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An Analysis of Latin American Peanut Trade

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The U.S. export share in the world peanut market has decreased due to heavy competition. In this paper, the Latin American peanut industry is modeled using seemingly unrelated regression (SUR). Based on these estimations, a scenario analysis was conducted. The results show that the Latin American demand is not affected dramatically by either domestic or world price shocks. The effects of price changes on net trade are noticeable. However, the world price does not significantly affect the Latin American peanut supply. The results imply that Latin American peanut farmers are more sensitive to changes in domestic prices than world price changes.

Key Words: agricultural trade, Latin America, peanuts, scenario analysis, SUR

JEL Classifications: Q11, Q17

The United States has strictly controlled its peanut imports since 1933 (Revoredo and Fletcher). As domestic and trade policies are modified, the U.S. peanut industry will likely face increased pressures from the world market. Argentina, Brazil, Mexico, and Nicaragua are four countries that will likely compete for additional shares of the U.S. market. As barriers to trade in the world market are gradually reduced through multilateral and regional trade agreements, it becomes increasingly important to understand the competitiveness of other countries.

For the past several years, U.S. annual peanut imports (shelled) have been over 55,000 metric tons (MT), with Argentina, Brazil, Mexico, and Nicaragua supplying more than 90% of U.S. peanut imports (USDA/ERS). Argentina and Nicaragua are net exporters of peanuts and peanut products, whereas Mexico and Brazil can be considered net importers although they have exported peanuts and peanut products to the United States. Total Latin American peanut production was approximately 780,000 MT in 2000, and the four countries produced roughly 765,000 MT in that year (USDA/FAS, PS&D). Among these countries exporting to the United States, Argentina has supplied over 75% of the U.S. import market. The Latin American peanut industry has, therefore, played an important role in the U.S. peanut import market.

Despite the importance of Latin American exports to the United States, there has been little research on the Latin American peanut industry. The USDA has been the only agency that has monitored this market. There have been several studies analyzing U.S. domestic peanut programs (Rucker and Thurman; Smith and Womack; Borges and Thurman; Skully;

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Borges; Revoredo and Fletcher). From an international perspective, Beghin et al. analyzed agricultural and trade policies affecting markets for peanut products for 13 countries, including Argentina and the United States. Mohanty, Beghin, and Kaus examined the impacts of federal support programs for sugar, peanuts, corn, and wheat on United States and world markets using a multicountry, multicommodity, partial equilibrium world agricultural model.

Given the relative few analyses concerning the Latin American peanut industry, this paper provides information to support public and private decision making related to peanut marketing and trade through the analysis of the Latin American peanut industry, including Argentina, Brazil, Mexico, and Nicaragua. Baseline projections are a major focus of the model, a framework that provides an economic analysis of the Latin American peanut industry. The goal of the analysis is to determine the impact of domestic and world price shocks on the Latin American peanut industry and to provide information on the industry, such as changes in demand, supply, and net trade.

The remainder of the paper is organized as follows. The following sections describe the current situation of the Latin American peanut industry, conceptualize the theoretic framework, and apply the framework to the peanut sectors of the four countries through the use of econometric techniques. The final section summarizes the results and provides several concluding comments and implications regarding the Latin American and U.S. peanut industries.

Latin American Peanut Industry

There is relatively little government intervention in the Latin American peanut industry, with the exception of a 3.5% export tax on Argentine unprocessed peanuts. In Argentina, exports of raw groundnuts were taxed at 3.5% until 2001, whereas exports of processed products were not taxed (Beghin et al.). The Latin American peanut industry has adopted more market-oriented trade reforms, particularly through the formation of regional and bilateral preferential trade agreements over the past two decades (USDA/FAS). Most of the Latin American countries, including Argentina, Brazil, Mexico, and Nicaragua, have protected their domestic agricultural sectors through the use of relatively high tariffs, inspection fees, and various registration systems. However, the liberalization of these economies during the past few years has reduced these duties to relatively low levels. A considerable number of regional trade agreements such as MERCOSUR (Common Market of the Southern Cone), the Andean Pact, the Central America Common Market (CACM), and the Caribbean Common Market (CARICOM; Stout and Ugaz-Pereda), which do not include the United States, have been established in Central and South America. As a result, there has been a reduction of trade barriers within the Latin American peanut industry.

In Argentina, peanut is an important minor oilseed crop. Since 1992, Argentina has sought to stimulate oilseed crop production and exports. Oilseed export taxes were lowered from 6% to 3.5%, whereas meal and oil exports received a 2.5% rebate on the f.o.b. (free on board) value of exports (Beghin et al.). However, there was no change to the existing export tax on unprocessed oilseeds, such as soybeans and sunflower-seed, which remains at 3.5%. As the largest peanut exporter in Latin America, Argentina generally follows an open-market policy for the production and trade of peanuts (USDA/FAS, attaché reports). Traditionally, Argentina ships most of its peanuts to external markets, with only a small percentage used for domestic human and/or animal consumption.

Although active in terms of trade prior to 1980, the Brazilian peanut industry has been inactive with respect to the world market since 1980 (USDA/ERS, PS&D). Peanuts in Brazil have been a minor oilseed crop that the government does not support financially. The main reason is that most of the early growth in the soybean area came at the expense of other crops such as peanuts and rice. As a result, the government has concentrated its agricultural policies on soybeans and related products since the 1980s.

Nicaraguan peanut policy has focused on export development since 1996. The primary market for Nicaraguan peanuts has been Mexico. Nicaraguan peanuts are not considered a major oilseed commodity in terms of production and trade volume. However, its production and trade volume has doubled in recent years. For example, its production increased from 31,000 MT in 1998 to 67,000 MT in 2000 (USDA/FAS, PS&D). The Nicaraguan peanut industry is a rising net exporter given its dramatic export growth since 1996 (USDA/FAS).

The main goal of Nicaraguan peanut policy is to export at least 30,000 MT to the United States. However, this goal has not been successful. Nicaragua exported only 2,700 MT to the United States in 2001. Nevertheless, total Nicaraguan exports have increased to a 3-year average of 30,000 MT in recent years. Of these exports, 53% were shipped to Mexico, 19% to the European Union (EU), 12% to Central American countries, and 16% to other countries, including the United States and Canada, in 2001 (USDA/FAS, attaché reports).

Mexico is largely reliant on imports of major oilseeds, including peanuts. Despite the economic volatility that has recently characterized the Mexican market, imports, exports, and domestic consumption of peanuts have steadily increased over the last several years (USDA/FAS, PS&D). To qualify for importation into the United States as raw peanuts, roasted and blanched peanuts, peanut butter, or peanut paste, peanuts must have Mexico as their source of origin. This rule, in terms of country of origin, also applies for U.S. exports of peanuts and peanut products to Mexico (Mohanty, Beghin, and Kaus).

The United States, Nicaragua, and Argentina will likely continue to be Mexico's main suppliers of peanut. As a result of lower prices, peanut imports from Argentina have become very attractive to Mexican peanut importers. Argentina's crop quality and attractive prices prompted Mexican importers to increase Argentine peanut imports by approximately 33% in 2001.

Conceptual Framework

One approach to modeling the effects of trade liberalization is to build a structural econometric model consisting of behavioral equations to explain the supply and demand decisions in the market, including the behavior of producers, consumers, traders, and state agencies. However, this requires a large model that embodies many over-identifying restrictions drawn from economic theory. These restrictions usually exclude variables from particular equations to motivate a particular economic interpretation from the model (Foschi and Kontoghiorghes; Greene; Harmon, Preckel, and Eales). Of course, it is not necessary to work with large systems because there are methods for estimating individual structural equations embedded within a larger system (Thompson, Sul, and Bohl; Seamon and Kahl). However, estimating liberalization effects in individual equations only provides information on the effects of liberalization on the behavior of the particular agent being modeled. This approach of estimating the effects of market reform on equilibrium prices requires behavioral equations for all market participants at each stage in the system, including production, marketing, and consumption.

An alternative is to specify a reduced-form model to determine equilibrium price levels. Such a model would consist of variables that might be included in behavioral equations drawn from economic theory, but otherwise the model is left relatively unrestricted. Data availability affects what can be feasibly estimated (Judge et al. 1985). In this study, historical price correlations are assumed by including lagged variables. When price correlation exists, it may be more efficient to estimate all equations jointly, rather than to estimate each one separately using least squares. The appropriate joint estimation technique involves seemingly unrelated regression (SUR) estimation. The advantage of this approach is that the minimal restrictions applied to the reduced form provide flexibility that allows the model to be consistent with a wide range of alternative economic structures

(Judge et al. 1988). The econometric model specified in this study is characterized by a combination of a partial adjustment and a price expectation process in both supply and demand, which can be considered as a reduced form.

The model used in the study is composed of supply, demand, trade, and price equations. Individual country submodels include behavioral equations for acreage response, yield, production, consumption, import, export, and price. The yield and acreage response models are estimated for the supply and an identity for production. For demand, per capita consumption, feed use, and crushed consumption are estimated. The trade equations include export and import estimations. In the price equation, the world price is considered to be an exogenous factor that affects the domestic price, assuming a small-country effect. Moreover, the price equation is assumed to be affected by the ratio between total supply and demand, world price, lagged price, and dummy variables.

The model specifications for the study are as follows.

Supply Specification

(1) Yield (*YD*):

$$YD_{it} = f(Trend, AHA_{it}, D_{it}, e_{it}),$$

where *Trend* is the time trend for technology, *AHA* is peanut area harvested, *D* is a dummy variable for unusual weather conditions, and *e* represents an error term.

(2) Acreage Response (*AHA*):

$$AHA_{it} = f(AHA_{it-1}, DPEAP_{it}, YD_{it}, e_{it}),$$

where AHA_{it-1} is lagged area harvested, and *DPEAP* is domestic price.

(3) Import (*IM*):

$$IM_{it} = f(PROD_{it}/TCON_{it}, WPRICE_t/DPEAP_{it}, D_{it}, e_{it}),$$

where *PROD/TCON* is the ratio of production and total consumption, *WPRICE/DPEAP* is the ratio of world price and domestic price, and *D* is a dummy variable for unusual production shortage or surplus.

(4) Production (*PROD*):

$$PROD_{it} = YD_{it} \times AHA_{it}.$$

(5) Total Supply (*TSUP*):

$$TSUP_{it} = PROD_{it} + IM_{it}.$$

Beginning and ending stock equations are not included in the supply model since these four countries do not have official stock policies, and they ship out most of their peanuts to external markets or consume in the domestic markets.

Demand Specification

(6) Per Capita Consumption (*PCON*):

$$PCON_{it} = f(PGDP_{it}, DPEAP_{it}, PCON_{it-1}, e_{it}),$$

where *PGDP* is per capita income and $PCON_{it-1}$ is a lagged per capita consumption.

(7) Edible Nut Consumption (*CON*):

$$CON_{it} = PCON_{it} \times POP_{it},$$

where *POP* is population.

(8) Crush Consumption (*CCON*):

$$CCON_{it} = f(DPEAP_{it}, PROD_{it}, EXP_{it}, e_{it}),$$

where *EXP* is export.

(9) Export (*EXP*):

$$EXP_{it} = f(WPRICE_t, PROD_{it}, CON_{it}, e_{it}),$$

where *WPRICE* represents world price.

(10) Feed (*FEED*):

$$FEED_{it} = f(PROD_{it}, EXP_{it}, FEED_{it-1}, e_{it}),$$

where $FEED_{it-1}$ is a lagged feed use.

(11) Total Consumption (*TCON*):

$$TCON_{it} = CON_{it} + CCON_{it} + EXP_{it} + FEED_{it} + Residual.$$

(12) Equilibrium Condition:

$$TSUP_{it} - TCON_{it} = 0.$$

Price Equation

(13) Domestic Price (*DPEAP*):

$$DPEAP_{it} = f(TSUP_{it}/TCON_{it}, WPRICE_t, DPEAP_{i,t-1}, e_{it})$$

where $i = A, B, M, N$ for Argentina, Brazil, Mexico, and Nicaragua, respectively, and e_{it} are the error terms. All of the prices and income variables are deflated using the consumer price index (CPI), and the CPI is omitted in the empirical results for simplicity. In addition, the linear functional form is applied for the analysis except for the per capita consumption, which is a double log function, because it is easier to obtain the elasticities.

For the Latin American peanut industries, the SUR estimation method is used. However, because autocorrelation was detected in the initial analysis, we adopted the Prais-Winsten transformation method to correct the problem.

Historical production and consumption data for the Latin American peanut industry is collected from the Foreign Agricultural Service, U.S. Department of Agriculture (USDA/FAS). However, USDA/FAS does not provide 30-year annual data for Nicaragua. Therefore, the Nicaraguan data are obtained from USDA/FAS attaché reports and Nicaraguan export agencies. In addition, demographic data for those countries are collected from the World Bank, International Monetary Fund (IMF), and the central banks of Latin American countries. The data used for the research are annual time series data for 1972–2000.

Empirical Results

The results of the estimation show the anticipated signs as implied by economic theory (Table 1) for all explanatory variables, with the exception of the yield variable in the Mexican acreage response equation. In addition, income in the Argentine per capita consumption equation is negative. This may occur because peanuts are either an inferior good or because peanuts are not grown for domestic consumption as they are in the United States. The prices received by peanut farmers in acreage response equations have a positive impact and are all statistically significant at the 5% level. Also, the soybean price has a negative impact on Brazilian area harvested and is statistically significant. The coefficient estimates (0.889) of the lagged dependent variables show a stable geometric lag process and support the existence of a lagged distribution of the dependent variables. The results for supply, demand, and prices are summarized in Tables 2, 3, and 4, respectively.

In the yield equations for all countries, with the exception of Argentina, the time trend variable used as a proxy for the technology is a significant factor affecting yield. One-year lagged area has a significant influence on yield for Argentina and Nicaragua. The variable is not statistically significant for Mexican yield. A dummy variable is used for Nicaraguan yield to explain unusual weather and other conditions for the years of 1984 and 1985 (Table 2).

For the importing countries, such as Mexico and Brazil, the significant factors influencing their imports are production and consumption variables. If production shortage (surplus) occurs, the countries' imports increase (decrease). These variables are statistically significant at the 5% level. In addition, the world peanut price (price ratio of world price to domestic price) has a negative effect on peanut imports for Brazil and Mexico. It is statistically significant at the 10% level for both countries.

The per capita consumption equation is hypothesized to be influenced by real prices, income levels, habit formation, and other exogenous variables. The habit formation variable seems to be a dominant factor affecting human consumption in these countries. The variable is statistically significant at the 5% level with expected signs for all countries (Table 3).

In the export equations for Argentina, Brazil, and Nicaragua, the world price has a positive impact on the countries' exports. However, it is not statistically significant for Brazil. For other types of consumption, such as crush consumption for Argentina and feed consumption for Brazil, Mexico, and Nicaragua, the production variable has a positive impact. However, the export variable has a negative impact on feed use and crushed peanut consumption.

For the price equations, it is assumed that the price is affected by changes in production

Table 1. Variables and the Anticipated Signs

Equations	Variables	Anticipated Sign
Yield (*YD*)		
Technology	*Trend*	Positive
Area harvested	*AHA*	Negative
Acreage response (*AHA*)		
Lagged area harvested	AHA_{t-1}	Positive
Domestic peanut price	*DPEAP*	Negative
Yield	*YD*	Negative
Import (*IM*)		
Ratio of production to consumption	*PROD/TCON*	Negative
Ratio of world price to domestic price	*WPRICE/DPEAP*	Negative
Per capita consumption (*PCON*)		
Per capita income	*PGDP*	Positive
Domestic peanut price	*DPEAP*	Negative
Lagged per capita consumption	$PCON_{t-1}$	Positive
Crush consumption (*CCON*)		
Domestic peanut price	*DPEAP*	Negative
Production	*PROD*	Positive
Exports	*EXP*	Negative
Export (*EXP*)		
World peanut price	*WPRICE*	Positive
Ratio of production to consumption	*PROD/CON*	Positive
Feed use (*FEED*)		
Production	*PROD*	Positive
Exports	*EXP*	Negative
Lagged feed use	$FEED_{t-1}$	Positive
Domestic price (*DPEAP*)		
Ration of total supply to total consumption	*TSUP/TCON*	Negative
World peanut price	*WPRICE*	Positive
Lagged domestic peanut price	$DPEAP_{t-1}$	Positive

shortage (surplus), lagged price, and world price. The world peanut price has a positive effect on the domestic prices, but it is not statistically significant for the Argentine and Nicaraguan domestic price equations, perhaps because the peanut industry in both countries has been managed by a few oligopolistic firms. Thus, those companies might be able to affect the domestic prices. However, the world peanut price is statistically significant at the 10% level for the importing countries such as Brazil and Mexico (Table 4).

The validation statistics show that the models can be a representation of the Latin American peanut industry. The root mean square percentage error ranges from 0.319% to 3.114%. U^M, U^S, U^C (the bias, the variance, and the covariance proportions, respectively), and Theil-U statistics illustrate that we are able to use the models to explain the historical Latin American peanut industry, with very low values for U^M (0.00) reflecting no systematic bias in the models.

Scenario Analysis

The focus of this analysis is on the impact of potential changes in the domestic prices on supply, demand, and net trade. This is because these countries' impact on the world market

Table 2. Empirical Results for Supply

Argentina

$$\text{Yield } (YD_{A,t}) = \underset{(0.053)^*}{1.036} + \underset{(0.002)}{0.0021}Trend - \underset{(-0.0001)^*}{0.0012}AHA_{A,t-1}$$

Adj R^2, 0.24; *DW*, 1.94

$$\text{Area Harvested } (AHA_{A,t}) = \underset{(10.24)}{3.994} + \underset{(0.056)^*}{0.8003}AHA_{A,t-1} - \underset{(-0.12)}{0.175}YD_{A,t} + \underset{(1.55)^*}{7.1585}DPEAP_{A,t}$$

Adj R^2, 0.71; *D-h*, 0.85

Brazil

$$\text{Yield } (YD_{B,t}) = \underset{(0.042)^*}{1.151} + \underset{(0.002)^*}{0.0167}Trend$$

Adj R^2, 0.49; *DW*, 1.95

$$\text{Area Harvested } (AHA_{B,t}) = \underset{(-39.73)}{-17.0856} + \underset{(0.048)^*}{0.8879}AHA_{B,t-1} - \underset{(-0.074)^*}{0.2007}\text{ Soybean } PRICE_{B,t} + \underset{(0.065)^*}{0.2128}DPEAP_{B,t}$$

Adj R^2, 0.85; *D-h*, 0.99

$$\text{Import } (IM_{B,t}) = \underset{(3.35)^*}{38.211} - \underset{(-3.22)^*}{29.1517}(PROD_{B,t}/TCON_{B,t}) - \underset{(-0.22)^{**}}{0.4279}(WPRICE_t/DPEAP_{B,t})$$

Adj R^2, 0.37; *DW*, 1.96

Mexico

$$\text{Yield } (YD_{M,t}) = \underset{(0.025)^*}{0.396} + \underset{(0.0015)^*}{0.0034}Trend - \underset{(-0.0005)}{0.00024}AHA_{M,t-1}$$

Adj R^2, 0.35; *DW*, 1.72

$$\text{Area Harvested } (AHA_{M,t}) = \underset{(3.08)}{4.1863} + \underset{(0.043)^*}{0.6253}AHA_{M,t-1} + \underset{(4.69)^*}{34.9034}YD_{M,t} + \underset{(0.00007)^*}{0.0002}DPEAP_{M,t}$$

Adj R^2, 0.41; *D-h*, 1.01

$$\text{Import } (IM_{M,t}) = \underset{(36.42)}{8.3761} - \underset{(-0.27)^*}{0.7627}PROD_{M,t}/TCON_{M,t} - \underset{(-0.015)^*}{0.0426}WPRICE_t/DPEAP_{M,t}$$

Adj R^2, 0.45; *DW*, 1.83

Nicaragua

$$\text{Yield } (YD_{N,t}) = \underset{(0.1333)^*}{1.516} + \underset{(0.0087)^*}{0.0341}Trend - \underset{(-0.0000042)^*}{0.00001}AHA_{N,t-1} - \underset{(-0.083)^*}{1.0179}D8485$$

Adj R^2, 0.54; *DW*, 2.21

$$\text{Area Harvested } (AHA_{N,t}) = \underset{(777.20)^{**}}{1500} + \underset{(0.049)^*}{0.8858}AHA_{N,t-1} + \underset{(0.0055)^*}{0.01195}DPEAP_{N,t}$$

Adj R^2, 0.58; *D-h*, 0.99

Note: Numbers in the parentheses represent standard errors.
* Statistically significant at the 5% level.
** Significant at the 10% level.

has been minimal. For example, Latin American peanut production was <1 million MT, compared with approximately 31 million MT of world production in 2000. Considering this, we assume that the industry does not significantly affect the world peanut price. Thus, we consider the world price variable as an exogenous factor. We consider that these countries have a small-country effect due to their small production volume in international markets. Furthermore, there are no trade barriers within the Latin American peanut industry. There-

Table 3. Empirical Results for Demand

Argentina

Per Capita (Ln $PCON_{A,t}$) = 3.9502 − 0.8361 Ln($INCOM_{A,t}$) − 0.0150 Ln($DPEAP_{A,t}$)
(0.21)* (−0.051)* (−0.004)*

+ 0.4477 Ln($PCON_{A,t-1}$) Adj R^2, 0.65; *D-h,* 1.0
(0.011)*

Export ($EXP_{A,t}$) = 3.6605 + 0.5926$PROD_{A,t}/TCON_{A,t}$ − 0.0012$EXP_{A,t-1}$ + 0.0004$WPRICE_t$
(0.115)* (0.24)* (−0.00006)* (0.000097)*

Adj R^2, 0.26; *D-h,* 1.08

Crush ($CRUH_{A,t}$) = −259.983 − 153.0892$EXP_{A,t}$ + 4.2313$PROD_{A,t}$ − 0.0019$DPEAP_{A,t}$
(−108.33)* (−62.74)* (2.215)** (−0.038)

Adj R^2, 0.17; *D-h,* 0.87

Brazil

Per Capita (Ln $PCON_{B,t}$) = 0.3478 + 0.2541 Ln($INCOM_{B,t}$) − 0.2752 Ln($DPEAP_{B,t}$)
(1.054) (0.12)* (−0.18)

+ 0.9051 Ln($PCON_{B,t-1}$) Adj R^2, 0.74; *D-h,* 0.96
(0.062)*

Feed ($FEED_{B,t}$) = 0.4529 + 0.1293$PROD_{B,t}$ − 0.4208$EXP_{B,t}$ + 0.0219$FEED_{B,t-1}$
(3.235) (0.015)* (−0.091)* (0.043)

Adj R^2, 0.50; *DW,* 2.18

Export ($EXP_{B,t}$) = 4.3861 + 0.6551$PROD_{B,t}$ − 0.6315$TCON_{B,t}$ + 0.0015$WPRICE_t$
(2.64) (0.031)* (−0.034)* (0.003)

Adj R^2, 0.89; *DW,* 2.17

Mexico

Per Capita (Ln $PCON_{M,t}$) = −4.9963 + 1.2131 Ln($INCOM_{M,t}$) − 0.0081 Ln($DPEAP_{M,t}$)
(−1.39)* (−0.21)* (−0.0074)

+ 0.0084 Ln($PCON_{M,t-1}$) Adj R^2, 0.49; *D-h,* 1.01
(0.0003)*

Feed($FEED_{M,t}$) = 0.8164 + 0.0014$PROD_{M,t}$ − 0.0526$EXP_{M,t}$ + 0.7009$FEED_{M,t-1}$
(0.126)* (0.0008) (−0.004)* (0.034)*

Adj R^2, 0.57; *D-h,* 0.86

Nicaragua

Per Capita (Ln $PCON_{N,t}$) = 0.7724 + 0.0061 Ln($INCOM_{N,t}$) − 0.0914 Ln($DPEAP_{N,t}$)
(0.88) (0.305) (−0.011)*

+ 0.5444 Ln($PCON_{N,t-1}$) Adj R^2, 0.39; *D-h,* 0.69
(0.054)*

Export ($EXP_{N,t}$) = 0.0101 + 0.0034$PROD_{N,t}/TCON_{N,t}$ + 0.0008$WPRICE_t$
(0.013) (0.0012)* (0.00029)*

Adj R^2, 0.12; *DW,* 1.85

Feed ($FEED_{N,t}$) = 0.1528 + 0.3431$PROD_{N,t}$ − 0.0126$EXP_{N,t}$ − 0.0009$FEED_{N,t-1}$
(0.072)* (0.296) (−0.0066)** (−0.00097)

Adj R^2, 0.65; *D-h,* 1.44

Note: Numbers in the parentheses represent standard errors.
* Significant at the 5% level.
** Significant at the 10% level.

Table 4. Empirical Results for Domestic Price Equations

Argentine price

$$DPEAP_A = \underset{(32.69)^*}{145.75} - \underset{(-31.96)^*}{138.40}PROD_{A,t}/TCON_{A,t} + \underset{(0.073)^*}{0.1893}DPEAP_{A,t-1} + \underset{(0.125)}{0.0025}WPRICE_t$$

Adj R^2, 0.21; *D-h,* 0.94

Brazilian price

$$DPEAP_B = \underset{(74.27)^*}{328.26} - \underset{(-58.34)^*}{217.593}PROD_{B,t}/TCON_{B,t} + \underset{(0.036)^*}{0.4399}DPEAP_{B,t-1} + \underset{(0.03)^{**}}{0.0544}WPRICE_t$$

Adj R^2, 0.75; *D-h,* 0.91

Mexican price

$$DPEAP_M = \underset{(2061.12)^*}{8285.7} - \underset{(2007.51)^*}{8050.1}PROD_{M,t}/TCON_{M,t} + \underset{(0.036)^*}{0.7260}DPEAP_{M,t-1} + \underset{(1.63)^*}{5.4293}WPRICE_t$$

Adj R^2, 0.64; *D-h,* 0.97

Nicaraguan price

$$DPEAP_N = \underset{(217.19)}{256.295} - \underset{(-117.74)^*}{578.10}PROD_{N,t}/TCON_{N,t} + \underset{(0.038)^*}{0.1753}DPEAP_{N,t-1} + \underset{(8.71)}{13.42}WPRICE_t$$

Adj R^2, 0.19; *D-h,* 1.0

Note: Numbers in the parentheses represent standard errors.
* Significant at the 5% level.
** Significant at the 10% level.

fore, the industry should be analyzed as a free market. Although Argentina decreased a 6% export tax on unprocessed groundnuts to a 3.5% in 1992, it has not been a major influence on farmers' production decisions (USDA/FAS, attaché reports; Beghin et al.; Revoredo and Fletcher).

Nevertheless, in recent years the Latin American peanut industry has increased its trade volume. For example, from 1991 to 1994 the average trade volume was approximately 88,000 MT. However, it has increased to 198,500 MT from 1995 to 2000, mainly as the result of the increase in Argentine and Nicaraguan exports. This suggests that the Latin American peanut industry might be able to play an important future role in the world peanut market. Therefore, four additional scenarios are examined based upon the world price changes in the scenario analysis. However, these eight scenarios are strictly based on the possibilities of what might happen to the Latin American peanut industry due to those potential changes in prices.

Eight scenarios are examined according to the price shocks on domestic prices and the world price. These scenarios are separated into two scenario analyses. The domestic peanut price changes in the first four scenarios are as follows: (1) 20% decrease in domestic price; (2) 10% decrease in domestic price; (3) 10% increase in domestic price; and (4) 20% increase in domestic price. For the second set of scenarios, the world price changes are as follows: (1) 20% decrease in the world price; (2) 10% decrease in the world price; (3) 10% increase in the world price; and (4) 20% increase in the world price.

The scenario analysis is conducted assuming that farmers adjust their production decision in accordance with the exogenous shocks. The base year chosen is 1995 because the impacts of the General Agreement on Tariffs and Trade (GATT) implementation in 1994 could be captured. Tables 5–10 present the simulation results.

As seen in Table 5, the Latin American peanut supply volume has increased as domestic prices have increased. The supply volume changes range from an approximately 7% decrease to a 9% increase over the entire simulation period. The supply volume in the sec-

Table 5. Domestic Price Changes on Supply

	Baseline (1,000 MT)	Percentage Changes in Domestic Price (Changes in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	453	−3.21	−1.74	4.69	11.79
1997	439	−3.12	−1.54	4.44	10.29
1998	396	−2.65	−1.21	1.23	6.86
1999	407	−2.34	−1.12	3.22	9.16
2000	365	−3.87	−1.23	3.03	9.79
Average change		−3.04	−1.37	−3.28	10.09
Brazil					
1996	214	−3.93	−0.67	3.52	4.68
1997	221	−1.77	−1.12	1.97	2.42
1998	253	−2.76	−1.57	3.57	4.95
1999	251	−2.23	−0.82	2.83	3.85
2000	262	−2.14	−0.95	3.20	3.63
Average change		−2.57	−1.03	3.02	3.91
Mexico					
1996	196	−2.20	−0.19	1.01	1.17
1997	201	−1.27	−0.19	0.64	3.21
1998	192	−1.00	−0.16	0.96	2.35
1999	273	−0.27	−0.14	0.02	0.27
2000	240	−0.31	−0.15	0.02	0.03
Average change		−1.01	−0.17	0.53	1.41
Nicaragua					
1996	38	−37.09	−16.70	13.81	25.79
1997	35	−35.12	−13.88	12.14	44.22
1998	41	−19.28	−13.21	10.76	32.98
1999	58	−18.00	−11.43	10.18	19.51
2000	63	−16.60	−13.89	10.03	20.78
Average change		−25.22	−13.82	11.38	28.66
Total change		−6.96	−2.86	3.81	9.02

Note: Percentage changes are calculated based on the baseline.

ond scenario analysis regarding world price shock is lower compared with the first scenario analysis with respect to domestic price shock, on average (Tables 5 and 8). The supply volume based on the world price shock changes by roughly 3%. In addition, the domestic price shock has a larger impact on Argentine and Nicaraguan supply volume compared with that of Brazil and Mexico. Argentina and Nicaragua would respond to a 20% increase in a domestic price shock by approximately 10% and 29%, respectively. However, in the case of Argentina, its production does not change dramatically from a 20% decrease in domestic price compared with Nicaragua, which decreased approximately 25%. Based on the scenario analysis regarding the changes in the world and domestic prices, Latin American peanut supply has been more sensitive to domestic price changes than the world price variations.

There is no noticeable change in the scenario analysis for Latin American peanut demand, as shown in Tables 6 and 9, which suggests that the Latin American demand would be stable and the price impact negligible. Latin American peanut demand is not significantly affected by world or domestic price changes

Table 6. Domestic Price Change on Demand

	Baseline (1,000 MT)	Percentage Changes in Domestic Price (Changes in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	451	3.78	1.26	−0.09	−0.46
1997	436	1.90	0.52	−0.34	−1.01
1998	389	3.71	1.90	−0.46	−1.07
1999	405	2.23	0.48	−0.35	−1.35
2000	359	2.01	1.08	−0.30	−0.65
Average change		2.73	1.05	−0.31	−0.91
Brazil					
1996	211	0.51	0.01	−0.58	−1.04
1997	214	0.00	0.00	−0.03	−0.03
1998	263	0.00	0.00	−0.02	−0.02
1999	244	0.01	0.00	−0.01	−0.01
2000	270	0.01	0.00	−0.02	−0.03
Average change		0.10	0.00	−0.13	−0.22
Mexico					
1996	200	0.64	0.30	−0.52	−0.53
1997	208	0.78	0.43	−0.40	−0.41
1998	183	0.78	0.43	−0.41	−0.43
1999	281	0.54	0.21	−0.60	−0.63
2000	245	0.95	0.62	−0.17	−0.19
Average change		0.74	0.40	−0.42	−0.44
Nicaragua					
1996	37	5.18	0.13	−0.79	−6.30
1997	36	2.60	1.98	−2.53	−3.93
1998	42	2.09	0.58	−0.58	−1.00
1999	54	2.19	1.09	−0.66	−1.67
2000	59	3.69	3.67	−0.13	−0.56
Average change		3.15	1.49	−0.93	−2.69
Total change		2.19	0.99	−0.49	−0.86

Note: Percentage changes are calculated based on the baseline.

in either set of scenarios. This could be explained by the fact that domestic consumption in Latin America has been static regardless of price variations. The volume of demand may be dependent on the processing industry, which has had a steady increasing peanut demand.

The Latin American net trade volume increases significantly, by roughly 26%, as domestic prices decrease by 20%, as shown in Tables 7 and 10. This means that peanut farmers, especially those in Argentina and Nicaragua, would increase the use of the world market to dispose of their peanut production. However, Nicaraguan exports would be dramatically affected by world price changes. Its exports would decrease by 44% when world price decreases by 20%, and increase by roughly 50% when world price increases by 20%. In the meantime, Brazilian and Mexican net trade was affected by world price shock more than from the domestic price shock. That may be because Brazil and Mexico have been net importers.

In general, the scenario analysis shows that domestic price changes affect the Latin Amer-

Table 7. Domestic Price Change on Net Trade

	Baseline (1,000 MT)	Percentage Changes in Domestic Price (Changes in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	117	32.40	22.95	−6.03	−21.16
1997	286	19.91	10.87	−4.47	−18.32
1998	144	32.02	16.43	−1.26	−14.03
1999	167	20.47	11.96	−3.35	−19.93
2000	152	22.44	12.51	−2.92	−17.64
Average change		25.45	14.94	−3.60	−18.22
Brazil					
1996	−10[a]	−1.43	−0.31	3.91	4.50
1997	−5	−0.50	−0.56	8.68	9.98
1998	−12	−0.80	−0.19	2.68	3.09
1999	−9	−0.45	−0.11	3.69	4.24
2000	−9	−0.34	−0.19	4.27	4.92
Average change		−0.70	−0.27	4.65	5.35
Mexico					
1996	−74[a]	−1.80	−0.05	1.05	2.70
1997	−68	−4.23	−0.05	0.98	1.81
1998	−57	−2.02	−0.07	1.07	1.54
1999	−108	−1.15	−0.03	0.54	1.69
2000	−97	−2.05	−0.04	0.99	0.59
Average change		−2.25	−0.05	0.93	1.67
Nicaragua					
1996	24	25.09	17.38	−2.95	−10.61
1997	25	34.51	21.21	−5.09	−8.82
1998	28	32.39	19.87	−5.45	−9.67
1999	41	27.36	7.57	−3.00	−5.00
2000	45	28.28	16.00	−2.33	−5.33
Average change		29.53	16.41	−3.77	−7.80
Total change		26.09	13.76	−2.98	−15.62

Note: Percentage changes are calculated based on the baseline.
[a] Negative signs stand for imports.

ican supply and net trade more significantly than world price changes. Regarding the world price shock, there are no significant changes for supply and demand, except Nicaraguan supply.

In the scenario analysis, we have found that domestic and world price changes, ranging from a 20% decrease to a 20% increase, do not dramatically affect Latin American peanut demand. However, their effects on the net trade are noticeable, with more than 9% with the world price shock and 26% with the domestic price shock. Moreover, the world price does not significantly affect the Latin American peanut supply, compared with 9% with domestic price changes.

Conclusion and Implications

The objective of this study was to analyze the Latin American peanut industry, including Argentina, Brazil, Mexico, and Nicaragua. Because there has not been any detailed research on the Latin American peanut industry, it has been very difficult to judge its competitiveness and movement toward freer trade in the fast-

Table 8. World Price Changes on Supply

	Baseline (1,000 MT)	Percentage Changes in World Price (Changes in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	453	−1.98	−1.01	2.62	4.61
1997	439	−1.65	−0.87	1.43	3.29
1998	396	−0.65	−0.02	1.11	2.97
1999	407	−1.72	−1.00	2.03	4.11
2000	365	−2.09	−1.21	1.87	3.98
Average change		−1.62	−0.82	1.81	3.79
Brazil					
1996	214	−0.95	−0.60	0.69	1.29
1997	221	−0.67	−0.22	0.71	1.54
1998	253	−0.65	−0.20	0.77	1.61
1999	251	−0.41	−0.15	0.61	1.11
2000	262	−0.61	−0.18	0.98	1.83
Average change		−0.66	−0.27	0.75	1.48
Mexico					
1996	196	−1.34	−0.71	0.13	1.07
1997	201	−1.11	−0.30	0.26	1.19
1998	192	−1.03	−0.28	0.51	0.91
1999	273	−2.01	−1.00	0.72	1.18
2000	240	−2.42	−1.15	0.61	1.13
Average change		−1.58	−0.69	0.45	1.10
Nicaragua					
1996	38	−18.11	−11.01	7.98	16.69
1997	35	−21.45	−14.60	8.32	19.06
1998	41	−10.97	−7.61	4.71	14.21
1999	58	−12.82	−6.37	6.21	18.54
2000	63	−11.32	−4.76	6.11	14.49
Average change		−14.93	−8.87	6.67	16.60
Total change		−1.34	−0.72	1.59	2.67

Note: Percentage changes are calculated based on the baseline.

changing and dynamic export market. Therefore, this paper attempts to provide information and economic analyses of the Latin American peanut industry.

Based on the findings of the study, we conclude that neither domestic nor world peanut price shocks affect the Latin American demand for peanuts. In contrast to the minimal impact on Latin American demand, the domestic and world peanut price shocks did affect the Latin American supply of peanuts. Domestic price shocks had a large impact on supply relative to the world price shocks.

It should be noted that the impact of price changes on Latin American peanut supply differed significantly across the four countries. Brazil and Mexico had the lowest impact, whereas Argentina and Nicaragua had the largest. The latter countries have seen the largest increase in supply in the last 10 years and have reacted more to changes in peanut prices.

Net Latin American peanut trade was affected in the domestic price change scenarios and, to a lesser degree, the world price scenarios. Moreover, Argentine and Nicaraguan net trade was affected more by domestic price shocks than world price shocks.

Overall, the Latin American peanut indus-

Table 9. World Price Change on Demand

	Baseline (1,000 MT)	Percentage Changes in World Price (Changes in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	451	1.38	0.76	−0.29	−0.81
1997	436	0.99	0.32	−0.76	−1.41
1998	389	1.00	0.41	−0.69	−1.20
1999	405	1.77	1.14	−0.89	−1.75
2000	359	0.81	0.33	−0.53	−1.01
Average change		1.19	0.59	−0.63	−1.24
Brazil					
1996	211	0.33	0.10	−0.35	−0.79
1997	214	0.00	0.00	−0.02	−0.03
1998	263	0.00	0.00	−0.01	−0.02
1999	244	0.01	0.00	−0.01	−0.01
2000	270	0.02	0.01	−0.01	−0.02
Average change		0.07	0.02	−0.08	−0.87
Mexico					
1996	200	0.52	0.29	−0.61	−1.09
1997	208	1.25	0.78	−0.61	−2.56
1998	183	1.31	1.00	−0.99	−1.59
1999	281	0.89	0.34	−0.69	−1.86
2000	245	1.78	1.02	−0.83	−2.09
Average change		1.15	0.67	−0.75	−1.84
Nicaragua					
1996	37	3.43	1.65	−2.40	−4.39
1997	36	2.00	1.07	−1.64	−2.47
1998	42	1.58	0.83	−1.92	−2.26
1999	54	1.33	1.01	−1.79	−3.43
2000	59	3.12	1.80	−2.76	−4.97
Average change		2.29	1.27	−2.10	−3.50
Total change		1.09	0.42	−0.39	−1.58

Note: Percentage changes are calculated based on the baseline.

try was affected more by domestic price variations than from world price variations. Yet, the Latin American peanut industry would likely be affected by new trade agreements such as the Free Trade Area of the Americas (FTAA) and the Central America Free Trade Area (CAFTA) just as it was when the GATT/World Trade Organization (GATT/WTO) was implemented in the mid 1990s. These countries view the U.S. domestic market as a major trade expansion area. The United States has the world's highest per capita consumption of edible peanuts. This market is mainly supplied by U.S. produced peanuts and is protected to a degree from world competition by means of tariff rate quotas. Thus, U.S. domestic peanut prices have been higher than the world prices.

According to these findings, Argentina and Nicaragua would seek to expand their export markets as their production increases due to the price changes. In this case, the United States would most likely be the major trade expansion area. In the meantime, since the 2002 farm bill eliminated production quotas and converted domestic policy to a system of direct and countercyclical payments, the price paid by U.S. food processors decreased and thus increased domestic use of peanuts. As a result, the incen-

Table 10. World Price Change on Net Trade

	Baseline (1,000 MT)	Percentage Change in World Price (Change in Quantity Based on the Baseline, %)			
		−20%	−10%	+10%	+20%
Argentina					
1996	117	−12.88	−4.22	4.21	12.62
1997	286	−6.38	−2.91	2.29	6.57
1998	144	−11.85	−8.57	7.65	14.17
1999	167	−8.48	−5.41	5.67	10.24
2000	152	−9.77	−6.36	6.02	9.11
Average change		−9.87	−5.49	5.17	10.54
Brazil					
1996	−10[a]	3.89	2.06	−4.91	−6.87
1997	−5	2.37	1.62	−7.20	−13.22
1998	−12	5.15	3.33	−6.42	−15.85
1999	−9	7.11	5.68	−7.78	−17.84
2000	−9	6.22	3.02	−6.13	−16.58
Average change		4.95	3.14	−6.49	−14.07
Mexico					
1996	−74[a]	4.75	2.90	−3.43	−6.02
1997	−68	6.99	4.51	−6.11	−10.25
1998	−57	5.15	3.35	−4.13	−8.54
1999	−108	3.73	1.99	−2.29	−5.10
2000	−97	4.36	2.22	−3.98	−6.77
Average change		5.00	4.48	−3.99	−7.34
Nicaragua					
1996	24	−34.77	−24.09	29.25	44.01
1997	25	−41.91	−28.88	30.22	52.12
1998	28	−57.32	−32.10	33.73	59.64
1999	41	−47.24	−26.52	31.10	50.76
2000	45	−39.02	−19.96	24.80	45.23
Average change		−44.05	−26.31	35.67	50.35
Total change		−8.81	−6.67	8.02	9.21

Note: Percentage changes are calculated based on the baseline.
[a] Negative signs stand for imports.

tives to import cheaper peanuts from other countries, such as Argentina, Mexico, and Nicaragua, would be mitigated by the recent changes in the farm program. Nevertheless, complete liberalization of the U.S. peanut market within an FTAA could possibly lead to an increase in Latin American peanut prices, which would stimulate net trade. Thus, the Latin American peanut industry would become more competitive within an FTAA with respect to the United States. Therefore, the U.S. peanut industry must consider strategies to enhance its competitive position in order to compete with peanut exports from countries such as Argentina and Nicaragua.

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