of high export intensity. Not enough statistical evidence exists to support the hypothesis that other organizations' services and publications, which are used by a firm influence the probability of that firm being at any given level of export intensity.

Conclusions and Recommendations

For many years, government agencies have provided a wide array of export assistance. However, agricultural exporters of high value, value-added products are now facing an unprecedented number of challenges. Some of those challenges include changes of consumers around the globe, diffusion of information technology, consumer advocates, and food safety, just to mention a few. Therefore, more targeted export assistance needs to be designed in order to stimulate exports. Firm size is important when designing appropriate targeted assistance, but export intensities should also be taken into account. The first step in designing appropriate targeted export assistance is to detect which firms are having low export intensity and which firms are having high export intensity. The sec-

ond step is to determine behavioral reasons. This study pinpoints the firms that were most likely to have high export intensity versus those firms that were most likely to have low export intensity. More in-depth analysis is required to ascertain why certain factors affect export intensity negatively or positively. Emphasis should be given to negative factors affecting export intensity and to address how those factors can be turned into a positive influence on exports. For example, firms exporting dairy products, eggs, and honey were more likely to have low export intensity. Analysis should be considered on why those commodities have an increased probability of low export intensity. This low export intensity may be the result of past government programs. It is important to recognize that many problems in exporting value-added products are specific within each group. Firms exporting value-added products cannot be treated as a homogenous group in terms of export assistance directed toward them.

On the other hand, for those firms whose characteristics indicated an increased probability of high export intensity, government agencies ought to invite them to participate in trade events. Thus, these firms may be actively recruited as part of export promotion programs. These firms should be linked by a strong informational network so that when problems are encountered in marketing their products, they can use the network interactively to discover strategies that would help them overcome obstacles to exporting. For example, local regulations, product labeling and standards, environmental concerns, social and cultural fit, technical information, and economic and political environments are some of the barriers for firms exporting highly processed products in new markets.

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