Title of the Presentation

The Impact of Diversifying China's Global Agri-Food Suppliers on U.S. Exports: A Case Study of China's Meat Import Demand

Mina Hejazi, Graduate Research Assistant and Ph.D. Candidate, Department of Agricultural and Applied Economics, Virginia Tech, minah@vt.edu
Jue Zhu, Ph.D. Candidate, Nanjing Agricultural University, China and Graduate Student Fellow, Virginia Tech, US, juezhu20@gmail.com
Mary A. Marchant, Professor, Department of Agricultural and Applied Economics, Virginia Tech, mmarchant@vt.edu

Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1

May 24, 2017

This is a preliminary draft. Please do not cite or distribute without permission of the authors.

 Funding for this work was provided by the Institute for Society, Culture and Environment (ISCE) at Virginia Tech

The Impact of Diversifying China's Global Agri-Food Suppliers on U.S. Exports: A Case Study of China's Meat Import Demand

Mina Hejazi, Jue Zhu, and Mary A. Marchant

1. Introduction

China has emerged as a leading importer in the global meat market in recent years along with its trade liberalization, rising living standards, changing consumption patterns and increasing production costs. According to the UN Comtrade database, China ranked 16th in the world meat imports in 2001 with meat imports of only $0.6 billion, significantly less than major importers such as Japan ($7.4 billion) and the U.S. ($3.9 billion). By 2016, China's imports increased to $10.3 billion, accounting for 12% of the world volume of meat imports, making it the largest meat importer in the world (Global Trade Atlas database, 2017).

In response to its increased role as a meat importer, China has begun initiating a trade diversification strategy to optimize import sources. With the purpose of providing greater opportunities for Chinese meat importers to negotiate lower prices and to reduce risks from supply disruptions, the No.1 Documents unveiled by the Central Committee of the Communist Party of China (CCCPC) in recent years have called for China to diversify sources of imports. Specifically, China continues to expand free trade agreements (FTA) with agricultural exporting countries, including Australia, New Zealand, Chile, etc. The agreements included tariff reductions on beef, mutton, etc. However, despite the importance of the trade relationship between the U.S. and China, no agreement establishes trade rules between these two countries outside of the WTO.

China's trade diversification strategy opens its meat market to new countries and increases competition for exporting countries, especially for U.S. meat exports. From 2001 to 2015, although U.S. meat exports going to China increased 25%, its market share declined from 70% to 8%. In contrast, the market share of countries that have FTAs with China increased significantly during this period—Australia (from 3% to 15%), New Zealand (from 3% to 13%) and Chile (from 1% to 2%). During 2001 to 2013, the U.S. has consistently been the primary supplier of China meat imports. However, the U.S. is now the sixth-leading supplier after Australia, Brazil, New Zealand, Germany and Uruguay.

With the implementation of China's trade diversification strategy, some research questions arise. For instance, how China allocates meat import expenditures across different source countries under its trade diversifying policies? What trade gains and losses for major meat exporting countries should be expected? How important are free trade agreements to the competitiveness of an exporting country? Addressing these questions is of importance to meat exporters and policymakers in evaluating potential risks and opportunities caused by China's strategy of diversifying its meat suppliers.

The objective of this research is to explore the impact of China's trade diversification strategy on the global meat market, with a focus on U.S. exporters. More specifically, we investigate the impacts of China's expanding global meat suppliers on the nature of its meat import demand, as well as on the relative competitiveness of U.S. meat exporters and other exporters. China's meat import demand is estimated using the Source-Differentiated Almost

Ideal Demand System (SDAIDS) that accounts for differentiation by source country and across meat products. In addition to traditional variables (prices and expenditures), other economic factors (exchange rate and price risk) and non-economic factors (free trade agreements and non-tariff barriers) are built into the model.

This paper is unique by examining China's meat import demand using the SDAIDS model. While the list of studies exploring meat import demand by source is extensive (e.g., Yang and Koo, 1994; Henneberry and Hwang, 2007; Mutondo and Henneberry 2007), there is only one study that focuses on China's source-differentiated meat import demand (Cheng et al., 2015). They also estimated China's import demand by meat type and by country of origin, but used the Armington trade model, which suffers from restrictive assumptions and may lead to biased parameter estimates (Yang and Koo, 1994). We applied the commonly used Almost Ideal Demand System, which is a flexible demand system compared to other functional forms available for import demand estimation (Hennneberry and Hwang, 2007).

The remainder of this paper is organized as follows. Section 2 reviews China's trade diversification strategy and China's meat import trends for the 2001-2016 period. Section 3 introduces the source-differentiated meat import demand model. Section 4 describes the data used for the estimations and estimation procedures. The empirical results are reported in Section 5, followed by concluding remarks in Section 6.

2. Background

2.1 China's trade diversification strategy

In 2001, when China joined the WTO, China's agricultural imports were limited to a few national suppliers, particularly the United States. However, China's No.1 Documents continuously stressed the need to diversify import channels for agri-food products (USDA-FAS, 2015), which is one of the strategies introduced by the Chinese government to boost food security. This strategy reveals China's strong signal of growing acceptance of imports. Diversification of agricultural import suppliers requires import through multiple regions. The purpose of import suppliers' diversification strategy is to reduce risks caused by over-dependence on a few suppliers. As mentioned earlier, this can be achieved by widening the list of countries that China can import from through free trade agreements and by growing the number of import protocols on specific goods (BMIResearch, March 2017), described below.

Currently, 15 FTAs have been signed and implemented by the Chinese government, and seven more agreements are under construction (MOFCOM, 2017). Among these FTAs, China's bilateral agreements with Chile (2006), New Zealand (2008), and Australia (2015) have benefited meat imports to China. While China's bilateral FTAs expand its relationship with other nations, it leaves the U.S. behind. Chile is the first Latin American country that signed a FTA with China, and under the agreement, China and Chile will extend zero duty treatment phase by phase to cover 97 percent of products in ten-year time. Recently, New Zealand and China launched an upgrade of their FTA. Therefore, China's tariffs on NZ$77 million of current exports will be eliminated. Beef and sheep meat, and edible offals are included in current New Zealand's meat exports. Over the last eight years, China's tariffs on

New Zealand beef, lamb and sheep products[1] have been reduced to 2.7%, and will be eliminated next year.

The China-Australia FTA (ChAFTA) created a competitive advantage for Australian meat producers and exporters compared to countries that had FTA with China such as New Zealand and Chile by facing significant tariff reductions on meat products. Furthermore, the issue addressed in the ChAFTA gives Australia a significant advantage over other larger players, such as the US, EU and Canada. The ChAFTA' tariff schedules on meats are similar to the New Zealand-China FTA. China's tariffs on Australian beef imports, ranging from 12-25%, will be eliminated by 1 January 2024 for beef (over nine years), and on beef offal by 1 January 2022. China's tariffs on Australian sheep meat imports, ranging from 12 to 23%, will be eliminated by 1 January 2023. China's tariffs on frozen sheep meat offal (18% tariff) and on goat meat (20% tariff) will be eliminated by 2022 and 2023, respectively. Therefore, ChFTA makes all Australian farmers more competitive compared to New Zealand. Furthermore, through ChAFTA, tariffs of up to 20% on pork will be eliminated by 1 January 2019 (the China-Australia Free Trade Agreement, 2016).

In terms of protocols on specific goods, some EU members have been continuing to negotiate with China on bilateral protocols to export meat products. If those bilateral protocols could be reached and enacted, it will further boost China's meat imports from the EU (Jimenez, 2016).

2.2 China's meat imports trends

According to the Global Trade Atlas database, China's meat imports have been growing at a phenomenal rate between 2001 and 2016. The total value of meat imports surpassed $10 billion in 2016 from below $1 billion in 2001. As indicated in Figure 1, while China's pork imports increased dramatically since 2007, beef, poultry, and mutton imports have also significantly increased.

Figure 2. displays China's import share by source countries for beef, mutton, pork, and poultry, respectively. When compared with other popular beef exporters, U.S. lost its share in 2004 because of the U.S. beef bovine spongiform encephalopathy (BSE) outbreak in 2003, and China banned all U.S. beef products (Anderson et al., 2011). Since then, Australia, New Zealand, and Uruguay replaced the U.S. share. While these suppliers remained the largest meat exporters to China, Brazil regained it market access in the middle of 2015 after its suspension due to disease. Brazil's share (30%) exceeded Australia (22%) and Uruguay (21%). However, as of May 2017, the BSE ban has been lifted for U.S. beef exports to China. As showed in figure 2, Australia and New Zealand are the two dominant mutton (sheep product) suppliers between 2001 and 2016; however, through the years, Australia's share of mutton exports increased, and while New Zealand is still the leading exporter of mutton into China, its share decreased.

China's major suppliers of pork included the EU, the U.S., and Canada, with the EU accounting for close to 70% share of pork imports, led by Germany, Spain, and Denmark. On average these three countries accounted for 98% of China's total pork imports between 2001

[1] Beef products include chilled and frozen beef muscle cuts, and lamb and sheep products (mutton) include frozen bone-in lamb

and 2016. It is noteworthy to mention that Brazil is currently becoming one of China's pork suppliers, and its import share in 2016 was half of Canada's share. Growing demand for pork in China, because of the domestic supply shortage and increasing consumers' appetite toward pork, created a potential market for pork exporters as China opened its market to the global pork market (Servon, 2015). Thus, attracts new countries, like Brazil, to enter as market and increases competition among exporters.

Between 2001 and 2013, the U.S., Brazil, and Argentina were the three largest poultry exporters to China. The U.S. was the dominant supplier of poultry imports to China, and accounted for 85% of poultry imports; however, the U.S. lost its share due to foodborne diseases and trade restrictions. Although controversy exists over whether China should have restricted poultry from the entire U.S. while outbreaks where regional. In 2010, Brazil surpassed the U.S. and became the largest exporter of poultry to China, and in 2016, accounted for 82% of Chinese poultry imports. In recent years, Chile became the third largest poultry exporter to China after Argentina.

3. Methodology

The Armington model, the Source Differentiated Rotterdam model and the SDAIDS have been frequently used in source-differentiated import demand estimations. Here we employ the SDAIDS model to estimate source-differentiated meat import demands in China. The SDAIDS is advantageous because it represents a flexible complete demand system and it does not require the additivity of the utility function (Deaton and Muellbauer, 1980), unlike the Armington model, which suffers restrictive assumptions of constant elasticity of substitution and homotheticity. Moreover, many studies have shown that the AIDS model does better in fitting the consumer demand analysis than the Rotterdam model (Tshitala and Fonsah, 2012)

Furthermore, we used the Restricted SDAIDS (RSDAIDS) model to save degrees of freedom. Given that meat imports usually have several non-separable substitutes from different import origins, the SDAIDS model may suffer from a degrees-of-freedom problem (Yang and Koo, 1994). To avoid this problem, Yang and Koo (1994) suggest using the RSDAIDS model, which assumes block substitutability among goods. That is, assuming the cross-price of good *j* on the demand of good *i* from source *h* are the same for good *j* from all sources. For example, this assumption says that the China's demand for U.S. beef exhibits the same cross-price response to pork from Brazil and pork from Canada.

Following Yang and Koo (1994), the RSDAIDS model is specified as follows:

$$(1) \qquad w_{i_h} = \alpha_{i_h} + \sum_k \gamma_{i_{hk}} \ln(p_{i_k}) + \sum_{j \neq i} \gamma_{i_h j} \ln(p_j) + \beta_{i_h} \ln\left(\frac{E}{P^*}\right)$$

where w_{i_h} is the budget share of good *i* (*i* and *j* are defined for different types of meat) from a source country *h* (*h* and *k* denotes source countries). It should be noted that meat *i* may have different source countries compared to meat *j* (when $i \neq j$, *h* = 1, …, *m*, and *k* = 1, …,*n*). p_{i_k} describes the price of meat *i* from source country *k*. p_j is the price of meat j (no source differentiation), $\ln(p_j) = \sum_k w_{j_k} \ln(p_{j_k})$. E is the total expenditure of all imported meat in this demand system. P^* defines a price index, which is computed based on the Stone's price index as suggested by Deaton and Mullbauer (1980), $lnP^* = \sum_i \sum_h w_{i_h} \ln(P_{i_h})$. However, since w_{i_h} in equation (1) is defined as dependent variable, it raised simultaneity bias if we employ w_{i_h} for the Stone's price index. To overcome this, we use the average share (Haden, 1990).

Since one of the key motivations is to investigate the impact of China's trade diversification strategy on the global meat market, with a focus on U.S. exporters. We extended the RSDAIDS with indicator variable demand shifters, such as the FTAs. This indicator variable is included in the intercept in the RSDAIDS model (Henneberry, Piewthongngam, and Qiang 1999). Therefore, the intercept in equation (1) is defined as

(2) $$\alpha_{i_h} = \alpha^*_{i_h} + \alpha_{ih}FTA$$

If China has a FTA with any source country, the FTA dummy variable is 1, otherwise 0. [2]

The general demand conditions of adding-up, homogeneity, and symmetry, which are derived from economic theory, are imposed using parameter constraints as the following:

Adding-up: $\sum_i \sum_h \alpha_{i_h} = 1; \sum_i \gamma_{i_{hk}} = 0; \sum_i \sum_h \gamma_{i_h j} = 1; \sum_i \sum_h \beta_{i_h} = 0;$

Homogeneity: $\sum_i \gamma_{i_{hk}} + \sum_i \gamma_{i_h j} = 0;$

Symmetry: $\gamma_{i_{hk}} = \gamma_{i_{kh}}.$

Since we assume block substitutability, the symmetry conditions among goods do not apply here.

The Marshalian own-price and cross-price elasticities, and expenditure elasticity for the RSDAIDS model are shown in equations (2) through (5), respectively:

(2) $$\epsilon_{i_h i_h} = -1 + \frac{\gamma_{i_{hh}}}{w_{i_h}} - \beta_{i_h},$$

(3) $$\epsilon_{i_h i_k} = \frac{\gamma_{i_{hk}}}{w_{i_h}} - \beta_{i_h}\left(\frac{w_{i_k}}{w_{i_h}}\right),$$

(4) $$\epsilon_{i_h j} = \frac{\gamma_{i_h j}}{w_{i_h}} - \beta_{i_h}\left(\frac{w_j}{w_{i_h}}\right),$$

(5) $$\eta_{i_h} = 1 + \frac{\beta_{i_h}}{w_{i_h}}.$$

$\epsilon_{i_h i_h}$, in equation (2), is the own-price elasticities for meat *i* from the source country *h*. $\epsilon_{i_h i_k}$, in equation (3), specifies the cross-price elasticities between meat *i* from source country *h* and meat *i* from source country *k*. In equation (4), $\epsilon_{i_h j}$ defines the cross-price elasticities between

[2] Because of time limitations, our model estimation is now limited to the main import demand variables, prices and expenditures, and we will incorporate these new factors in the model later. In the next step we will introduce exchange rates to the model, equation (1), as fluctuations in exchange rates may impact China's meat imports from its suppliers as suggested in the literature that estimated import demand models (Jones, Muhammad and Mathew, 2013). Furthermore, we will introduce two other indicator variables, non-tariff measures (NTMs) into the model, as intercept shifters in the model. Similarly, if there is an outbreak of a disease related to a specific type of meat in any source country, the NTM dummy variable is 1, otherwise zero. Moreover, we will introduce another indicator variables into the import demand model that captures other trade restrictions, tariff barriers, in addition to NTMs for meat, such as an anti-dumping and countervailing duties. If China imposed an anti-dumping and countervailing duties on specific meat from a source country, the indicator variable is equaled to 1, otherwise 0.

meat *i* from source country *h* and meat *j*. Lastly, η_{i_h} represents the expenditure elasticity of meat *i* from source country *h*.

4. Data and Estimation Procedures

Monthly data from January 2001 to February 2017 are used to estimate the RSDAIDS model. We choose 2001 for the beginning of the data as this is the year that China joined the WTO. Meat imports are reported by China Customs and provided by the Global Trade Atlas. The data contain the values (U.S. dollars) and quantities (kilograms) of China's meat imports defined at the 4-digit level of the Harmonized System (HS) and disaggregated by country of origin. In this study, China's imported meats are categorized into five groups: beef (0201 and 0202), pork (0203), mutton (0204), poultry (0207), and other meats (0205, 0206, 0208, 0209 and 0210). A country is identified as an import origin if it exported over 5% of China's total imports of the selected meat in most years. Otherwise, exporting countries are aggregated into the rest of the world (ROW) category for each meat. Using this norm, China's meat imports are classified as follows: beef from Australia, New Zealand, Uruguay, and the ROW; mutton from Australia, New Zealand, and the ROW; pork from Brazil, Canada, the EU, the U.S., and ROW; poultry from Argentina, Brazil, Chile, the U.S., and the ROW. The summary statistics of expenditure shares for each meat is presented in Table 1.

Import price, price risk, exchange rate, FTAs and non-tariff barrier indicator variables are included in the model. Since import prices for source-differentiated meats are not available, we use the unit-value as a proxy for import prices. Unit-value of each meat is calculated by dividing the import value by the import quantity. The moments of import prices are used to measure price risk. Exchange rates are obtained from the International Monetary Fund (IMF). FTAs between China and other countries (or blocs) are collected from the World Trade Organization (WTO). NTMs, in particular animal disease outbreaks and other trade restriction data are taken from the WTO as well.

The seemingly unrelated regression (SUR) method is used to estimate the parameters of the RSDAIDS model. The theoretical restrictions of adding-up, homogeneity and symmetry are imposed to make the model consistent with economic theory. Due to the adding-up condition, the equation for other meat is dropped from the system for estimation purposes to avoid singularity. The parameter estimates for the dropped equations can be calculated using the adding-up restriction.

5. Results

Marshalian demand elasticities in equations (3) through (5) are calculated from the estimated parameters in equation (1). The expenditure and price elasticities for beef, mutton, pork and poultry across different source countries are presented in table 2. In should be noted that the results in this section are preliminary. In the beef market, all the expenditure elasticities are positive and statistically significant. The magnitude of the expenditure elasticities from Australia, New Zealand, Uruguay and the ROW are elastic (lowest Australia (2.1) and highest ROW (2.8)).

For mutton, the expenditure elasticities for Australia, New Zealand, and the ROW are positive and statistically significant. The expenditure elasticity is in same range for mutton imported from these sources (between 1.4 and 1.5), which indicates there is not much of consumer preference difference between imported mutton from Australia and New Zealand.

Similar to beef and mutton market, all expenditure elasticities for pork are positive and statistically significant. The expenditure elasticity is high for Brazil (2.8), the ROW (2.2), and the EU (2.0), while the expenditure elasticity for the U.S. and Canada are less than one. The results also show a high expenditure elasticity for pork imported from Brazil as it is becoming a new emerging supplier in the pork market. The results suggest that a significantly higher percentage of pork demanded in China might be imported from the EU. This shows the preference of Chinese consumers for pork imported from the EU.

In the poultry market, all expenditure elasticities are positive; however, the expenditure elasticities for poultry imported from Argentina, Brazil, Chile, and the ROW are statistically significant, and the expenditure elasticities for poultry imported from the U.S. is not statistically significant. The highest expenditure elasticities belong to poultry imported from Chile (1.7) and Brazil (1.4) followed by Argentina (0.8) and the ROW (0.7).

Consistent with economic theory, the own-price elasticities for meat import demand show negative elasticity for individual meat across different source countries. Notably, all own-price elasticities are statistically significant. In the beef market, own-price elasticities for beef imported from New Zealand and Uruguay are elastic but from Australia and the ROW are inelastic. For mutton, the own-price elasticities for different sources are greater than one in absolute values, except for imported mutton from the ROW. All own-price elasticities for imported pork from different source countries are elastic, except for imported pork from Canada. In the poultry market, all own-price elasticities for imported poultry are less than one, except for imported poultry from Chile.

In terms of cross-price elasticities, the cross-price elasticity within specific meat across different sources and the cross-price elasticity between different meat categories are calculated based on the RSDAIDS model. The cross-price elasticity measures the level of competitiveness of China's global meat suppliers within a specific meat category, and it also provides information on the level of competitiveness between different meat categories. In the beef market, most of the cross-price elasticities are not statistically significant. In only two cases that the cross-price elasticities are statistically significant, they have negative sign, which indicates a strong complementary relationship between Australian beef and New Zealand beef. For mutton, the only statistically significant cross-price elasticity belongs to between Australian mutton and the ROW mutton, and these two sources have a complementary relationship. In the pork market, most of cross-price elasticities are not statistically significant, except there is a substitutability relationship between imported pork from Brazil and Canada. In the poultry market, there is a weak substitutability relationship between U.S. poultry and Argentinian poultry.

Most of the estimated results of cross price elasticities across different meat categories are statistically significant. In the beef market, the results suggest that there is a strong substitutability relationship between New Zealand beef and aggregated mutton, and similarly between Uruguay beef and aggregated mutton. The results also indicate that there is a weak complementary relationship between beef and pork and between beef and other meats, while this relation is stronger between beef and poultry. For mutton, the results suggest that there is a weak complementary relationship between mutton and beef, pork, poultry, and other meats. In the pork market, the results show there is a strong substitutability relationship between pork from all different sources and beef, except between pork from Canada. Furthermore, there is a weak substitutability relationship between pork from Canada and mutton, while there is an opposite relationship (complementary relationship) between pork from the U.S. and mutton.

Comparing the cross price elasticities between pork from different sources and poultry indicate that there is a strong substitutability relationship between pork from the U.S. and poultry and a weak complementary relationship between pork from the EU and poultry. In the poultry market, the results provide a clear path that there is a substitutability relationship between poultry from the U.S. and the ROW and beef. However, there is a complementary relationship between poultry from Argentina and beef, and poultry from Brazil and beef. Furthermore, there is a weak substitutability relationship between poultry from Brazil and pork, and poultry from the U.S. and pork.

6. Conclusions

This research investigated how China allocates meat import expenditures across different source countries under its trade diversifying policies. This work is one of the first to analyze source differentiated meat demand in China. Calculated price and expenditure elasticities are used to evaluate the competitiveness of meat suppliers especially the U.S. in China. This paper used monthly data from January 2001 to February 2017 to estimate the Restricted Source Differentiated AIDS model for five categories of meat including beef, mutton, pork, poultry, and other meats. It should be noted that because of time limitations, our estimations contained economic factors (meat prices and expenditures), and in the next step the non-economic factors especially FTA will be included in the model.

For the source differentiated import demand model, a source country has a strong potential to be considered as an import market if any specific meat carries a higher expenditure elasticity but insensitive across changes in prices. The empirical results suggest that New Zealand and Uruguay have the largest potential for beef exports to China. Australia is in a strong position in the mutton market. In the pork market, Brazil and the EU are strong. Chile and Brazil have the largest potential for poultry exports to China. The U.S. competes with Argentina, the EU, and the ROW in the poultry market. The competition between Brazil and Canada are the strongest in the pork market.

7. References

Anderson, Shonda, Bieroth Shonda, Tucker Grace, and Ted Schroeder. 2011. "Chinese Beef Consumption Trends: Implications for Future Trading Partners." Department of Agricultural Economics MF-3000, www.agmanager.info

Anderson-Sprecher, Andrew, and Wu Bugang. 2015. "Chinese Government Tackles High Production Costs and Uncompetitive Prices in New Agriculture Strategy." Washington, DC: U.S. Department of Agriculture, Foreign Agricultural Service, GAIN Report CH15010.

Australian Trade and Investment Commission. 2017. "The China-Australia Free Trade Agreement, Factsheet: Agriculture and Processed Food." https://www.austrade.gov.au/Australian/Export/Free-Trade-Agreements/chafta.

BMIResearch, March 2017 "Industry Trend Analysis-China Trade: Import Diversification Strategy To Gain Pace – APR 2017. https://www.BMIResearch.com

Cheng, Ya Hao, Zhifeng Gao, and James Seale. 2015. "Changing Structure of China's Meat Imports." *Journal of Integrative Agriculture* 14 (6): 1081–91. doi:10.1016/S2095-3119(14)60991-6.

Deaton, Angus, and John Muellbauer. 1980. "An Almost Ideal Demand System." *The American Economic Review* 70 (3): 312–26. doi:10.1016/0014-2921(94)90008-6.

Global Trade Atlas database. 2017. http://www.gtis.com/gta/

Haden, Kim. 1990. "The Demand for Cigarettes in Japan." *American Journal of Agricultural Economics* 72: 446-50.

Henneberry, Shida R, and Seong-huyk Hwang. 2007. "Meat Demand in South Korea: An Application of Restricted Source-Differentiated Almost Ideal Demand System Model." *Journal of Agricultural and Resource Economics* 39(1): 47-60.

Henneberry, Shida R, Piewthongngam, Kullapapruk and Han Qiang. 1999. "Consumer Food Safety Concerns and Fresh Produce Consumption." *Journal of Agricultural and Resource Economics* 24: 98-113.

Jimenez, Rafael. 2016. "Trends of China's Meat Imports from the EU: A Brief Analysis of 2016 Trade Data (Jan to Sep)." EUSMECentre, http://www.eusmecentre.org.cn/article/trends-china-meat-imports-eu-brief-analysis-january-september-2016-trade-data

Ministry of Commerce (MOFCOM). 2017. "China FTA Network" http://fta.mofcom.gov.cn/english/index.shtml

Mutondo, Joao E, and Shida, Rastegari Henneberry. 2007a. "A Source-Differentiated Analysis of U.S. Meat Demand." *Journal of Agricultural and Resource Economics* 32 (3): 515-533 URL: http://www.jstor.org/stable/40982694.

Mutondo, Joao E, and Shida R Henneberry. 2007b. "Competitiveness of U.S. Meats in Japan and South Korea: A Source Differentiated Market Study." Selected Paper Prepared for Presentation at the American Agricultural Economics Association Annual Meeting, Portland, Oregon, July 29 – August 1.

Tshikala, Kaninda S, and Greg Fonsah Esendugue. 2012. "Analysis of US Demand for Imported Melons using a Dynamic Almost Ideal Demand System." In SAEA annual meeting, Birmingham, Alabama, February 4-7. http://purl.umn.edu/119779

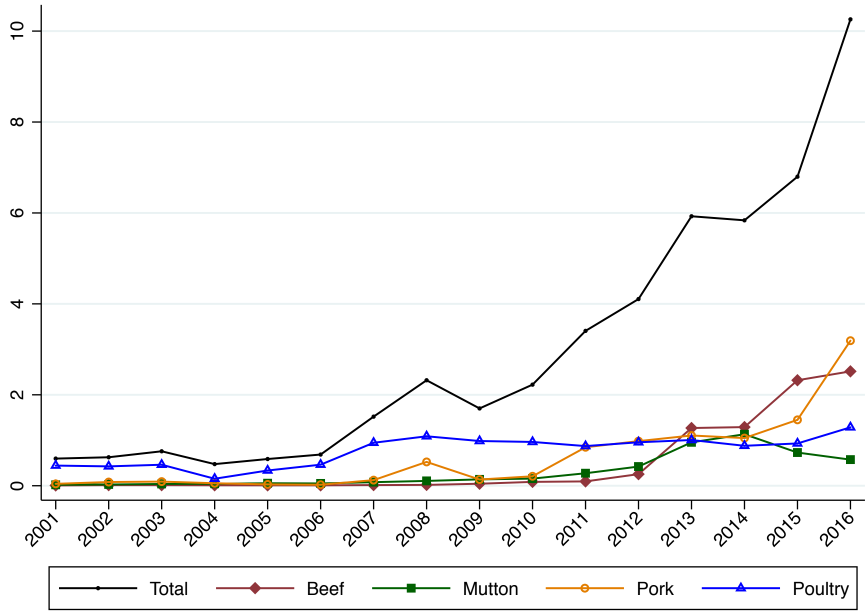
United Nation Comtrade. 2017. Information Obtained from http://comtrade.un.org/db/dqQuickQuery.aspx

Servon, Lisa. 2015. "China's Astounding Appetite for Pork: Recent Trends and Implications for International Trade." Penn Wharton, University of Pennsylvania 5(4). https://publicpolicy.wharton.upenn.edu/live/news/644-chinas-astounding-appetite-for-pork-recent-trends

Yang, Seung-ryong, and Won W Koo. 1994. “Japanese Meat Import Demand Estimation with the Source Differentiated AIDS Model.” *Journal of Agricultural and Resource Economics* 19 (2): 396–408.

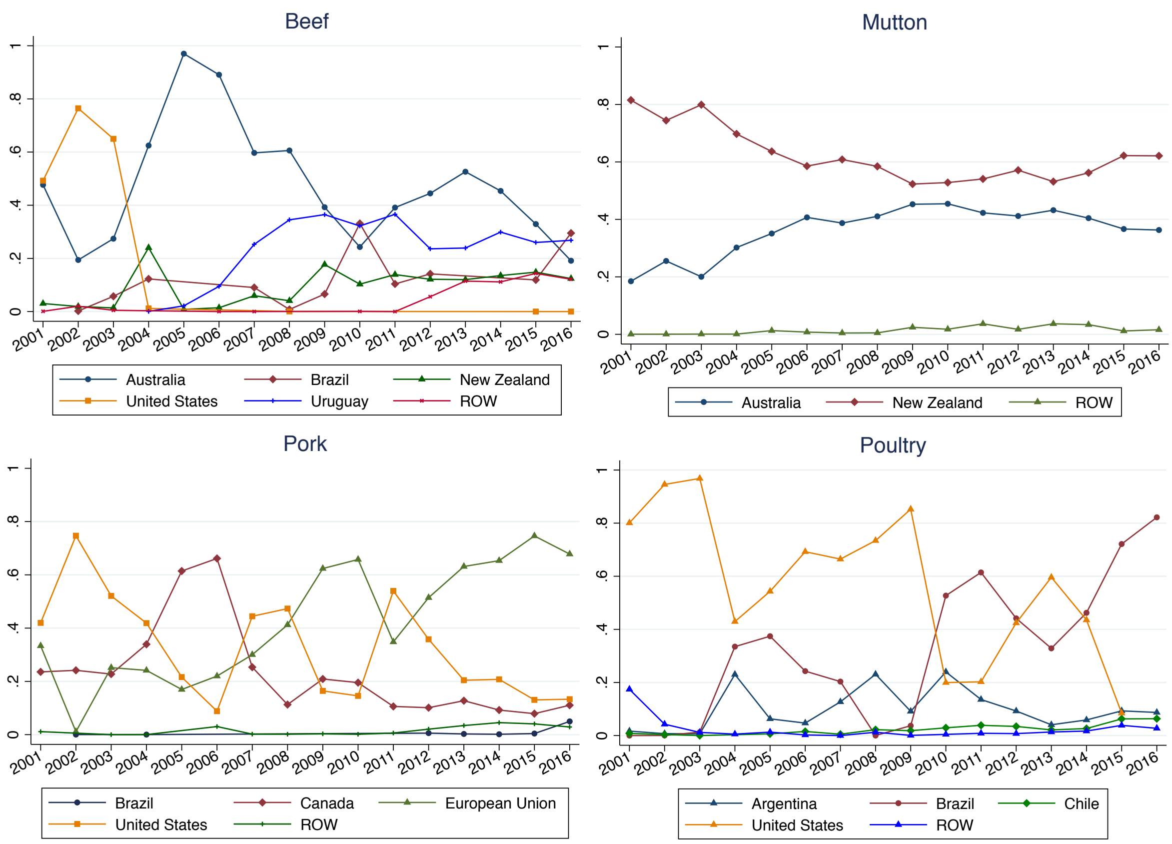
8. Figures and Tables

Figure 1. China's meat imports ($ billion), 2001-2016



Source: Global Trade Atlas, China Customs Data, March 2017

Figure 2. China's meat import share by quantity across source countries, January 2001-Februrary 2017



Source: Global Trade Atlas, China Customs Data, March 2017.

Table 1. Summary statistics for expenditure shares of China's meat imports for January 2001-Februrary 2017

Variable	Mean	Std.Dev.	Minimum	Maximum
Beef	0.0822	0.1092	0.0033	0.3888
Australia	0.0343	0.0424	0.0013	0.1592
New Zealand	0.0106	0.0176	0.0000	0.0789
Uruguay	0.0170	0.0249	0.0000	0.0958
ROW [a]	0.0202	0.0388	0.0000	0.1809
Mutton	0.0853	0.0490	0.0193	0.2579
Australia	0.0294	0.0187	0.0026	0.0894
New Zealand	0.0544	0.0335	0.0089	0.1911
ROW	0.0014	0.0022	0.0000	0.0118
Pork	0.1459	0.0908	0.0197	0.4135
Brazil	0.0015	0.0054	0.0000	0.0431
Canada	0.0251	0.0120	0.0058	0.0781
European Union	0.0690	0.0633	0.0000	0.2597
United States	0.0476	0.0529	0.0000	0.3137
ROW	0.0026	0.0033	0.0000	0.0122
Poultry	0.4203	0.2245	0.0890	0.8129
Argentina	0.0381	0.0451	0.0000	0.2427
Brazil	0.1012	0.0896	0.0000	0.3844
Chile	0.0072	0.0061	0.0000	0.0308
United States	0.2606	0.2405	0.0000	0.7195
ROW	0.0132	0.0181	0.0000	0.0855
Other Meat	0.2664	0.1000	0.0902	0.6274

[a]) ROW is the rest of the world

Table 2. Marshallian Elasticities of China's meat import demand model, January 2001-Februrary 2017

	Beef				Pork					Poultry					Mutton		
	AUS	NZL	URL	ROW	BRA	CAN	EU	USA	ROW	ARG	BRA	CHL	USA	ROW	AUS	NZL	ROW
Beef																	
AUS	-0.771***	-0.492**	-0.067	-0.027													
NZL	-0.148**	-1.052***	-0.027	0.001													
URL	-0.027	-0.043	-1.007***	0.025													
ROW	-0.003	0.006	0.035	-0.796*													
Pork																	
BRA					-1.155***	0.069***	-0.027	-0.014	0.155*								
CAN					1.083**	-0.711***	0.061	-0.025	0.330**								
EU					-1.276	0.239	-1.278***	0.224	-1.450***								
USA					-0.538	-0.045	0.108	-1.958***	-0.168								
ROW					0.266*	0.038***	-0.054***	-0.006	-3.044**								
Poultry																	
ARG										-0.785***	-0.117	-0.367***	0.087***	-1.072***			
BRA										-0.255	-0.551**	-0.052	0.022	-5.186***			
CHL										-0.063**	-0.001	-2.076***	0.001	1.136***			
USA										0.379***	-0.304***	-0.405***	-0.788***	0.298			
ROW										-0.178***	-0.327***	0.994***	0.012*	-9.295***			
Mutton																	
AUS															-1.176***	-0.023	-0.676***
NZL															-0.052	-1.366***	-0.305
ROW															-0.033***	-0.008	-0.279
Beef					1.747***	-0.420***	0.425***	0.796***	0.138	-0.685***	-1.182***	-0.056	0.942***	2.025***	-0.700***	-0.459***	-0.604***
Pork	-0.363***	-0.456**	-0.626***	-0.564***						0.063	0.251**	-0.092	0.283***	-0.780***	-0.225***	-0.115	-0.363*
Poultry	-1.110***	-1.654***	-1.442***	-0.639	2.207	0.137	-0.688***	1.734***	0.839						-0.170	-0.676***	-1.196***
Mutton	0.265	2.836***	1.883***	5.600***	1.563	0.367*	0.214	-0.975**	0.112	0.268	1.309***	-0.437	-0.969***	1.715			
Other meats	0.020	-1.680***	-1.279***	-6.163***	-6.742***	-0.609***	-0.728***	-0.763	-0.984**	0.591	-0.146	-0.355	0.420	1.464***	0.955***	1.407***	0.0197
Expenditure	2.135***	2.534***	2.530***	2.781***	2.845***	0.935***	1.966***	0.981***	2.278***	0.798***	1.361***	1.715***	-0.024	0.740**	1.401***	1.239***	1.530***

Notes: The numbers in parenthesis are standard errors. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively. In column one, AUS = Australia, ARG = Argentina, BRA = Brazil, CAN = Canada, CHL = Chile, EU = European Union, NZL = New Zealand, URL = Uruguay, USA = United States, and ROW = rest of the word