Determinants of Foreign Direct Investment in the Food-Processing Industry: A Comparative Analysis of Developed and Developing Economies

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This paper analyzes the determinants of foreign direct investments by the U.S. food-processing industry in developed and developing countries. We find that market size, per-capita income, and trade openness significantly affect U.S. food-processing firms' decisions to invest abroad, but their influence differs between developed and developing countries. Economic development is positively associated with FDI in developing countries but negatively associated in developed countries. Market size is a major determinant of FDI only in developed economies. Trade openness seems to be important for sales by U.S. foreign affiliates in both developed and developing countries and for exports to developed country markets.

In recent years the global market for processed food has been shifting towards developing countries. While several studies have examined the determinants of the food-processing industry's foreign direct investment (FDI) in developed countries (Gopinath, Pick, and Vasavada 1999; Bolling, Neff, and Handy 1998), little is known about these determinants in developing countries. This study identifies and analyzes the factors that determine the flow of FDI across a broad spectrum of economies with different income levels, macroeconomic policies, and factor prices. In particular we examine the impact of host-country characteristics and macroeconomic forces on the U.S. food-processing industry's FDI in developed and developing countries. We find that market size, per-capita income, and openness to trade significantly affect U.S. food-processing firms' decisions to invest abroad, but their influence differs between developed and developing countries.

World trade in processed food has been growing in response to increasing consumer demand for diversified diets. In a globalized economy, FDI is often necessitated by pressures to reduce transaction costs, access foreign markets, and, in some cases, circumvent trade and transport barriers. Table 1 summarizes the U.S. food-processing industry's FDI and affiliate sales as well as U.S. processed-food exports from 1989 through 2000. U.S. foreign direct investment in processed food increased from $16 billion in 1990 to $37 billion in 2000. Nearly half of the U.S. FDI in food-processing industries has been in the European Union (EU). Even though a large proportion of U.S. processed food FDI is in developed countries, U.S. FDI in the developing and transition economies has been increasing rapidly in recent years. Per-capita income growth and favorable economic conditions in developing countries have certainly contributed to this increase in the demand for processed food. For example, U.S. FDI in Central and South America increased from less than $3 billion in 1990 to $11 billion in 2000, with an annual growth rate of 14 percent. During the same period, U.S. FDI in Asia increased from less than $2 billion to more than $4 billion, with an annual growth rate of 8 percent (Table 1).

Direct sales by U.S. food-processing companies have been not only large relative to exports, but have been growing faster than exports. Recent trends indicate that sales from U.S. foreign direct investment in the processed-food industry increased from $76 billion in 1990 to $138 billion in 2000, with an annual growth rate of 6 percent (Table 1). During the same period, U.S. exports of processed food increased from $19 billion to $30 billion, with an annual growth rate of 5 percent. U.S. foreign affiliate sales in processed food increased rapidly in Central and South America with an annual growth rate of 10 percent between 1989 and 2000. Foreign

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Table 1. U.S. Foreign Direct Investment, Foreign Affiliate Sales, and Exports in Processed Food, 1989–2000.

	Europe			Asia			Central and South America			World		
YEAR	FDI (bil. $)	Sales (bil. $)	Exports (bil. $)	FDI (bil. $)	Sales (bil. $)	Exports (bil. $)	FDI (bil. $)	Sales (bil. $)	Exports (bil. $)	FDI (bil. $)	Sales (bil. $)	Exports (bil. $)
1989	5.59	41.00	3.25	1.77	11.06	7.56	2.37	5.20	1.97	11.89	70.20	17.63
1990	7.83	44.50	3.43	2.10	11.62	7.78	2.99	6.05	1.75	15.57	75.96	18.56
1991	8.02	49.82	3.57	2.64	11.98	8.14	3.54	5.90	2.49	17.15	82.34	19.95
1992	10.44	52.23	4.15	3.22	13.71	9.46	4.08	6.97	2.98	21.14	87.58	22.70
1993	13.00	53.97	3.88	3.31	14.46	9.67	5.60	8.04	3.09	25.86	95.36	23.24
1994	11.43	58.05	3.98	2.98	16.85	11.22	6.05	10.01	3.62	24.89	104.85	26.05
1995	13.78	63.98	4.59	3.08	20.16	13.73	7.22	11.76	3.22	28.90	115.28	29.49
1996	14.35	66.03	4.98	3.21	22.48	13.29	8.79	13.87	3.50	31.02	122.98	30.10
1997	14.69	66.01	4.80	3.70	22.60	12.83	9.15	14.10	4.21	32.77	128.27	30.75
1998	16.34	67.23	4.83	3.42	20.41	11.19	9.88	15.07	5.08	35.30	132.51	29.93
1999	16.09		4.20	3.65		11.58	9.71		4.68	35.15	131.93	29.07
2000	16.79		3.98	4.12		12.64	10.60		4.78	36.84	138.27	30.27
Growth rate (%):	9.99	4.50	1.85	7.66	5.57	4.68	13.63	9.68	8.04	10.28	6.16	4.92

affiliate sales in Asia grew at an annual rate of 6 percent during that period. Since 1995, U.S. exports of processed food have been stagnant at around $30 billion, while U.S. foreign affiliate sales have grown from $115 billion to $138 billion, a net increase of $23 billion (see Table 1).

This recent trend in U.S. food-processing industry FDI raises the question of what drives the rapid growth of FDI in developing countries; perhaps other, more important underlying economic forces need to be explored. At issue is whether the determinants of FDI in the food-processing industry differ between developed- and developing-country markets. Apart from few limited attempts, economics literature has not yet offered detailed analysis of how the economic characteristics and economic policies of host countries affect FDI. The findings of this study provide further insights into the determinants of U.S. FDI in processed foods and may inform food-processing firms of the potential location of growth markets.

Analytical Framework

To analyze the factors that determine the flow of U.S. FDI in the food-processing industry across a broad spectrum of economies with different income levels, we estimate a system of equations that relate U.S. FDI, affiliate sales, and exports to host country characteristics. The econometric framework used in this study is an extension of many related studies in the literature, including Baja-Rubio and Sosvilla-River (1994), Barrel and Pain (1996), Gopinath, Pick, and Vasavada (1999), Fung, Iizaka, and Parker (2002), and Slaughter (2003). These studies, however, are too limited in their coverage of countries to assess the impact of host-country characteristics on FDI. Baja-Rubio and Sosvilla-River (1994) and Fung, Iizaka, and Parker (2002), for example, focus on a single country. Their results therefore do not shed much light on the importance of host-country characteristics and policies on the inflow of FDI. Barrel and Pain (1996), Gopinath, Pick, and Vasavada (1999), and Slaughter (2003), on the other hand, analyze investments by U.S. companies primarily in developed OECD countries. By focusing only on developed countries, these studies fail to identify factors that determine the growth of FDI in developing countries. In this study we analyze a broad spectrum of countries that represent varying economic, political, and institutional conditions.

Our econometric specification, which follows closely the specification of Barrel and Pain (1996) and its extension by Gopinath, Pick and Vasavada (1999), is

$$(1)\quad \mathbf{Y}_{it} = \alpha + \beta\,\mathbf{X}_{it} + \mathbf{e}_{it},\ i = 1, 2, \ldots, N;\ t = 1, 2, \ldots, T,$$

where **Y** is the vector of endogenous variables representing FDI, affiliate sales, and exports; **X,** a matrix of exogenous variables, represents various host-country characteristics; α is the vector of intercept terms and β is the vector of parameters to be estimated; and $\mathbf{e}_{it}$ is the error term. Subscript i represents country index and subscript t denotes time period, N is the number of countries, and T is the length of time series for each country. The host-country characteristics examined include the market size, the stage of economic development, trade openness, exchange rate, prices of exports of processed food products, and costs of labor and capital. The market size of the host country is indicated by the gross domestic product (GDP) in purchasing-power-parity (PPP) adjusted dollars. The stage of economic development is measured by the per-capita income in the host country, also in PPP-dollars. The share of imports in the GDP measures trade openness of the host-country economy. Real effective exchange rate (indexed 1995 = 100) is a measure of the value of currency against a weighted average of several major foreign currencies (International Monetary Fund 2003). The export prices are indicated by unit value of exports. Relative wage rate is measured as a ratio of host-country wage rate to U.S. wage rate. Cost of capital is captured by the real interest rates in the U.S.

Data and Estimation Procedure

Data on U.S. FDI in the food-processing industry (Standard Industrial Classification Category 20—SIC20) are obtained from the U.S. Department of Commerce (1989–2000). Variables include total FDI, U.S. affiliate sales, and wages paid by U.S. affiliates. Data on U.S. exports of processed food—SIC20—are obtained from the U.N. Trade database. Data on various host-country characteristics are obtained from World Development Indicators (WDI) database published by the World Bank (2004) and International Monetary Fund (2003). We analyze panel data from 36 countries for the years 1989 through 2000.

While the use of panel data has the advantage of providing additional insights into country characteristics intertemporally, the error term often exhibits serial correlation, heteroscedasticity, and contemporaneous correlation. However, appropriate data transformations can make the error term serial non-autoregressive and homoscedastic (Kmenta 1986), while the Seemingly Unrelated Regression (SUR) method accounts for the potential contemporaneous correlation problems (Greene 1997). Our preliminary analysis indicates that the data follow a first-order autoregressive AR(1) process and that they are heteroscedastic. Using the estimated autocorrelation coefficient ρ_k, we rewrite Equation (1) as

$$(2)\quad Y^*_{it} = \alpha + \beta X^*_{it} + e^*_{it},$$

where $Y_{itk}^{*} = Y_{itk} - \rho_k Y_{i,t-1,k}$; $X_{itk}^{*} = X_{itk} - \rho_k X_{i,t-1,k}$ and $e_{itk}^{*} = e_{itk} - \rho_k e_{i,t-1,k}$.

To resolve heterscedastic disturbances, we transform the data once again as

$$(3)\quad Y_{it}^{**} = \alpha + \beta X_{it}^{**} + e^{**},$$

where the transformed variables (denoted by two asterisks) are defined as $Y_{itk}^{**} = Y_{itk}^{*}/\sigma_k$; $X_{itk}^{**} = X_{itk}^{*}/\sigma_k$; and $e_{itk}^{**} = e_{itk}^{*}/\sigma_k$. σ_k is obtained from Equation (2) as $\sigma_k^2 = \Sigma(e_{itk} - \bar{e}_{itk})^2 / (T*N-1)$. The disturbance e^{**} is asymptotically non-autoregressive and homoscedastic. See Kmenta (1986) or Baltagi (2001) for more details on the transformation of panel data to correct for autocorrelation and heteroscedasticity.

Contemporaneous correlation refers to cross-equation correlation, where different endogenous variables are affected by some common factor. It is likely that the macroeconomic and other host-country characteristics would affect all four equations to varying degrees, implying the presence of contemporaneous correlation among the error terms. We use the SUR method, which accounts for contemporaneous correlation in the errors across equations. All variables are expressed in the natural logarithmic form for estimation purposes so that the estimated coefficients can provide measures of elasticity.

We separate developed and developing countries based on U.N. criteria for classifying countries based on per-capita income. High-income OECD countries are considered developed countries (per-capita annual income of more than 12,000 PPP-adjusted dollars), while low- and middle-income countries are considered developing countries. Based on these criteria, we have 19 developed and 17 developing countries in our sample. Classification of countries into developed and developing allows us to distinguish statistically how various factors affect U.S. FDI in food processing at different stages of economic development.

Empirical Findings

Table 2 presents the parameter estimates of the system of equations for the developed and developing countries. Each system has three equations. As Table 2 shows, the model fits the data reasonably well for both developed and developing countries. The adjusted-R^2 values are 0.55 and 0.45 for developed and developing countries, respectively. Our econometric analysis shows that the level of U.S. FDI in food processing, foreign affiliate sales, and exports are affected by various country characteristics and their policies, but the importance of economic characteristics and policies appears to vary between developed and developing countries.

Market Size

Market size is one of the most important characteristics of host countries vis-à-vis U.S. FDI in food processing. We would expect larger market size, captured by the host country's PPP-adjusted GDP, to attract greater outside investment. In the case of developed countries, market size is positively related with U.S. FDI in food processing, their foreign affiliate sales, and exports, as we would expect, and are statistically significant (Table 2). Our results show that a one-percent increase in market size in developed countries is associated with a 1.7-percent increase in U.S. FDI in food processing, a 1.1-percent increase in foreign affiliate sales, and a 1.3-percent increase in U.S. exports of processed foods. Market size does not play a significant role in promoting U.S. FDI and exports of processed food products to developing countries, but the size of the market is crucial for affiliate sales of processed foods in developing countries. The estimated coefficient, which is positive and statistically significant, implies that a one-percent increase in GDP across developing countries would increase foreign affiliate sales of the food-processing industry by 0.4 percent.

Table 2. Parameter Estimates of FDI, Affiliate Sales, Affiliate Employment, and Exports.

Developed Countries			System Weighted R-Square:5467			
	FDI [1]		Affiliate Sales [2]		Exports [3]	
Variable	Parameter Estimate	t-value	Parameter Estimate	t-value	Parameter Estimate	t-value
Intercept	-13.311	-2.67	-8.537	-1.81	8.009	1.89
GDP	1.663	7.26	1.070	10.49	1.346	18.30
PC Income	-4.964	-4.79	-1.101	-2.45	0.300	0.93
Openness	0.887	1.96	0.574	2.78	1.066	7.05
Exchange rate	-3.392	-3.34	-1.933	-4.61	0.081	0.27
Wage rate	0.188	0.75	0.007	0.08	-0.036	-0.59
Interest rate	-0.042	-0.06	-0.187	-0.77	0.002	0.01
Export prices	-0.159	-0.24	0.055	0.08	-1.754	-2.40

Developing Countries			System Weighted R-Square:4517			
	FDI [1]		Affiliate Sales [2]		Exports [3]	
Variable	Parameter Estimate	t-value	Parameter Estimate	t-value	Parameter Estimate	t-value
Intercept	1.245	2.01	2.143	4.83	-2.135	-4.23
GDP	0.058	0.43	0.379	5.36	0.014	0.39
PC Income	1.481	3.81	0.868	4.27	-0.055	-1.10
Openness	-0.443	-1.28	0.709	3.95	0.060	0.63
Exchange rate	-0.019	-0.83	0.163	5.98	0.023	1.29
Wage rate	-0.032	-0.19	0.002	0.03	0.073	1.36
Interest rate	-0.278	-0.61	0.095	0.44	0.029	0.63
Export prices	5.820	3.08	0.805	1.86	0.927	3.93

Economic Development

As argued earlier, economic development is a key determinant of U.S. FDI in food-processing industries. For this study, the level of economic development is measured by PPP-adjusted per-capita income. Results presented in Table 2 indicate that per-capita income affects U.S. FDI activities in food processing and foreign affiliate sales differently in developed and developing countries. In the case of developed countries, for example, per-capita income appears to be negatively related to U.S. FDI in food processing and foreign affiliate sales (Table 2). Although aggregate U.S. FDI in developed countries has increased during the past decade, U.S. FDI in food processing remained stagnant during the same period. As high-income developed countries already consume large quantities of processed food, any increase in income may increase demand for special diets such as consumption of fresh and other less-processed foods.

Per-capita income is positively related to U.S. FDI in food processing and foreign affiliate sales in developing countries. A one-percent increase in the per-capita income of developing countries leads to a 1.5-percent increase in U.S. FDI and a 0.9-percent increase in foreign affiliate sales of processed food products. In developing countries, the demand for high-value processed food, typically purchased by higher-income consumers, increases with income (Regmi 2001). Higher per-capita income appears to attract U.S. FDI of food-processing industries in developing countries without regard to market size. As the growth rate of U.S. FDI in the processed-food sector in developed markets remains low, fast-growing developing economies--including

China, India, Malaysia, Indonesia, Brazil, Mexico, Chile, and South Africa--are emerging as potential growth markets for U.S. processed food products. This suggests that the level of economic development of a country could be the key for U.S. FDI presence in food processing in those markets. This is not surprising, as demand for processed food tends to increase with income in developing and transition economies.

Openness to Trade

The trade openness of host countries is a critical policy indicator that influences both FDI and trade. Openness of a country to outside investments and trade is likely to have a positive effect on U.S. FDI in processed food. A country that is more open is often forced to improve institutions and infrastructure and is likely to be less corrupt (Ades and Di Tella 1999). Trade liberalization often includes investment liberalization and increased investment opportunities. Our analysis indicates that openness, measured by share of imports of goods and services in the host country's GDP, is positively associated with FDI, foreign affiliate sales, and exports of processed foods in the case of developed countries. The estimated coefficients are statistically significant in all three equations. In the case of developing countries, however, openness does not seem to be a critical factor either for U.S. FDI or for exports of processed food products in these countries. Openness to trade, however, is important for increasing affiliate sales.

Real Exchange Rates

The exchange rate, which reflects the value of domestic currency relative to foreign currency, is used to control for the effects of broader economic policies on both U.S. FDI and trade. There are several channels through which the real exchange rate may affect direct investment. For example, investment in new assets increases in response to real exchange depreciation. This channel suggests that we should expect a negative coefficient on the real exchange rate in FDI regression (Calderón, Servén, and Loayza 2004). Exchange rates may also affect direct investment through an imperfect capital-markets channel, as discussed in Froot and Stein (1991). Goldberg and Kolstad (1995) show that exchange rate influences both trade and FDI flows, which in part substitute for trade, and that FDI can replace exports when the FDI is induced by the volatility of exchange rates. In this study we analyze the effects of changes in the value of host-country currency on U.S. FDI, affiliate sales, and exports. Our econometric results indicate that the effect of the exchange rate appears to be different between developed and developing countries (Table 2). Our results indicate that exchange rate is negatively related with FDI in both developed and developing countries, but the estimated coefficient is statistically significant only in the developed country equation.

Factor Prices

Our model also allows us to examine whether the factor prices are critical factors in determining the choice of destination country for direct investments. Multinational companies often choose production locations based on labor costs. Our results, however, show that relative wage rates are not critically important for food-processing firms in deciding whether or not to invest in foreign markets.

The U.S. interest rate represents the opportunity cost for U.S. firms of investing in foreign markets. We use commercial bank lending rates in the U.S. in our estimation. These rates are used by commercial banks for meeting the short- and medium-term credit needs of the private sector. As the interest rate rises, the opportunity cost of investing abroad increases for food-processing industries. Our results, presented in Table 2, indicate that the U.S. interest rate is not a significant factor in either developed or developing countries.

Export Prices

In the case of developed countries, as expected, export prices are negatively associated with the exports of processed food. We find that a one-percent increase in export prices is likely to decrease U.S. exports of processed food by 1.8 percent. This suggests a price-sensitive market for processed foods in developed countries. In case of developed countries, surprisingly, export prices are positively related to U.S. exports of processed food to those markets. This is perhaps due to excess demand for processed foods in the fast-growing developing-country markets.

Summary and Implications

This paper analyzes the effects of host-country characteristics on foreign direct investments by the U.S. food-processing industry in developed and developing countries. The most important host-country characteristics attracting U.S. FDI have been market size and per-capita income, but their influence differs between developed and developing countries. In the case of developed countries, large market size has a positive influence; in the case of developing countries, market size is not a major determinant of U.S. FDI in food-processing industries while per-capita income is a very significant factor in attracting FDI. We find the openness of a country is unlikely to have a significant impact on U.S. food-processing firms' decisions to invest abroad. Our results also indicate that relative factor prices are not critical in determining investment in food-processing plants abroad.

The findings of this study are consistent with recent trends in U.S. food industry's direct investments in transition and emerging markets. As the demand for processed food increases in these new markets, some multinational food-processing companies respond by investing directly in processing plants. As countries prosper, consumers change their diets from staples to more-processed and packaged food items. Under favorable circumstances, new opportunities will develop for food processing in emerging markets in Africa, Asia, and South America, where the demand for processed food is growing and costs of production are still relatively low. Fast-growing developing economies, including China, India, Malaysia, Indonesia, Brazil, Mexico, Chile, and South Africa, are emerging as potential growth markets for U.S. processed food products.

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