Who Dominates Market Power for U.S.-China Soybean Trade?

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Abstract

This research develops a two-country partial equilibrium trade model to test the market power of Chinese soybean importers and U.S. soybean exporters in the soybean trade between the two countries. Results show that Chinese soybean importers have stronger market power than U.S. soybean exporters.

Key Words: market power, reverse residual demand, reverse residual supply, partial equilibrium trade model, U.S.-China soybean trade

JEL Classifications: Q110, Q170, D430

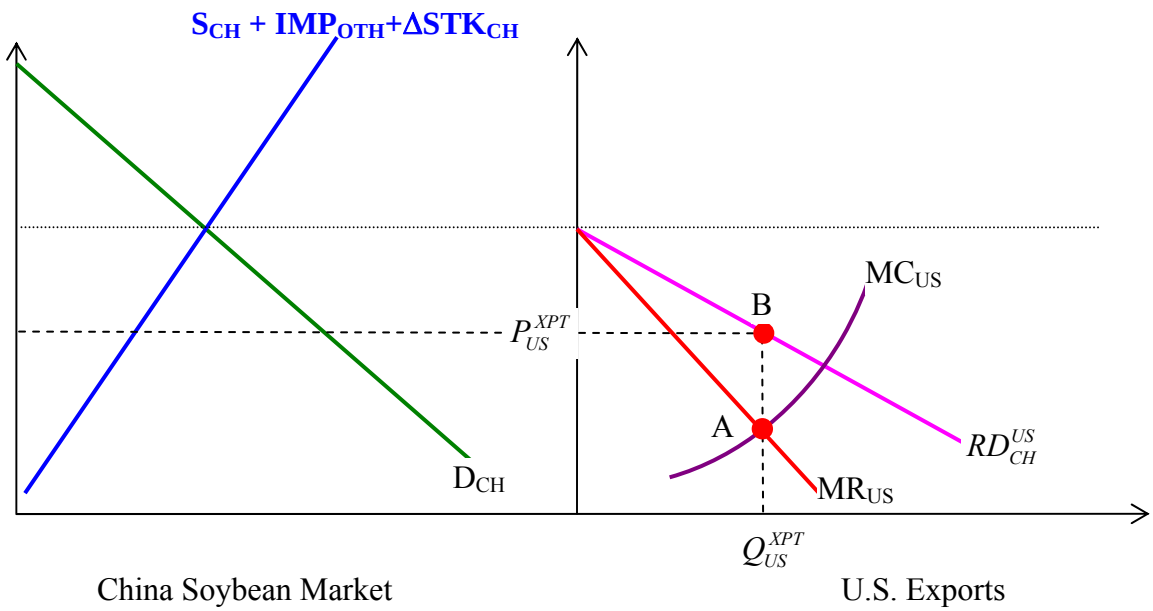
Who Dominates Market Power for U.S.-China Soybean Trade?

Globally, China is the number one soybean importer, and the U.S. is the number one soybean exporter. In 2004 Chinese soybean imports accounted for 35% of global soybean imports, and U.S. soybean exports accounted for 44% of global soybean exports (USDA-FAS, 2005a). In addition, the U.S. is also the number one soybean supplier for China and China is the number one soybean importer of U.S. soybeans. In 2004, U.S. soybean exports to China reached 9.4 million metric tons, accounting for 37% of U.S. total soybean exports and 43% of Chinese total soybean imports (USDA-FAS, 2005b). Given the above facts, it is reasonable to assume that Chinese soybean import market is not perfectly competitive. Knowing who has stronger market power for soybean trade between the two countries is of interest to soybean producers, agribusinesses, traders, and policymakers in both countries. Market power can be considered as a signal to competitiveness. Therefore, results from this research can provide information to U.S. soybean producers and exporters as they make their soybean-related decisions and for policymakers as they formulate policies to enhance the competitiveness of U.S. soybean industry in the world market.

Modification of the Lerner Index

Reverse residual demand model has been widely used in literature (Godlberg and Knetter, 1999; Glauben and Loy, 2003). Following Carter et al. (1997, 1999), assuming that all the soybean exporters in the soybean exporting country can be considered as an aggregated firm, the estimated parameters can be interpreted as the share-weighted industry averages for all the soybean exporters in the soybean exporting country. In addition soybeans exported to China from different countries are assumed as homogeneous products.

Figure 1. China's Residual Demand for U.S. Soybeans



From the U.S. side, it is assumed that U.S. soybean exporters face a downward sloping residual demand curve RD_{CH}^{US} as shown in figure 1. The Chinese soybean residual demand equals the Chinese soybean domestic supply, S_{CH}, plus the Chinese soybean imports from the other countries, mainly from Brazil and Argentina, IMP_{OTH}, and the net change of soybean stocks in China, ΔSTK_{CH}, minus the Chinese domestic soybean demand, D_{CH}. The curve MC_{US} is the marginal cost for U.S. soybean exporters. To maximize soybean export profits, U.S soybean exporters choose point A, where the marginal cost equals the marginal revenue. Accordingly, the equilibrium quantity is Q_{US}^{XPT} at the equilibrium price P_{US}^{XPT}. The distance between A and B is the mark-up for U.S. soybean exporters.

Mathematically, U.S. soybean exporters choose export quantity, Q_{US}^{XPT}, to maximize their profits, π_{US},

$$\underset{Q_{USi}^{XPT}}{Max}\ \pi_{US} = P_{US}^{XPT}(Q_{US}^{XPT}) * Q_{US}^{XPT} - (P_{US}^{Farm} + C_{US}) * Q_{US}^{XPT} \qquad (1)$$

where π_{US} is the profits of U.S. soybean exporters. The variable P_{US}^{XPT} is the U.S. soybean export price, which is a function of the U.S. export quantity, Q_{US}^{XPT}. The variable P_{US}^{Farm} is the U.S. soybean farm level price, or the exporters' purchase cost from soybean farmers, and C_{US} is the transaction costs of U.S. soybean exporters.

The first order condition (FOC) gives

$$\frac{\partial \pi_{US}}{\partial Q_{US}^{XPT}} = \left(\frac{\partial P_{US}^{XPT}}{\partial Q_{US}^{XPT}} * Q_{US}^{XPT} + P_{US}^{XPT} \right) - (P_{US}^{Farm} + C_{US}) = 0 \tag{2}$$

After some mathematic operation, we get

$$\frac{P_{US}^{XPT} - (P_{US}^{Farm} + C_{US})}{P_{US}^{XPT}} = -\frac{\partial P_{US}^{XPT}}{\partial Q_{US}^{XPT}} * \frac{Q_{US}^{XPT}}{P_{US}^{XPT}} = -\frac{\partial P_{US}^{XPT} / P_{US}^{XPT}}{\partial Q_{US}^{XPT} / Q_{US}^{XPT}} \tag{3}$$

The left hand side of equation (3) looks very similar to the Lerner index (Lerner, 1934). Defining $\frac{P_{US}^{XPT} - (P_{US}^{Farm} + C_{US})}{P_{US}^{XPT}}$ as the Adjusted Lerner Index (ALI), the market power of U.S. soybean exporters over Chinese soybean importers can be measured by the ALI. The right hand side of equation (3) is the price flexibility of the Chinese reverse residual demand for U.S. soybeans. Therefore, the price flexibility of the Chinese reverse residual demand for U.S. soybeans can be used as an indirect measure to evaluate the market power of U.S. soybean exporters.

The next step is to derive the relationship between the U.S soybean export price, P_{US}^{XPT}, and the U.S. farm level price, P_{US}^{Farm}. Considering equation (3), we assume that the transaction

costs of U.S. soybean exporters, C_{US}, is a constant ratio, γ_{US}, of the U.S. soybean farm level price. Let $\theta_{US}^{CH} = \frac{\partial P_{US}^{XPT} / P_{US}^{XPT}}{\partial Q_{US}^{XPT} / Q_{US}^{XPT}}$, which is the price flexibility of the Chinese reverse residual demand function for U.S. soybeans and it can be used to measure the market power of U.S. soybean exporters, then equation (3) can be written as

$$P_{US}^{Farm} = \varphi_{US} P_{US}^{XPT} \tag{4}$$

Where $\varphi_{US} = \frac{(1+\theta_{US}^{CH})}{(1+\gamma_{US})}$ (5)

Equation (4) shows the relationship between the U.S. soybean export price and the U.S. farm level price.

Similarly, Chinese soybean importers, facing the upward sloping U.S. soybean residual supply, choose an optimal import quantity to maximize their import profits. Then from the first order condition of the profit maximization function, we can get

$$P_{CH} = [(1+t)(1+\theta_{CH}^{US}) + \gamma_{CH}] * ER_{CH} * P_{US}^{IMP} \tag{6}$$

Where P_{CH} is the Chinese domestic soybean price and *t* is the Chinese import tariff (*ad valorem*) on soybeans. Parameter $\theta_{CH}^{US} = \frac{\partial P_{US}^{IMP}}{\partial Q_{US}^{IMP}} * \frac{Q_{US}^{IMP}}{P_{US}^{IMP}}$ is the price flexibility of the U.S. reverse soybean residual supply function for China and it can be used to measure the market power of Chinese soybean importers. The variable P_{US}^{IMP} is the Chinese soybean import price from the U.S., and Q_{US}^{IMP} is the Chinese soybean import quantity from the United States. The variable ER_{CH} in equation (6) is the exchange rate, and γ_{CH} is the ratio of the transaction costs for

Chinese soybean importers of the Chinese soybean import price. Set $\varphi_{CH} = [(1+t)(1+\theta_{CH}^{US}) + \gamma_{CH}] * ER_{CH}$, then equation (6) can be written as

$$P_{CH} = \varphi_{CH} * P_{US}^{IMP} \tag{7}$$

Equation (7) shows the relationship between the Chinese domestic soybean price and the Chinese soybean import price from the United States.

Derivation of the Two-Country Trade Equilibrium Model

As shown in figure 1, the U.S. residual soybean supply for China includes four components: the U.S. domestic soybean demand, D_{US}, the U.S. domestic soybean supply, S_{US}, the U.S. soybean exports to other countries, XPT_{US}^{OTH}, and the U.S. net soybean stock changes, ΔSTK_{US}. Mathematically, the U.S. residual soybean supply function for China can be written as

$$RS_{US}^{CH} = S_{US} - (D_{US} + XPT_{US}^{OTH}) + \Delta STK_{US} \tag{8}$$

Where the U.S. domestic demand and supply functions are defined as

$$D_{US} = D(P_{US}^{Farm}; Z_{US}^{D})^{*} \tag{9}$$

$$S_{US} = S(P_{US}^{Farm}; Z_{US}^{S}) \tag{10}$$

where P_{US}^{Farm} is the U.S. soybean farm level price, Z_{US}^{D} is a vector of demand shifters in the U.S., and Z_{US}^{S} is a vector of supply shifters. The U.S. soybean exports to the other countries and the U.S. soybean stock changes are considered as exogenous variables in this research.

[*] Assuming a constant market margin between the U.S. soybean retail price and the U.S. farm level price, the U.S. farm level price can be used in the U.S. domestic demand function instead of the U.S. soybean retail price.

Substitute the U.S. domestic soybean supply and demand functions into the U.S. residual soybean supply function (equation (8)) and write it in an implicit form as

$$RS_{US}^{CH} = RS(P_{US}^{Farm}; Z_{US}^{S}, Z_{US}^{D}, XPT_{US}^{OTH}, \Delta STK_{US}) \tag{11}$$

Given the relationship between the U.S. soybean export price and the U.S. farm level price (equation (4)), substitute equation (4) into equation (11), and write it in its reverse form as

$$P_{US}^{XPT} = P_{US}^{XPT}(RS_{US}^{CH}; Z_{US}^{S}, Z_{US}^{D}, XPT_{US}^{OTH}, \Delta STK_{US}) \tag{12}$$

Similarly, the Chinese reverse residual demand function for U.S. soybeans can be derived as

$$P_{CH}^{IMP} = P_{CH}^{IMP}(RD_{CH}^{US}; Z_{CH}^{D}, Z_{CH}^{S}, IMP_{CH}^{OTH}, \Delta STK_{CH}, BP_{CH}) \tag{13}$$

Where the variable P_{CH}^{IMP} is the Chinese soybean import price from the U.S., and RD_{CH}^{US} is the Chinese residual demand for U.S. soybeans. The variable Z_{CH}^{D} is a vector of Chinese soybean demand shifters, including the prices of substitutes or complements, income, population, among others, and Z_{CH}^{S} is a vector of Chinese supply shifters, including prices of substitutes or complements, technology, production costs, among others. The Chinese soybean imports from the other countries, IMP_{CH}^{OTH}, and the Chinese soybean stock changes, ΔSTK_{CH} are considered as exogenous variables. To test the impacts of Chinese biotech policies on U.S. soybean exports to China in the model, a dummy variable, the Chinese biotech policy, BP^{CH}, is also included in this model.

Combining the U.S. reverse residual soybean supply function for China and the Chinese reverse residual demand function for U.S. soybeans together and adding the equilibrium condition, where the U.S residual soybean supply for China equals the Chinese residual demand for U.S. soybeans, the two-country trade equilibrium model can be written as

$$\begin{cases} P_{US}^{XPT} = P_{US}^{XPT}(RS_{US}^{CH}; Z_{US}^{S}, Z_{US}^{D}, XPT_{US}^{OTH}, \Delta STK_{US}) & (12) \\ P_{CH}^{IMP} = P_{CH}^{IMP}(RD_{CH}^{US}; Z_{CH}^{D}, Z_{CH}^{S}, IMP_{CH}^{OTH}, \Delta STK_{CH}, BP_{CH}) & (13) \\ P_{CH}^{IMP} = \phi P_{US}^{XPT} & (14) \\ RD_{CH}^{US} = RS_{US}^{CH} & (15) \end{cases}$$

Equation (12) is the U.S. reverse residual soybean supply for China and equation (13) is the Chinese reverse residual demand for U.S. soybeans. Equation (14) examines transportation and insurance cost ration to U.S. soybean export price, since the U.S. export price is FOB price and the Chinese soybean import price is CIF price. The price difference between the Chinese soybean import price and the U.S. soybean export price reflects the freight and insurance as well as other related transaction costs. Equation (15) is the equilibrium condition where, at equilibrium status the U.S. residual soybean supply for China equals the Chinese residual demand for U.S. soybeans.

Empirical Model Identification and Estimation

The U.S. reverse residual soybean supply function for China, includes five groups of variables. The first one is the U.S. soybean exports to China, or the U.S. residual soybean supply for China, RS_{US}^{CH}. The second group is the U.S. soybean demand shifters, including the U.S. personal disposable income, INC_{US}, the U.S. corn price, P_{US}^{Corn}, a substitute for soybeans, the U.S. soyoil price, P_{US}^{Oil}, and the U.S. soymeal price, P_{US}^{Meal}. The third group is the U.S. soybean supply shifters, including technology, measured by time trend variable, T, and the U.S. corn price, P_{US}^{Corn}. The fourth group is the U.S. soybean exports to the other countries, XPT_{US}^{OTH}. The last group is the U.S. soybean stocks, STK_{US}.

The Chinese reverse residual demand function for U.S. soybeans (equation (13)) includes four groups of variables. The first group is the Chinese soybean imports from the U.S., or the Chinese residual demand for U.S. soybeans, RD_{CH}^{US}. The second group is the Chinese domestic demand shifters, Z_{CH}^{D}. In this research, the Chinese domestic soybean demand shifters include: the corn price in the Chinese domestic market, P_{CH}^{Corn}, assuming that corn is a substitute for soybeans, the Chinese personal disposable income, INC_{CH}, and the livestock development index, LDI_{CH}. The Chinese livestock industry developed quickly in recent years, whereby soymeal is a main feed material for livestock. The development of the livestock industry in China incurred an increasing demand for soymeal, and finally led to a soybean demand increment. This index was developed by calculating the chain growth rate of the Chinese total meat output. Meats used to calculate this index include beef, pork, poultry, and fish. In addition, the Chinese domestic soybean product prices—soyoil price, P_{CH}^{Oil}, and soymeal price, P_{CH}^{Meal}—are also included in the model.

The third group is the Chinese soybean supply shifters. In this research, the Chinese soybean supply shifters include the corn price in the Chinese domestic market, P_{CH}^{Corn}. Similarly, as in the Chinese soybean domestic demand model, corn is assumed to be a substitute for soybeans. Another variable included in the Chinese soybean domestic supply model is technology, measured by the time trend variable, T.

The last group includes the Chinese soybean imports from the other countries, and Chinese biotech policy, BP_{CH}, which may impose impacts on U.S. soybean exports to China, since 85% U.S. soybean are biotech varieties. China passed its first biotech product regulations in May

2001. Therefore in this research, BP_{CH} equals 0 before May 2001 and 1 otherwise. Since the Chinese soybean stocks were very low and did not change much, the changes of the Chinese soybean stocks were not included in this model.

Based on the above analyses, the empirical two-country trade equilibrium model can be written as

$$\begin{cases} P_{US}^{XPT} = \alpha_0 + \alpha RS_{US}^{CH} + \alpha_1 P_{US}^{Corn} + \alpha_2 INC_{US} + \alpha_3 P_{US}^{Oil} + \alpha_4 P_{US}^{Meal} + \alpha_5 T \\ \qquad + \alpha_6 XPT_{US}^{OTH} + \alpha_7 STK_{US} + \varepsilon_{US} & (16) \\ \mathrm{P}_{\mathrm{CH}}^{\mathrm{IMP}} = \beta_0 + \beta \mathrm{RD}_{\mathrm{CH}}^{\mathrm{US}} + \beta_1 \mathrm{P}_{\mathrm{CH}}^{\mathrm{Corn}} + \beta_2 \mathrm{INC}_{\mathrm{CH}} + \beta_3 \mathrm{LDI}_{\mathrm{CH}} + \beta_4 \mathrm{P}_{\mathrm{CH}}^{\mathrm{Oil}} \\ \qquad + \beta_5 \mathrm{P}_{\mathrm{CH}}^{\mathrm{Meal}} + \beta_6 \mathrm{T} + \beta_7 \mathrm{IMP}_{\mathrm{CH}}^{\mathrm{OTH}} + \beta_8 \mathrm{BP}_{\mathrm{CH}} + \varepsilon_{\mathrm{CH}} & (17) \\ P_{CH}^{IMP} = \phi P_{US}^{XPT} & (18) \\ RD_{CH}^{US} = RS_{US}^{CH} & (19) \end{cases}$$

Where P_{CH}^{IMP}: The China's soybean import price from the United States (USD/MT);

RD_{CH}^{US}: The China's residual demand for U.S. soybeans (MT) or China's soybean import quantity from the United States;

P_{CH}^{Corn}: The China's corn price (RMB/MT);

INC_{CH}: The China's personal disposable income (RMB);

LDI_{CH}: The China's livestock industry development index, which is the chain growth rate of China's meat production, including pork, beef, poultry, and fish;

P_{CH}^{Oil}: The China's soyoil price (RMB/MT);

P_{CH}^{Meal}: The China's soymeal price (RMB/MT);

T: Time trend variable;

IMP_{CH}^{OTH}: The China's soybean imports from the other countries (MT);

BP_{CH}: The China's biotech policy, a dummy variable, equaling 0 before May 2001 and 1 otherwise;

ε_{CH}: Error term.

P_{US}^{XPT} : The U.S. soybean export price to China ($/MT);

RS_{US}^{CH} : The U.S. residual soybean supply for China or U.S. soybean exports to China (MT);

INC_{US} : The U.S. personal disposable income ($);

P_{US}^{Corn} : The U.S. corn price ($/MT);

P_{US}^{Oil} : The U.S. soyoil price ($/MT);

P_{US}^{Meal} : The U.S. soymeal price ($/MT);

XPT_{US}^{OTH} : The U.S. soybean exports to the other countries (MT);

STK_{US} : The U.S. beginning soybean stocks (MT);

ε_{US} : Error term.

Assuming that in the short-run, the price flexibility of either the Chinese reverse residual demand for U.S. soybeans or the U.S. reverse residual soybean supply for China is constant, then equations (16), (17), (18), and (19) are estimated by using the double-log form to get the parameter of interest directly.

Data Description

Data used in this research are monthly data from January 1999 to February 2005, 74 observations. Data sources of this research are listed in table 1. Among these variables, the raw data for the personal disposable incomes are annual data. However, in this research, we need to use monthly data. To be able to include the personal disposable income in this model, the personal disposable income needs to be transformed into monthly format.

To transform the personal disposable income from annual format to monthly format, the average growth rate, consistence, and precision were taken into consideration. Using some mathematical techniques, Chinese personal disposable income and U.S. personal disposable income were transformed from annual format into monthly format.

For the variables Chinese livestock industry development index, LDI_{CH}, Chinese meat outputs, including beef, pork, poultry, and fish output were integrated in annual format. Then, similar method was used to transform the annual data into monthly data. Finally, calculate the chain growth rate as an index to reflect the demand change in feed because of the fast development of the Chinese livestock and fishery industry.

Table 1. Variables and their sources

Variable	Meaning	Source
P_{US}^{CH}	The U.S. soybean export price to China ($/MT);	USDA-FAS.
RS_{US}^{CH}	The U.S. soybean residual supply for China (MT);	The Chinese Minister of Agriculture.
INC_{US}	The U.S. personal disposable income ($);	USDA-ERS.
P_{US}^{Corn}	The U.S. corn retail price at Chicago market ($/MT);	USDA-ERS.
P_{US}^{Oil}	The U.S. soyoil price ($/MT);	USDA-ERS.
P_{US}^{Meal}	The U.S. soymeal price ($/MT);	USDA-ERS.
XPT_{US}^{EU}	The U.S. soybean exports to the EU (MT);	USDA-FAS.
XPT_{US}^{JP}	The U.S. soybean exports to Japan (MT);	USDA-FAS.
XPT_{US}^{MX}	The U.S. soybean exports to Mexico (MT);	USDA-FAS.
STK_{US}	The U.S. soybean beginning stocks (MT).	USDA-ERS.
P_{CH}^{IMP}	The Chinese soybean import price from the United States (RMB/MT);	The Chinese Minister of Agriculture.
RD_{CH}^{US}	The Chinese residual demand for U.S. soybeans (MT);	The Chinese Minister of Agriculture.
P_{CH}^{Corn}	The Chinese corn price at Dalian Port (RMB/MT);	Shanghai JC Intelligence Co., Ltd.
INC_{CH}	The Chinese personal disposable income (RMB);	USDA-ERS.

LDI_{CH}	The Chinese livestock industry development index;	Chinese Statistics Yearbook (1999-2005)/
P_{CH}^{Oil}	The Chinese soyoil prices (RMB/MT);	Shanghai JC Intelligence Co., Ltd.
P_{CH}^{Meal}	The Chinese soymeal prices (RMB/MT);	Shanghai JC Intelligence Co., Ltd.
IMP_{CH}^{BR}	The Chinese soybean imports from Brazil (MT);	The Chinese Minister of Agriculture.
IMP_{CH}^{AR}	The Chinese soybean imports from Argentina (MT);	The Chinese Minister of Agriculture.

Empirical Estimation and Interpretation

The two-country partial equilibrium model was estimated by SAS full information maximum likelihood (FIML) method. Estimation results are reported in table 2. For the U.S. reverse residual soybean supply function for China, six independent variables, including the residual supply quantity, RS_{US}^{CH}, the U.S. personal disposable income, INC_{CH}, the U.S. soyoil prices, P_{US}^{Oil}, the U.S. soymeal prices, P_{US}^{Meal}, the U.S. soybean exports to Mexico, XPT_{US}^{MX}, and the U.S. soybean stocks, STK_{US}, were statistically significant at 5% significant levels or better as shown in table 2. The sign of the parameter for the U.S. residual soybean supply for China, RS_{US}^{CH}, was correct as expected.

For the Chinese reverse residual demand function, four variables, including the Chinese residual demand, RD_{CH}^{US}, the corn price in China, P_{CH}^{Corn}, the prices of soyoil and soymeal in China, P_{CH}^{Oil} and P_{CH}^{Meal}, were statistically significant at 1% level. In addition, the sign of the parameter for the Chinese residual demand, RD_{CH}^{US}, was negative as expected.

Table 2. Estimation Results of the Two-country Partial Equilibrium Model

Equation	Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
U.S. Reverse Residual Supply: $P_{US}^{XPT} = P(...)$	Intercept	10.6230***	3.9991	2.66	0.0103
	RS_{US}^{CH}	0.1306***	0.0405	3.23	0.0021
	P_{US}^{Corn}	-0.2770	0.1442	-1.92	0.0600
	INC_{US}	-1.1029**	0.5496	-2.01	0.0497
	P_{US}^{Oil}	0.4348***	0.0734	5.92	<.0001
	P_{US}^{Meal}	0.5027***	0.1315	3.82	0.0003
	XPT_{US}^{EU}	-0.0067	0.0052	-1.27	0.2082
	XPT_{US}^{JP}	-0.0093	0.0370	-0.25	0.8023
	XPT_{US}^{MX}	-0.0848***	0.0265	-3.19	0.0023
	STK_{US}	-0.0694***	0.0260	-2.67	0.0100
China's Reverse Residual Demand: $P_{US}^{IMP} = P(...)$	Intercept	-4.2451	3.5773	-1.19	0.2405
	RD_{CH}^{US}	-0.0392***	0.0141	-2.78	0.0074
	P_{CH}^{Corn}	0.2717***	0.0914	2.97	0.0044
	INC_{CH}	0.2961	0.5201	0.57	0.5714
	LDI_{CH}	0.5782	0.8977	0.64	0.5222
	P_{CH}^{Oil}	0.4430***	0.0743	5.96	<.0001
	P_{CH}^{Meal}	0.3011***	0.0794	3.79	0.0004
	IMP_{CH}^{BR}	-0.0015	0.0010	-1.48	0.1448
	IMP_{CH}^{AR}	-0.0005	0.0009	-0.52	0.6062
	BP_{CH}	-0.0692	0.0435	-1.59	0.1179
Price Relationship: $P_{US}^{IMP} = P(P_{US}^{XPT})$	Intercept	-0.5210	0.3634	-1.43	0.1566
	P_{US}^{XPT}	1.1145***	0.0676	16.48	<.0001

Note: *** 1% significant level, ** 5% significant level, * 10% significant level.

For the estimated parameter of Chinese domestic corn price, it meant that keeping other variables constant, a 1% corn price increase would cause a 37% of increase in Chinese soybean import price from the United States. For Chinese domestic prices of soyoil and soymeal, they

were moving in the same direction with the soybean import price, and the estimated cross price elasticities of Chinese soybean import price form the U.S. with respect to soyoil or soymeal prices were 0.44 and 0.30 respectively.

The estimated parameter for the Chinese residual demand, RD_{CH}^{US}, was the price flexibility of the Chinese reverse residual demand function for U.S. soybeans. From another perspective, the parameter was also the market margin of U.S. soybean exporters (equation (3)). The U.S. soybean exporters' market margin of soybean exports to China was 4% of U.S. farm level price.

The estimated parameter for the U.S. residual soybean supply, RS_{US}^{CH}, is the price flexibility of the U.S. reverse residual soybean supply function for China. From another perspective, this price flexibility can be used to measure the market power of Chinese soybean importers. The estimation result implied that the market margin of Chinese soybean importers was 13% of the import price from the United States. Comparing the two market margins of Chinese soybean importers and U.S. soybean exporter, we inferred that the market power of Chinese soybean importers was stronger than that of U.S. soybean exporters.

Conclusion and Discussion

Based on the reverse residual demand and reverse residual supply model, this research developed the two-country trade partial equilibrium model, incorporating the reverse residual demand function and the reverse residual supply function as well as the equilibrium condition, where the residual demand equals the residual supply in equilibrium. Applying this model to U.S. soybean exports to China, this paper examined the market power of both the U.S. soybean exporters and China's soybean importers through estimating the price flexibilities of the Chinese reverse residual demand function for U.S. soybeans and the U.S. reverse residual soybean supply

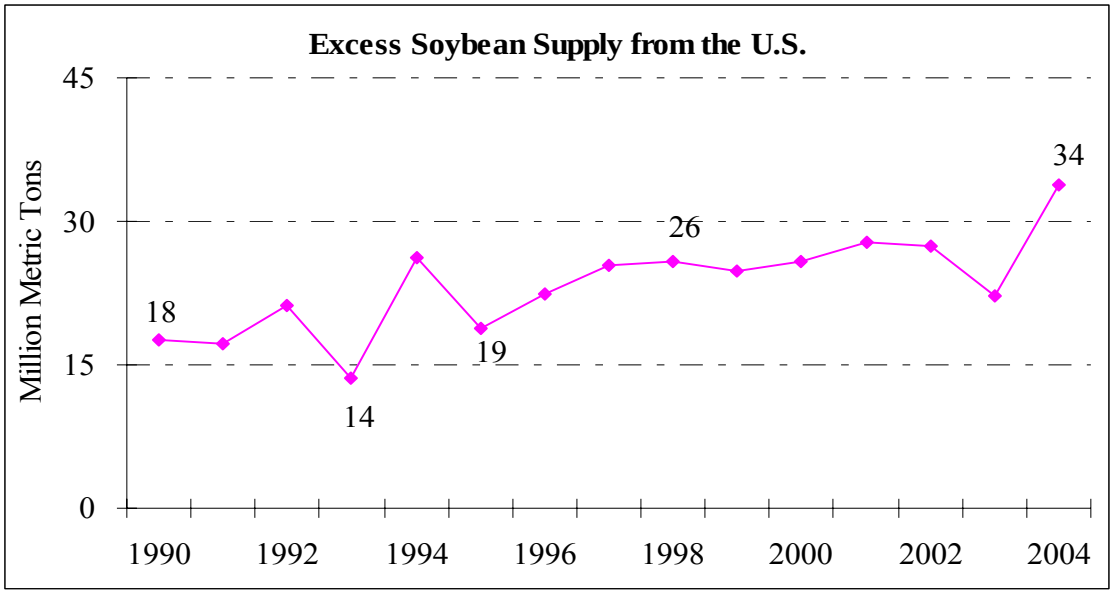
function for China. Results indicated that Chinese soybean importers have stronger market power than U.S. soybean exporters in the Chinese soybean import market.

The empirical result is consistent with the actual observations. Figure 2 plots the U.S. excess soybean supply and it shows that the U.S. excess soybean supply increased fast in the past. The U.S. excess soybean supply was only 18 million metric tons in 1990 and reached 34 million metric tons in 2004. With the increment of excess soybean supply, the U.S. soybean industry depends more on export markets to deal with their soybean surplus.

Figure 3 depicts the excess soybean demands for the main soybean importing countries in the world and it shows that excess soybean demands from the EU, Japan, and Mexico were quite stable in the past. By these trends, we can not expect that the excess soybean demands from the EU, Japan, and Mexico will increase much in the future. However, the Chinese excess soybean demand skyrocketed in the last decade and became the premier export market for soybeans in the world.

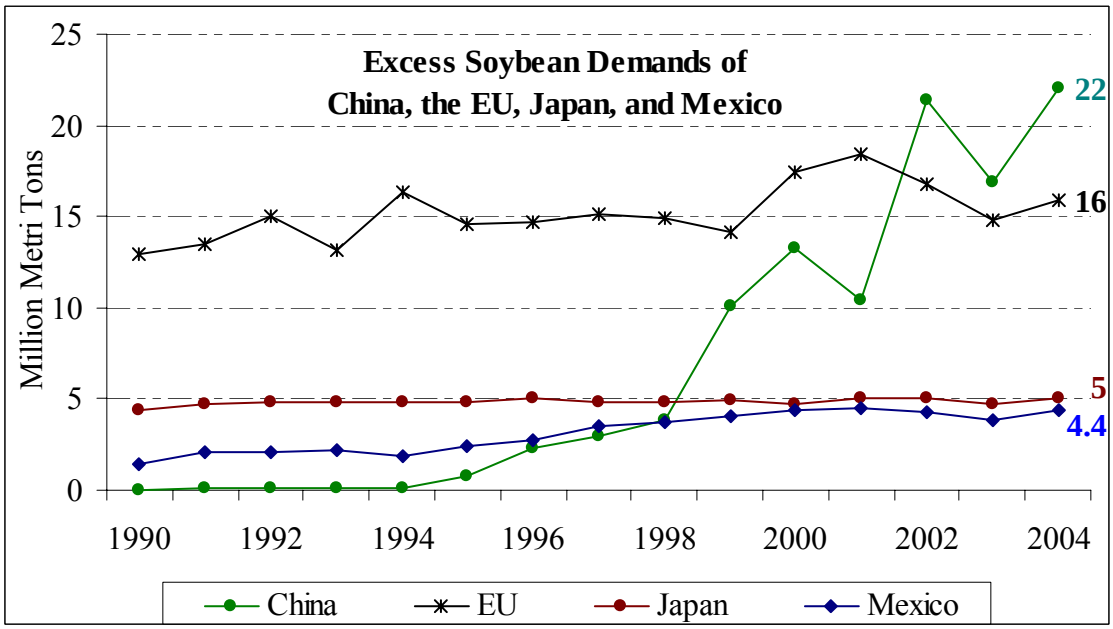
In addition, the soybean industry in Brazil and Argentina developed very fast in recent years and became strong competitors for the U.S. in the world soybean market (Flaskerud, 2003; Schnepf, et al, 2001; Warnken, 1999). Figure 4 shows that excess soybean supplies from Brazil and Argentina also increased fast in the past few years. To deal with their soybean surplus, they were also trying to take bigger shares in the Chinese soybean market. All these facts also support the empirical results from this research that Chinese importers have stronger market power than the U.S. soybean exporters.

Figure 2. Excess Soybean Supply from the U.S.



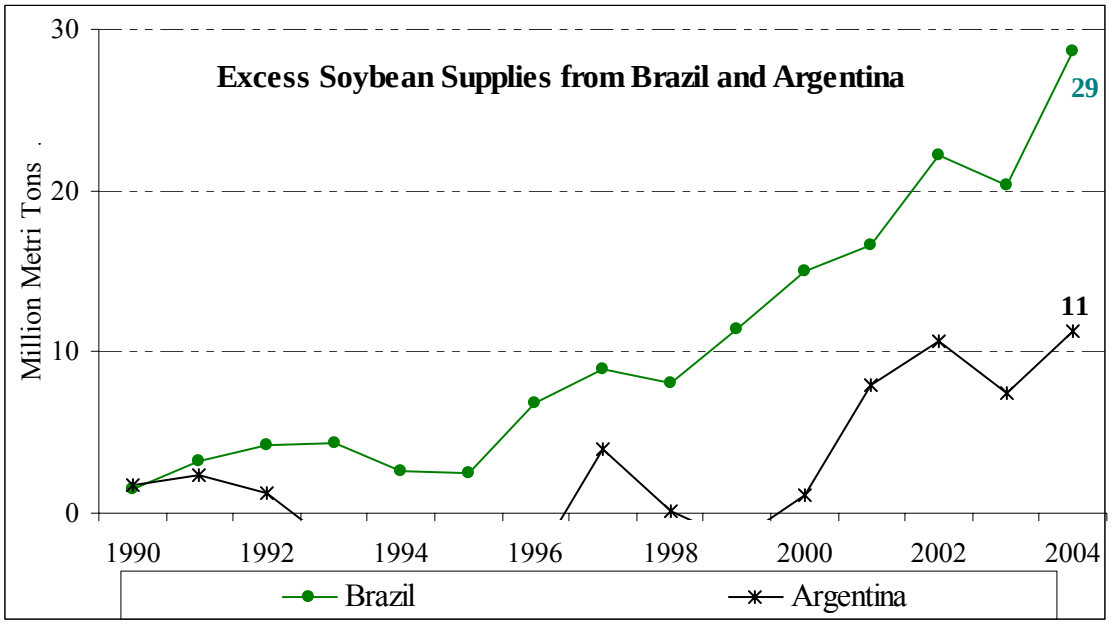
Data source: USDA-FAS, 2005a.

Figure 3. Excess Soybean Demands of China, the EU, Japan, and Mexico



Data source: USDA-FAS, 2005a.

Figure 4. Excess Soybean Supplies from Brazil and Argentina



Data source: USDA-FAS, 2005a.

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