Soybean Policies in Argentina and Brazil: A Simultaneous Analysis

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Abstract

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Argentina and Brazil have significantly expanded their soybean and product production capabilities over the last decade. To investigate the changes in U.S. competitive position in the world soybean market a spatial equilibrium model is employed to model expected policy changes in Brazil and Argentina.

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Since the early 1980s, soybean producers in the United States (U.S.) have experienced declining exports and a loss of world market share. Lower domestic prices and farm incomes from soybeans have followed. The lower farm incomes lead to reduced profits and a decline in farm acreage devoted to soybean production.

Current agricultural and trade policies in Argentina and Brazil impact on the U.S. soybean industry. The Argentine Government utilizes a differential *ad valorem* tax on soybean and products exports. This tax has been reduced and faces possible elimination in the future. Brazil, on the other hand, subsidizes the cost of soybean production through lower than market interest rates on soybean production loans and employs a differential export tax on soybeans and products. The Brazilian government raised the interest rate on soybean production loans closer to market levels with the intention of equating market interest rates in the future.

These soybean market changes indicate that U.S. soybean farmers' competitiveness in the international marketplace may be changing. The competitiveness issue is of concern not only to farmers in the U.S. but also to soybean crushers, food processors, grain storage and handling establishments, and grain transportation enterprises. In addition, soybeans are the second largest cash crop in the U.S. farm sector with over half of the crop being exported.

The purpose of this study is to analyze the competitive position of U.S. soybeans relative to Argentina and Brazil. In this paper the impacts of eliminating the *ad valorem* tax on Argentine soybean exports

and reducing the Brazilian soybean production subsidy are examined.

Competitive Position

Competitive position has been defined as the relative ability of two or more regions to produce and transfer a common product profitably to the same market. Within the context of this study, competitive position refers to the relative abilities of Argentina, Brazil, and the U.S. to export soybeans to the European Community (EC) and Asia.[1]

The ability of a country to produce a raw product in a dynamic framework can be affected by many factors including the endowments of natural resources such as land, water, minerals and climate characteristics. The infrastructures of each region such as internal transportation, storage, and handling costs may affect competitive relationships. External factors such as ocean transportation, regulation, insurance rates, and trade policy restrictions play a role in competitive relationships. Macroeconomic factors such as currency exchange rates, interest rates, and inflation rates also have profound effects upon competition.

World Exports

U.S. soybean exports fell from 25.3 million metric tons (MMT) in 1982 to 16.3 MMT in 1985 and have recovered to 21.3 MMT in 1988, still down 16 percent from 1982. Argentine soybean exports have remained relatively constant from 1978-1988 while Brazil expanded soybean exports nearly four-fold over the same time period.

U.S. soybean meal exports in 1980 totaled 7.2 MMT and by 1985 had fallen to 4.5 MMT. Argentine soybean meal exports have increased over 1200 percent in the last ten years. Brazilian exports of soybean meal

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[1]Refer to footnotes d & e in Table 1.

reached a high in 1981 but have remained constant since.

Argentina

Domestic Agricultural Policy

In December 1986, The Argentine government created support price systems for corn and grain sorghum and additionally increased the support price for wheat (Ahalt). There is no price support program for soybeans, however, the price support program for wheat indirectly affects soybean production since it is possible to double crop soybeans after the wheat crop.

Trade Policy

Argentine agricultural trade policy has encouraged soybean production and promoted exports of soybean meal and soybean oil as opposed to exports of raw soybeans by means of a differential *ad valorem* export tax on soybeans and soybean products. The driving force behind this differential export taxation scheme is to gain foreign exchange earnings and value added receipts through soybean meal and soybean oil sales. In January of 1987 the *ad valorem* export tax on soybeans and products was reduced from 28.5 percent on soybeans and 16.6 percent on soybean meal and oil to 15 percent on soybeans and 3 percent on soybean meal and oil and future elimination of the tax was proposed (USDA, FOP 12-86). Late in 1988 the Argentine government implemented a Tributary Return System whereby soybeans were levied an *ad valorem* tax of 11 percent while soybean meal and oil were taxed at a rate of 3 percent each. However, the 3 percent tax on soybean meal and oil was refunded once the paper work on the transactions was complete (USDA, FOP 9-88). Hence, the Tributary Return System. Essentially, this yields a realized *ad valorem* export tax of 11 percent on soybeans and no tax on soybean meal and oil.

Brazil

Domestic Agricultural Policy

Minimum support prices and a production loan schedule are the major policies that characterize the Brazilian governments method of shaping soybean production and sales. For 1989 the minimum price set by the Brazilian government for corn is $2.65/bu and $3.25/bu for soybeans. While the corn price does seem favorable the soybean price is very low. In fact the minimum price for soybeans has only on rare occasions been effective, generally market prices are substantially higher.

The production loan schedule allows farmers to borrow certain amounts of variable production costs at an interest rate of 7-9 percent per month. However, the inflation rate in Brazil has been estimated at approximately 20 percent per month, resulting in a negative rate of interest, or a production subsidy.

Trade Policy

The export retention tax scheme for soybeans favors soybean meal and oil exports over the exports of raw soybeans. The capacity of the Brazilian oilseed crushing industry far exceeds that of the oilseed production. This not only implies that soybeans are imported into Brazil as they are, it also indicates that nearly all domestically produced soybeans are crushed. In fact, Brazil exports very few raw soybeans. Nearly all of the soybean oil produced domestically is consumed by Brazilians while approximately two-thirds of the soybean meal is exported. This vast crushing capacity allows Brazil to earn the value added receipts on the soybean meal and oil sales, much like the practice in Argentina. Further, the export quota system provides a stimulus to export more than might otherwise occur.

Methodology

To perform this competitive position analysis a linear complementary program (LCP) was employed by the use of LCRAND, a mathematical programming system developed by Stan Bartilson et al. LCP much like Quadratic Programming (QP), assumes linear supply and demand curves and fixed unit transportation costs.

LCP maximizes consumer and producer surplus in each individual region of the model subject to transfer costs. This procedure allows price and quantity to be determined endogenously. The optimal solutions of the LCP model will yield equilibrium prices and quantities under given market conditions.

The general LCP problem is stated as:

find w and z such that

$$w = q + Mz, \tag{1}$$

$$w'z = 0, \tag{2}$$

and

$$w, z \geq 0 \tag{3}$$

where

w = a $(n \times 1)$ vector of unknown slack variables,

q = a $(n \times 1)$ fixed vector of intercept terms,

M = a $(n \times n)$ known positive semi-definite matrix of slope coefficients, and

z = a $(n \times 1)$ vector of unknown prices.

This program requires that the domestic supply and demand equations be price dependent.

Supply

The supply equation parameters were estimated by equating the known price elasticity of domestic supply to the unknown partial derivative of

quantity supplied with respect to supply price (β) multiplied by the ratio of actual mean price and actual mean quantity of supply as[2]

$$\varepsilon_s = \frac{\partial Q_s}{\partial P_s} \times \frac{\tilde{P}_s}{\tilde{Q}_s} . \tag{4}$$

Letting

$$\delta = \frac{\partial Q_s}{\partial P_s} ,$$

then

$$\varepsilon_s = \delta \times \frac{\tilde{P}_s}{\tilde{Q}_s} , \tag{5}$$

$$\hat{\delta} = \varepsilon_s \times \frac{\tilde{Q}_s}{\tilde{P}_s} , \tag{6}$$

where

δ = the true price coefficient of quantity dependent domestic supply equation,

$\hat{\delta}$ = estimated price coefficient,

$\tilde{P}_s$ = mean supply price,

$\tilde{Q}_s$ = mean supply quantity,

ε_s = price elasticity of supply.

The intercept term of the linear supply function can be derived as

$$\hat{\gamma} = \tilde{Q}_s - \hat{\delta} \times \tilde{P}_s, \tag{7}$$

where $\hat{\gamma}$ is the estimated intercept for the supply equation.

This results in the following quantity dependent supply equation

$$Q_s = \hat{\gamma} + \hat{\delta} \times P_s, \tag{8}$$

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[2]Mean price for Argentina, Brazil is free on board (F.O.B.) price and mean price for EC and Asia is cost insurance and freight price (C.I.F.). Mean quantities for domestic supplies are production quantities in metric tons. Mean prices and quantities were computed for the period 1984-1986.

which can be arranged in to price dependent form by substitution of α and β

$$P_s = -\alpha + \beta Q_s, \tag{9}$$

where

$$\alpha = \frac{\hat{\gamma}}{\hat{\delta}}, \text{ and } \beta = \frac{1}{\hat{\delta}}.$$

Demand equation parameters were derived in the same manner. The price elasticities of supply and demand are presented in Table 1. The resulting price dependent soybean supply and demand equations for each region are shown in Table 2.

Procedure

A base scenario will be generated to reflect current market conditions. As well, an alternative scenario incorporating the Argentine and Brazilian policy changes will be generated and compared to the base scenario with the differences being noted. The alternative scenario will represent a simultaneous application of an elimination of the Argentine *ad valorem* export tax under an elasticity of price transmission of 0.80 (Bredhal et al.)and a 5 percent reduction in the intercept parameter of the Brazilian soybean supply equation.[3] The resulting changes in the output of the alternative scenario will be compared to the base scenario and the changes in production,

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[3]Elasticity of price transmission is the responsiveness of Argentina's price relative to a change in the world price. The value of 0.80 was chosen to best reflect the actual transmission of price from the world market to Argentina. The intercept parameter is affected because it is assumed that the quantity of soybeans produced is directly a function of the interest rate which is accounted for, at the mean level, in the intercept. The 5 percent reduction of the intercept was arbitrarily chosen.

consumption, trade flows, and prices will be analyzed.

When modeling trade flows of a commodity that yields two marketable products when processed, special care must be taken to calculate commodity equivalents of products. In the case of soybeans, two products are produced when the oilseed is processed (crushed), soybean meal and soybean oil. When calculating quantities of soybeans consumed in individual regions it is not appropriate to sum the quantities of soybeans, soybean equivalents of soybean meal, and soybean equivalents of soybean oil. This will result in double counting. Rather, the researcher should determine which product is the driving force behind processing and calculate the commodity equivalents of that product.

This concept is important because soybean consumption generally occurs in the form of soybean meal by livestock, and soybean oil by humans. It was assumed for this study that the driving force behind the soybean market is soybean meal. Given this assumption, soybean consumption is calculated as the sum of soybean consumption and soybean equivalents of soybean meal consumption. Soybean oil equivalents were not included in the analysis. However, soybean oil is included to the extent of the residual oil form the soybean equivalents of the soybean meal.

Results

The production, consumption, and prices for the base scenario, and alternative scenario are presented in Table 3. The changes and percentage changes for production, consumption and prices for the base and alternative scenario are presented in Table 3 also. The trade flows, changes, and percentage changes in trade flows for the base and alternative scenario are presented in Table 4.

The combined effect of the Argentine tax elimination and the Brazilian supply reduction yields an increase in Argentine soybean production while the other sectors of the model experience a decrease in production. This combined effect yields a decrease in soybean consumption for the Argentines and an increase in consumption for the rest of the world. This is reflected in the increase in price of soybeans for the Argentines and decrease in soybean price for the rest of the world.

The simultaneous application of these policy changes results in a 6.56 percent increase in soybean exports for the Argentines and a 3.25 percent decrease in soybean exports for the Brazilians. Total U.S. soybean exports decrease 0.34 percent as a result of a decrease in U.S. soybean exports to the EC and an increase in soybean exports to Asia.

Conclusions

The purpose of this study was to simulate policy changes affecting the world soybean industry and to examine the impacts of those changes on the competitive positions of Argentine, Brazilian, and the U.S. soybeans. A spatial equilibrium model was employed to generate an alternative scenario which in turn was compared to the base scenario that represented the world soybean market before the expected policy changes were implemented.

This model allows farmers, agriculture policy makers, and agri-business related firms the opportunity to investigate industry impacts of expected market or policy changes before the change actually occurs. The evaluation of these policy changes reveals that the competitive position of the U.S. decreased, but finitely relative to Brazil, while the competitive position of Argentine soybeans increased.

Table 1. Soybean Price Elasticities of Domestic Supply and Domestic Demand by Regions

Region	Supply	Demand
Argentina[a]	0.61	-0.41
Brazil[b]	0.60	-0.96
United States[c]	0.84	-0.25
European Community[d]	0.84	-0.25
Asia[e]	0.70	-0.14

[a]Arburn, G.W. Competitive Position of United States Soybeans in a Dynamic World Economy: A Sectoral Sensitivity Analysis. Unpublished Master's Thesis, Clemson University, Department of Agricultural Economics and Rural Sociology, 1988.

[b]Williams, G.W. Returns to U.S. Soybean Export Market Development, Staff Paper #136, Iowa State University, Department of Economics, December, 1983.

[c]Davis, G.C. A Linear Logarithmic Equilbrium Displacement Approach to Analyzing the Impact of a European Community Vegetable Oils Tax on the U.S. Soybean Market. Unpublished Master's Thesis, Clemson University, Department of Agricultural Economics and Rural Sociology, 1986.

[d]Ibid c. EC-6 (1957-1973) Belgium, Federal Republic of Germany, France, Italy, Luxembourg, and the Netherlands; EC-9 (1973-1981) EC-6 and Denmark, Ireland and the United Kingdom; EC-10 (1981-1986) EC-9 and Greece; EC-12 (1986-) EC-10 and Spain and Portugal.

[e]Liu, Karen. A Grain, Oilseeds, and Livestock Model of Japan, USDA, ERS, IED, Staff Report No. AGES850627, August 1985. Asia includes the countries of Japan, Malaysia, South Korea, Philippines, Indonesia, Taiwan, Singapore, and Hong Kong.

Table 2. Estimated Price Dependent Supply and Demand Equations for Soybeans by Region

Region	Supply[c]	Demand[d]
Argentina	P = -85.56 + 0.0000358Q	P = 571.19 - 0.0012503Q
Brazil	P = -119.4 + 0.00001884Q	P = 366.03 - 0.0000657Q
United States	P = -34.65 + 0.00000427Q	P = 909.60 - 0.0000337Q
European Community[a]	P = -43.87 + 0.00144Q	P = 1151.5 - 0.0000357Q
Asia[b]	P = -98.44 + 0.00025Q	P = 1870.3 - 0.0001682Q

[a]Refer to Table 1.

[b]Refer to Table 1.

[c]P indicates price of soybeans in dollars/MT. Q indicates quantity in MT.

[d]Ibid c.

Table 3. Production, Consumption, Prices and Changes and Percentage Changes for Production, Consumption and Prices for Base and Alternative Scenarios.

Region	Base Scenario (1984-86)	Alternative Scenario	Alternative Scenario Change[c]	Alternative Scenario % Change
		metric tons		
Production				
Argentina	6,271,487	6,649,544	378,057	6.03
Brazil	14,009,849	13,666,276	-343,573	-2.45
U.S.	42,486,079	42,452,611	- 33,468	-0.08
EC[a]	139,077	138,978	- 99	-0.07
Asia[b]	1,039,926	1,039,355	- 571	-0.05
Consumption				
Argentina	345,400	334,557	- 10,843	-3.14
Brazil	3,335,673	3,357,838	2,165	0.06
U.S.	22,436,307	22,440,510	4,203	0.02
EC[a]	27,639,845	27,643,815	3,970	0.01
Asia[b]	10,169,193	10,170,043	850	0.01
Price		dollars/metric ton		
Argentina	139.34	152.89	13.55	9.72
Brazil	144.56	144.41	- 0.15	-0.10
U.S.	146.77	146.62	- 0.15	-0.10
EC[a]	156.47	156.32	- 0.15	-0.10
Asia[b]	161.91	161.76	- 0.15	-0.09

[a]Refer to Table 1.

[b]Refer to Table 1.

[c]Units are metric tons for production and consumption, and dollars per metric ton for price.

Table 4. Trade Flows, Changes, and Percentage Changes in Trade Flows for Base and Alternative Scenario.

	Base Scenario		Alternative Scenario	
Destination: Origin	EC[a]	Asia[b]	EC[a]	Asia[b]
Trade Flows				
	----------metric tons----------			
Argentina	5,926,087		6,314,986	
Brazil	10,654,175		10,308,437	
U.S.	10,920,505	9,129,266	10,881,412	9,130,688
Change in Trade Flows				
	----------metric tons----------			
Argentina			388,899	
Brazil			-345,738	
U.S.			- 39,093	1,422
Percentage Change in Trade Flows				
	----------percent----------			
Argentina			6.56	
Brazil			-3.25	
U.S.			-0.36	0.02

[a]Refer to Table 1.

[b]Refer to Table 1.

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