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Trade and Foreign Direct Investment Management Strategies for U.S. Processed Food Firms in China☆

ABSTRACT: This research examines the relationship between U.S. foreign direct investment (FDI) and exports of processed foods to China and identifies management strategies to enhance U.S. competitiveness. Two-stage least-squares empirical econometric results from a simultaneous equation system indicate that there exists a strong complementary relationship between U.S. exports and FDI into China. Therefore, the appropriate managerial strategy to access Chinese processed foods markets is to increase overall business activity, both FDI and exports into China.

INTRODUCTION

Trade and foreign direct investment (FDI) are the principal strategies for firms to access foreign markets. As the world becomes increasingly interdependent through international trade and investment flows, the linkages between these two strategies become increasingly important. Processed foods are the fastest growing market for U.S. agricultural exports, and Asian markets are the region where

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exports have grown fastest. Additionally, foreign affiliate sales, which stem from U.S. FDI, have grown faster than exports (U.S. Dept. of Agriculture, Economic Research Service [USDA-ERS], 1997). A key question regarding U.S. competitiveness is whether exports and FDI are complements or substitutes; does FDI displace or enhance exports? The overall goal of this research was to model the relationship between U.S. FDI and exports for processed food products into China to determine whether U.S. FDI and exports are substitutes or complements and to identify management strategies for U.S. agro-food firms to enhance competitiveness.

The U.S. is the largest food exporting country in the world, and its multinational agribusinesses also supply the world with much of its FDI in food and kindred products. The total value of global trade in processed food products climbed from $38 billion in 1972 to $256 billion in 1993, an annual growth rate of 9.5%, which has dramatically exceeded trade in bulk agricultural exports (Henderson et al., 1996). East Asia is the most populous region in the world and also among the fastest growing. This research focused specifically on U.S. exports and FDI with China, where for example, real gross domestic product (GDP) growth in China exceeded 10% for most of the last decade. As incomes rise, the demand for more and higher quality food also rises.

U.S. Trade in Processed Foods and Bulk Commodities

As described by Henderson et al. (1996), international trade in processed foods has been the most rapidly growing portion of world food and agricultural trade during the past decade. Processed food's share of global agricultural trade rose from 58% in 1972 to 67% in 1993, making up two thirds of the $381 billion global trade in agricultural products and commodities. The U.S. is a key player on the world market for processed food trade, with a global market share of 10%.

These global trends mirror developments in U.S. trade, where U.S. exports of processed foods, which are also referred to as high-value products, now outpace bulk commodity exports (USDA-ERS, 1997). Historically, bulk commodities accounted for the majority of U.S. agricultural exports. In 1991, U.S. processed foods surpassed bulk goods in export value. The United States Department of Agriculture (USDA-ERS, 1997) identified this export growth in processed products stemming from a response to growing demand in East Asia and North America, where incomes are increasing; diets are diversifying; and, in the case of some East Asian markets, production capacity is very constrained. Additionally, USDA trade forecasts indicate that

> the composition of trade will continue to shift toward high value products. HVP [high-value products] exports are expected to increase about 6% a year between 1996 and 2005, while bulk commodity exports are expected to increase slightly more than 3% a year. (USDA-ERS, 1997; Fig. 1).
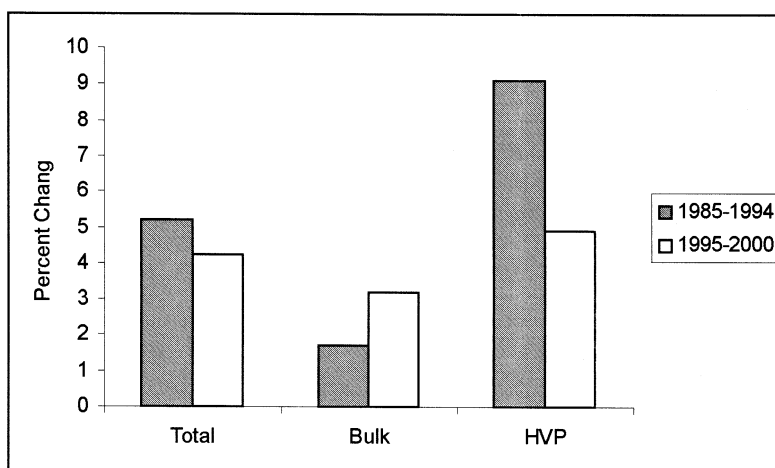
Figure 1. Projected export growth rates for agricultural products: total agricultural exports, bulk, and high value products (HVP) (Source: USDA-ERS, 1997).

Thus, high-value processed food products are the growth market for U.S. exports, and this study focused on them.

Relationship Between U.S. Agricultural Exports and FDI

As described above, international trade in processed foods has been the most rapidly growing portion of U.S. food and agricultural trade during the past decade. Even more significant are sales from foreign affiliates of U.S. food manufacturing firms, where sales are the direct result from U.S. FDI in other countries. Henderson et al. (1996) observed that foreign affiliate sales have long exceeded the value of U.S. exports, but since 1985, this gap has widened. In 1996, sales from foreign affiliates reached $121 billion, nearly four times larger than U.S. exports of $34 billion (USDA-Foreign Agricultural Trade of the United States [FATUS]; U.S. Dept. of Commerce; Fig. 2). Thus, FDI sales of processed foods is larger and has grown faster than U.S. agricultural exports.

Potential Growth Market for the United States

China is the most populated country in the world and its real GDP growth has exceeded 10% for much of the last decade. U.S. exports to China, including Hong Kong, more than doubled, from $1.4 billion in 1992 to $3.7 billion in 1997 (USDA *Agricultural Fact Book*). As Chinese incomes rise, the demand for more and higher quality food also rises. As food production has expanded in China, the country has sought foreign investment to improve its agricultural production capacity and food processing productivity. China encourages FDI, and in the past
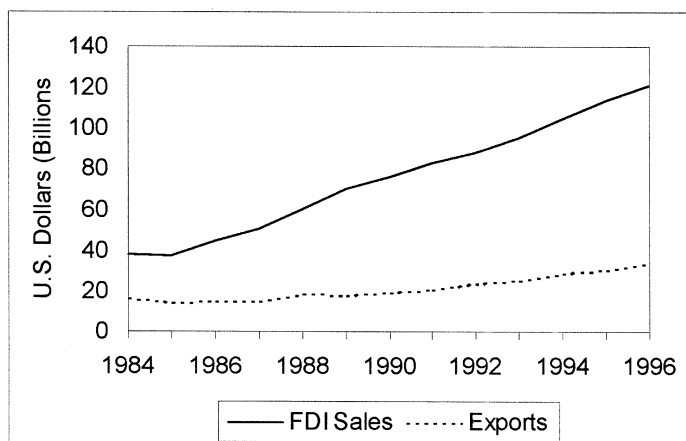
Figure 2.   U.S. foreign affiliate sales (FDI sales) and exports of processed
food products (Source: USDA-FATUS and U.S. Dept. of Commerce).

has discouraged imports to help its food processing industry. Desired membership
in the World Trade Organization may discourage this. Furthermore, at present
China is a net exporter of food.

In regard to the trade with the U.S., China is a net importer of U.S. agricultural
products. For processed foods, both U.S. exports and FDI into China have
increased. For example, the U.S. exported approximately $50 million of processed
foods to China in 1982, whereas U.S. FDI in China was virtually nonexistent
(USDA-FATUS; U.S. Department of Commerce). However, since then, U.S.
exports and FDI of processed foods to China have continually increased. In 1997,
U.S. exports of processed foods to China were about $400 million, representing
an eightfold increase from the 1982 level, and U.S. FDI of processed foods in
China reached $200 million.

RELATED LITERATURE

Trade and FDI theories have evolved through several stages. Theoretical models
for FDI and trade originated from the neoclassical Heckscher-Ohlin-Samuelson,
and Mundell models (Kojima, 1975; Varian, 1992). These models examine free
trade and the FDI process between two countries, assuming that they have unequal
resources or factor endowments, the same production technology, face perfect
competition and free trade, and produce identical or homogeneous products.

Trade and FDI theory of processed foods currently focuses on industrial
organization theory, such as imperfect competition, economies of scale, and
product differentiation. This theory of trade and FDI is a collection of theories
regarding ownership, location, and internalization, which were originally intro-

duced by Dunning in 1981. The theories most relevant to this research are the location advantage and internalization theories. Location advantage of FDI is determined by the potential size of the host market, access to consumers, and market structures. Internalization theory explains why multinational enterprises establish foreign production by using the FDI mode in contrast to exporting or licensing their products abroad without capital movements.

Exports versus FDI

In the above traditional models, the FDI process is treated as an international capital transfer between two countries. These neoclassical theories concluded that as international factors become mobile, differences in countries' factor endowments become smaller and trade flows between countries decline. In this context, trade exports will eventually be displaced by FDI. Thus, exports and FDI are viewed as substitutes (Dunning and Rugman, 1985; Gopinath et al., 1997).

Hymer (1976) argued that multinational enterprises have become institutions that transfer intangible assets, such as knowledge, technology, and brand names, into markets in other countries. As these intangible assets flow into another country, they attract movement on factors of production, which increase trade flows. In this case, FDI and trade have a complementary relationship, where both trade and FDI increase.

Empirical studies of the relationship between exports and FDI in the food processing industry have mixed results. Overend et al. (1997) found evidence equally divided among complement, substitute, and neutral relationships between trade and FDI. Connor (1983) and Pagoulatos (1983) concluded that the effect of FDI on exports depends on the mode of FDI entry. Acquisition of an existing firm and horizontal FDI are considered substitutes for exports because they are driven by competitive advantages of the home country (Kojima, 1975). Alternatively, greenfield investment, where the parent company builds a new facility in the host country, and vertically integrated FDI are considered complementary market access strategies with exports (Kojima, 1975; Graham, 1996).

Malanoski et al. (1997) concluded that FDI and exports were negatively correlated among developed countries (i.e., Organization for Economic Cooperation and Development countries). They found that the relationship between FDI and exports from developed countries to developing countries was positively correlated, especially in the Asian-Pacific region, indicating that FDI and exports are complements. Gopinath et al. (1997) confirmed this result. In particular, by using a sample of developed countries as host countries, they found that U.S. FDI was a substitute for exports from the home country.

Munirathinam et al. (1997, 1998) found that the Canada-United States Trade Agreement (CUSTA) stimulated both U.S. exports and FDI in Canadian food industries by $2.3 billion and $1.06 billion per year, respectively, since CUSTA's

enactment in 1989. This complementary relationship, we believe, is due to the effects of CUSTA, not the evolution of the food market. Econometric results indicated synergistic, complementary effects between export and FDI strategies used by food processing firms in both the U.S. and Canada.

According to Handy and Henderson (1994), most large food manufacturers rely more heavily on foreign investment than on exports as their major strategy to access foreign markets. Sales from U.S. foreign affiliates are 9–10 times larger than exports from their U.S. parent firms. This highlights the importance of using both trade and foreign affiliate sales data in assessing the international competitiveness of food manufacturing firms.

Determinants of Exports and FDI

Export determinants are based on net demand factors of the importing country. For example, Davison and Arnade (1987) investigated the demand for U.S. corn and soybean exports by the rest of the world. In their model, they tried to explain the variation in exports by using exchange rates, the U.S. export price, the importing country's GDP as an income variable, and the importing country's domestic production and price. Ruppel (1997) analyzed the determinants of U.S. exports of processed foods on 50 countries during 1989 to 1995. Real per capita GDP, real per capita reserves, and the real exchange rate were consistently inelastic, while price was elastic for European and Pacific Rim countries. Oscar and Simon (1994) and Ning and Reed (1995) investigated the determinants of FDI. In both studies the authors tried to explain the variation in FDI with GDP of the foreign country, real effective exchange rates, an index of labor costs, and interest rate differentials between the host and foreign country.

Previous studies of the relationship between exports and FDI have had mixed empirical results. For the purpose of this study, the relationship of FDI and exports between developed and developing countries is considered to be the most relevant. Thus, Malanoski et al.'s (1997) conclusion that FDI and exports are complementary between developed and developing countries is critical to our study. Given China's current objective to join the World Trade Organization, the impact of trade liberalization on FDI and exports is also relevant to this study. Thus, Munirathinam et al.'s (1997) conclusions that trade liberalization has a positive impact on both FDI and exports is noted.

MODEL DEVELOPMENT

A system of simultaneous equations is used to model export and FDI strategies employed by U.S. agro-food firms for the Chinese processed food market. Based on the empirical findings in the literature review, the stylized theoretical econometric system of equations is given by

$$EXPORTS_t = f(ER_t, GDP_t, XPRICE_t, FDI_t) + \epsilon_{1t} \tag{1}$$

$$FDI_t = g(ER_t, GDP_t, IR_t, EXPORTS_t) + \epsilon_{2t} \tag{2}$$

where t represents years; EXPORTS are U.S. exports of processed foods to China; FDI is the U.S. foreign direct investment in the Chinese food processing industry; ER is the exchange rate measured in Chinese Yuan per dollar; GDP is the gross domestic product for China; XPRICE is the price of U.S. exports to China; IR is the U.S. lending interest rate; and ϵ_{1t} and ϵ_{2t} are stochastic errors. The functions f and g presume linearity in the parameter estimates on the explanatory variables.

A priori, ER is expected to be inversely related to EXPORTS and directly related to FDI. Intuitively, this suggests that an appreciation in the U.S. dollar relative to the Chinese Yuan makes U.S. exports more expensive to Chinese importers, hence lowering U.S. exports to China and, thus, making FDI a more attractive alternative. GDP is a proxy for Chinese income and it is expected to be directly related to both EXPORTS and FDI. Hence higher incomes are expected to lead to higher consumption of processed U.S. food products regardless of distribution channel. XPRICE is expected to be inversely related to EXPORTS, indicating a downward sloping demand curve for exports. IR is expected to be inversely related to FDI because a higher U.S. interest rate increases the debt capital cost for U.S. firms to invest in China. The relationship between FDI and EXPORTS is difficult to predict a priori based on the mixed results in the literature. If there is a direct relationship between the two variables, FDI and EXPORTS are considered complementary, whereas an inverse relationship would indicate a substitute relationship.

DATA DESCRIPTION

The annual data for the period 1982 to 1997 were collected. Data for EXPORTS and XPRICE of processed foods to China were taken from the FATUS calendar year report. Thirteen different categories of processed and consumer-ready foods were analyzed. These included meats and meat products; poultry meats; dairy products; fats, oils, and greases; grains and feeds; fresh fruits; dried, canned, and frozen fruits; fruit juice including frozen; nuts and nut preparations; fresh vegetables; frozen and canned vegetables; pulses (i.e., dried beans, peas, and lentils); and oilseeds and oilseed products.[1] In the FATUS report, the 13 processed food categories are further itemized into subcategories. In general, all items reported by FATUS were used in each category, with the exception of dairy products, and grains and feeds, where nonprocessed food items were dropped. The dairy product category includes evaporated and condensed milk, nonfat dry milk, butter and anhydrous milkfat and cheese, while fluid milk and dried whey were excluded. The grains and feeds category includes wheat flour, rice paddy, and feed

grain products, such as cereals. In this category unmilled wheat and feed grains, which are not processed, were excluded.[2] Export data for each group in terms of quantity (metric tons), value ($1,000), and unit value ($) from FATUS were collected. For the EXPORTS and XPRICE variables, weighted averages of the 13 categories were aggregated by using export shares to China. Furthermore, the unit prices were divided by their 1990 values to calculate an index for the XPRICE variable.

The FDI data were taken from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The FDI variable represents the U.S. direct investment position in China in millions of U.S. dollars. The BEA defines direct investment, an historical cost measure, to be equal to the net book value of U.S. parents' equity in, and net outstanding loan to, their foreign affiliates. A U.S. foreign affiliate is defined to be a business entity in which a U.S. citizen owns at least 10% of the voting stock. Data for the real GDP and IR were obtained from the *International Financial Statistics Yearbooks* of the International Monetary Fund (1998). GDP was measured in billions of Chinese Yuan. IR is the U.S. lending interest rate percentage per annum. The ER data were taken from the USDA-ERS (1997) Web site. It is the end-of-period average market exchange rate of number of Yuan per U.S. dollar. Descriptive statistics of our data are described in Table 1.

EMPIRICAL RESULTS

Because FDI appears as a contemporaneous explanatory variable in Eq. (1) and EXPORTS appears similarly in Eq. (2), the regressor-error independence property is violated, rendering traditional ordinary least-squares estimates biased and inconsistent. In the literature, this knotty econometric problem has been coined "simultaneity bias." Instrumental variable estimation is standard recourse to recover the consistency property and is employed here (Kmenta, 1986). In particular, we estimated the unknown structural parameters in our simultaneous equations system by using the two-stage least-squares (2SLS) routine in the Eviews software package (1995).

The instrument set contains only strictly exogenous variables; ER, GDP, XPRICE, and IR were used to instrument FDI out of Eq. (1) and EXPORTS out of Eq. (2). Diagnostically, there was no reason to include lagged endogenous variables in the instrument set. The system given by Eqs. (1) and (2) is identified with respect to the order and rank conditions of identification. In fact, each equation is exactly identified according to the order condition (e.g., the number of included endogenous variables less one equals the number of excluded exogenous variables); thus there exists a solution to the system. Because Eqs. (1) and (2) do not contain the same instruments as explanatory variables, rank identification is

Table 1. Descriptive Statistics of Continuous Variables in Econometric Model[a]

Variable	Mean	Standard Deviation	Minimum	Maximum
Exports (metric tons)	199,828	138,785	89,039	529,479
FDI (million dollars)	500	641	0	1,849
Exchange rate (Yuan per U.S. Dollar)	4.43	0.92	2.72	6.25
GDP (billion Yuan)	2,047	936	864	3,850
Export price (unit-free index)	0.96	0.10	0.79	1.11
Interest rate (percentage per annum)	9.24	2.22	6.00	14.86

Note [a]Calculations based on 16 years of annual observations from 1982 to 1997.

also satisfied, indicating the solution to the system is unique. If, in the empirical inquiry, those instruments used as explanatory variables are found to be insignificant, the system will still remain identified, and the 2SLS estimates will be a unique and consistent estimate of the structural parameters.

Table 2 summarizes the point estimates of the unknown parameters in the final empirical model. Because all variables were transformed by using a natural logarithm, the parameter estimates have an elasticity interpretation. In the export equation, the parameter estimates for GDP and the exchange rate were found to be insignificant ($p > .10$) and so, were only excluded as explanatory variables from the final structural model. Over the analysis period in the study, this finding implies that, regardless of any temporary unfavorable macroeconomic conditions (i.e., an appreciation of the U.S. dollar against the Yuan), U.S. agro-food firms are committed to exporting to the Chinese market because of its long-run attractive-

Table 2. Point Estimates of Parameters in Trade Model[a]

	Exports	FDI
Intercept	11.64**	−6.41**
	(0.08)[b]	(0.89)
Exports	—	0.61***
		(0.06)
FDI	0.95**	—
	(0.33)	
Export Price	−1.91*	—
	(1.11)	
Interest Rate	—	−0.25*
		(0.14)
Model Diagnostics:		
R^2	0.95	0.93
Durbin-Watson *d*	2.22	2.16
Ljung-Box *Q* (1 year lag)[c]	0.44	0.65
ARCH LM *F*-statistic	0.31	0.01
Jarque-Bera	1.29	0.77

Note [a]All variables are log-transformed so parameter estimates are elasticities.
[b]Standard errors are in parentheses.
[c]The Ljung-Box *Q*-statistics for lags 2 to 10 were also not significant.
*10% significance level, **1% significance level.

ness. The information from these two variables, however, was still used to obtain the 2SLS parameter estimates in the structural model because GDP and the exchange rate were included with the export price and interest rate in the instrument set (Kmenta, 1986). The final empirical model is still properly identified.

The elasticity of export demand was found to be significant ($p < .10$) and, consistent with a priori expectations, negative. Export demand is price elastic; a 1% increase in export price leads to a 1.91% decrease in exports. Thus, by lowering price, exporters can increase total revenue. The parameter estimate on FDI was found to be significant ($p < .01$) and positive, implying a complementary relationship between U.S. FDI and exports to China for processed foods. Thus, a 1% increase in U.S. FDI in China's processed food industry leads to a 0.95% increase in U.S. processed food exports to China. This result is consistent with findings in Malanoski et al. (1997) that a complementary relationship between FDI and exports is expected between developed and developing countries.

The complementary relationship between FDI and exports is further corroborated in the FDI equation [Eq. (2)]. The parameter estimate on exports was found to be significant ($p < .01$) and positive. Hence, a 1% increase in U.S. processed food exports to China leads to a 0.61% increase in U.S. FDI in the Chinese food processing industry. As was the case in the exports equation, the parameter estimates on GDP and the exchange rate were found to be insignificant ($p > .10$) in our FDI equation [Eq. (2)], but information from these variables is still embodied in the 2SLS estimator of the model's structural parameters through the instrument set. Again, U.S. agro-food firms appear to be committed to the Chinese market regardless of any short-term undesirable macroeconomic conditions. The parameter estimate on the interest rate was found to be significant ($p < 0.10$) and, consistent with a priori expectations, negative. In this case, a 1% increase in the interest rate leads to a 0.25% decrease in FDI. Higher debt capital costs lower a project's net present value, and, hence, deter investment.

The model fit the data well: 95% of the variation in exports and 93% of the variation in FDI was explained by our specification. As with any time series model, the issue of autocorrelation is important to address to preserve the sampling properties of the estimator. Both Durbin-Watson d statistics exceeded the upper limit critical value of 1.54 in the bounds test, indicating first-order autocorrelation or serial correlation did not exist at the 5% level. Additionally, to address higher order autocorrelation, we examined the correlogram of the residuals series across the data set and the associated Ljung-Box Q-statistics. The p-values for the Q-statistics well-exceeded the 10% threshold in both equations for 10 lags indicating no autocorrelation exists in the residuals; the residuals were a white noise process as desired. Using a Lagrange Multiplier test, we examined the residuals for an auto-regressive conditional heteroskedastic process. In each equation, we failed to reject the null hypothesis of homoskedasticity, indicating

the residuals were an auto-regressive conditional heteroskedastic-free process. Also, we failed to reject the null hypothesis that the residuals were normally distributed at the 1% level of significance when using the standard Jarque-Bera test statistic. Thus, the empirical residuals from the final structural model maintained the necessary theoretical properties to ensure the integrity of our statistical inferences and hypothesis testing.

SUMMARY AND MANAGEMENT IMPLICATIONS

A simultaneous equation econometric model of U.S. processed foods FDI and exports to China was constructed by using annual data from 1982 to 1997. Exports and FDI were found to be complementary in each equation. This result is consistent with the trade literature for developing countries. As expected a priori, exports were found to be inversely related to export price, and FDI was found to be inversely related to the interest rate.

Market access decisions rely heavily on the export-FDI relationship. Given the complementarity between exports and FDI in this study, the appropriate management strategy for U.S. agro-food firms to access Chinese processed food markets is to increase overall business activity, both FDI and exports to China. A managerial decision to increase FDI in processed foods can help increase exports of processed foods to China and vice versa. However, an increase in the price of exports or an increase in the cost of debt capital make exports and FDI, respectively, less desirable strategies to increase the sales of processed food in China. These empirical results can help managers of U.S. agro-food firms in choosing the right strategy to ensure competitiveness.

NOTES

1. The product coverage for exports and FDI do not completely match. The export categories exclude alcoholic beverages, soft drinks, and fish and seafood products, whereas FDI data includes all food and kindred products, including the above categories.
2. A detailed description of the subcategories may be obtained from us on request.

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