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INDUSTRIAL ORGANIZATION AND EXPORT COMPETITIVENESS OF U.S. FOOD MANUFACTURERS

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ABSTRACT

Domestic income multipliers associated with U.S. exports of processed and other high-value agricultural products such as meats and manufactured foods are shown to be about 55 percent greater than those for exports of primary agricultural commodities such as grains and oilseeds. About 90 percent of the high-value product exports originate in the food manufacturing industries. Yet, when expressed in terms of export propensity, the external market performance of U.S. food manufacturers trails substantially behind that of similar industries in other countries.

The U.S. food manufacturing industries are characterized by competitive imperfections such as product differentiation, scale economies, and seller concentration. Traditional international trade theories based on factor endowment constructs have not proved robust in explaining trade flows under such imperfectly competitive conditions. Recently some economists have applied industrial organization concepts to international markets that are imperfectly competitive. Linkages have been established both between elements of imperfect competition and external market performance, and between international trade and economic welfare in imperfectly competitive markets. This paper reports on an industrial organization-based analysis of the export market performance of U.S. food manufacturers. The analysis utilizes panel data from 78 leading food processing firms and cross-sectional Census data from 42 4-digit SIC food manufacturing industries.

Export market performance varies widely among these firms and industries. About 84 percent of the variation was explained through the use of industrial organization characteristics as explanatory variables in regression analysis. Food manufacturer export propensity was found to be significantly and positively related to firm size, research and development, and product transportability, and significantly and

negatively related to advertising, vertical coordination in sourcing of raw agricultural commodities, wage rates, and height of foreign import barriers. Other explanatory variables that show promise, pending adequate data, include the extent to which firms operate foreign plants, seller concentration, and investor vs. cooperative firm ownership. Alternative measures of international market performance, including export market share, relative export advantage, and revealed competitiveness, are also examined.

INTRODUCTION

The economic importance of international markets to the U.S. food and farm system is illustrated by the observation that, during the past 15 years, the value of exports has exceeded 45 percent of the gross domestic product (GDP) of the farm sector. The purposes here within are to assess the competitiveness of the U.S. in world markets for one group of agricultural products, processed foods, and to identify factors that affect the export performance of food processing firms and industries.

Agricultural exports can be segmented in many ways. Recently, much attention has focused on a division between primary or basic farm commodities and high-value products. The former include bulk commodities such as wheat, feed grains, and soybeans, with relatively low per ton values. The latter include processed products such as meat, dairy and poultry products, cereal mill and bakery products, refined fats and oils, sugars and sweeteners, preserved fruits and vegetables, beverages and syrups, hides and skins, natural fiber products, tobacco products, and spices and extracts, along with high-value farm commodities such as live animals, fresh fruits and vegetables, and tree and ground nuts.

For statistical convenience, high-value products here within include all foods and agricultural products with a wholesale value exceeding $400 per ton (1987 basis). In terms of volume, products meeting this criterion account for less than 10 percent of all U.S. agricultural exports. But, they constitute about half of the value (Table 1). Processed foods, those produced by the food manufacturing industries, dominate the high-value product category. Manufactured or processed products made up more than 70 percent of all high-value exports during the 1970s, 79 percent during the 1980s, and currently account for nearly 90 percent of the total [3, 8]. Thus, more than 40 percent of all agricultural exports are originated by U.S. food manufacturers.

Table 1. U.S. Agricultural Exports

Year	All Products ($ million)	High Value Products* $ Million	Percent
1960	4,832	2,749	56.9
1965	6,529	2,949	45.2
1970	7,259	3,449	47.5
1975	21,889	7,375	33.7
1980	41,233	17,362	42.1
1985	29,041	13,428	46.2
1989	39,651	18,735	47.3

* Animals and products, fruits and preparations, vegetables and preparations, oilseed products, tobacco and products, natural fibers, seeds, sweeteners, beverages, and nursery products.
Source: [14], various issues.

ECONOMIC GAINS FROM HIGH-VALUE AGRICULTURAL EXPORTS

In addition to accounting for a significant share of the value of agricultural exports, international markets for high-value products generate economic benefits that are distinguished from other agricultural exports in two ways: (1) greater stability, and (2) higher domestic income multipliers. Because of these characteristics, arguably exports of processed products offer more significant economic gains to the U.S. at large, and to the farm and food sector specifically, than do exports of primary farm commodities.

As an indicator of instability, annual variations in food and agricultural exports are shown in Table 2. Variability in exports for all classes of products increased appreciably following the 1960s. However, high-value exports are more stable and, contrary to primary commodities, have become somewhat less volatile in recent years. Thus, external markets for processed products appear to provide a more stable source of sector earnings than do external commodity markets, helping to mitigate economic swings caused by gyrations in foreign sales.

Table 2. Annual Variation in Agricultural Exports*

	1961-1970	1971-1980	1981-1989
Grains and Oilseeds	0.38	2.29	2.89
High-Value Products	0.16	1.53	1.41

* Average annual change (billion dollars)
Source: Compiled from [14].

Further, the domestic income multiplier of high-value exports is 2.88, and in aggregate is about 55 percent greater than the primary commodities, at 1.86 (Table 3). As logic suggests, the additional income effects associated with high-value exports come in the down-stream processing and distribution industries.

Table 3. Economic Multipliers for U.S. Agricultural Exports

	Total	Up-Stream	Farm-Level	Down-Stream
All Products	2.23	0.59	0.83	0.81
Primary Commodities	1.86	0.72	0.85	0.29
High-Value Products	2.88	0.31	0.78	1.79

Source: [7]

Interestingly, the farm-level income effects from high-value exports are about equal to those from primary commodities. That is, even though the share of the value of products sold in international markets generated in the down-stream industries is greater for processed products than primary commodities, the aggregate farm income benefits generated by each group of products are nearly the same. This occurs because, many processed products such as beef, pork, and cheese are produced from livestock, the production of which, in turn, demands relatively large amounts of farm-produced inputs such as feed grains and breeder animals. For example, about 14 pounds of feed

grains are required to produce one pound of ready-to-cook beef. That is, there is a considerably higher farm-level income multiplier associated with animal production than with crops.

International Trade in Imperfectly Competitive Markets

It is generally recognized that U.S. food processing and manufacturing industries are imperfectly competitive. Competitive imperfections such as relatively high levels of seller concentration, extensive product differentiation, and scale economies are dominant characteristics. For example, Connor et al. have shown that more than half of the food processing industries have high seller concentration[1], that advertising-created product differentiation is a major entry barrier into food manufacturing, and that the minimum efficient scale of food processing plants in 36 food manufacturing industries averages more than 200 percent of annual industry shipments [2].

Richardson [11] has demonstrated through a comprehensive survey of recent literature that imperfect competition has become increasingly relevant to both the theory and empirical analysis of international trade. Most theoretical arguments relate to the impacts of international trade in imperfectly competitive markets on national economic welfare, while most empirical research has focused on differences between the effects of trade on market performance under imperfectly and perfectly competitive conditions.

Predominately, theoretical reasoning attributes gains in economic performance and welfare to the competition-enhancing impacts of international trade on imperfectly competitive markets in importing countries, and to scale economies from expanded

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[1]Defined as a four-firm concentration ratio of at least 50 percent or an eight-firm ratio of at least 65 percent.

output in exporting countries. Refinements include increases in the variety of products available in the marketplace, which is often equated with intraindustry trade; expansion in the size of the relevant market, that is, the integration of two or more national markets into a common market; and gains to a national economy from imperfectly competitive firms as collectors of excess profits on exports.

Recent empirical studies have largely been either of the calibration/counterfactual nature or more data-intensive regression analyses. These have demonstrated that the inclusion of industrial organization variables, particularly scale economies, makes a significant difference in the estimated effects of trade on economic welfare and market performance. Compared to perfectly competitive markets, most calibration studies have shown that changes in international trade under imperfectly competitive conditions have about twice as large an impact on such market performance measures as costs, price-cost margins, and profits. In general, regression studies have shown import penetration to be positively related to seller concentration and technical efficiency, while negatively related to price-cost margins.[2] Studies of both types demonstrate positive effects of trade on economic welfare under conditions of imperfect competition. These findings appear to be consistent with the available evidence on the magnitude of economic gains from trade in processed agricultural products.

While both theoretical and empirical linkages between international trade, imperfect competition, and economic performance have been reasonably well established, the implicit line of causation has been from trade to market performance. However, an alternative perspective is to view trade as a component of market

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[2]For a comprehensive discussion of recent empirical findings, see [11].

performance. In this sense, one could consider exports to be a positive dimension of economic performance. This would seem to be consistent with the contemporary concept of international competitiveness. It also suggests an alternative line of causation, running from industrial organization to export market performance. Indeed, such a line of causation is consistent with the traditional industrial organization analyses of domestic markets.

A few studies have examined the impacts of competitive imperfections in domestic industries on international market performance. For example, in a cross sectional regression analysis of 88 U.S. 3-digit SIC[3] manufacturing industries, Pagoulatos and Sorensen found statistically significant relationships between both exports and imports as shares of domestic shipments and such industrial organization variables as seller concentration, scale economies, product differentiation, and expenditures on research and development [10]. Also, from regression analyses of 382 4-digit SIC manufacturing industries, Marvel reported significant relationships between U.S. exports and industrial organization variables such as an industry's share of total employees working in research and development, and geographic dispersion [9].

The remainder of this paper focuses on empirical linkages between industrial organization and the external competitiveness, or export market performance of the U.S. food manufacturing industries.

U.S. Competitiveness in World Markets for Processed Products

Whereas processed and other high-value products make up about half of the value of U.S. agricultural exports, these products constitute more than three-fourths of all world trade in agricultural products (Table 4). This suggests that, U.S. food processing

[3]Standard Industrial Classification.

industries, as a group, are less competitive in international markets than are similar industries in other exporting countries.

Table 4. High Value Products as a Share of Agricultural Trade

Year	Total World Trade	U.S. Exports
1965	85.2%	45.2%
1970	83.7%	47.5%
1975	75.9%	33.7%
1980	79.5%	42.1%
1985	82.1%	46.2%

Source: Table 1 and [12], various issues.

Using export propensity as a measure of international market performance, that is, exports as a share of total shipments from domestic plants, U.S. food processors trail well behind those in other industrial countries (Table 5). Within the other OECD classification, Japan is the only country where the food processing industries export a smaller share of output than do U.S. firms: 1.9 percent vs. 3.1 percent. By contrast, exports account for more than 40 percent of all processed food output in four OECD countries: Belgium, Denmark, the Netherlands, and New Zealand. Further, trends in recent years show export propensity declining among U.S. firms while increasing elsewhere in the OECD.

Table 5. Exports as a Share of Processed Food Production

	1975	1985
18 OECD Countries*	19.2%	21.2%
9 European Community Countries	22.7%	27.2%
8 Other Non-U.S. OECD Countries	11.5%	16.6%
United States	3.4%	3.1%

* Organization for Economic Cooperation and Development
Source: [6]

There is, nonetheless, considerable variance in the export performance of different food processing industries in the U.S. (Table 6). Even so, no single industry exports as large a share of its output as is the average for all food industries in the OECD bloc of countries. The fats and oils industry stands out as the export leader in the U.S. Of all industry groupings shown, this one produces the most homogeneous products, led by soybean oil. This suggests that U.S. food processors may be most export-oriented for the less differentiated, more commodity-like products, an observation that is supported by subsequent analysis.

Table 6. Exports by U.S. Food Processing Industries, 1988

Industry	Exports as a Share of Total Shipments
Fats and Oils	18.8%
Grain Products	7.1%
Meat Products	5.2%
Sugar and Confections	3.5%
Preserved Fruits and Vegetables	3.0%
Beverages	1.2%
Dairy Products	1.1%
Bakery Products	0.3%

Source: [13]

EXPORT PERFORMANCE OF LEADING U.S. FOOD PROCESSING FIRMS

To develop some insights into the interrelationships between structure, behavior, and external market performance in the food manufacturing industries, panel data from a sample of 78 leading U.S. food processing firms were subjected to discriminant analysis. The results were used to structure the regression analysis of cross-sectional data for U.S. 4-digit SIC food processing industries reported in the following section.

Advertising expenditures are a commonly-used measure of product differentiation. In essence, heavily advertised products are viewed as less homogeneous; the most important purpose of advertising is to create a unique image of and demand for the advertised product. Based on data from the panel of leading U.S. food processing firms, it appears that those who sell less advertised (more homogeneous) products have a higher export propensity than do firms with heavily advertised goods (Table 7).

Further, firms selling less advertised or more homogeneous products depend more heavily on domestic production to supply international markets, whereas highly differentiated products tend to be supplied to foreign markets primarily from foreign plants. The corollary is, U.S. producers of differentiated food products have a strong propensity to invest in foreign processing plants and a low propensity to export from the U.S.

Table 7. Foreign Market Performance of Leading U.S. Food Processors

	Heavy Advertisers*	Light Advertisers**
Exports as a Share of Shipments From U.S. Plants	1.9%	4.7%
Exports as a Share of Total Foreign Sales	27.9%	73.9%
Shipments from Foreign Plants as a Share of Worldwide Sales	18.0%	4.4%

* Expenditures on media advertising equal to 1 percent of sales or more
** Expenditures on media advertising less than 1 percent of sales
Source: panel data

Firm size is also a relevant factor. Larger firms export less and invest in foreign production facilities more than do smaller firms (Table 8). The value of exports as a

share of total sales of food products by all firms that are involved in food processing averages more than three times larger than the export share for the 10 largest U.S. food processing firms. By contrast, the largest firms supply a substantially larger share of their total worldwide food sales from plants that they own in foreign countries. Thus, export propensity for U.S. food processors appears to be inversely related to firm size.

Table 8. Shipments by U.S. Food Processors*

	U.S. Plants	Foreign Plants
All Food Processing Firms	4.7%	9.7%
64 Leading Firms	2.2%	20.0%
10 Largest Firms	1.6%	22.9%

* Percent of total food sales
Source: [13] and panel data

Firm specialization also appears to influence export performance (Table 9). Exports account for nearly twice the share of total shipments from U.S. plants for firms that are exclusively in the food business compared to firms where food accounts for less than two-thirds of total sales. Likewise, exports make up a significantly larger share of total foreign food sales for the specialized food firms.

Table 9. Exports by Leading U.S. Food Processing Firms

	Specialized Food Firms*	Diversified Product Firms**
Exports as a Share of Food Shipments from U.S. Plants	3.4%	1.8%
Exports from the U.S. as a Share of Total Foreign Food Sales	61.5%	46.0%

* Food products account for 100 percent of total sales
** Food products account for less than two-thirds of total sales
Source: panel data

Logic would suggest that firms with investments in foreign-located food processing plants are more oriented toward sales in foreign markets than are firms without foreign plant operations. However, panel data indicate that there is an inverse relationship between the share of total food sales made from foreign plants and exports from the U.S. (Table 10). That is, firms that operate non-U.S. plants appear to substitute products from those plants for exports from U.S. plants.

Table 10. Effects of Foreign Plants on Exports by U.S. Food Processors

World-wide Food Sales Shipped from Foreign Plants	Exports as a Percent of Total Shipments from U.S. Plants
Firms shipping less than 5% from foreign plants	4.3%
Firms shipping 5% or more from foreign plants	1.4%

Source: panel data

Also based on panel data, food processing firms that are organized as farmer cooperatives appear to be more export oriented than are investor-owned firms (Table 11). Exports as a share of total shipments from domestic plants are roughly twice as great for the former. Arguably this reflects the primary orientation of farmer cooperatives toward expanding the market for their member-owner products in contrast to the return-on-investment motivation typical of investor-owned firms.

Table 11. Exports by Cooperative and Investor-Owned Food Processing Firms

	Exports as a Share of Food Shipments from U.S. Plants
Investor-Owned Corporations	1.9%
Farmer-Owned Cooperatives	3.9%

Source: panel data

EXPORT PROPENSITY OF U.S. FOOD MANUFACTURING INDUSTRIES

The discriminant analysis of panel data on leading food processing firms suggest that there are a number of structural and behavioral characteristics that influence competitiveness and other dimensions of external market performance. Using regression analysis on 1982 cross sectional data from 42 U.S. food manufacturing industries defined at the 4-digit SIC level, the relationships between several industrial organization characteristics and export propensity were estimated (Table 12).

Because data on shipments from foreign plants operated by U.S. food processing firms were available for only 20 of the 42 industries studied, two separate regression equations were estimated: equation 1 incorporates a foreign operations variable fitted to data from 20 industries (column 1, Table 12), and equation 2 excludes the foreign operations variable, fitted to data from all 42 industries (column 2, Table 12). A list of the industries included in equation 1 is shown in Appendix Table 1 and the additional industries included in equation 2 are listed in Appendix Table 2.

Industrial organization characteristics used as explanatory variables include: vertical coordination (VC), four-firm concentration ratio (CR4), average establishment size measured by value of shipments (AES), expenditures on research and development as a percent of sales (RD), expenditures on media advertising as a percent of sales (AS), production worker hourly earnings (PWHE), geographic dispersion of shipments (GDI), potential increase in trade with the elimination of import barriers in import countries (PTWOB), industry specialization ratio (SPCR), and the value of shipments from foreign plants as a percent of world-wide sales (FOSFTS). Export propensity, the dependent variable, was specified as exports as a percent of total shipments from U.S. establishments.

Table 12. Regression Equations Relating Industrial Organization Characteristics of U.S. Food Manufacturers to Export Propensity

Dependent Variable = Export Propensity Explanatory Variables	Industries with Foreign Operations Data (Equation 1)	All Food Industries (Equation 2)
Constant	0.091 (0.97)	0.17 (1.27)
VC	-0.073[b] (2.98)	-0.11[c] (3.05)
CR4	-0.0007 (1.33)	0.0002 (0.24)
AES	0.002[c] (3.83)	0.0014 (1.23)
RD	7.55[b] (2.85)	-0.70 (0.28)
AS	-1.13[c] (3.40)	-1.40[b] (2.39)
PWHE	-0.022[c] (3.13)	-0.025[b] (1.79)
GDI	0.093[c] (4.20)	0.075[c] (3.70)
PTWOB	-0.00002[b] (2.67)	-0.00003[b] (2.13)
SPCR	0.001 (1.36)	0.001 (0.64)
FOSFTS	-0.06 (1.03)	
R^2	0.84	0.42
F-value	4.88[b]	2.54[b]
Sample size	20	42

Note: t-values are in parenthesis.
a, b, and c are significant at the 0.90, 0.95, and 0.99 level, respectively.

Several of the independent variables follow directly from the discriminant analysis of firm data, as well as received industrial organization theory. AES is used as a proxy

for firm size, as suggested by data in Table 8. AS is a proxy variable for product differentiation, per Table 7. SPCR is a measure of establishment specialization, which the data in Table 9 indicate is a potentially significant variable. FOSFTS provides a measure of the extent of foreign plant operations, as suggested in Table 10. Due to unavailability of industry-wide data, the potential impact of the ownership structure of firms, suggested in Table 11, could not be included in the regression analysis.

Lacking sufficient firm-level data for discriminant analysis, other potential explanatory variables were identified from generally accepted microeconomic theory. VC measures the importance of input linkages between farms and food processors, capturing the extent to which such inputs are supplied under contractual or integrated arrangements.[4] Food processing industries have increasingly utilized contracts to organize farm production when spot markets have failed to provide needed quality, quantity, and timing of inputs. It has been demonstrated that vertical coordination is a response to high transaction costs, thus it should be efficiency-enhancing.

CR4 is a conventional measure of seller concentration in industrial organization studies. However, both theoretical reasoning and the available, albeit limited empirical evidence, suggest that seller concentration is positively related to import penetration but are ambivalent regarding expected impacts on export performance [9, 10]. RD is commonly used as a proxy for innovative behavior, representing leadership in creating new and improved products and production processes. RD is expected to be positively related to competitiveness in external markets.

PWHE is used to represent the impact of production worker wages on export performance. As a proxy for the cost of labor, a negative relationship is expected. GDI,

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[4]For a detailed explanation of vertical coordination and its quantification in industrial organization analyses, see [4, 5].

specified as an index of absolute values of differences between regional concentration of production and consumption, is a measure of product transportability. Increases in the index are expected to be associated with increased export propensity.

PTWOB is included to capture the effects of foreign trade barriers. This variable represents the potential percentage increase in U.S. exports if foreign trade barriers were removed. This was calculated by averaging country-by-country estimates, as reported in [15], of increases in U.S. exports of specific agricultural products if foreign import restrictions were lifted. The higher the calculated value, the greater the magnitude of existing trade barriers. Therefore, it is expected that PTWOB is inversely related to export performance.

Regression results validate the expectation of a statistically significant relationship between characteristics of industrial organization and export propensity (Table 12). Equation 1 appears to be particularly strong, with a coefficient of determination (R^2) of 0.84 and a significant F-value. Equation 2, excluding the foreign operations variable and including a larger number of industries, also has a statistically significant F-value but a lower R^2.

Focussing primarily on the regression results for equation 1, seven of the 10 industrial organization variables examined were found to be statistically related to export propensity with a 90 percent or higher level of confidence. Two variables, CR4 and SPCR, approach significance at this confidence level. By in large, results in equation 2 are consistent, although the interpretation of relationships between export propensity and two of the nine primary variables, CR4 and RD, becomes ambiguous.

Negatively related to export propensity in the food manufacturing industries are VC, CR4, AS, PWHE, PTWOB, and FOSFTS. The inverse relationships for AS,

PWHE, PTWOB, and FOSFTS are consistent with received theory and/or the results of analysis of firm-level data. That is, industries that are characterized by high product differentiation, wage rates, foreign import barriers, and shipments from foreign operations are less likely to export products from the U.S.

The negative sign for VC appears to be counterlogical, given evidence that VC is a response to high transactions costs. That is, if transaction costs are being reduced through VC, efficiency and thus competitive gains should obtain. Arguably, the negative relationship may be an indication that vertical coordination is not completely offsetting transactional inefficiencies where such costs exist, i.e. VC mitigates but does not eliminate transactional efficiencies. This suggests that food industries with low transactional costs are characterized by low VC values. If so, industries with low transactional inefficiencies may be more competitive than industries with high transactional costs that are only partially offset through vertical coordination.

Given the ambivalence of both previous empirical studies and theory, the negative and nearly significant coefficient for CR4 can't be viewed as unexpected. Hypothetically, it may be that the dominant firms in highly concentrated industries find the domestic market sufficiently profitable to dissuade aggressive interest in external markets.

Positively related to export propensity are AES, RD, and GDI. That is, food processing industries characterized by relatively large size plants, high levels of research and development, and easily transportable products are those most likely to export. These relationships are consistent with theoretical expectations, although the positive sign for AES could be interpreted as inconsistent with the negative relationship between firm size and exports shown in Table 8. However, firm size and establishment size are

not necessarily correlated, thus both may be relevant industrial organization characteristics. Unfortunately for the present analysis, data on the former were not available on an industry basis.

Alternative Measures of Export Performance

In addition to export propensity, there are several alternative trade intensity measures that can be used to capture the welfare effects of international trade. These measures include export market share, relative export advantage, and revealed competitiveness.[5] One of the most commonly used indicators is export market share (XMS). This is defined as the percentage of the world market for a product held by a given exporter. Due in part to its ease of calculation, market share is often used in policy analysis. This measure is easily tractable through time, aiding analysis of changes in a sector's competitiveness. However, comparative analysis of cross-sectional market share data does not always accurately describe differences in competitiveness, primarily due to such things as policy-induced price distortions.

In the event of some form of market distortion, relative export advantage and revealed competitiveness can be used to more completely represent competitive performance. Relative export advantage (RXA) is based upon the comparison of a country's export propensity for a particular product with the export propensities of all other countries for the same product.

Revealed competitiveness (RC) represents a country's competitive trade performance for a particular product in both export and import markets. It is the ratio of a country's relative export advantage for a specific product to that country's relative

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[5]For a discussion of export performance measures, see [16].

import penetration for the same product. As such, it recognizes the economic effects of two-way trade and captures the impacts of intra-industry trade. Revealed competitiveness is an attempt to bridge the measurement of real world trade flows under conditions of competitive imperfections and other market distortions with the theoretical concept of comparative advantage.

Each of these alternative export performance measures, export market share (XMS), relative export advantage (RXA), and revealed competitiveness (RC) were fitted as the dependent variable in equation 1. A comparison of the resulting coefficients of determination (R^2), F-values, and the number of significant independent variables for each is shown in Table 13. Contrasted to export propensity (EP), XMS and RC performed comparably, with a slight advantage for XMS. The industrial structural characteristics captured as much as 86 percent of the variation with the test of overall relation and 8 variables statistically significant. The estimated equation for the relative export advantage measure, RXA, was not impressive. Thus, at this point, export propensity and export market share appear to be superior measures of industrial performance in external markets, with revealed competitiveness as a possible alternative.

Table 13. Comparison of Alternative Export Performance Measures.

Export Performance Measures	Equation 1 Attributes		
	R^2	F-value	Number of Significant Variables
EP	0.84	4.88[a]	7
XMS	0.86	5.69[b]	8
RXA	0.31	0.41	1
RC	0.83	4.30[b]	5

Note: a and b are significant at the 0.95 and 0.99 levels, respectively.

CONCLUDING COMMENTS

It is evident that the performance of U.S. food manufacturing industries in international markets affects the welfare of both the food and agricultural sector and the national economy, as is the relatively poor export performance of these industries vis-a-vis competing industries in other advanced economies. Further, the analysis herein provides compelling evidence that there are important and significant linkages between the structure of the food manufacturing industries, the behavior of firms therein, and the performance of these industries in external markets. By any measure, explanation of at least 80 percent of the variation in export performance within these industries, based on analysis of industrial organization characteristics, is a significant step forward in international market research.

There are, nonetheless, a number of research challenges that surface as a result of this work. First, differences between the industries included in the estimation of equation 1 and the other 22 food processing industries that were added for equation 2 need careful examination. Foreign operations data on the remaining 22 is a starting point. However, it seems likely that there are additional distinctions associated with differences in the coefficients of determination. Identification of such factors should lead to a further improved understanding of industrial organization-external market performance linkages.

Second, a number of industrial organization variables need to be examined in an international context. For example, logic would suggest that down-stream vertical coordination linkages between U.S. food processors and foreign firms would enhance export propensity, as would advertising expenditures for U.S. products in foreign

markets. Likewise, discriminating between research and development activities aimed at external markets from those directed primarily to domestic markets could be instructive.

Thirdly, international sourcing of food processing operations may also be related to industrial organization. This argues for extension of this type of analysis to international trade in farm commodities for further processing.

Also, industrial organization analysis of international market performance should be extended to food processing industries in other countries, and to a broader array of external market performance dimensions. This would contribute greatly to our overall understanding of the applicability of industrial economic analysis to world markets. Finally, much work remains to ascertain policy and strategic implications.

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APPENDIX TABLE 1. FOOD PROCESSING INDUSTRIES INCLUDED IN EQUATION 1

SIC	Industry Description
2011	Meat Packing
2013	Sausages and other prepared meats
2022	Cheese, natural and processed
2026	Fluid milk
2032	Canned specialties
2033	Canned fruits and vegetables
2041	Flour and other mill products
2043	Cereal breakfast foods
2046	Wet corn milling
2048	Prepared feeds
2051	Bread, cake, and related products
2052	Cookies and crackers
2066	Chocolate and cocoa products
2075	Soybean oil mills
2079	Shortening and cooking oils
2082	Malt beverages
2085	Distilled liquor, except brandy
2086	Bottled and canned soft drinks
2087	Flavoring extracts and syrups
2095	Roasted coffee

APPENDIX TABLE 2. ADDITIONAL INDUSTRIES INCLUDED IN EQUATION 2

SIC	Industry Description
2016	Poultry dressing
2017	Poultry and egg processing
2021	Creamery butter
2023	Condensed and evaporated milk
2024	Ice cream and frozen desserts
2034	Dehydrated fruits, vegetables and soups
2035	Pickles, sauces, and salad dressings
2037	Frozen fruits and vegetables
2038	Frozen specialties
2044	Rice milling
2047	Dog, cat, and other pet food
2061	Raw & refined cane and beet sugar
2065	Confectionery products
2074	Cottonseed oil mills
2076	Other vegetable oil mills
2077	Animal and marine fats and oils
2083	Malt
2084	Wines, brandy, and brandy spirits
2091	Canned and cured seafoods
2092	Fresh or frozen packaged fish
2098	Macaroni and spaghetti
2099	Other food preparations

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