

The Cuban Embargo and Southeastern Agricultural Export Markets

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Cuba is a large neighbor of the US Southeast with substantial export potential given a lifted embargo. The present paper estimates the potential gains from trade in Southeastern agricultural export markets calibrating linear excess supply and excess demand to observed prices, outputs, exports, Cuban imports, and price elasticities in the literature. A brief review of Cuban trade history provides perspective and motivates the model.

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Lifting the Cuban embargo will lead to gains from trade estimated in the present paper for Southeastern US agricultural markets. The present paper gauges linear excess supply and demand gauge market gains from trade in rice, grains, soybeans, poultry, pork, and meat. This paper is the first such direct simulation of excess supply and demand with its focus on the international market and total surplus gains from trade. Excess supply from the US and excess demand of the rest of the world are calibrated to observed prices, outputs, exports, and estimates of price elasticities of supply and demand in the literature. Cuban excess demand is calibrated to import data and related proxy elasticities.

A short review of the economic history of Cuba stresses that the US was Cuba's major pre-embargo trade partner, motivating the market analysis and justifying the assumption that the US will supply Cuban excess demands in these agricultural markets when the embargo is lifted. The largest gains are for rice, grains, and soybeans with moderate gains for poultry and pork. Across these markets, total surplus increases by over 3%.

1. Cuban economic history and trade potential

For a review of available historical economic data on Cuba see Jolly and Thompson (2008). Trade and geography dominate Cuban-US economic history as noted by Whittlesey (1922). In the early 1800s the US expanded south acquiring Florida and turning attention to the Caribbean. Cuba's location favored US trade, investment, and tourism but Cuba remained a Spanish colony through the 1800s. By the late 1800s the US was the major consumer of Cuban exports. The US and Spain had an effective reciprocal free trade agreement. Cuba traded sugar, tobacco, tropical products, copper, and iron for US grains, meats, manufactures, vegetable oils, and fuel as documented by Wakefield (1937).

Sugar dominated the Cuban economy and by the 1860s Cuba was the world's largest producer with over 1500 plantations according to Hitchman (1970). About half of Cuba's cultivated land was in sugar cane but the international price was erratic and income unstable.

Tobacco also had ups and downs in Cuba. The Foraker Act of 1899 prevented US investment and tariffs making cigars a luxury good. Cuban tobacco export revenue rose from \$77 million in 1889 to \$422 million in 1920 but then collapsed to \$163 million in 1932.¹

The US acquired Cuba in 1898 after the Spanish-American War. The Treaty of Paris assumed the US would occupy Cuba and the Platt Amendment in 1901 sanctioned US troops in Cuba. The US established a land market, reduced taxes, expanded utilities, and reduced tariffs by over half.

Cuba became independent largely due to Western US sugar beet farmers not wanting competition from Cuban sugar cane. Annexation was debated but prohibited by the Teller Amendment and the stage was set for Cuban independence then solidified by the Reciprocity Treaty in 1903 as discussed by Deere (1998). Nevertheless US immigration grew and by 1903 there were 37 colonies in Cuba and 64 colonies ten years later. The Underwood-Simmons Tariff Act of 1913 lowered US import duties on citrus and by 1914 Cuba accounted for 84% of US grapefruit imports, peaking in 1922. Hitchman (1970) estimates US investment capital of \$1 billion in Cuba by 1914.

In the late 1920s isolation and protectionism began to surface. The Fordney-McCumber Tariff Act of 1922 raised the average US tariff from 9% to 14% followed by the suffocating Smoot-Hawley Tariff Act of 1930. The tariff on grapefruit that had doubled with Fordney-McCumber from \$.04 to \$.08 per pound increased with Smoot-Hawley to \$.12.

Military juntas vied for power in Cuba during the 1930s leading to periodic US military intervention to protect investment, primarily in agriculture. The Great Depression of the 1930s led

¹ All dollar figures throughout the paper are inflated to 2000 dollars.

to an exodus of US immigrants. During the 1940s there was political stability. Batista then became an unpopular dictator supported by the US during the 1950s leading to the rise of Castro in 1959. US assets in Cuba were at that time over three times that in the rest of Latin America and included most of the Cuban utilities, half of the railways, and almost half of the sugar refining capital.

Castro seized large plantations and established trade agreements with the Soviet Union and China for the barter of sugar for oil as discussed by Johnson (1965). When Castro nationalized US assets Eisenhower eliminated the sugar trade agreement that paid Cuba \$.11 per pound above the world market price, worth a yearly premium of \$600 million. The ensuing embargo only spotlighted Castro and the US continued trading with other Communist countries throughout the Cold War. With the elimination of Soviet subsidies during the 1990s Castro was forced into market initiatives but Cuba has struggled.

Income per capita in Cuba remains near its 1959 level of \$3000, the lowest in the hemisphere. For comparison, real income per capita is \$8000 in Mexico and \$40,000 in the US. Sugar remains the primary export although it has become much less dominant since the 1980s and the largest other exports are cigars, fish, and citrus as discussed by Messina, Bonnett, and Taylor (2007). Cuba also has the world's second largest proven reserves of nickel as well as significant reserves of cobalt, iron, copper, chromite, manganese, zinc, and tungsten, not to mention largely undeveloped petroleum potential.

Cuba is the world's third largest grapefruit producer and citrus accounts for 10% of Cuban export revenue. The Cuban citrus industry is undergoing adjustment as pointed out by Gonzalez, Spreen, and Jauregui (2007) and the Florida citrus industry could gain through investment as stressed by Kost (2002).

The relaxed humanitarian embargo in 2001 greatly increased Southeastern agricultural exports. As an example, Cuba accounted for a quarter of Alabama agricultural export revenue in

2006. Mobile is a two day sail from Havana and was the dominant port prior to the embargo.

Figure 1 reports US agricultural exports of grains, poultry, soybeans, and meat to Cuba in 2006.

Figure 2 shows the dominant position of US trade in 1957, and that pattern is poised to re-emerge with a lifted embargo.

* Figure 1 * Figure 2 *

2. Excess supply gains from trade

In the domestic linear export market in Figure 3 excess supply is the difference between linear supply and demand,

$$XS(P) \equiv S(P) - D(P) = (a_0 + a_1P) - (b_0 - b_1P) = (a_0 - b_0) + (a_1 + b_1)P. \quad (1)$$

Laws of supply and demand imply positive a_1 and b_1 leading to positively sloped excess supply. A positive domestic price requires $b_0 > a_0$. At the observed price P_0 in Figure 3 the export level is Q_0 .

Supply and demand functions are derived from elasticities, production, consumption, and the observed price P_0 and export level Q_0 . The elasticity of excess supply is derived as $\epsilon_{XS} = (dXS/dP)P/Q = (a_1 + b_1)P_0/Q_0$

* Figure 3 *

Excess demand from importers of US commodities XD is derived assuming its price elasticity ϵ_{XD} is the negative of the excess supply elasticity, $\epsilon_{XD} = -\epsilon_{XS}$. It follows that

$$XD(P) \equiv D_R(P) - S_R(P) = \alpha_0 - \alpha_1P \quad (2)$$

where $\alpha_0 = Q_0 - \alpha_1P_0$ and $\alpha_1 = \epsilon_{XD}Q_0/P_0 = a_1 + b_1$.

Cuban excess demand XD_C is derived from Cuban import data from the USDA (2007) with proxy countries for imports of meat (Costa Rica), poultry (Honduras), and pork (Uruguay).

Elasticities of demand are from the USDA (2008b). Elasticities of supply are based on summaries of the literature in Askeri and Cummings (1977) and Arnade and Kelch (2007). Demand and supply elasticities are primarily short run estimates. There is no data on prices in Cuba but the

gains from trade are not sensitive to a wide range of prices. The embargo free market equilibrium at P_T and Q_T is derived from total excess demand XD_T which is the sum of importer XD and Cuban excess demand XD_C as in Figure 3. The simulation assumes there is no shift in importer XD to supply the Cuban markets as seems reasonable.

Summarizing, market specifications include the current price P_0 , export level Q_0 , output Q_S , Cuban price P_C , Cuban imports Q_C , and price elasticities of supply ϵ_S and demand ϵ_D . The gain from trade is the shaded area in Figure 3 with the underlying gain in producer surplus outweighing lost consumer surplus. Figure 3 is scaled approximately to the poultry market. Sensitivity analysis examines the effect of price elasticities and other assumptions.

Prices in Table 1 from USDA (2007) are standardized to \$/metric ton. The US quantity produced Q_S , export level Q_0 , and quantity imported in Cuba Q_C from USDA (2007) are in thousands of metric tons. Price elasticities in Table 2 are from various sources as indicated.

* Table 1 * Table 2 *

3. Simulated Gains from Trade

In Table 1 the price of poultry is $P_0 = \$961$ and US exports or quantity of excess supply is $Q_0 = 2,967$. The demand elasticity for poultry is $\epsilon_D = -0.56 = -b_1P_0/Q_0$ and the supply elasticity is $\epsilon_S = 1 = a_1P_0/Q_S$ in Table 2. The slope of the US poultry supply function is derived as $a_1 = \epsilon_S Q_S / P_0 = 23$ given US production of $Q_S = 21,700$ in Table 1. The price intercept of the US poultry supply function is then $a_0 = Q_S - a_1P_0 = 0$.

The slope of the US poultry demand function is derived as $b_1 = \epsilon_D Q_D / P_0 = -10.9$ where quantity demanded $Q_D = 18,733$ is derived as output $Q_S = 21,700$ less exports $Q_0 = 2,967$. The intercept of the US poultry demand function is derived as $b_0 = Q_D + b_1P_0 = 29,223$. The implied US autarky price is $\$872$ implying exports increase the domestic price of poultry by 10%.

The elasticity of US excess supply in Table 3 $\epsilon_{XS} = (a_1 + b_1)P_0/Q_0 = 10.8$ is derived from the slope of the excess supply function $(a_1 + b_1) = 33$. The quantity intercept of the poultry XS function is $a_0 - b_0 = -29,233$ and the derived price intercept is \$812 as pictured in Figure 1. Producer surplus in the US poultry market is \$131 million.

* Table 3 *

The elasticity ϵ_{XD} of importer excess demand XD is assumed to be the negative of the excess supply elasticity, $\epsilon_{XD} = -\epsilon_{XS}$. The slope of XD in (2) is then $\alpha_1 = \epsilon_{XD}Q_0/P_0 = -33.5$ and its quantity intercept is $\alpha_0 = Q_0 - \alpha_1P_0 = 35,157$ implying the price intercept 1,049 pictured in Figure 1.

To derive the Cuban excess demand function XD_C begin in Table 1 with poultry imports of $Q_C = 215$ from the USDA (2007) with Venezuela as a proxy country. Given the lack of data on consumption and production, assume Cuba produces half its consumption. Poultry production would then be 215 and consumption 430 which is a very low level of consumption implying a trivial impact on exports and US producer surplus.

Alternative, the present simulations assume Cuba begins with half the per capita consumption of poultry in the US, implying imports and production would each be 550. Similar assumptions are made for meat and pork given the very low import levels in Uruguay as a proxy country. For rice and grains, Cuban imports in Table 1 directly enter the simulations assuming production in Cuba matches imports. Soybean imports are from Costa Rica as a proxy country. All import quantities Q_C for Cuba are averaged across available years from 2000 to 2005.

The price of poultry in Cuba is assumed to be $P_C = \$1,500$ in Table 1, about 50% higher than the current price. Reasonable variation in P_C makes little difference in the gain from trade. Poultry elasticity assumptions for Cuba in Table 2 are $\epsilon_S = 0.50$ and $\epsilon_D = -0.50$ and other elasticities are described in Table 2. The derived -1.50 elasticity of XD_C in Cuba leads to its slope -0.55 and quantity intercept 1,375 reported in Table 3 and pictured in Figure 3.

Excess demand in Cuba XD_C is added to importer excess demand XD to find the total excess demand XD_T . Cuba imports from other countries but the presumption is that the US would return to dominate Cuban markets. The free trade equilibrium for poultry occurs where XD_T meets XS_{US} at $P_T = \$974$ and $Q_T = 3,387$ as reported in Table 1 and pictured in Figure 3. The international price of poultry increases 1.3% and exports increase 14% with the lifted embargo.

The surplus gain from trade is the shaded area in Figure 1 equal to \$2.6 million in the poultry market. This 2% gain in total surplus is reported in Table 4. The Southeast accounts for 39% of US poultry exports according to USDA (2008a) and this proportion would imply a total surplus gain of \$1 million.

* Table 4 *

Analysis of the other export markets is similar in Tables 1 through 4. Surplus gains range from \$13.7 million for beef (but only 0.4% for the large beef market) to \$0.02 million in soybeans. The largest percentage gains in producer surplus are for pork at 9.1% and rice at 6.5%.

4. Conclusion

The Southeast can expect gains from trade with a lifted Cuban embargo. The largest percentage gains in producer surplus are for pork and rice exports, while poultry and grains enjoy moderate gains. The large meat export market enjoys the largest surplus gain. Turning the logic around, the model estimates a yearly excess supply surplus loss of \$19 million across all these markets. The International Trade Commission (2007) conservatively estimates the embargo costs the US \$1.2 billion annually in lost export revenue but the present model goes deeper to look at producer surplus.

The present application of the linear model of excess supply and demand invites application to other products and instances of trade liberalization and protection. Advantages of the model

include the derivation of the international equilibrium and the focus on total surplus rather than the offsetting effects of producer versus consumer surplus.

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Table 1. Market Prices and Quantities

	P ₀	Q ₀	Q _S	P _C	Q _C	P _T	%ΔP	Q _T	%ΔQ
rice	\$215	1,420	8,800	\$300	550	\$221	2.7%	1,813	2.8%
grains	\$151	6,141	67,700	\$350	900	\$152	0.6%	6,619	0.8%
soybeans	\$220	8,244	86,800	\$350	140*	\$224	1.7%	9,379	1.4%
poultry	\$961	2,967	21,700	\$1,500	215**	\$980	1.9%	3,594	2.1%
pork	\$1,042	1,359	95,600	\$1,500	20 [†]	\$1,048	0.6%	1,973	4.5%
meat	\$1,886	5,832	11,900	\$2,500	20 [†]	\$1,995	5.8%	6,379	0.1%

*Costa Rica **Venezuela [†]Uruguay

Table 2. Price Elasticities of Supply and Demand

	ε _S US	ε _D US	ε _{XS} Derived	ε _D Cuba	ε _S Cuba
rice	0.55**	-1.30*	7.55	-0.34*	0.50**
grains	0.89 [†]	-0.25*	10.0	-0.34*	0.37**
soybeans	0.31 [†]	-0.50 ^{††}	13.7	-0.50 ^{††}	0.50 ^{††}
poultry	1.0**	-0.56*	7.19	-0.50 ^{††}	0.50 ^{††}
pork	0.24**	-0.82*	56.7	-0.56*	0.50 ^{††}
meat	0.24**	-1.09*	1.32	-0.56*	0.50 ^{††}

*USDA (2008b) **Askeri-Cummings (1977) [†]Arnade-Kelch (2007) ^{††}Author assumption

Table 3. Slopes and Intercepts

	slope XS	P _{int} XS	slope XD _R	P _{int} XD _R	slope XD _C	P _{int} XD _C
rice	67	-13014	-69	17,053	-2.16	1,199
grains	501	-69502	-504	83,629	-2.70	1,845
soybeans	301	-57942	-301	74,780	-0.60	350
poultry	33	-29223	-34	36,532	-0.55	1,375
pork	96	-98863	-97	103,022	-0.39	1,441
meat	5	-3638	-5	16,743	-0.56	1,441

Table 4. Surplus Market Gains

	gain \$mil	% gain
rice	\$0.97	6.5%
grains	\$0.51	1.4%
soybeans	\$0.02	0.02%
poultry	\$2.63	2.0%
pork	\$0.87	9.1%
meat	\$13.7	0.4%

Figure 1. US Agricultural Exports to Cuba, 2006, *US-Cuba Trade & Economic Council*

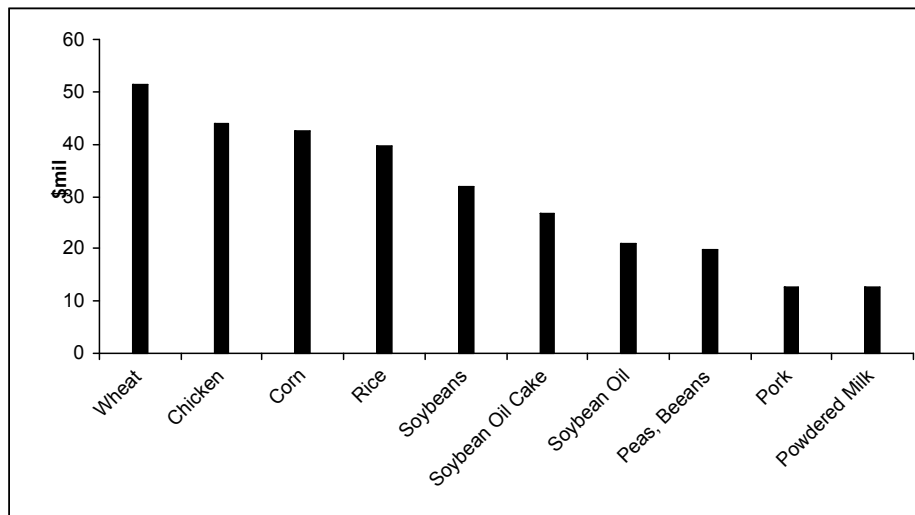
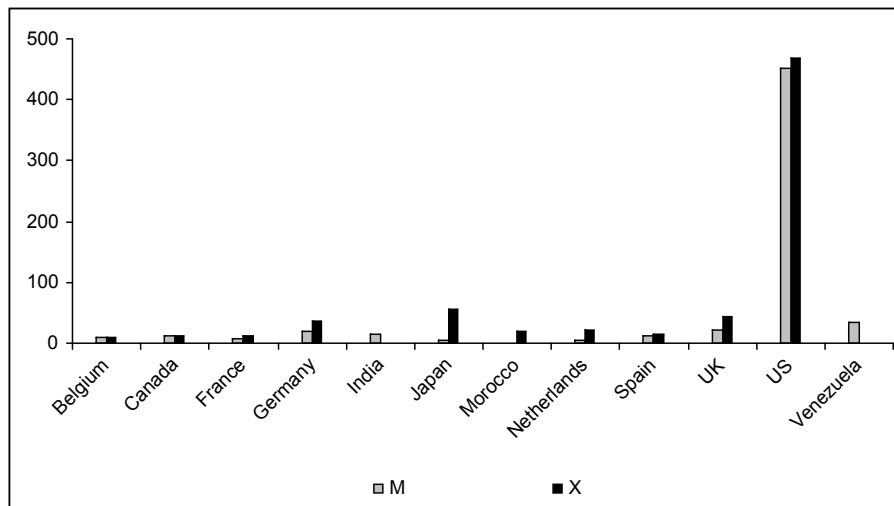


Figure 2. Pre-Embargo Trade Partners in 1957, *International Historical Statistics*



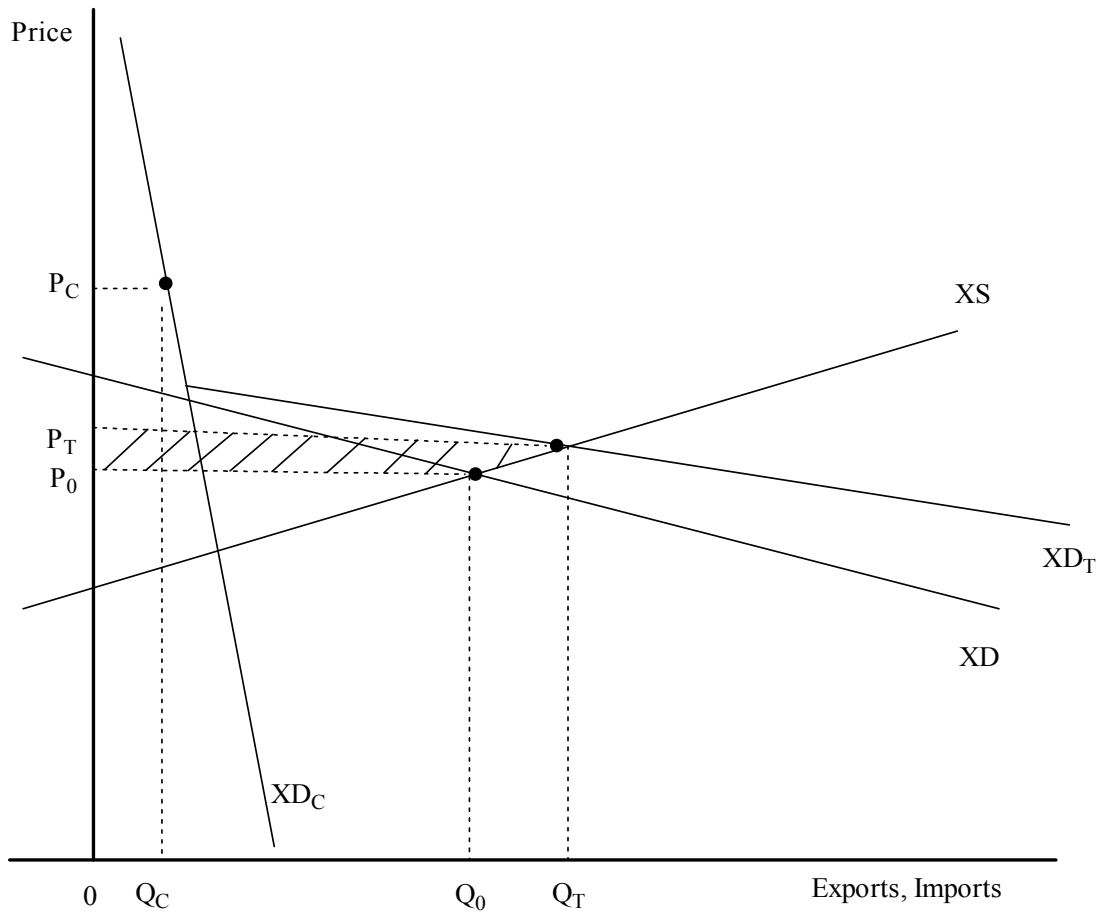


Figure 3. Excess Supply and Increased Excess Demand