Exchange Rates, Income Growth, and Chinese Agricultural Imports

Chang Hong, USDA Economic Research Service, chang.hong@ers.usda.gov

William Liefert, USDA Economic Research Service, wliefert@ers.usda.gov

Sun Ling Wang, USDA Economic Research Service, slwang@ers.usda.gov

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Chang Hong*
William Liefert†
Sun Ling Wang‡

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Abstract

Using disaggregated data describing trade between China and the rest of the world over the period of 1997-2015, this paper estimates the impacts of changes in China's real exchange rate and income growth on Chinese agricultural imports. A ten percent annual appreciation of the RMB is found to raise China's total agricultural imports by about 3.7 percent in the short run and 4.7 percent in the long run. A ten percent annual income growth in China is found to increase these imports by about 19.3 percent in the short run and 3.8 percent in the long run. These general effects also apply to the subcategories of bulk, intermediate, and consumer-ready goods.

Keywords: China, agricultural trade, exchange rate, import elasticities, agricultural imports
JEL classification: F31, F32, F41, F14

* USDA ERS. 355 E Street SW, Washington DC 20024. Tel: (202)694-5222. Email: chang.hong@ers.usda.gov
† USDA ERS. 355 E Street SW, Washington DC 20024. Tel: (202)694-5156. Email: wliefert@ers.usda.gov
‡ USDA ERS. 355 E Street SW, Washington DC 20024. Tel: (202)694-5460. Email: slwang@ers.usda.gov

I. Introduction

From a closed economy 40 years ago, China has become a leading participant in world markets. However, its export surge has coincided with growing trade imbalances with the rest of the world. The undervaluation of the Chinese currency, the renminbi (RMB), and its impact on China's huge trade surplus with the United States has been a contentious issue for some time.

Despite its large overall trade surplus since joining the World Trade Organization (WTO) in 2001, China has become a major net agricultural importer (fig. 1). China's agricultural imports increased from 1997 to 2015 by more than 12 times, whereas its agricultural exports only quadrupled. The same trade relationship holds vis-à-vis the United States ─ a large overall surplus, but a substantial deficit in agricultural trade (fig. 2). Also, in recent years, the RMB has appreciated vis-à-vis the U.S. dollar and other major currencies. This appreciation should increase agricultural imports further and expand the country's trade deficit for the sector. Will that be the case? Will the import impact differ by product category or individual commodity? The criticism that the RMB has been undervalued call for careful empirical investigation of the relationship between changes in China's exchange rate and its agricultural trade. This paper addresses these questions and issues.

The importance of exchange rates for agricultural trade was revealed by Schuh (1974), who found that the overvalued dollar in the post-World War II period caused major decline in U.S. agricultural exports and income. His work stimulated the large and still growing body of literature on the relationship between exchange rates and agricultural markets, much of which focuses on U.S. markets and trade within countries at an aggregate level (see Kritinek and Anderson (2002) for a review of this literature). However, the conclusions of this empirical work are somewhat ambiguous. While most investigators find a significant negative effect of exchange rate fluctuations on trade (Cushman 1988; Thursby and Thursby 1987; Cho, Sheldon, and McCorriston 2002; Rose 2000; De Grauwe and Skudelny 2002), others find positive trade flow effects stemming from uncertainty in the exchange rate (Klein 1990; Broll and Eckwert 1999; Jozsef 2011), or a weak or insignificant impact on trade (Rose 1990; Rose 1991; Ostry and Rose 1992). Pick (1990) and Kandilov (2008) find that the impact of exchange rate volatility on exports is much larger for developing countries than for developed ones.

Numerous studies have examined the commodity-level trade effects of exchange rates. Anderson and Garcia (1989) find significant negative effects of exchange rate volatility on U.S. soybean exports. Shane et al. (2008) examine exchange rate impacts on U.S. agricultural exports across 12 commodity products including soybeans. In general, the results vary with the crops examined, modeling techniques used, and the time frame of the studies.

Concerning China, relatively little work has been done on the empirical relationship between the exchange rate and agricultural trade. Until the mid-1980s, international trade was conducted by a small number of state-owned trading companies and subject to government targets, leaving little role for the exchange rate to affect trade (Lardy 2002). Also, from the late 1970s to the mid 1990s, the Chinese government controlled the exchange rate, which makes it difficult to identify exchange rate effects using aggregate data. Another problem is the lack of data on China's import and export prices, such that the choice of deflator can significantly affect results.

Nonetheless, some recent work has been done on China's exchange rate and its agricultural trade. Koo and Zhuang (2007) find that U.S.-China agricultural trade can be explained by exchange rate movements. A few studies have examined how exchange rate changes have affected agricultural trade at the commodity level, including Zhang et al. (2010) for soybeans, Izotov (2012) for 18 major commodities traded by China and Russia, Mutuc et al. (2011) for U.S.-China trade in corn, soybeans, and cotton, and Devadoss et al. (2014) for U.S.-China trade in milk, soybeans, bean, cotton, fruit, and fruit juice. Yet, these studies collectively do not yield complete, consistent, and unambiguous conclusions on the relationship between China's exchange rate and agricultural trade.

To fill this gap, we examine how Chinese agricultural imports react to bilateral exchange movements by using product level Chinese import data over the period 1997-2015 collected by the Chinese Customs Office. By employing highly disaggregated trade data, this paper makes several contributions. First, as our trade data include both quantities and trade value, we can decouple volume from value effects in a more rigorous way. We, therefore, are able to estimate the responsiveness of Chinese trade to exchange rates without using proxies for trade prices. Second, we estimate at various aggregation levels and find significant though moderate volume elasticities for Chinese agricultural imports. By examining agricultural trade for subcategories of products and individual commodities, we avoid commodity aggregation problems and provide results helpful to individual producers and traders. We confirm the finding by Maskus (1986) that the impact of exchange rates varies across sectors and commodities because different sectors have different degrees of openness to trade.

At the aggregate level, we find that a 10 percent annual real appreciation in the RMB would increase China's overall agricultural imports by 3.7 percent in the short run and 4.7 percent in the long run. China's income growth is also found to affect strongly the demand for its agricultural imports. These results also carry over to the three major subcategories of bulk, intermediate, and consumer-ready products. We further decompose aggregate trade flows and effects to individual products. The relationships between imports and the exchange rate, and real domestic income, appear to hold for consumer-ready goods, but not for intermediate products.

The paper is divided into seven sections. The next section reviews the structure of Chinese agricultural imports and the country's exchange rate policy. Section III describes the methodology and data. Section IV reports exchange rate effects for aggregate agricultural imports, section V presents results for the major subcategories of agricultural products, and section VI presents results for individual commodities. Section VII concludes the paper.

II. The Structure of Chinese Agricultural Imports and Exchange Rate Policy

China is a large country with 10 percent of the world's arable land and over 20 percent of its population. With its economy entering a new period of urbanization and labor scarcity, China's small scale agricultural production and low productivity cannot meet the country's growing demand for food and non-food agricultural products. Despite its relatively small share in China's overall trade, the country's agricultural sector plays an increasingly important role globally. Since joining the WTO in 2001, China's agricultural trade has grown substantially, particularly imports. China has become one of the most important agricultural export markets for the United States. In 2016, China was the second largest agricultural importing country behind the United States and the fourth leading agricultural exporter.

Figure 3 shows the evolution of China's agricultural imports by its three major categories: bulk commodities, processed intermediate goods, and consumer-ready products. In 2015, total Chinese agricultural imports consisted of 52 percent bulk, 32 percent intermediate goods, and 16 percent consumer-ready products. During the period 1997-2015, bulk commodities were the dominant type of agricultural import, with their share growing steadily from 42 to 52 percent. However, the share of consumer-ready goods increased the most, tripling from 9 to 27 percent. The import share of intermediate agricultural goods declined by more than half, from 49 percent in 1997 to 21 percent in 2015. As consumer-ready goods tend to be preferred by higher income consumers, this structural change reflects the growth of consumer income.

Table 1 shows the commodity structure of Chinese agricultural imports by 5-year period from 2001 to 2015. Columns (1) through (3) rank the commodities by their 5-year average share in agricultural imports. Columns (4) through (6) give their average share in total agricultural imports in each 5-year period. Most of China's agricultural imports are concentrated in a small number of commodities: the top three products ─ soybean, cotton, and rubber ─ account for almost half of the country's agricultural imports in each of the 5-year periods. The top 10 products accounted for 72 percent of total agricultural imports for the period of 2001-2005, 78 percent for 2006-2010, and 73 percent for 2011-2015. The three commodities of distiller grains, corn, and wine stand out in recent years, with their import share increasing significantly after 2005.

This import structure reflects China's comparative advantage in agriculture. China has been the world's top importer of land-intensive agricultural products, such as soybeans, vegetable oils, and cotton, reflecting its relative scarcity of agricultural land. In contrast, China's agricultural exports consist mainly of labor-intensive products such as fruits and vegetables.

Table 2 gives the import share of individual commodities within the three major subcategories of bulk, intermediate, and consumer-ready products. For example, over the full period of our study 1997-2015 (column 1), soybeans comprised 52 percent of bulk imports, and their share increased from an annual average of 34 percent in 1997-2000 to 59 percent in 2011-2015. The next largest bulk imports are cotton and rubber, whose shares in this category are fairly stable, accounting for 14 and 12 percent, respectively, over the period 1997-2015.

With the economic opening up of China in 1978, the country implemented a dual track exchange rate system with no convertibility of the RMB. In January 1994, the government unified the official and swap market rates, at 8.7 Yuan/US$, and then fixed the exchange rate at 8.28 Yuan/US$. Meanwhile, China's foreign reserves have increased from 21 billion US dollars in 1994 to 1.06 trillion by the end of 2006, when the country surpassed Japan as the largest holder of foreign exchange reserves. Due to its longstanding conflict with the United States on exchange rate policy, in July 2005 China moved away from a fixed exchange rate to a managed float. Instead of being strictly and solely tied to the US dollar, the RMB exchange rate became adjustable with respect to a basket of currencies, including the US dollar, euro, Japanese yen, and South Korean won (Frankel and Wei 2007). After that policy change, the RMB gradually appreciated from 8.11 Yuan/US$ in 2005 to 6.83 Yuan/US$ in 2008. It then further appreciated in 2010 and reached 6.21 Yuan/$ in 2012.

III. Methodology and Data

Our method for examining the effect of exchange rate changes relies on bilateral annual variation in exchange rate movements. We use the standard reduced-form partial equilibrium trade model as the basic analytical framework. Imports are expected to depend on the real exchange rate and domestic income. On account of non-stationarity, we estimate the basic workhorse model in the first difference form:

$$\Delta \ln M_{jkt} = \sum_{m=0}^{T} \beta_{1,m} \Delta \ln ER_{j/RMB,(t-m)} + \sum_{m=0}^{T} \beta_{2,m} \Delta \ln Income_{k(t-m)} + \gamma_j + \gamma_k + \varepsilon_{jkt} \qquad (1)$$

where M_{jkt} is the volume of China's imports of product *k* from market *j* at time *t*. Products are defined at the highly disaggregated Harmonized System (HS) 8-digit level. $\Delta\, lnER_{j/RMB}$ is the real appreciation of the RMB versus foreign currency *j* (an increase in $ER_{j/RMB}$ denotes an appreciation of the RMB). Given that the RMB did not fluctuate much against the U.S. dollar during our period of study, we rely on the real time variation of the real exchange rate across China's bilateral trading partners for identification. $\ln Income_{kt}$ is the natural log of China's real consumer income, for which we use the common proxy of GDP. ε_{jkt} is an error term.

We expect β_1 to be positive, indicating that a real RMB appreciation raises the price competitiveness of imports vis-à-vis domestically produced goods, thereby increasing imports. Eventually, competition between imports and domestic output will drive down domestic prices as well. β_2 is expected to be positive, meaning China's imports increase with consumer income.

To allow for the possibility of gradual adjustment of trade to exchange rate changes, such as the standard argument for the J-curve, we also estimate with two lags of the exchange rate and income variables. The short run relationship between the exchange rate and imports is given by the estimated coefficient β_1. The long run elasticity is given by the sum of the coefficient on the contemporaneous exchange rate and two lags of exchange rate terms. γ_j is the exporter fixed effect, which will pick up average export supply growth. The product fixed effect γ_k will pick up average differences in import growth across products. Standard errors are clustered at the HS 2-digit level.

Our empirical exercise requires data on disaggregated bilateral trade between China and each of its trading partners. Data for Chinese imports over the period 1997-2015 are available at the detailed commodity level, broken down by destination, city of origin, customs regime (including both ordinary and processing trade), and firm ownership.[1] Besides trade values, the dataset also reports the quantity of trade (in different units of measure).[2] Products are classified at the 8-digit HS level for the 1997-2015 period.

To estimate the workhorse model of trade, real exports and import values are needed (see for example, Bahmani-Oskooee and Goswani 2004; Marquez and Schindler 2011). Prices are typically used to deflate nominal trade values (Mann and Pluck 2007; Cheung, Chinn and Fujji 2010).The commonly used proxies for Chinese trade prices are trade price data from Hong Kong. Since our trade data include both unit values and quantities of trade, we bypass this difficulty by relying on import quantities in the regressions. This is an important advantage of our paper over previous studies, where price indices had to be constructed from aggregate data. China's real GDP is taken from Penn World Table 9.0.[3]

There are several ways of measuring exchange rates, including the nominal exchange rate (NER), real bilateral exchange rate (RER), nominal effective exchange rate (NEER), and

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[1] Data source: China Customs General Administration, Statistics Department. See Feenstra and Hong (2010) and Feenstra and Hanson (2005) for more detail.

[2] The units reported in the Chinese trade data include: Metric carat, Number, Cubic Metre, Thousand, Litre, Pair, Kilolitre, Set, Megalitre, Packet, Metre, Kilmetre, Gram, Kilogram, Square Metre, Tonne, Gigawatt hour.

3 We test different series of real GDP, expenditure side real GDP at current PPPs, output side real GDP at current PPPs, real consumption, and real domestic absorption. The results are robust across these different GDP measures.

real effective exchange rate (REER). We use the purchasing power parity (PPP) method to obtain the real bilateral exchange rate for China relative to each partner country at yearly frequency, which is defined as:

$$RER_{j/RMB} = \frac{NER_{j/\$}}{NER_{RMB/\$}} \cdot \frac{P_{RMB}}{P_j} \quad (2)$$

where P_{RMB} is China's price level, P_j is the foreign country price level, and $NER_{j/\$}$ is the nominal exchange rate of each country *j* against the U.S. dollar. $RER_{j/RMB}$ therefore gives the bilateral real exchange rate of the foreign country per RMB, such that an increase in $RER_{j/RMB}$ represents an appreciation of the Chinese RMB. We use the CPI for both China and foreign countries to convert from nominal to real exchange rates. Both the nominal exchange rate and CPI data are obtained from the IMF's International Financial Statistics (IFS) database. We set 2000 as the base year for the CPI index for all the countries, which makes this index comparable across countries in any given year. Although the RMB/dollar nominal exchange rate did not change very much before 2005, there have been substantial variations in the real RMB exchange rates vis-a-vis other countries.

IV. Results at the Aggregate Level

Table 3 reports the results of estimating equation (1) for China's aggregate imports. Columns (1) and (2) give the import regression for the whole period of 1997-2015, and columns (3) and (4) cover the period after 2001 so that we can check whether elasticities changed after China's accession to the WTO. There are two consistent findings. First, the coefficient for the real exchange rate has a positive sign, statistically significant at 1 percent. This indicates that a stronger RMB induces more agricultural imports, as expected. Second, the income elasticity has a statistically significant positive number, such that Chinese agricultural imports increase with income growth.

For aggregate agricultural import flows, the short run exchange rate elasticity is 0.37. This smaller than unity elasticity is consistent with elasticities found in the empirical literature and provides another example of the "Exchange Rate Disconnect" puzzle (Obstfeld and Rogoff 2000).[4] In the long run, the price elasticity increases to 0.47. Thus, if the RMB appreciates by 10 percent in the long run, Chinese agricultural imports increase by almost 5 percent over that time. Most of the import increase from RMB appreciation is felt immediately, confirming the standard J-curve effect. These results suggest that agricultural importers adjust their import demand rather quickly given exchange rate shocks.[5]

The income elasticity is significantly positive and exceeds unity. As Chinese consumer income (GDP) increases by 10 percent, agricultural imports rise by 19.3 percent in the short run and 3.8 percent in the long run, for the 1997-2015 period. Given a domestic income shock, about 70 percent of the total impact is felt immediately (2.688/3.8). Most of the response happens in the first year after the shock, with the effects vanishing within two years. The large income elasticity indicates substantial expenditure-switching effects, as Chinese agricultural imports appear to be highly sensitive to domestic income fluctuation.

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[4] Hopper et al. (2000) find an exchange rate elasticity of trade below unity for OECD countries. Most other work finds an elasticity less than 2.

[5] Our product-level estimates of elasticities are generally lower than those figures found in existing studies using aggregate Chinese trade data. For example, Aziz and Li (2007) find an aggregate elasticity of about -1.5; Garcia-Herrero and Koivu (2009) find an elasticity of -2.3 for the period of 1994-2005 and a lower elasticity of -1.6 for 2000-2005; and Ahmed (2009) finds a cumulative elasticity of -1.8. Only Thorbecke and Smith (2010) find an exchange rate elasticity of export lower than unity, but only for exports of processed goods. Their elasticity estimate for overall trade is around -1.2.

This estimate confirms that the robust income gains in China will boost import demand for food and non-food agricultural goods.

After China joined the WTO in December 2001, both exchange rate and income elasticities became larger, indicating that with trade liberalization China's agricultural imports become more sensitive to price changes and income growth.

V. Results at the BICO Level

We next examine the results at the major subcategory (BICO) level. As shown in Table 4, a stronger impact of RMB exchange rate changes on China's agricultural imports is evident for bulk commodities compared to consumer-ready products. All else held constant, a ten percent RMB real appreciation increases bulk commodity imports by 15.8 percent in the short run and 25 percent in the long run. On the other hand, a ten percent RMB real appreciation expands imports of consumer-ready goods by 8.1 percent in the short run, but only 1.5 percent in the long run.

The difference in import impact reflects the characteristics of the two subgroups. Bulk commodities tend to be more homogeneous and therefore more substitutable between suppliers, whereas consumer-ready products are more differentiated and less substitutable across countries of origin. When exchange rates change relative prices among suppliers, it becomes easier for China to substitute bulk commodities across exporters. This finding is consistent with that of Cooke et al. (2016) for U.S. agricultural exports. Bulk good imports are also found to be more sensitive to income growth than either consumer-ready or intermediate products.

We also find an overall strong positive relationship between China's GDP growth and agricultural imports. Other things being equal, a 10 percent increase in real GDP growth in

China increased the real value of Chinese imports by about 65, 19.2, and 18 percent in the short run for bulk, consumer-ready, and intermediate goods, respectively. Price and income elasticities are more sensitive after WTO accession, consistent with the results at the aggregate level discussed earlier.

VI. Results at the Commodity Level

We next examine the impacts of exchange rate and income change on important individual commodities, in part to avoid commodity aggregation bias. We focus on China's main agricultural imports, which include soybeans, cotton, corn, hides and skins, pork, and dairy products. The results based on the parameters of equation (1) for the selected commodities are reported in Table 5. The findings show that pork, dairy, meat, beef, and poultry follow the theoretical prediction: Chinese imports of these consumer-ready commodities respond positively to RMB appreciation as well as to real income growth. For bulk commodities, the estimated exchange rate and income elasticities for soybeans, cotton and corn are correct in sign, though not significant. However, the rest of the commodities (grain, wheat, and rice) have negative exchange rate elasticity estimates, which is puzzling. For intermediate goods (hides and skins, distilled dried goods, soybean meal), the income elasticity estimates have the correct positive sign, but the exchange rate elasticities are negative.

What caused the strange results for bulk and intermediate commodities? There could be several possible explanations. Chinese agricultural markets are still relatively closed to foreign trade because of China's self-sufficiency policy, which encourages domestic production and discourages certain imports through domestic support (Gale et al. 2015). Such a relationship between domestic agricultural policies and trade in the face of exchange rate fluctuations is not limited to the Chinese case. For example, Grennes (1975) pointed out in the mid 1970's that most U.S. agricultural commodities were subsidized, and the subsidy may have offset the market effects of exchange rate fluctuations. We hypothesize that China's agricultural subsidies, price controls, and import quotas interfere with the country's domestic markets for these bulk and intermediate commodities such that local prices might not change as expected in response to exchange rate movements.

Another consideration is that China is a large producer of many of the agricultural products it imports. This is true even for the country's top agricultural import ─ soybeans ─ of which China is the world's biggest importer. Large domestic output allows China to adjust its production and import volumes in response to world price (and import) changes. This helps explain why the rise in world prices for grains, oilseeds, and cotton during 2006-12 did not generate much increase in China's domestic prices for these commodities. Lastly, the unexpected empirical results may be caused by omitted variables in the elasticitity estimation, such as the prices of substitutes and complements, as well as competing supply from Brazil and Argentina.

VII. Conclusion

In the past couple decades, China's foreign trade has grown substantially, and the country has run large overall trade surpluses. However, since China joined the WTO in 2001, its agricultural imports have grown considerably, and the country has run big agricultural trade deficits. After years of criticism that China's currency the renminbi (RMB) has been undervalued, it has been appreciating in recent years in real terms. This paper examines how Chinese agricultural import demand responded to changes in the country's exchange rate and growing consumer income over the period 1997-2015. We find that a 10 percent real appreciation of the RMB raises total agricultural imports by 3.7 percent in the short run and 4.7 percent in the long run. Imports of bulk commodities are the most responsive to exchange rate movement, followed by consumer-ready and then intermediate goods. However, there is much variation in response across individual products. Exchange rate transmission to domestic prices in general is low, the likely cause being Chinese agricultural policies that promote domestic production and self-sufficiency and interfere in markets, such as budget subsidies, price controls, and import quotas. If the RMB continues to appreciate, Chinese agricultural imports will rise further and the country's agricultural trade deficit will widen, which would help reduce China's overall trade imbalance with the United States.

The results also show that Chinese agricultural import demand is fairly responsive to income growth, with income elasticities of demand greater than one. China's GDP and consumer income are projected to continue their high growth (though at rates below the extremely high levels of past decades). This growth should also further increase the country's agricultural imports, especially of bulk and consumer-ready products.

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Table 1: Rank of Chinese Agricultural Import Share by Commodity (%), by 5-year Period

		Rank			**Share**		
Category	**Commodity**	2001-2005 (1)	2006-2010 (2)	2011-2015 (3)	2001-2005 (4)	2006-2010 (5)	2011-2015 (6)
B	Soybeans	1	1	1	27.8	35.0	33.1
B	Cotton	2	3	2	8.6	8.4	7.0
B	Rubber & Allied Gums	5	4	3	6.4	8.1	5.9
I	Palm Oil	4	2	4	7.4	9.2	5.4
I	Other Intermediate Products	3	5	5	8.5	5.7	4.9
C	Dairy Products	9	10	6	2.1	1.7	3.8
I	Hides & Skins	6	6	7	6.0	4.1	3.6
C	Prepared Foods	14	9	8	1.8	2.2	3.0
C	Fresh Fruit	10	15	9	2.0	1.2	2.9
I	Vegetable Oils NESOI	13	8	10	1.8	2.7	2.8
B	Coarse Grains (ex. corn)	12	19	11	1.9	0.9	2.2
C	Pork & Pork Products	19	18	12	0.9	0.9	1.9
B	Rapeseed	21	12	13	0.9	1.5	1.9
I	Sugars & Sweeteners	16	16	14	1.6	1.1	1.9
C	Wine & Beer	27	17	15	0.5	1.0	1.8
C	Processed Vegetables	15	13	16	1.8	1.3	1.7
I	Soybean Oil	7	7	17	4.3	3.9	1.2
I	Distillers Grains	52	28	18	0.0	0.4	1.2
B	Tobacco	17	14	19	1.4	1.3	1.2
B	Oilseeds NESOI	33	20	20	0.4	0.8	1.0
C	Beef & Beef Products	36	45	21	0.2	0.1	1.0
B	Rice	22	25	22	0.8	0.5	1.0
B	Wheat	8	34	23	2.9	0.3	1.0
B	Corn	50	39	24	0.0	0.2	0.9
C	Meat Products NESOI	20	27	25	0.9	0.4	0.8
C	Poultry Meat & Prods. (ex. eggs)	11	11	26	2.0	1.5	0.7
B	Other Bulk Commodities	18	21	27	1.1	0.8	0.7
C	Chocolate & Cocoa Products	30	26	28	0.4	0.4	0.6
C	Processed Fruit	31	24	29	0.4	0.5	0.5
I	Essential Oils	25	23	30	0.6	0.5	0.4

Source: Chinese Customs Trade Data.

Table 2: List of BICO Products and Their Respective Share in BICO Category (%), by 5-Year Period

Category		Agricultural Commodity	Period Average Category Share				
			1997-2015	1997-2000	2001-2005	2006-2010	2011-2015
			(1)	(2)	(3)	(4)	(5)
	1	**Soybeans**	52.2	33.8	54.5	58.4	58.6
	2	**Cotton**	13.6	13.6	12.6	15.7	12.4
	3	Rubber & Allied Gums	12.4	12.0	12.7	14.2	10.5
	4	Rapeseed	5.0	13.4	2.6	2.5	3.3
	5	Coarse Grains (ex. corn)	4.7	9.8	4.5	1.7	3.9
	6	Wheat	3.1	6.6	4.4	0.5	1.7
	7	Tobacco	2.5	2.3	3.3	2.3	2.1
B	8	Other Bulk Commodities	1.9	2.5	2.4	1.4	1.2
	9	Rice	1.8	3.4	1.6	0.9	1.7
	10	Oilseeds NESOI	1.1	0.4	0.6	1.4	1.8
	11	Corn	0.6	0.4	0.0	0.2	1.6
	12	Cocoa Beans	0.4	1.1	0.4	0.3	0.2
	13	Peanuts	0.04	0.04	0.004	0.02	0.09
	14	Coffee, Unroasted	0	0.2	0.1	0	0
	15	Pulses	0	0.7	0.5	0	0
	16	Prepared Foods	14.0	5.2	11.6	18.9	18.5
	17	**Dairy Products**	13.8	11.3	13.9	12.9	16.7
	18	**Poultry Meat & Prods. (ex. eggs)**	11.7	20.6	14.3	10.8	3.0
	19	Processed Vegetables	9.0	5.6	11.7	10.4	7.5
	20	Wine & Beer	7.6	6.7	3.4	8.6	11.8
	21	**Pork & Pork Products**	6.0	2.8	6.0	6.6	8.0
	22	**Meat Products NESOI**	4.7	6.9	6.0	2.8	3.4
	23	Chocolate & Cocoa Products	3.3	2.3	2.9	3.8	3.8
	24	Processed Fruit	3.0	2.3	2.7	4.1	2.6
	25	Condiments & Sauces	2.8	5.9	3.3	1.8	0.7
	26	Beef & Beef Products	2.0	1.9	1.6	0.4	3.9
	27	Fruit & Vegetable Juices	1.8	1.0	2.1	2.5	1.5
C	28	Snack Foods NESOI	1.7	2.0	1.3	1.7	2.0
	29	Non-Alcoholic Bev. (ex. juices, coffee, tea)	0.5	0.2	0.2	0.7	0.8
	30	Coffee, Roasted and Extracts	0.4	0.1	0.2	0.5	0.7
	31	Tea	0.3	0.3	0.2	0.3	0.3
	32	Dog & Cat Food	0.1	0.0	0.1	0.1	0.1
	33	Eggs & Products	0.1	0.1	0.1	0.04	0.03
	34	Fresh Fruit	0	19.3	13.3	0	0
	35	Fresh Vegetables	0	0.5	0.1	0	0
	36	Tree Nuts	0	3.0	3.0	0	0
	37	Spices	0	0.7	0.4	0	0
	38	Nursery Products & Cut Flowers	0	1.1	1.6	0	0
	39	Other Intermediate Products	23.3	24.8	27.6	19.8	21.4
I	40	Palm Oil	23.2	15.3	21.5	30.9	23.4
	41	**Hides & Skins**	15.5	12.4	18.9	14.2	15.8

42	**Soybean Oil**	10.2	11.2	11.5	13.2	5.3
43	Vegetable Oils NESOI	8.7	8.2	5.6	8.8	12.0
44	Sugars & Sweeteners	5.6	4.6	5.5	4.0	8.0
45	Soybean meal	2.9	12.5	0.2	0.7	0.2
46	Feeds & Fodders NESOI	2.0	3.7	2.0	1.3	1.2
47	Animal Fats	1.9	2.9	2.2	1.8	0.8
48	**Distillers Grains**	1.7	0.0	0.0	1.1	5.2
49	Essential Oils	1.6	1.1	1.8	1.7	1.8
50	Planting Seeds	1.2	1.4	1.3	0.9	1.1
51	Oilseed Meal/Cake (ex. soybean)	0.7	0.4	0.2	1.0	1.0
52	Hay	0.3	0.01	0.01	0.1	1.2
53	Live Animals	0	1.5	1.5	0	0

Source: Chinese Customs Trade Data.

Table 3: The Effect of Changes in the Exchange Rate on China's Total Agricultural Imports, 1997-2015

	1997-2015		2001-2015	
	(1)	(2)	(3)	(4)
Δ Exchange Rate	0.367***	0.815***	0.452***	0.598***
(up means RMB stronger)	(0.058)	(0.087)	(0.081)	(0.094)
Δ Exchange Rate		-0.104*		0.198*
(1-Lag)		(0.058)		(0.113)
Δ Exchange Rate		-0.242***		-0.275***
(2-Lag)		(0.058)		(0.075)
Δ Domestic Income	1.930***	2.688***	2.291***	2.424***
	(0.229)	(0.347)	(0.309)	(0.348)
Δ Domestic Income		-0.161		0.089
(1-Lag)		(0.380)		(0.411)
Δ Domestic Income		1.361***		5.164***
(2-Lag)		(0.256)		(0.455)
Constant	1.270***	-0.988	0.134	-0.678
	(0.121)	(0.653)	(0.260)	(0.619)
Observations	95,304	55,748	78,444	49,967
R-squared	0.012	0.015	0.015	0.017
HS2 FE	Y	Y	Y	Y
Partner FE	Y	Y	Y	Y

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.

Table 4: The Effect of Change in the Exchange Rate on Chinese Agricultural Imports, BICO Group, 1997-2015

	Bulk				Intermediate				Consumer-Ready			
	1997-2015		2001-2015		1997-2015		2001-2015		1997-2015		2001-2015	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Δ Exchange Rate (up means RMB stronger)	1.576***	3.055***	2.027***	2.762***	-0.008	0.360**	0.136***	0.298*	0.810***	0.962***	0.896***	0.619***
	(0.401)	(0.630)	(0.479)	(0.638)	(0.041)	(0.145)	(0.037)	(0.164)	(0.134)	(0.118)	(0.192)	(0.114)
Δ Exchange Rate		-0.690		0.363		0.378		0.470		-0.510***		-0.043
(1-Lag)		(0.532)		(0.649)		(0.238)		(0.336)		(0.146)		(0.086)
Δ Exchange Rate		0.123		-0.791		-0.196***		-0.327***		-0.293***		-0.164
(2-Lag)		(0.447)		(0.564)		(0.057)		(0.096)		(0.103)		(0.105)
Δ Domestic Income	6.548***	11.340***	13.290***	11.315***	1.790***	3.205***	2.038***	3.055***	1.925***	1.505***	1.977***	1.216***
	(1.437)	(2.429)	(1.921)	(2.451)	(0.316)	(0.576)	(0.487)	(0.579)	(0.326)	(0.438)	(0.432)	(0.438)
Δ Domestic Income		-1.783		-1.312		2.800***		2.552***		-2.428***		-1.674***
(1-Lag)		(2.032)		(2.352)		(0.615)		(0.722)		(0.530)		(0.536)
Δ Domestic Income		-7.078***		-0.571		-1.335***		-0.578		3.773***		10.131***
(2-Lag)		(1.871)		(2.903)		(0.324)		(0.716)		(0.357)		(0.640)
Constant	-0.605***	-0.480	-1.203***	-1.181**	-0.230	-0.307	1.574***	-0.341	-2.649***	-1.466***	1.556***	-1.835***
	(0.193)	(0.409)	(0.218)	(0.547)	(1.251)	(1.224)	(0.162)	(0.665)	(0.059)	(0.135)	(0.158)	(0.193)
Observations	5,237	2,675	4,147	2,387	33,203	20,467	27,849	18,637	56,864	32,606	46,448	28,943
R-squared	0.020	0.039	0.029	0.040	0.038	0.031	0.042	0.032	0.014	0.022	0.017	0.026
HS2 FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Partner FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.

Table 5: The Effect of Change in the Exchange Rate on Chinese Agricultural Imports, Individual Commodities, 1997-2015

Commodity	Period	ΔER	ΔER (1-Lag)	ΔER (1-Lag)	ΔIncome	ΔIncome (1-Lag)	ΔIncome (2-Lag)	Constant	Obs	R-square
Soybean	1997-2015	1.831			-10.078*			1.476***	141	0.140
		(1.684)			(7.764)			(0.650)		
		1.696	0.330	-0.367	-14.810	-21.557*	11.078	3.086	72	0.200
		(1.871)	(2.150)	(1.664)	(17.180)	(13.541)	(10.690)	(2.930)		
	2001-2015	1.224			3.861			0.359	105	0.436
		(1.541)			(8.443)			(0.612)		
		1.365	2.803**	1.297	3.545	-7.118	21.794**	-0.980	65	0.428
		(1.509)	(1.425)	(1.985)	(14.740)	(11.543)	(11.302)	(2.469)		
Cotton	1997-2015	0.087*			17.539***			-2.984***	429	0.086
		(0.056)			(6.439)			(0.403)		
		-0.097	-0.124***	-0.201**	2.285	8.828	-9.297	-2.167*	232	0.318
		(0.161)	(0.055)	(0.119)	(7.604)	(7.002)	(12.999)	(1.434)		
	2001-2015	0.099**			21.348***			1.114***	382	0.100
		(0.054)			(7.510)			(0.494)		
		-0.055	-0.098***	-0.177*	3.994	12.715***	2.197	-3.254***	222	0.370
		(0.173)	(0.045)	(0.118)	(8.131)	(5.240)	(5.355)	(0.971)		
Grain	1997-2015	-1.175			-20.351***			8.778***	234	0.244
		(2.214)			(6.909)			(0.605)		
		-4.206***	1.825*	-4.474***	8.551*	-22.209***	-9.863***	0.980	99	0.835
		(1.307)	(1.381)	(1.197)	(6.408)	(5.202)	(3.066)	(1.007)		
	2001-2015	-6.645***			-24.208***			1.358*	185	0.221
		(2.185)			(8.641)			(0.932)		
		-4.374***	2.728***	-4.936***	10.307*	-22.121***	-10.109***	0.804	90	0.844
		(1.286)	(1.318)	(1.210)	(6.491)	(5.769)	(4.762)	(1.257)		
Corn	1997-2015	10.495			64.685			-4.165	37	0.511
		(15.063)			(52.562)			(3.572)		
		-17.401**	-7.030	-9.373	-8.082	-23.621**	-0.499	3.051*	11	0.603
		(7.394)	(6.673)	(6.465)	(5.859)	(10.165)	(9.456)	(1.733)		
	2001-2015	12.740			64.425			-8.737*	34	0.512
		(25.210)			(51.973)			(5.608)		
		-17.401**	-7.030	-9.373	-8.082	-23.621**	-0.499		11	0.603

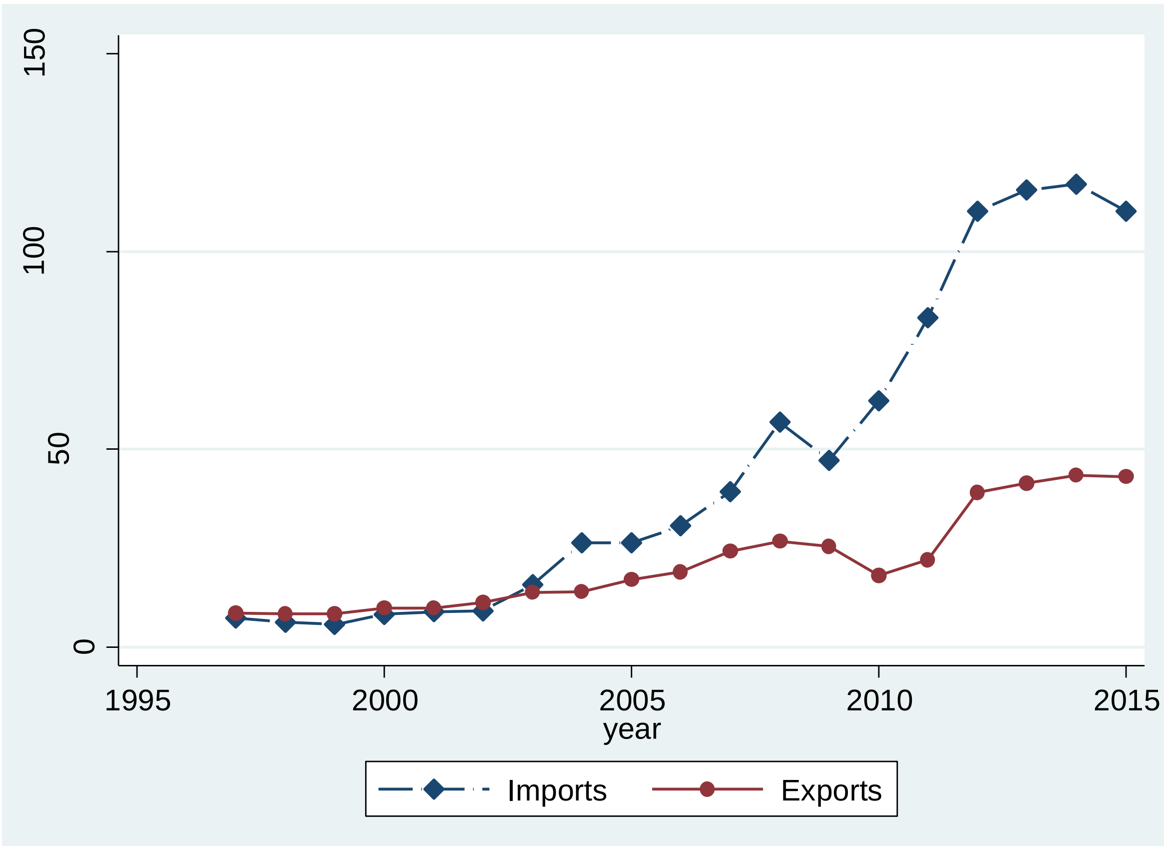
		(7.394)	(6.673)	(6.465)	(5.859)	(10.165)	(9.456)			
Wheat	1997-2015	-3.329			4.131			-0.673	44	0.136
		(4.648)			(9.910)			(1.031)		
		-0.804	3.084	-1.956	21.659	-12.399	-7.921	-1.491	24	0.143
		(4.444)	(8.850)	(3.023)	(25.738)	(19.457)	(12.209)	(2.063)		
	2001-2015	-5.728			22.591*			-2.229*	33	0.284
		(5.167)			(16.046)			(1.472)		
		1.236	1.571	-1.104	24.477	-10.091	-8.859	-1.991	19	0.155
		(5.961)	(10.598)	(3.537)	(32.559)	(22.501)	(18.113)	(3.060)		
Rice	1997-2015	-4.899*			-7.639			0.249	152	0.063
		(3.046)			(10.399)			(0.937)		
		6.759*	6.796***	15.417***	-18.260	40.743***	5.775	-2.435**	88	0.234
		(5.040)	(2.805)	(5.839)	(14.960)	(10.882)	(13.423)	(1.435)		
	2001-2015	1.567			-10.103			-0.919	133	0.057
		(3.115)			(13.656)			(1.059)		
		7.280*	5.093*	12.832**	-19.035	33.595***	-3.154	-0.709	83	0.177
		(4.885)	(3.283)	(7.117)	(14.833)	(10.451)	(13.649)	(1.744)		
Intermediate										
Hide	1997-2015	-0.352*			5.649***			-0.482	545	0.163
		(0.259)			(2.843)			(1.037)		
		0.259	2.184***	-0.492	5.920*	2.781	-2.735	-1.996*	277	0.235
		(1.046)	(1.033)	(1.042)	(3.615)	(4.217)	(2.697)	(1.553)		
	2001-2015	-0.351*			5.545**			-0.474	417	0.203
		(0.268)			(3.279)			(1.090)		
		-1.244	2.978***	0.894	4.713*	3.578	4.542	-2.544*	250	0.302
		(1.052)	(1.178)	(0.957)	(3.576)	(4.766)	(3.560)	(1.642)		
DDG	1997-2015	-7.477			8.591			-0.523***	32	0.213
		(5.750)			(10.962)			(0.195)		
		0.193	3.048	1.413	51.673	9.251	-17.637	-5.063	17	0.242
		(9.895)	(7.407)	(6.091)	(79.432)	(22.290)	(19.333)	(7.353)		
	2001-2015	-8.571			13.419			-2.621	27	0.232
		(8.019)			(31.985)			(3.402)		
		-8.057	13.470	7.638	77.716	57.083	15.775	-16.394	15	0.404
		(13.600)	(14.359)	(12.168)	(96.485)	(61.829)	(32.656)	(17.070)		
Soybean Meal	1997-2015	-2.305			-16.073***			0.885*	142	0.063
		(2.312)			(6.331)			(0.653)		

		-2.692	-4.999	5.203	-8.855	42.669***	1.314	-3.381*	70	0.273
		(4.576)	(3.948)	(5.321)	(20.732)	(13.419)	(8.137)	(2.483)		
	2001-2015	-0.676			-29.408*			3.051*	90	0.071
		(5.213)			(19.664)			(1.962)		
		-1.854	-11.859***	1.884	-14.183	28.494***	7.727	-1.952	52	0.323
		(4.502)	(3.162)	(5.449)	(19.060)	(14.074)	(16.246)	(2.792)		
Consumer-Ready										
pork	1997-2015	-0.004			-6.077			1.109***	426	0.082
		(2.462)			(5.413)			(0.387)		
		2.766	-6.451***	-0.785	-3.338	-1.529	33.101***	-1.356	231	0.210
		(4.536)	(3.030)	(2.943)	(11.554)	(12.814)	(6.707)	(1.595)		
	2001-2015	4.106			19.492**			-0.974	307	0.086
		(4.289)			(10.128)			(0.882)		
		-2.758	0.468	2.923	-5.320	16.387*	107.364***	-9.593***	185	0.300
		(4.952)	(4.345)	(5.301)	(11.395)	(12.431)	(21.170)	(2.808)		
dairy	1997-2015	1.045*			3.090*			0.008**	1,016	0.074
		(0.719)			(2.051)			(0.005)		
		0.585	-0.552	-0.877	1.213	-17.509***	11.238***	1.698**	532	0.103
		(1.454)	(1.340)	(1.002)	(4.470)	(5.383)	(2.983)	(0.937)		
	2001-2015	1.824*			3.353			2.670***	799	0.094
		(1.214)			(3.607)			(0.330)		
		-0.622	2.001	0.088	1.886	-9.969**	40.974***	-1.326*	470	0.176
		(1.654)	(1.585)	(1.519)	(4.313)	(5.260)	(5.931)	(0.879)		
meat	1997-2015	0.073			11.368***			-0.743***	1,921	0.081
		(0.398)			(1.474)			(0.314)		
		2.288***	-3.349***	1.324***	15.250***	-7.729***	7.607***	0.816**	959	0.173
		(0.908)	(0.787)	(0.627)	(3.898)	(3.199)	(1.646)	(0.432)		
	2001-2015	2.361***			18.680***			-1.379***	1,336	0.107
		(0.546)			(2.508)			(0.348)		
		-0.388	-0.127	0.589	10.364***	-6.364*	30.336***	-2.558**	745	0.145
		(0.961)	(1.106)	(0.748)	(3.972)	(4.305)	(6.994)	(1.363)		
beef	1997-2015	0.233			9.971*			-1.461***	191	0.075
		(1.878)			(7.564)			(0.689)		
		2.593	-3.748	-0.976	6.183	2.510	7.741	-1.888	79	0.050
		(4.106)	(4.649)	(3.351)	(24.293)	(31.619)	(17.757)	(3.528)		
	2001-2015	2.120			-1.496			-0.833	112	0.055

		(4.776)			(14.478)			(1.447)		
		6.916	-13.984	-3.979	11.151	-5.940	29.587	-3.085	59	0.168
		(7.662)	(11.132)	(9.313)	(24.277)	(38.135)	(41.150)	(5.214)		
poultry	1997-2015	4.395***			-3.716			0.425*	514	0.102
		(1.833)			(3.279)			(0.304)		
		5.261	-12.733***	-6.085**	-18.140	-47.802***	3.260	5.095***	213	0.325
		(6.229)	(4.989)	(3.536)	(17.718)	(14.611)	(6.785)	(2.006)		
	2001-2015	9.167*			18.805*			-1.115	294	0.212
		(6.322)			(11.857)			(1.251)		
		7.276	-17.721**	-9.950*	-13.284	-55.968***	10.328	5.460*	142	0.374
		(13.914)	(8.955)	(6.396)	(24.488)	(20.564)	(22.157)	(3.958)		

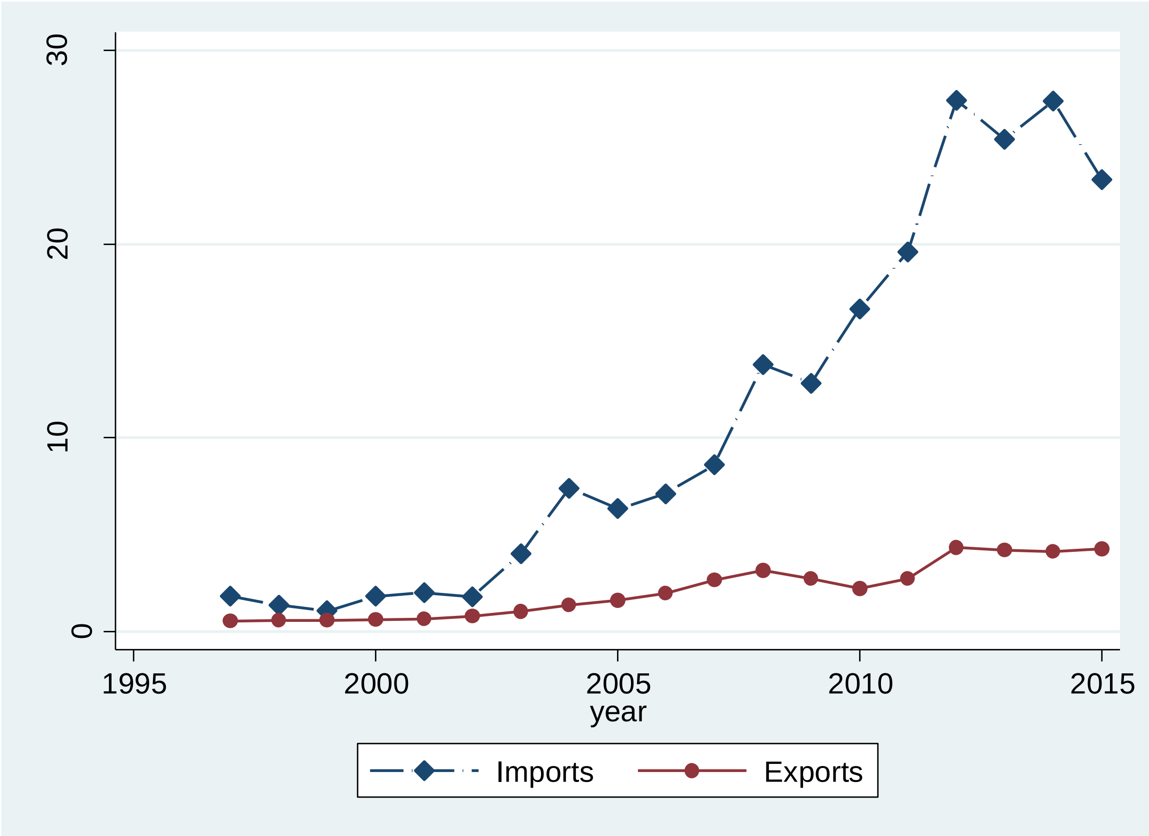
Notes: Robust standard errors in parentheses; *** p<0.05, ** p<0.10, * p<0.20.

Figure 1: Chinese Agricultural Imports and Exports, 1997-2015



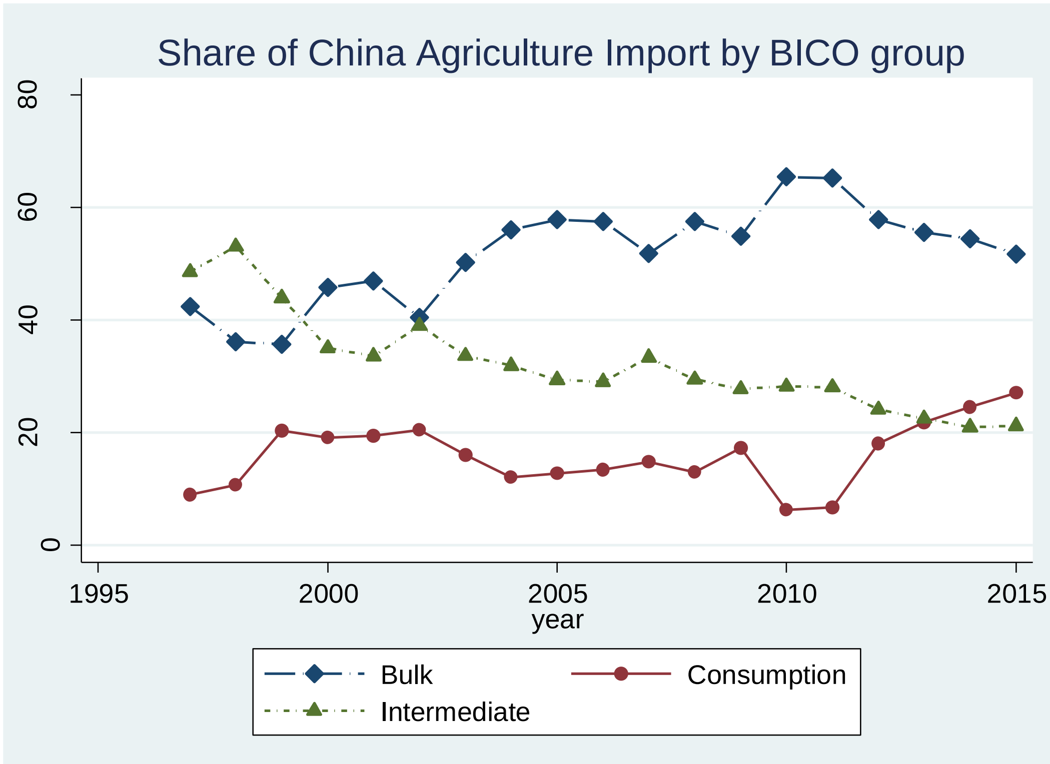
Source: Chinese Customs Trade Data.

Figure 2: Chinese Agricultural Trade with the United States



Source: Chinese Customs Trade Data.

Figure 3: Share of Chinese Agricultural Imports by BICO Group, 1997-2015



Source: Chinese Customs Trade Data.