FOREIGN TRADE, PROTECTION, AND MULTINATIONAL ACTIVITY IN U.S. FOOD PROCESSING INDUSTRIES

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The analytical framework of international trade and industrial organization is used to review and test some new hypotheses about the effect of foreign trade, protection, and foreign direct investment on domestic profitability of U.S. food processing industries. Though several studies have examined the relationship between market structure and performance in food processing [7, 10], they are based on an implicit assumption that the economy is closed. The extensive multinational expansion of American food processors, documented by Horst [8], and their growing dependence on foreign trade suggest that this assumption has become untenable and that the proper identification of industrial structure must account for these foreign factors.[1]

The purpose of this article is two-fold. First, an analytical framework is presented that incorporates not only the role of import competition and protection, but also the impact of export opportunities and foreign direct investment in the structure-profitability relationship. Second, the impact of these factors on one aspect of U.S. food industry performance, price-cost margins, is tested statistically.

FOREIGN TRADE, FOREIGN DIRECT INVESTMENT, AND INDUSTRY PROFITABILITY

Economic theory states that in long run competitive equilibrium, resources will be allocated efficiently when the prices of all goods equal their marginal cost and producers earn only normal rates of return. Because departures from the competitive norm lead to inefficient allocations of resources and result in some producers earning greater than normal returns, one objective of industrial organization research has been to determine the particular market characteristics that are associated with observed levels of economic profits. Traditionally, this type of analysis has related industry profitability to various dimensions of market structure such as the degree of seller concentration, the growth and elasticity of demand, and the conditions of entry.

If an economy were closed, these variables theoretically would be sufficient to describe the major determinants of interindustry differentials in profitability. In an open economy a more complete specification of the structure-profitability relationship should account for foreign factors, because industries differ with respect to international trade and investment activity. In particular, attention should be given to the impact of actual and potential import competition, the availability of export opportunities, and the extent of foreign direct investment and multinational activity.

The role of actual import competition is straightforward: the presence of foreign suppliers increases the number of competitors in the domestic market. In effect, their presence reduces domestic seller concentration and should result in more competitively determined prices and lower profits for the domestic firms. Modern oligopoly theory suggests, however, that potential competition may produce similar results. That is, the threat of entry and, by extension, the threat of foreign entry may constrain domestic firms to adopt entry-forestalling prices which more closely approximate competitive levels. Esposito and Esposito [6] point out that foreign-based potential entrants, in the absence of tariff and nontariff protection, may more easily overcome barriers to entry than their domestic counterparts. As a result, foreign firms may pose the most "immediate" threat of entry and exert the strongest influence on the pricing decisions of the established domestic firms. To the extent that actual or potential import competition discourages established firms from maintaining prices far above long run average cost, profit rates generally are expected to be lowest in those industries facing the greatest degree of import competition.

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[1]Though dependence on exports and imports varies considerably from industry to industry, the average ratio of exports and imports to value of shipments for the whole food processing sector was, respectively, 6 percent and 7 percent in 1972. Moreover, in the 1967-1972 period the export share increased by about 13 percent and the import share registered a 25 percent increase.

Though it has been recognized [6, 12, 13] that import competition could influence pricing decisions by firms in domestic markets, recent theoretical work suggests that exporting opportunities also may have a significant role. The theoretical relationship between exports and profitability, however, yields conflicting hypotheses. Caves [4] suggests that the existence of export markets may constrain domestic producers to a more competitive pricing behavior. He demonstrates, for example, that in response to export demand a profit-maximizing monopolist, who is unable to price discriminate between foreign and domestic markets, will expand total output and reduce the domestic price. He further argues that this result is equally plausible under conditions of oligopoly, in that the presence of export markets may render sellers less conscious of their mutual interdependence in the domestic market. If reliance upon export markets does have the effect of diluting the market power of firms in domestic markets, exporting would be expected to exert a negative influence on industry profitability.

Several arguments run counter to the foregoing conclusion. In the Caves analysis, for instance, an expansion of exports would cause the domestic price and profits to rise rather than fall if the monopolist were capable of international price discrimination (dumping) and the foreign demand curve were more elastic than the domestic one. Exporting activity might also lead to higher profitability if the export good has international product differentiation, because the product's special appeal on world markets may enable firms to earn rents abroad. Finally, profits may be enhanced if export demand enlarges the size of the market and allows firms to take advantage of greater technical efficiency through increased size of plants.

Another international factor which may influence the profitability of domestic firms is the extent of their foreign investment and multinational activity. Several studies [3, 4, 8] suggest that foreign investment occurs mainly in industries characterized by oligopoly in both the parent and host countries. Typically, "horizontal" investment (i.e., firms producing abroad the same or similar products as those produced in the domestic market) is most prevalent in industries in which product differentiation is present. In contrast, "vertical" investment (i.e., the production abroad of raw materials or other imputs for the production process at home) usually arises in undifferentiated oligopoly.

Although many factors influence the foreign investment decision, it is argued that generally horizontal investment takes place when a firm has a unique rent-earning asset, such as a patented invention, a differentiated product, or specialized managerial expertise in the production and distribution of a product, on which maximum profits can be earned in foreign markets only through foreign production. The establishment of foreign subsidiaries is seen as a strategy providing for growth and the earning of further rents on these unique forms of capital without impairment of rents currently being earned in the domestic market. Industries characterized by extensive horizontal investment, therefore, are those most likely to be able to earn and maintain supranormal profits in the domestic market.

The effects of direct foreign investment of a vertical nature are analogous to those of vertical integration in the domestic market. "Upstream" foreign investment, to produce a necessary input, for example, may allow domestic processing firms to achieve lower input cost by importation of semifinished goods and/or raw materials from foreign subsidiaries. These cost advantages could be extremely important for firms that integrate backward into less developed countries to obtain raw materials which otherwise might not be forthcoming because of shortages in overhead capital or entrepreneurial talent in the host country. Furthermore, if vertical investment abroad provides established firms control over sources of domestically scarce raw materials, then nonintegrated potential entrants face significant cost disadvantages in relation to established firms. Under such circumstances, prices for the processed product can be raised by the established firms without attracting new rivals. All of these factors thus suggest that vertical direct foreign investment would increase industry profitability in the domestic market.

The foregoing arguments imply that profit margins are influenced by international factors in addition to the more traditional domestic structure variables. The following profit equation is suggested.

$$PMG_i = f(Z_i, MN_i, X_i, FC_i)$$

where PMG is an indicator of profitability for industry i, Z is a vector of domestic structure variables, MN is an index of the extent of multinational involvement, X is a measure of export activity, and FC is an indicator of the degree of foreign competition. The analysis predicts a positive sign for the multinational variable, a negative sign for the foreign competition variable, and an indeterminate sign for the export variable.

DESCRIPTION OF VARIABLES AND DATA

In this section the framework is presented for analyzing the nature of the structure-profitability relationship when account is made for the influence of international trade and multinational activity. The industry sample consists of 47 U.S. food processing industries defined by the Census at the four-digit level of aggregration for the year 1972. Each variable included in the model is discussed briefly and a more complete description of their sources and construction is provided in the appendix.

The dependent variable used in the estimated equation to represent profitability is the price-cost margin, defined as the gross return (before taxes) expressed as a percentage of industry value added. This variable measures the percentage markup over direct cost. The margin on value added is used in preference to the more frequently used margin on sales because it is less sensitive to differences in both the degree of vertical integration and the stage in the production process of the sample industries.

The independent variables in the profit equation reflect both elements of domestic market structure and international influences. Traditionally elements of domestic market structure include the degree of seller construction, the growth and elasticity of demand, and the conditions of entry. As the theoretical rationale for the use of these variables is widely covered in the literature, only brief justification for their inclusion in the model is given here.

Oligopoly theory suggests that the ability of firms to collude (tacitly or overtly) to maintain prices above long run average cost of production is greater in industries in which few sellers dominate the market. The four-firm seller concentration ratio (CR) thus is included in the model with the expectation that it exerts a positive influence on profit margins.

An implicit assumption underlying the published concentration ratios is that markets are national in scope. A number of food processing industries, however, are more properly classified as regional or local. To adjust for the geographic dimension of industries in the sample, a dummy variable (RD) is included to distinguish regional and local markets. This variable is constructed to take a value of one if the industry is regional or local and a value of zero otherwise. Because the national concentration figures tend to understate the degree of concentration in local markets, the dummy variable is expected to be related positively to profitability.

Two market characteristics, price elasticity of demand (EL) and growth rate in demand (GVA), also are included in the profit equation. The familiar rules for profit maximization require that profit margins be set in an inverse relationship to elasticity of demand. Thus, lower absolute values of demand elasticity (i.e., more inelastic demand) should result in higher margins. Unfortunately, estimates of demand elasticities for the sample of industries were not available. It was necessary therefore to make independent estimates for this variable. The procedures and data used to obtain these estimates are described in the appendix. The absolute values of the elasticity coefficients obtained from the estimated industry demand equations are included in the profit equation with the expectation they are inversely related to margins.

The second market characteristic, growth in demand, is expected to influence margins in a positive direction. When an industry undergoes great growth in demand (particularly when it is unexpected), demand pressure should lead to higher prices resulting in firms securing higher profits. In contrast, when growth is slow or declining (especially in industries in which fixed costs are high), firms may find it necessary to squeeze margins to maintain adequate levels of sales. Furthermore, slow growth may reduce profitability by leading to breakdowns in price agreements among oligopoly firms. To estimate the growth in demand, the percentage change in nominal value added during the 1967-1972 time period for each industry is included in the model.

A final element of domestic structure is the height of barriers to entry. A potentially important barrier to entry in food processing industries is the degree of product differentiation. Though product differentiation is difficult to quantify, Bain [1] suggests that the most important source of differentiation is advertising. Thus the advertising to sales ratio (AD/S) for each industry is included to account for potential entry barriers arising from product differentiation. To the extent advertising raises barriers, profitability is expected to be related positively to the advertising variable.

In addition to the domestic structure variables, variables to account for the influence of international trade and investment on profitability are included in the model. Theoretically, the degree of potential import competition would be measured best by the elasticity of foreign supply with respect to the domestic price. Unfortunately, such data are not available. Thus, a number of alternative proxies are used to capture the effect of import competition. The first is the ratio of imports to domestic value of shipments (M/S). The higher the import share, the greater is the degree of actual import competition. Because this variable is

measured *ex post*, it may fail to capture the effects of potential import competition on the pricing decisions of domestic firms. For this reason two alternative proxies, nominal tariff rates (NTAR) and effective tariff rates (EFTAR), are also utilized. Because tariffs constitute barriers to entry only to foreign producers, the greater the rate of tariff, the higher domestic prices and profits can be without inducing foreign entry.

The reliance of an industry on export markets is also expected to influence profits, although no unambigious relationship can be derived. To measure the degree to which industries rely on foreign rather than domestic markets for sales, the ratio of the industry's exports to domestic value of shipments (X/S) is included in the equation.

The last variable in the equation measures the degree of multinational activity of each industry (MN). The measure used, was developed by Bruck and Lees [2], estimates the percentage foreign component of total economic activity for the largest firms within each industry. On the basis of the arguments presented in the preceding section, profitability is expected to be related positively to the degree of foreign investment.

EMPIRICAL RESULTS

The results of the multiple regression equations relating price-cost margins to various domestic and foreign structural variables are shown in Table 1. Because the various structural variables are expected to interact in influencing profitability, the model is specified in a long linear fashion. Equation 1 contains only domestic structure variables as independent variables, whereas equations 2 through 4 contain additional variables that represent alternative formulations of the international factors.

Inspection of Table 1 indicates that, regardless of model specification, the signs on the coefficients for the domestic structure variables conform to theoretical expectation. Price-cost margins are related positively to concentration, and the coefficient for this variable is significant at the 1 percent level. Likewise, the coefficients for the advertising intensity and elasticity of demand variables have the expected positive and negative signs, respectively, and both variables are significant at the 5 percent level or better. Finally, although the coefficients for the growth in demand and regional dummy variables have the expected positive sign, neither is significant in any formulation of the model.

Though the preceding results confirm the importance of traditional domestic structural variables in affecting industry profitability, the results obtained for the international trade and investment variables are of greater interest. The regression coefficients for the multinational variable, for example, are positive as expected and significant in all cases at the 10 percent level of better. These results thus conform to those of Horst [8] and suggest that multinational expansion has augmented the market power and profits of U.S. food processing firms.

TABLE 1. REGRESSION EQUATIONS RELATING PRICE-COST MARGINS (LOG) TO DOMESTIC AND FOREIGN STRUCTURE VARIABLES, 1972

Equation Number	Intercept	Domestic Market Structure					Foreign Variables					R^2	F-tests F (3,38)
		LnCR	LnGVA	RD	LnAD/S	LnEL	LnMN	LnX/S	LnM/S	LnNTAR	LnEFTAR		
(I.1)	3.38[a] (6.85)	.167[a] (3.71)	.050 (.595)	-.047 (1.04)	.045[a] (3.29)	-.029[b] (2.01)						.643	
(I.2)	3.03[a] (6.27)	.186[a] (4.28)	.083 (1.03)	.019 (.389)	.044[a] (3.04)	-.031[b] (2.31)	.042[c] (1.44)	.019[b] (2.14)	-.006 (.845)			.712	3.04[b]
(I.3)	3.03[a] (6.44)	.182[a] (4.26)	.066 (.843)	.042 (.847)	.044[a] (3.08)	-.029[b] (2.16)	.045[c] (1.57)	.018[b] (1.96)		.029[c] (1.45)		.722	3.61[b]
(I.4)	3.06[a] (6.52)	.174[a] (4.02)	.063 (.804)	.024 (.505)	.048[a] (3.34)	-.029[b] (2.15)	.047[c] (1.63)	.016[b] (1.82)			.021[c] (1.43)	.721	3.58[b]

The significance of the coefficients was tested using a one-tail t test.

a indicates that the coefficient is significant at the 1% level, while b and c indicate significance at the 5% and 10% level, respectively.

The independent variables are:

CR = 4-firm concentration ratio
GVA = percentage growth of value added from 1967 to 1972
RD = a regional industry dummy
AD/S = the advertising to sales ratio
EL = price elasticity of demand
MN = index of multinational activity
X/S = exports as a percent of value of shipments
M/S = imports as a percent of value of shipments
NTAR = nominal tariff rate
EFTAR = effective tariff rate

The coefficient for the import share variable has a negative sign as expected, but is not statistically significant. Contrary to results obtained in other studies of U.S. manufacturing industries [6, 12], this result suggests that actual import competition has had little impact on the profitability of U.S. food processing firms. The differing results found here probably reflect some special aspects of the U.S. food processing sector. Many industries within the sector, for instance, are highly protected by tariffs, quotas, and government inspection standards [20]. Thus, actual import competition is ineffectual in influencing domestic profits. This conclusion is supported by the reported results for the equations using nominal tariffs and effective tariffs as proxies for barriers to foreign competitors. Both formulations of the tariff variable show the expected positive sign and are significant at the 10 percent level. Protection from actual import competition apparently has allowed U.S. food processing firms to maintain profit margins in excess of those obtainable if the sector were more open to foreign producers.

Finally the coefficient on the export share variable is positive and significant at the 5 percent level. Whether this finding reflects the effects of increased technical efficiency due to a widening of markets, rents earned on differentiated products, or price discrimination unfortunately cannot be determined with the data available.

A final test was undertaken to evaluate the overall contribution of foreign factors in affecting industry profitability. The error sum of squares was computed for a restricted form of the model which included only the domestic variables and for the various unrestricted forms of the model which included the foreign variables. The overall significance of the foreign factors was then determined by an F-test for the reduction in error sum of squares between the restricted and unrestricted regression models.[2] The F-statistics obtained are shown in Table 1; all are significant at the 5 percent level. Thus, international factors constitute an important addition to domestic structural variables in determining price-cost margins in U.S. food processing industries.

CONCLUSIONS

Several hypotheses are reviewed and tested for the role of international trade and investment activity in influencing domestic profitability in U.S. food processing industries. The empirical results obtained suggest that the inclusion of variables depicting the international involvement of the industries of the sample is a fruitful addition to conventional structure variables in explaining interindustry differentials in price-cost margins.

In particular, industries which have expanded across national boundaries through horizontal or vertical direct investment have significantly higher domestic price-cost margins than industries oriented toward the domestic market. Thus, as hypothesized, multinational investment does appear to maintain and augment the market power of domestic firms. The export intensity of industries also is found to be related positively to profitability. This finding is consistent with the hypotheses that U.S. food processing industries export internationally product differentiated goods, or are benefiting from international price discrimination.

Finally, import competition, measured by the actual share of the market accounted for by imports, appears to have no significant influence on industry profitability. However, barriers to foreign entrants, measured by the height of tariffs, are significantly and positively related to industry profits. Because tariffs and other government imposed impediments to trade support domestic oligopoly structures by limiting sources of potential competition, the analysis generally supports a policy of openness toward entry via international trade for the purpose of promoting effective competition in U.S. food processing industries.

APPENDIX

DATA CONSTRUCTION AND SOURCES

The price-cost margin (PMC) is estimated on the basis of Census data [16] as follows.

$$PMC = \frac{\text{Value Added} - \text{Payroll} - \text{Rentals}}{\text{Value Added}}$$

Value added is obtained by the Census by subtracting the total cost of materials (including supplies, fuel, electricity, cost of resales, and miscellaneous receipts) from value of shipments. Subtracting payroll and expenditures for rentals of equipment and machinery from value added yields a figure which approximates profits before taxes plus interest.

[2]The F-statistic is calculated as follows.

$$F_{(m,n-k)} = [(ESSr - ESSu)/m] / [ESSu/(n-k)]$$

where ESSr and ESSu are the sums of squared residuals in the restricted and unrestricted equations, respectively, m is the number of additional parameters estimated in the unrestricted equations, n is the sample size, and k is the number of estimated parameters.

The measure of seller concentration used in the analysis is the four-firm concentration ratio (CR) published by the Census [16].

The regional dummy (RD) is constructed to take the value of one if the industry is regional or local and a value of zero otherwise. The distinction between local and national markets for the industry sample was obtained from Siegfried and Grawe [15]. Their determination of whether an industry is local or not was made on the basis of the geographic dispersion of industry employment in the United States.

The growth in demand variable (GVA) is measured as the percentage change in nominal value added during the 1967-1972 period. Data for this variable were obtained from the Census [16].

The advertising intensity variable (AD/S) is the advertising to sales ratio obtained from Ornstein [11].

The variable denoting price elasticity of demand (EL) was obtained from regression estimates of demand equations for the industries in the sample. For each industry category a consumer demand equation was estimated using annual data for the 1952-1975 period. The only exception were the chewing gum (1957-1975) and soft drink (1960-1975) industries where only a smaller sample was available. The general equation estimated is

$$Q^i = a_0 + a_1 p^i + a_2 Y$$

where

Q^i = an index of per capita consumption of goods in industry i (1967=100)

p^i = an index of retail prices for goods in industry i deflated by the retail food price index (1967=100)

Y = an index of disposable personal income per capita deflated by the implicit GNP deflator (1967=100).

The estimated value of the price elasticity of demand is calculated as $EL^i = \hat{a}_1 (\bar{p}^i / \bar{Q}^i)$, where $\bar{p}^i$ and $\bar{Q}^i$ are the mean values of the two variables. Data for the variables were obtained from various U.S. Department of Agriculture [18] and U.S. Department of Labor [19] publications.

The ratio of exports to domestic value of shipments (X/S) and the ratio of imports to domestic value of shipments (M/S) are computed from Census data [17].

To represent the extent of multinational activity (MN) by U.S. food processing industries, a measure developed by Bruck and Lees [2] is used. Their measure of multinational activity is the percentage foreign component of total economic activity for the largest firms within each industry on the basis of data for *Fortune's* 500 largest U.S. corporations. Total economic activity for an industry is measured by either one or a combination of the following factors: sales, earnings, employment, or production abroad.

Nominal tariffs (NTAR) and effective tariffs (EFTAR) are included to represent barriers to entry faced by foreign producers. Nominal tariffs were obtained from Census data [17] and the Committee for Economic Development [5]. Effective tariffs, defined as the difference between protected value added per unit of output and unprotected value added, expressed as a percentage of unprotected value added, were obtained from results published by Wipf [20].

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