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Competitive Analysis and Market Power of China's Soybean Import Market[1]

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Abstract

This research conducts a competitive structure analysis of the Chinese soybean import market which leads to the hypothesis that China's soybean importers may have stronger market power in China's soybean import market. Then, this research develops and simultaneously estimates a two-country partial equilibrium trade model to test U.S.-China market power of soybean trade. The empirical result supports our hypothesis that Chinese soybean importers have stronger market power relative to U.S. soybean exporters. This Chinese market power can be countered by U.S. and South American companies through developing new and expanding existing markets for soybeans throughout the world and investing in Chinese soybean storage and crushing capacity.

Keywords: Chinese soybean import market, competitive structure analysis, market power, two-country partial equilibrium trade model

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Introduction

Globally, China is the number one soybean importer, and the U.S., Brazil, and Argentina are the top three soybean exporters. In 2005, China's soybean imports accounted for 41% of the world total, and soybean exports from the above three soybean producing countries accounted for over 90% of the world total (USDA-FAS, 2006a). Given the above aggregate market shares of these soybean traders in the world soybean market, it is reasonable to assume that the world soybean market is not perfectly competitive. Since China is the largest soybean import market, this research will focus on the Chinese soybean importer. The Chinese soybean import market may be characterized as either a monopsony where China, as the major soybean importer, has stronger market power relative to soybean exporters from the U.S., Brazil, and Argentina or as an oligopoly where the U.S., Brazil, and Argentina, as major soybean exporters, have relatively stronger market power. Knowing who has stronger market power for soybean trade and the competitive structure of the Chinese soybean import market can provide important information to U.S. soybean producers, agribusinesses, and exporters as they make marketing decisions and for policymakers as they formulate policies to enhance U.S. competitiveness of the soybean industry in the world market.

Objectives

In this research, our objectives include 1) to provide an overview of the world soybean industry; 2) to perform a competitive structure analysis of the Chinese import market, 3) to develop and simultaneously estimate a two-country partial equilibrium soybean trade model to test the market power of the Chinese soybean import market, and 4) discuss the implications of this competitive structure for producers and agribusinesses in exporting countries.

Overview of the World Soybean Industry

Leading Global Soybean Producers

Globally, the top four soybean producing countries include the U.S., Brazil, Argentina, and China, as shown in figure 1 (USDA-FAS, 2006a). In 2005, soybean output from these four countries reached 200 million metric tons, accounting for 90% of the global total. Among them, the U.S. led the world in soybean production with an output of 84 million metric tons in 2005. Brazilian soybean output reached 57 million metric tons, about 76% of U.S. production, and ranked second in the world. Argentina produced 41 million metric tons of soybeans and China produced 18 million metric tons.

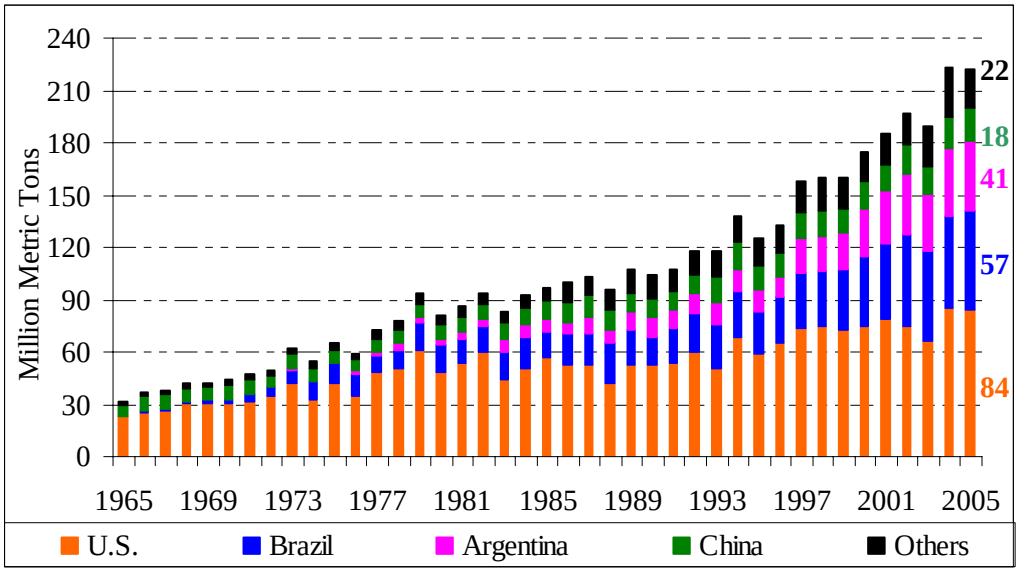

Figure 1: Leading Global Soybean Producing Countries
Source: USDA-FAS, 2006a.

Figure 1 also indicates that the growth of soybean production was quite stable for the U.S., China, and other countries. In the last four decades, the average annual growth rates of soybean production in the U.S. and China were 5% and 3%, respectively (USDA-FAS, 2006a). In contrast, soybean production in Brazil and Argentina increased dramatically in recent years. From 1964 to 2005, the average annual growth rates of soybean production in Brazil and Argentina were 14% and 27%, respectively. From these trends shown in figure 1, it is reasonable to expect that within a few years Brazil may surpass the U.S. and become the largest soybean producer in the world, if the U.S. and Brazil continue on their current growth rates. The growth rate of Argentinean soybean production is even higher than that of Brazil, and Argentina has also become a strong competitor for the U.S. in the world soybean market.

Leading Global Soybean Consumers

Leading global soybean consuming countries (or economic groups) include the U.S., China, Brazil, Argentina, and the EU-25. Figure 2 compares soybean consumption among these countries (USDA-FAS, 2006a). The U.S. is the number one soybean consumer in the world. In 2005, U.S. soybean consumption reached 51 million metric tons, accounting for 61% of U.S. soybean output. For Brazil, 32 million metric tons were consumed in 2005, accounting for 56% of its production. Argentina's soybean consumption reached 31 million metric tons in 2005, accounting for 76% of its production.

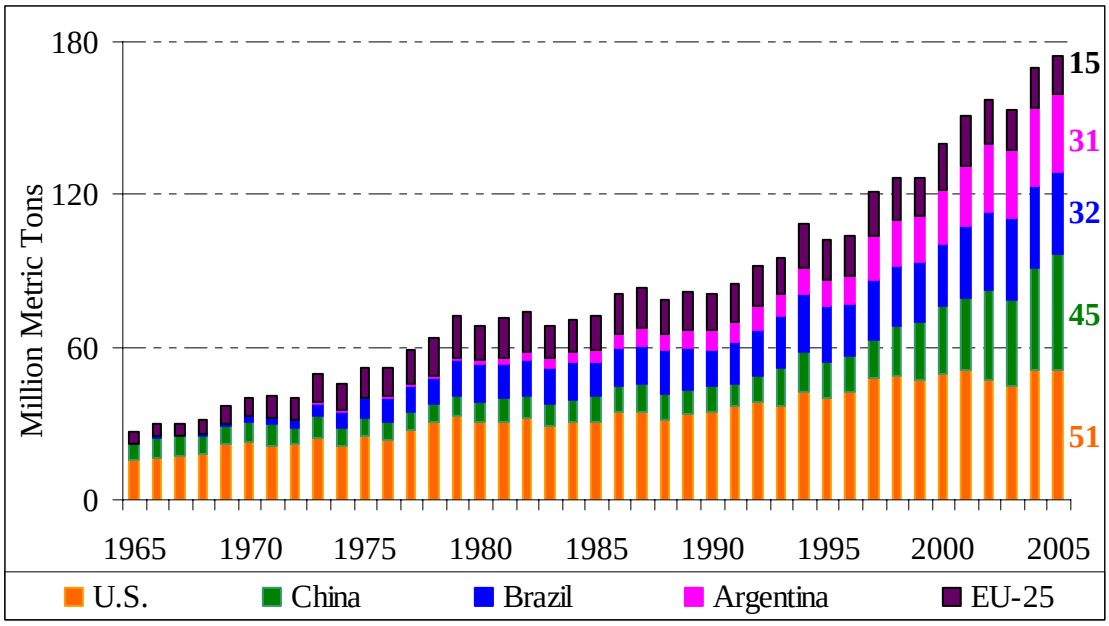

Figure 2: Leading Global Soybean Consumers
Source: USDA-FAS, 2006a.

In contrast, China's soybean consumption was 45 million metric tons in 2005, while China's production was only 18 million metric tons, resulting in 27 million metric tons of imports from other countries, mainly from the U.S., Brazil, and Argentina. Main reasons for the rapid increase in China's soybean consumption include (1) income growth—leading to an increased demand for soyoil; (2) the development of China's livestock industry—leading to an increased demand for soymeal used for feed; and (3) extensive domestic and foreign investment in crushing facilities along China's coastal cities—leading to an increased demand for imported soybeans.

Leading Global Soybean Exporters

The top three soybean exporters in the world include the U.S., Brazil, and Argentina. Figure 3 shows that Brazil's soybean exports reached 25 million metric tons in 2005, surpassing the U.S. for the first time, and Brazil became the number one soybean exporter in the world. The U.S. exported 24 million metric tons of soybeans, a reduction of 3 million metric tons compared to 2004 (USDA-FAS, 2006a). Brazil's soybean exports increased dramatically in the last decade from 4 million metric tons in 1995 to 25 million metric tons in 2005, an increase of over 500%. Soybean exports from Argentina also increased in recent years, and reached 10 million metric tons in 2005. Brazil and Argentina have been expanding their market shares in the world soybean market, competing with U.S. soybean exports.

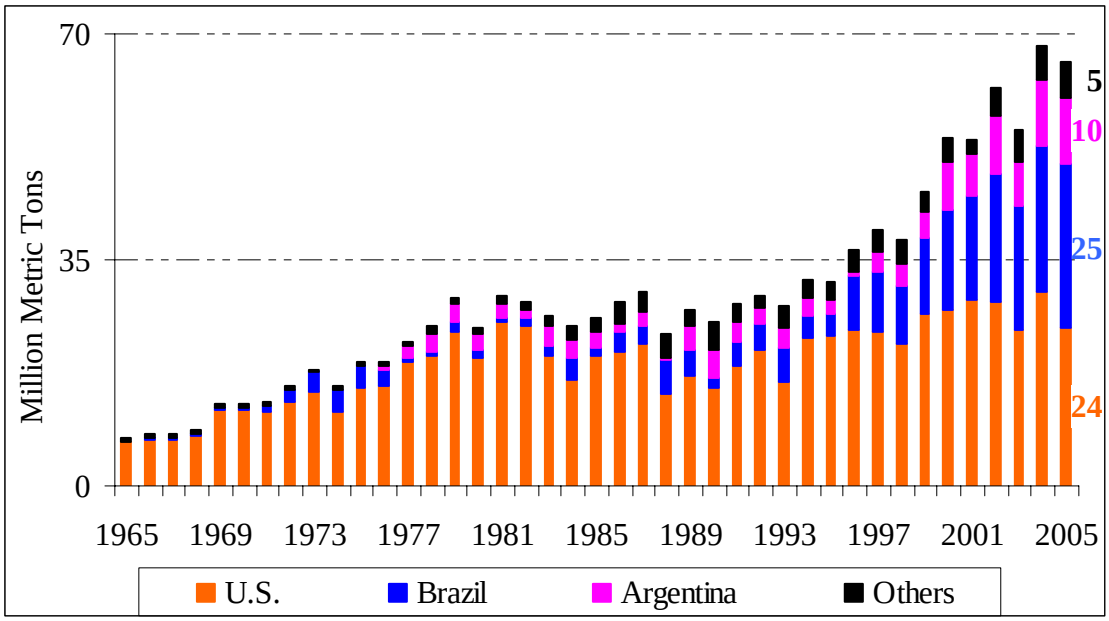

Figure 3: Leading Global Soybean Exporters
Source: USDA-FAS, 2006a.

The export shares in the world soybean market for Brazil, the U.S., and Argentina were 39%, 37%, and 16%, respectively in 2005 (USDA-FAS, 2006a). The sum of soybean exports from these three countries accounted for 92% of the 2005 global total. The trends for market shares and the structural changes in the world soybean market are shown in figure 4.

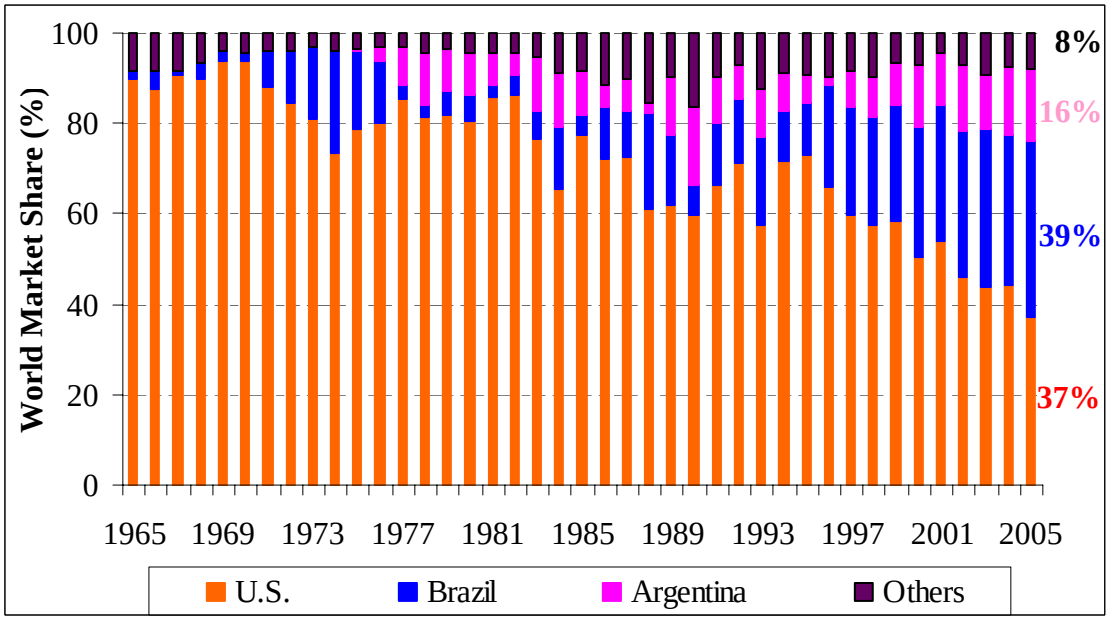

Figure 4: Export Share of Top Soybean Exporters in the World Soybean Market
Source: USDA-FAS, 2006a.

The U.S. soybean export share in the world market has been decreasing, especially in the last decade. In 1995, the U.S. soybean export share was 73%, but fell to 37% in 2005, a 36% market share drop in the world soybean market. In contrast, Brazilian market share in the world soybean market increased from 11% in 1995 to 39% in 2005, gaining 28% more within a decade. Argentina also competes with the U.S. in the world soybean market, and Argentinean market share increased from 6% in 1995 to 16% in 2005.

Leading Global Soybean Importers

The leading global soybean importers include China, the EU-25, Japan, and Mexico as shown in figure 5. China's soybean imports skyrocketed in the last decade from 0.8 million metric tons in 1994 to 27 million metric tons in 2005, an almost 27-fold increase, while soybean imports into the EU, Japan, and Mexico remained quite stable (USDA-FAS, 2006a). Reasons for China's dramatic increase in soybean imports include China's rapid increase in soybean demand as discussed in the previous section and relative slow increase in domestic soybean production, creating a large demand for imports. In 2005, China's soybean imports accounted for 41% of the world total. The EU-25 imported 14 million metric tons of soybeans in 2005, which was 22% of global soybean imports. Soybean imports for Japan and Mexico were 4 million metric tons each. Japanese and Mexican soybean import shares were each only about 6% of the world total.

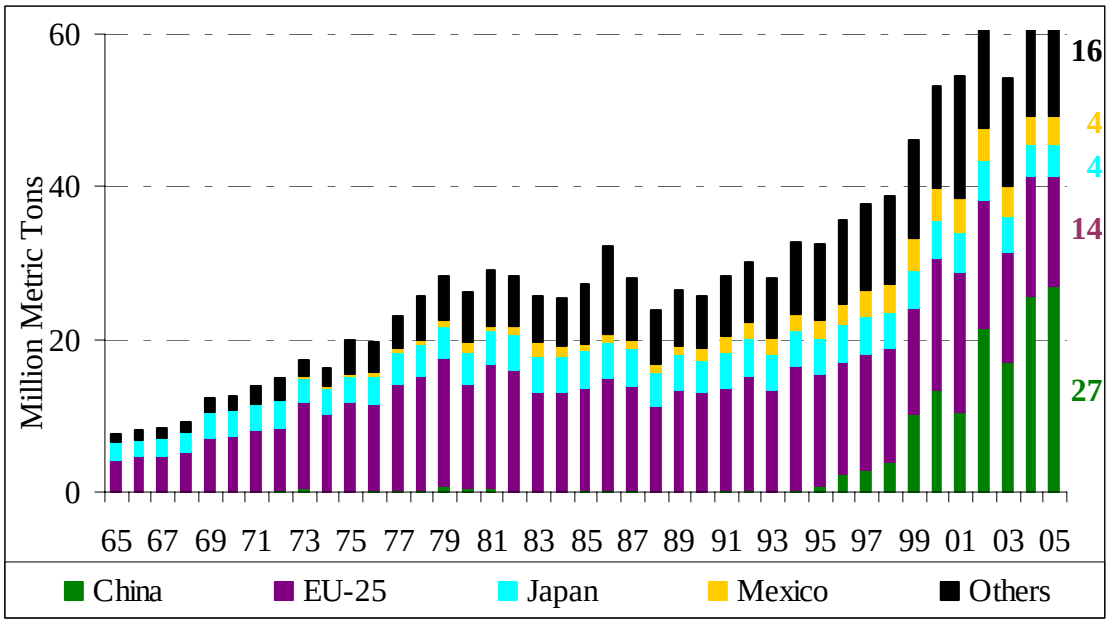

Figure 5: Leading Global Soybean Importers
Source: USDA-FAS, 2006a.

Competitive Analysis of China's Soybean Import Market

One Basic Assumption

As discussed in the introduction, the U.S., Brazil and Argentina are three main soybean suppliers for China. Since data for Brazil and Argentina are difficult to obtain. Thus, the two-country partial equilibrium soybean models for Brazil-China, and Argentina-China were not estimated in next section. However, to gain a better understanding of the competitive structure of the Chinese soybean import market, soybean exports from Brazil and Argentina should be considered as well. For the competitive structure analysis of the Chinese soybean import market, we assumed that Chinese soybean importers have stronger market power over exporters in the U.S., Brazil, and Argentina. By examining the historical trends of soybean surpluses in leading soybean exporting countries and soybean shortages in leading soybean importing countries, we find evidence to support this assumption.

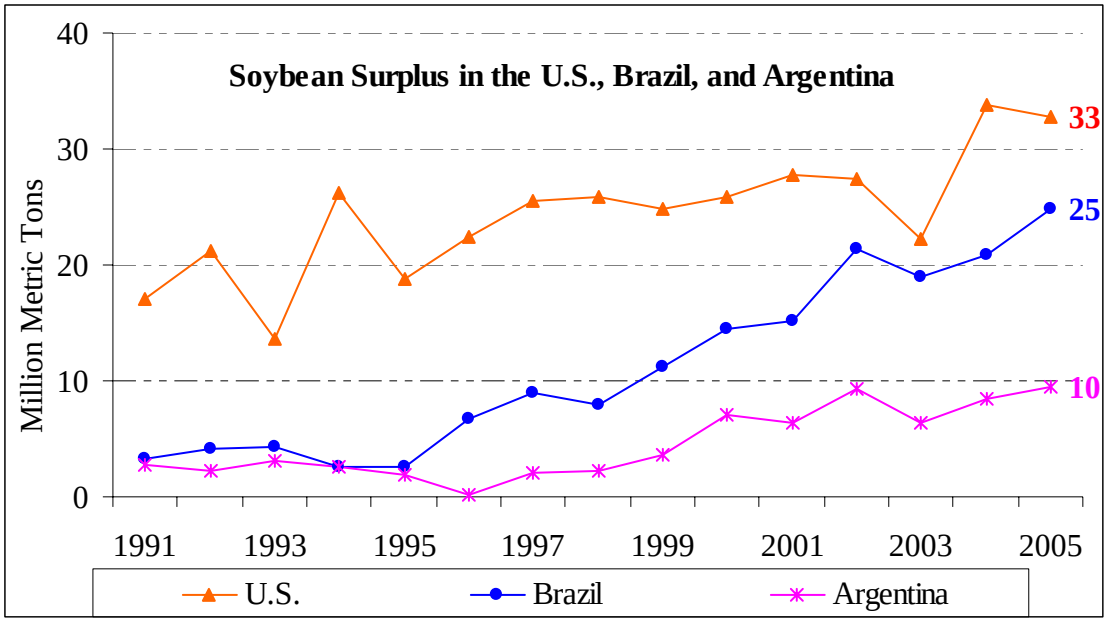

Figure 6: Soybean Surplus in Main Soybean Exporting Countries
Source: USDA-FAS, 2006a.

Figure 6 shows that soybean surpluses (defined as the difference between domestic production and consumption in soybean exporting countries) for the U.S., Brazil, and Argentina increased annually in recent years. In 2005, soybean surpluses in the U.S., Brazil, and Argentina reached 33, 25, and 10 million metric tons, respectively (USDA-FAS, 2006a). To avoid large accumulation of soybean stockpiles, export markets become crucial for these three countries.

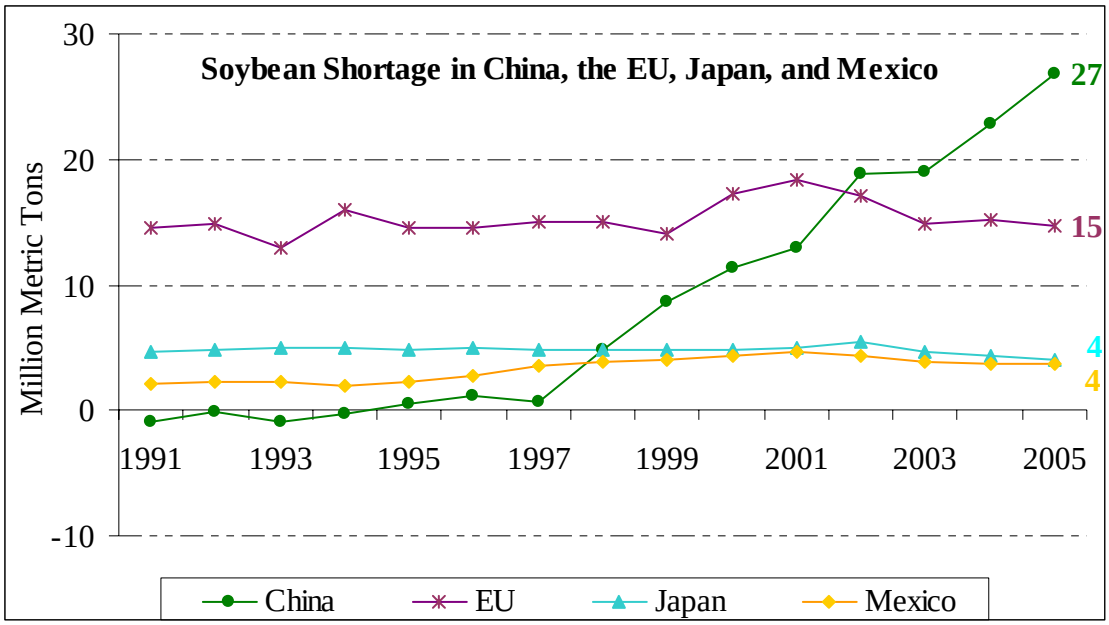

Figure 7: Soybean Shortage in Main Soybean Importing Countries
Source: USDA-FAS, 2006a.

Figure 7 shows the trends of soybean shortages (defined as the difference between domestic consumption and production in soybean importing countries) for the top soybean importers in the world, including China, the European Union, Japan, and Mexico. In contrast to the stable soybean shortages in the EU, Mexico, and Japan, China's soybean shortage increased dramatically in recent years, from almost null in 1991 to 27 million metric tons in 2005.

The above analysis indicates that China is and will continue to be the most important soybean market for the U.S., Brazil, and Argentina. Three large soybean suppliers—U.S., Brazil, and Argentina facing one large soybean buyer—China with rapid import growth support the assumption that Chinese soybean importers may have stronger market power than soybean exporters from the U.S., Brazil, and Argentina.

The U.S. and SA Are Seasonal Complementary Soybean Suppliers for China

Because China is the most important market for the U.S., Brazil, and Argentina, these three soybean exporters compete with each other in the Chinese soybean import market to expand their soybean market shares. However, the question is "what is the relationship between the U.S. and South America in the Chinese soybean import market?" This section seeks to find an answer. To simplify the problem, Brazil and Argentina are considered as a group, South America (SA) soybean supplier.

Figure 8 shows that Chinese annual soybean imports from SA were slightly lower than that from the U.S. before 2001 and in 2004. From 2001 to 2003 and 2005, Chinese annual soybean imports from SA surpassed imports from the United States. In 2005, China imported over 15 million metric tons of soybeans from SA with Brazil's 8 million metric tons and Argentina's 7 million metric tons. In contrast, China imported 11 million metric tons of soybeans from the United States. Over a ten-year average (1996-2005), the U.S. and SA had close market shares in the Chinese soybean import market with U.S. at 47% and SA at 53%. These annual data imply that the U.S. and SA have been strong competitors in the Chinese soybean import market.

To understand the competitive structure of the Chinese soybean import market, using only annual data analysis is not enough to be informative. Further analysis of monthly data will be helpful in identifying different characteristics of U.S. and SA soybean exports to China.

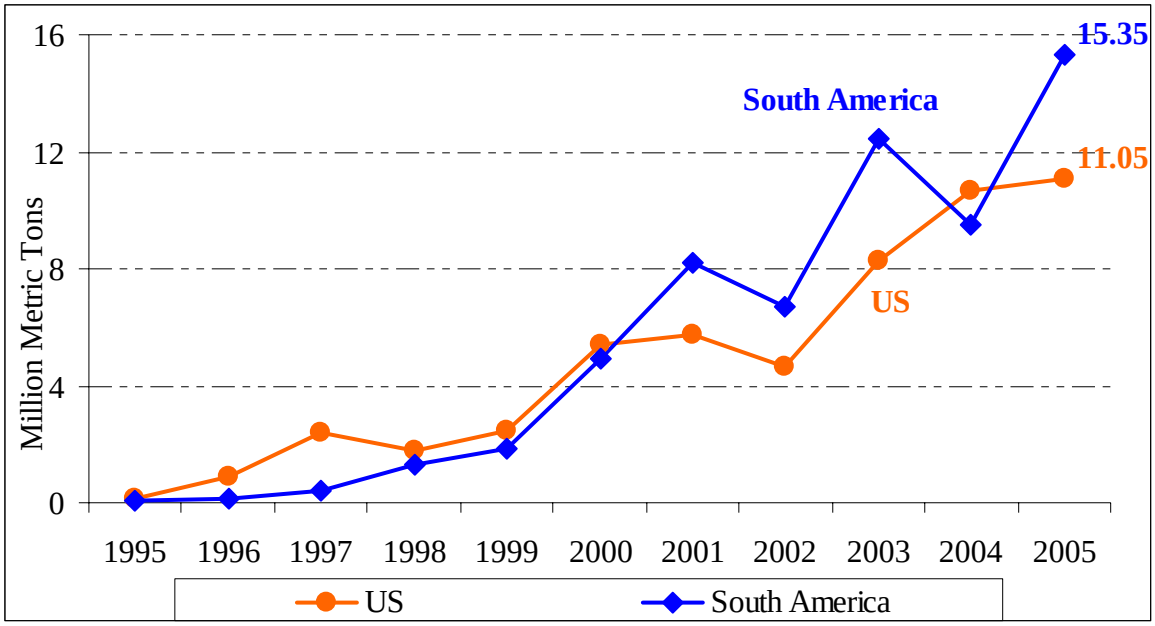

Figure 8: Chinese Soybean Imports from the U.S. and South America
Source: The Chinese Minister of Agriculture, 2006.

Since the U.S. is located in the northern hemisphere and SA is located in the southern hemisphere, they have opposing growing seasons, i.e., different production time periods to supply soybeans to markets. The harvest season for U.S. soybeans is in October and November, and for SA, March and April. Figure 9 plots the U.S. monthly soybean stocks and figure 10 shows the monthly soybean stock levels in Brazil (Argentina data is not available). Figure 9 indicates that generally, U.S. soybean stocks reach the highest level in November. Then due to consumption and exports, U.S. soybean stocks decrease to their lowest levels in August and

September, with some years in October. For Brazil (figure 10), the soybean stocks normally reach their highest level in April. Then due to consumption and exports, Brazilian soybean stocks decline gradually, and reach their lowest levels in January and February.

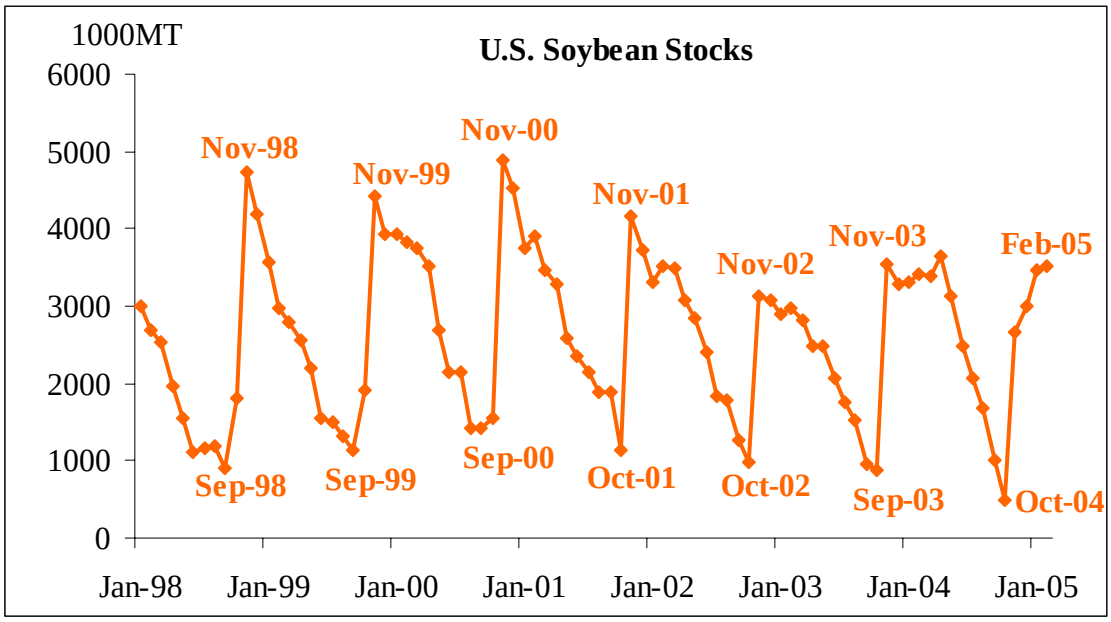

Figure 9: U.S. Soybean Stocks (1000MT)
Source: USDA-FAS, *Attache Report* (1998-2005).

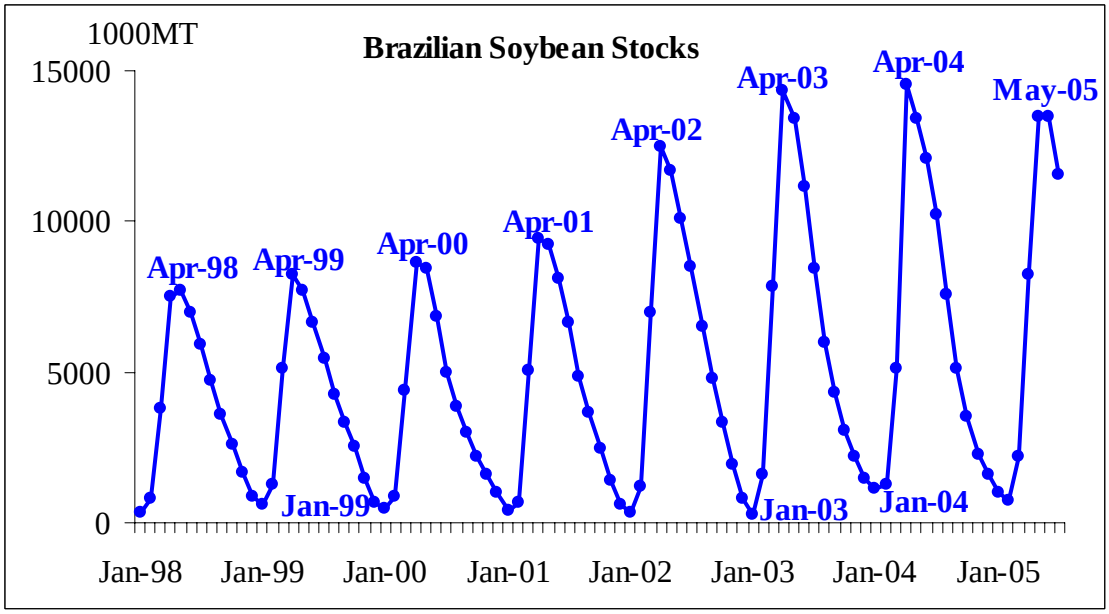

Figure 10: Brazilian Soybean Stocks (1000MT)
Source: USDA-FAS, *Attaché Report* (1998-2005).

Because of the difference in soybean growing seasons for the U.S. and SA, their soybean exports differ over time. Figure 11 depicts the U.S. and SA's average monthly soybean exports to China from 1999 to 2005. Figure 11 clearly shows that soybean trade in the Chinese import market can be divided into two periods. The first period (period I) includes June, July, August, September, and October. In period I, SA exports just-harvested soybeans to China, with little or no storage costs, while the U.S. exports soybeans from its stockpiles to China with additional storage costs. South America has the seasonal advantage and results in a dominant position in the Chinese soybean import market.

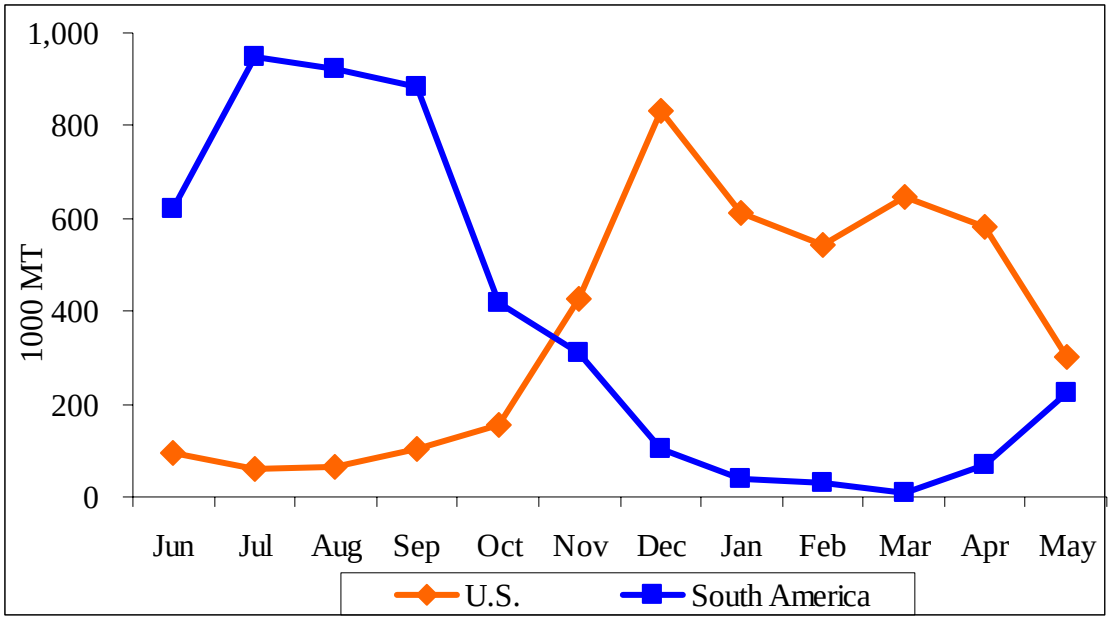

Figure 11: Average Monthly Soybean Exports from the U.S. and South America (Brazil and Argentina) to China (1999-2005).
Source: The Chinese Ministry of Agriculture, 2006.

In the second period (period II), which includes November, December, January, February, March, April, and May, the U.S. exports just-harvested soybeans to China and becomes their main soybean supplier. South America supplies only a small amount of their soybeans to China from their stockpiles incurring storage costs. Therefore, the U.S. has the seasonal advantage in this period, resulting in a dominant position in the Chinese soybean import market. The above analysis implies that South America and the U.S. are seasonal complementary soybean suppliers for China, with South America dominating period I and the U.S. dominating period II.

From the importers' perspective, Chinese soybean importers may have stronger market power relative to soybean exporters from both the U.S. and SA, and they

can exercise their monopsony power to maximize their soybean import profits. Strategically, to reduce the risk of price increases, Chinese soybean importers will not rely on only one soybean supplying country. Chinese soybean importers will work with different soybean supplying countries to diversify their supply risk. In that case, because of the market power of Chinese soybean importers and seasonal production differences, the U.S. and SA actually become seasonal complementary soybean suppliers for China, with SA dominating period I and the U.S. dominating period II. In next section, a two-country partial equilibrium trade model will be developed and used to empirically test the market power in China's soybean import market.

Empirical Test of Market Power in China's Soybean Import Market

Literature Review

Lerner (1934) developed an index (the Lerner Index) to measure market power of a single firm. The Lerner index is defined as $LI = \frac{P - MC}{P}$, where the variable P is the market price and MC is the marginal cost. The Lerner Index is able to measure the degree of market power of a firm in an imperfect market, but it was difficult to use empirically because marginal cost data are typically unavailable. However, the Lerner Index does provide a provocative idea to measure market power. Based on the Lerner Index, subsequent literature found other ways to approximate the Lerner Index to measure market power in an imperfectly competitive market.

Baker and Bresnahan (1988) first developed the residual demand elasticity (RDE) model to measure market power of a single firm in an imperfect market. Baker and Bresnahan took three U.S. brewing firms – Anheuser-Busch, Coors, and Pabst – as their samples to estimate and analyze the residual demand curves faced by these three companies. They found that for the period 1962-1982, Coors had substantial market power, Anheuser-Busch had some market power, and Pabst had no market power. Baker and Bresnahan's work provided a new approach to measure market power of a single firm with differentiated products within a national market.

Goldberg and Knetter (1999) adopted the RDE model to measure the degree of competition in segmented export markets. They started from the general case, which assumed homogenous products and a group of exporters facing a particular foreign market, and developed the residual demand function. They used annual data for U.S. Kraft linerboard paper (1973-1987) and German beer (1975-1993) to estimate this model. In the case of German beer, their empirical results indicated that "the elasticity of the residual demand curve German exporters face in each destination is closely related to the presence of the Netherlands as a competitor," (page 58) and for U.S. linerboard exports, they found "strong evidence of imperfect

competition in the case of Australia, which is a very small market where U.S. firms face almost no competition from other producers" (page 58).

Carter, et al. (1999) tested the world wheat market using the RDE model, which provided a new approach to measure market power for wheat, a key international bulk agricultural commodity market. Carter, et al. assumed that each country was a firm, and that parameters could be interpreted as share-weighted industry averages for all firms within one country. Based on Goldberg and Knetter's RDE model, Carter, et al. directly defined a reduced form of the inverse residual demand function for U.S. wheat and used quarterly data (1970 to 1991) to estimate their model. Their results indicated that "the United States is possibly a price leader in the Japanese market for imported wheat whereas Australia and Canada form a competitive fringe" (page 9).

Poosiripinyo and Reed (2005) applied the RDE model to the Japanese chicken meat market and estimated price flexibilities of Japanese inverse residual demand for whole birds, legs with bone, and other cuts from Brazil, China, Thailand, and the United States. Their results indicated that only Brazil (in whole birds and leg with bone) and the U.S. (in other cuts) have significant market power over Japanese chicken meat importers.

The RDE model has been adopted by many researchers because of the following advantages: 1) the RDE model can measure market power with modest data requirements, which are generally lacking in domestic and international markets; 2) the RDE model can be defined in double-log form and the elasticity can be estimated directly; and 3) the RDE model can incorporate exchange rate variable in the model as an indicator of marginal cost change. However, when applying the RDE model, we must also consider the disadvantages of the RDE model, which include 1) the RDE model entails a loss of price elasticity of demand; and 2) the estimated coefficients are difficult to interpret. With these disadvantages of the RDE model, however, in cases where the Lerner Index is very difficult or infeasible to compute, the RDE model appears to be the next best alternative to evaluate market power.

Mathematic Model

Based on the RDE model, Song (2006) developed a two-country (U.S.-China) partial equilibrium soybean trade model, which incorporate 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. The specific functional form of the model follows:

$$
\begin{cases}
(1) \quad P_{US}^{XPT} = \beta_0 + \beta RS_{US}^{CH} + \beta_1 P_{US}^{Corn} + \beta_2 INC_{US} + \beta_3 P_{US}^{Oil} + \beta_4 P_{US}^{Meal} + \beta_5 T \\
\qquad + \beta_6 XPT_{US}^{OTH} + \beta_7 STK_{US} + \varepsilon_{US} \\
(2) \quad P_{CH}^{IMP} = \alpha_0 + \alpha RD_{CH}^{US} + \alpha_1 P_{CH}^{Corn} + \alpha_2 INC_{CH} + \alpha_3 LDI_{CH} + \alpha_4 P_{CH}^{Oil} \\
\qquad + \alpha_5 P_{CH}^{Meal} + \alpha_6 T + \alpha_7 IMP_{CH}^{OTH} + \alpha_8 BP_{CH} + \varepsilon_{CH} \\
(3) \quad P_{CH}^{IMP} = \phi P_{US}^{XPT} \\
(4) \quad RD_{CH}^{US} = RS_{US}^{CH}
\end{cases}
$$

Where

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

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

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

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

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

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

T : Time trend variable

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

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

ε_{US} : Error term

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

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

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

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

LDI_{CH} : 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} : China's soyoil price (RMB/MT)

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

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

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

ε_{CH} : Error term

Equation (1) is the U.S. inverse residual soybean supply function for China, and equation (2) is the China's inverse residual demand for U.S. soybeans. Equation (3) is the equilibrium condition, where the U.S. residual soybean supply for China

equals China's residual demand for U.S. soybeans. Equation (4) captures the relationship between U.S. soybean export prices (FOB prices) and China's soybean import prices (CIF prices).

The contribution of this two-country partial equilibrium trade model compared to prior models is that this model incorporates the equilibrium condition, where residual demand equals residual supply. Assuming that in the short-run, the price flexibility of either China's inverse residual demand for U.S. soybeans or the U.S. inverse residual soybean supply for China is constant, then equations (1), (2), (3), and (4) can be estimated simultaneously using the double-log form.

Data Description

Data used in this research are monthly data from January 1999 to February 2005, 74 observations. The variables and their sources are listed in the appendix A. The Chinese livestock industry development index, LDI_{CH}, and Chinese meat products, including beef, pork, poultry, and fish, were aggregated. Finally, the chain growth rate was calculated as an index to reflect the change in feed demand because of the fast development of the Chinese livestock and fishery industries.

Empirical Estimation and Interpretation

The two-country partial equilibrium model was estimated using the SAS full information maximum likelihood (FIML) method. Estimation results are reported in table 1. For the U.S. inverse residual soybean supply function (equation (1)), six independent variables, including the U.S. soybean residual supply for China, RS_{US}^{CH}, the U.S. personal disposable income, INC_{US}, the U.S. soyoil prices, P_{US}^{Oil}, the U.S. soymeal prices, P_{US}^{Meal}, U.S. soybean exports to Mexico, XPT_{US}^{MX}, and the U.S. soybean stocks, STK_{US}, are statistically significant at the 5% significance level or better respectively as shown in table 1. The sign of the parameter for the U.S. soybean residual supply, RS_{US}^{CH}, is positive as expected. This estimated parameter, $\hat{\beta}$, for the U.S. soybean residual supply, RS_{US}^{CH}, is the price flexibility of the U.S. soybean inverse residual supply function. From another perspective, this price flexibility can be used to measure the market power of Chinese soybean importers. Its estimation result, $\hat{\beta}$=0.13, implies that the marketing margin for Chinese soybean importers (the difference between the Chinese domestic soybean price and the soybean import price from the U.S.) is 13% of the import price from the United States plus tariffs and transaction costs of Chinese soybean importers. This is a large margin for such a standardized product and is certainly evidence that the Chinese have market power.

Table 1: 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% significance level, ** 5% significance level, * 10% significance level.

For the Chinese inverse residual demand function (equation (2)), four variables, including the Chinese soybean 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}, are statistically significant at the 1% significance level. In addition, the sign of the parameter, $\hat{\alpha}$, for the Chinese soybean residual demand, RD_{CH}^{US}, is negative as expected. The estimated parameter for the Chinese soybean residual demand, RD_{CH}^{US}, is the price flexibility of the Chinese inverse residual demand function for U.S. soybeans. From another perspective, this price flexibility can be used to measure *the market power of U.S. soybean exporters.* Its estimation result, $\hat{\alpha}$ =-0.04, implies that the marketing margin for U.S. soybean exporters (the difference between the U.S.

soybean export price and the U.S. farm level soybean prices plus transaction costs of U.S. soybean exporters) is 4% of the U.S. farm level price plus transaction costs. The relatively small marketing margin for US soybean exporters indicates that they have little market power.

In addition to the price flexibilities, estimation results for some other variables are also meaningful. For the Chinese inverse residual demand function (equation (2)), estimated coefficient for China's biotech policy (BP_{CH}) is not significant. It means that China's biotech policy did not impose significant impacts on U.S. soybean exports to China. This is consistent with the results found by Marchant, et al. (2002) and Marchant and Song (2005). It makes sense that given China's huge demand and insufficient domestic supply, China cannot stop importing soybeans. For U.S. soybean exporters, they do not need worry about China's biotech policy changes. It may delay soybean trade in short run, but will not stop or reduce it in the long run.

The estimated coefficients for China's imports from Brazil and Argentina are not significant, either. It means that China's imports from Brazil and Argentina did not impact U.S. exports to China. This finding is surprising because South American producers have added much more storage capacity in recent years and they can compete with the U.S. during months outside the harvest season. The results are consistent with the Chinese arranging their purchasing decisions such that their importation of South American soybeans does not impact the price they pay for U.S. soybeans. This also implies that the U.S. and South America are complementary soybean suppliers for China. The results are also contrary to our expectation in that China's income and livestock development index are not significant. Again, this might reflect very good import management on the Chinese side. They have a vested interest in managing their import levels so that they do not affect world price significantly. It appears that they have used their market power to help assure that they obtain soybeans for a relatively low price from all suppliers, using the fact that they can obtain soybeans from multiple sources as a strategy to lower the price they pay.

Summary and Conclusions

In the world soybean market, China is and will continue to be the largest soybean importer, and the U.S., Brazil, and Argentina are the top three soybean exporters. Considering that soybean import demand for other main soybean import countries are quite stable, China becomes the most important soybean market for these top three soybean export countries. As the number one soybean importer in the world, Chinese soybean importers have developed stronger market power over soybean exporters from the U.S., Brazil, and Argentina. They have used this power and the availability of soybeans from South America throughout more of the year, to

increase their import margins for soybeans. This is clearly an issue for producers and agribusinesses that are exporting soybeans from North and South America. By examining monthly data, this research conducted a competitive structure analysis of the Chinese soybean import market. Results imply that the U.S. and South America (Brazil and Argentina), three main soybean suppliers for China, are seasonal complementary soybean suppliers for China. The Chinese seem to take advantage of the differing production seasons in their purchasing behavior to assure lower prices. The empirical results of the U.S.-China two-country partial equilibrium trade model show that the price flexibility of China's residual demand, which can be used to measure *the market power of U.S. soybean exporters,* is 4% and the price flexibility of U.S. residual supply, which can be used to measure *the market power of China's soybean importers,* is 13%, indicating that China's soybean importers do have stronger market power relative to U.S. soybean exporters. The increased availability of South American soybeans throughout the marketing year seems to have allowed more market power for the Chinese.

From China's perspective, since Chinese soybean importers have stronger market power over soybean exporters from the U.S. and South America, Chinese soybean importers can exercise their monopsony power to maximize their import profits by working with both the U.S. and South America to diversify their soybean suppliers to reduce price risk. Due to Chinese soybean importers' strategic choice and the seasonal production differences for the U.S. and South America, the U.S. and South America become seasonal complementary soybean suppliers for China, with South America dominating period I (June, July, August, September, and October) and the U.S. dominating period II (November, December, January, February, March, April, and May). Yet the availability of soybeans from the U.S. and South America throughout the year seems to have allowed the Chinese to exert more market power.

This study has many implications for the U.S. soybean industry. U.S. growers and soybean marketing firms should favor increased promotion of soybeans for various uses and argue for increased market access through lower trade barriers. This will not only increase the demand for soybeans, but also diversify the destinations for soybean shipments. Yet, the marketing firms are global, so they have more interest in soybeans in general, than in U.S. soybeans in particular, because they operate in so many countries. Certainly the fast development of soybean industries in Brazil and Argentina is threatening U.S. position in the world soybean market, yet the market power of Chinese soybean importers is also a concern for all soybean exporting countries. Exporting countries and agribusiness firms need to diversify their sales and bring more dynamic importers into the market through product promotion and incentives for new uses (such as biofuels).

The U.S., Argentina, and Brazil have a common interest in developing new and expanding existing markets for soybeans to help combat this market power of the

Chinese. More market outlets for soybeans will bring new customers to compete with the Chinese for exported soybeans, reducing the reliance on Chinese imports and possibly shrinking Chinese marketing margins. Lower trade restrictions, through WTO negotiations or other means, could improve access to potential soybean importing countries and result in less Chinese market power. The use of soybeans for biofuels might also help exporters diversify their markets.

Another alternative to reduce China's market power is to have U.S. and South American firms invest directly in soybean storage and crushing capacity in China. This is already allowed and such investments are taking place (Goldsmith et al). Increased horizontal integration among firms invested in exporting countries could also combat Chinese market power through better coordination of exporting among countries. The large grain trading firms already operate throughout the world, but it appears that they have a difficult time in dealing with Chinese market power.

China's soybean market is a very dynamic market that has great implications for US agriculture. Situations in China's soybean market change quickly and it is difficult to understand all aspects of this market without much research. Further research is needed to understand how Chinese soybean imports are undertaken and how Chinese crush capacity, storage capacity, and foreign investment affect the world soybean markets. This paper has found strong market power for the Chinese and little market power for the U.S. What is the source of that power? Will this change over time? What strategies might successfully change these power relationships? These are important issues that this paper has begun to address. It is hoped that more answers will be forthcoming as time passes.

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Appendix. Data Source

Variable	Definition	Source
P_{US}^{CH}	U.S. soybean export price to China ($/MT)	USDA-FAS, 2006b
RS_{US}^{CH}	U.S. soybean residual supply for China (MT)	The Chinese Minister of Agriculture, 2006
INC_{US}	U.S. personal disposable income ($)	USDA-ERS, 2006
P_{US}^{Corn}	U.S. corn retail price at Chicago market ($/MT)	USDA-ERS, 2006
P_{US}^{Oil}	U.S. soyoil price ($/MT)	USDA-ERS, 2006
P_{US}^{Meal}	U.S. soymeal price ($/MT)	USDA-ERS, 2006
XPT_{US}^{EU}	U.S. soybean exports to the EU (MT)	USDA-FAS, 2006b
XPT_{US}^{JP}	U.S. soybean exports to Japan (MT)	USDA-FAS, 2006b
XPT_{US}^{MX}	U.S. soybean exports to Mexico (MT)	USDA-FAS, 2006b
STK_{US}	U.S. soybean beginning stocks (MT)	USDA-ERS, 2006
P_{CH}^{IMP}	Chinese soybean import price from the United States (RMB/MT)	The Chinese Minister of Agriculture, 2006
RD_{CH}^{US}	Chinese residual demand for U.S. soybeans (MT)	The Chinese Minister of Agriculture, 2006
P_{CH}^{Corn}	Chinese corn price at Dalian Port (RMB/MT)	Shanghai JC Intelligence Co., Ltd. 2006
INC_{CH}	Chinese personal disposable income (RMB)	USDA-ERS, 2006
LDI_{CH}	Chinese livestock industry development index	Chinese Statistics Yearbook (1999-2005)
P_{CH}^{Oil}	Chinese soyoil prices (RMB/MT)	Shanghai JC Intelligence Co., Ltd. 2006
P_{CH}^{Meal}	Chinese soymeal prices (RMB/MT)	Shanghai JC Intelligence Co., Ltd 2006
IMP_{CH}^{BR}	Chinese soybean imports from Brazil (MT)	The Chinese Minister of Agriculture, 2006
IMP_{CH}^{AR}	Chinese soybean imports from Argentina (MT)	The Chinese Minister of Agriculture, 2006

