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The Economic Importance of the KORUS FTA: A Case Study of the Korean Beef Market After Renegotiations

By Jin Kyo Suh

Abstract

Beef trade was a major sticking point between the United States and South Korea in ratifying the KORUS FTA. The outcome of the renegotiations that led to the March 2018 agreement in principle did not impact sections pertaining to beef in the agreement, though looking at how beef trade would have been affected should the talks have failed highlights the importance of the agreement to both countries, but particularly the United States. This paper estimates the demand for imported beef in South Korea by source and product by using the production version of the Rotterdam demand system and assesses what the potential impact of U.S. withdrawal from the KORUS FTA would have been on beef trade between the U.S. and South Korea. The results suggest U.S. withdrawal from the KORUS FTA would have resulted in a considerable increase in Australian beef exports to South Korea, largely at the expense of U.S. beef. This is because there is significant price competition between beef imports from the United States and Australia. Furthermore, Korean consumers substitute American beef for Australian beef when the relative price of U.S. beef rises.

Key Words: *Beef, Import Demand Elasticity, KORUS FTA, tariffs, Rotterdam Demand Model*

Introduction

After starting talks in January, 2018 to amend the U.S.-Korea Free Trade Agreement (KORUS FTA), the United States and South Korea (hereafter Korea) have now reached an agreement in principle on amendments and modifications to the deal.[1] The renegotiations were initiated by the U.S. over its bilateral trade deficit in goods. Since almost 90 percent of the bilateral trade deficit can be attributed to the automotive sector,[2] under the revised agreement, U.S. automakers will receive greater access to the Korean market.[3] The White House confirmed that, as part of the deal, Korea will double its annual quota for imported cars that meet American safety standards, not the more stringent Korean standards, from 25,000 per manufacturer to 50,000.[4]

Renegotiations, however, did not incorporate changes to agriculture, which could have been a deal-breaker for the successful conclusion of the talks. Even though agriculture is a very small part of both the U.S. and Korean economies, it is politically sensitive in both countries. Before the amendment negotiations, agriculture was recognized as Korea's Achilles' heel. Korea could hardly accept any additional market-access concessions for agricultural commodities considering its already huge trade deficit with the U.S. The deficit of South Korea in agricultural trade with the U.S. steadily increased to $6.7 billion in 2017, up from $5.8 billion in 2012. Consequently, it was often said that additional market access for U.S. agricultural commodities was a red line in the amendment negotiations.

Among agricultural goods, beef has great significance for both countries. From the U.S. viewpoint, beef is the single most important agricultural export to Korea and one of the most successful aspects of the KORUS FTA. U.S. beef exports to Korea amounted to $1.15 billion in 2017, which is a new record and an increase of 13.2 percent from 2016. It is also more than 55 percent of total livestock and meat exports to Korea and 17 percent of total agricultural exports of the U.S. to Korea (Table 1). This is largely because Korea's 40 percent tariff on U.S. beef in 2011, the year before the deal went into force, was gradually reduced to 21.3 percent in 2018 and will be removed by 2026.

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Table 1. Korea's Agricultural Imports from the U.S.

Unit: USD million, %

	2014	2015	2016	2017
Total Agricultural Exports (1)	6,884	6,028	6,186	6,889
A. Livestock & Meat (2)	1,793	1,701	1,780	2,061
- Beef and Veal (3)	814	766	1,013	1,147
B. Grains & Feed	2,104	1,696	1,858	1,813
C. Horticultural Products	1,366	1,435	1,418	1,507
D. Oilseeds and Products	602	371	397	617
E. Dairy Products	415	305	231	280
F. Cotton, Linter & Waste	208	241	165	248
G. Sugar & Tropical Products	206	199	222	221
H. Poultry & Products	122	22	39	57
I. Planting Seeds	37	33	39	52
J. Tobacco & Products	32	24	36	34
(3)/(2) (%)	45.4	45.0	56.9	55.7
(3)/(1) (%)	11.8	12.7	16.4	16.6

Source: GATS (Global Agricultural Trade System) Online, FAS/US Department of Agriculture

For Korea, beef was the most contentious issue during the KORUS FTA negotiations and played a major role in delaying the ratification of the deal from when it was signed in 2007 and ratified in 2011.[5] Furthermore, during required National Assembly hearings in late 2017 as part of renewed KORUS FTA talks, agriculture groups argued that the deal should be scrapped, highlighting the limited room Korea has to maneuver on beef.[6] Economically, domestic beef amounted to 10.6 percent of the total value of agricultural production in 2016, making it the third highest commodity by value.

While agriculture was seemingly not a key issue in the talks from the U.S. side, American farmers and ranchers would have clearly benefited from greater access to the Korean market. Given the political importance of agriculture and the Trump administration's repeated claims that it seeks to protect American farmers and ranchers through its trade agenda,[7] the administration could have sought major revisions to relevant sections in the KORUS FTA ahead of important mid-term elections in November.

The result of the KORUS FTA renegotiations could therefore have significantly affected the beef sectors of both countries, including other beef exporting countries which are competing with the United States in the Korean beef market. It is likely that Australia or New Zealand could have been the real beneficiaries of the talks should they have failed or resulted in a contentious outcome.

While both sides have reached an agreement in principle, there are still hurdles to jump before the changes to the KORUS FTA are finalized. For Korea, the amendments and modifications must be approved by a vote in the National Assembly. Although Congressional approval may not be required—changes in the agreement will not engender modifications to U.S. law and therefore do not trigger Trade Promotion Authority—President Trump's comment in March that he may not sign off on the deal until an agreement with North Korea is reached add uncertainty to its fate in the U.S.[8]

In this respect, it is important to reiterate the importance of the KORUS FTA to both countries, using bilateral beef trade, particularly in the context of other beef exporting countries and South Korea, as a case study. To do this, this paper considers the impact of two scenarios. The first is if the talks were to have failed and the U.S. withdrew from the agreement and the second is that the beef sections of the deal are unaltered as they are under the agreement in principle. While it may have also been possible for the agreement to be modified so that the tariff phase out schedule was accelerated or should this occur if the agreement in principle is altered, because beef is politically very sensitive, such an outcome would likely have the opposite of the intended effect and cause U.S. beef exports to decrease due to negative perceptions from Korean consumers. Consequently, the impact of this outcome would be similar to the second scenario.

The first section of the paper briefly describes patterns in Korea's beef production, consumption, and trade. Then, the import demand model used for quantifying the economic effect of the amendment negotiations of the KORUS FTA is presented and the policy simulation is conducted. After, the estimation results and policy simulations are reported.

Table 2. Korea's Production, Consumption of Beef, 2003-16 (Boneless Weight Equivalent)

Unit: 1,000 MT

	2003	2004	2005	2010	2011	2012	2013	2014	2015	2016
Beginning stocks	55	100	50	0	0	0	0	0	0	0
Production	142	145	152	186	216	234	260	261	255	231
Imports	294	133	143	245	289	254	257	282	299	363
Exports	0	0	0	0	0	0	0	0	0	0
Total Supply	490	378	345	431	505	488	519	543	554	594
Consumption	390	328	317	431	505	486	519	542	554	594
Self-sufficiency Ratio (%)	36.3	44.2	48.1	43.2	42.8	48.2	50.1	48.1	45.9	38.9
Per capita Consumption (kg)	8.1	6.8	6.7	8.8	10.2	9.7	10.3	10.8	10.9	11.6

Source: Materials on Price, Supply & Demand of Livestock Products, Each year, National Agricultural Cooperative Federation

Korea's Beef Market

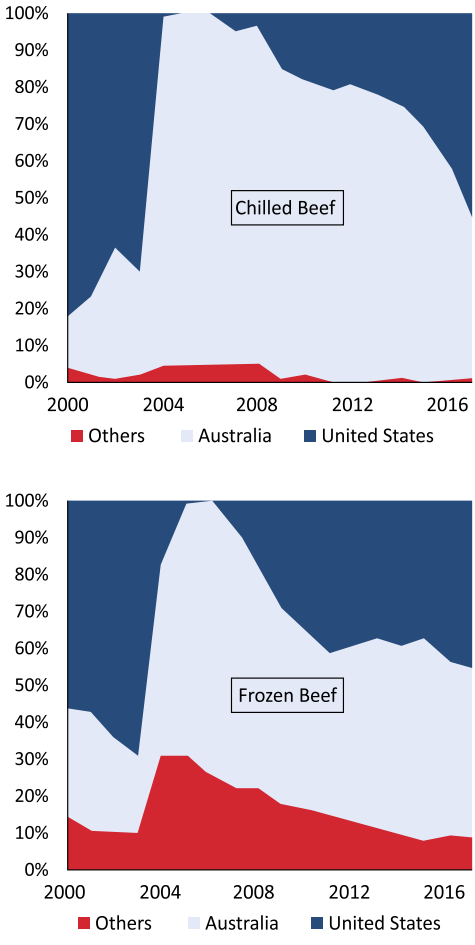
Domestic Production and Consumption

Korea's beef production has steadily expanded since the mid-2000s. Domestic beef production increased to 231 thousand metric tons in 2016, up from 142 thousand metric tons in 2003, a more than 150 percent increase. Domestic beef production as a share of beef consumption (self-sufficiency ratio) reached a high of 50.1 percent in 2013, but dropped to 38.9 percent in 2016 after the domestic outbreak of foot-and-mouth disease in 2015. Korean beef consumption has also continuously increased since 2005, totaling to 595 thousand metric tons in 2016. This corresponds to over 25 pounds of beef per person, per year.

Demand in the Korean beef market is highly segmented. High-quality domestic beef, known as Hanwoo, is a premium product in Korean retail outlets and restaurants, and Korean consumers pay a substantially higher price per pound, while imported beef, mostly from the U.S. and Australia, is less expensive. Although U.S. and Australian beef generally compete for market share in Korea, Korean consumers distinguish between U.S. beef, which is mostly grain-fed, and Australian beef, which is mostly grass-fed. These two production methods produce beef with qualities that are valued differently by Korean consumers. Grain-fed beef is more heavily marbled than grass-fed beef, and marbled beef is preferred by Korean consumers.

Korean consumers substitute U.S. for Australian beef and beef offal products when the price of U.S. beef is higher or U.S. supplies are reduced. Australia's share of the Korean market for frozen beef and fresh or chilled beef rose remarkably from

Figure 1. Change in Australia's Share of Korea's Imports during U.S. BSE Crisis



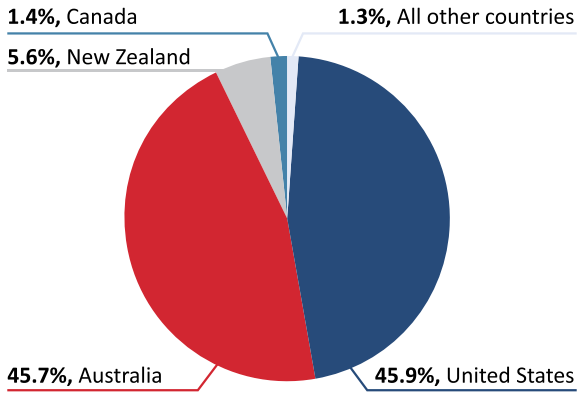
2004 to 2006 due to import restrictions on U.S. beef following the discovery of bovine spongiform encephalopathy (BSE) in U.S. cattle stocks in 2004 (Figure 1). Although total imports declined somewhat during this period, Australia's disproportionately larger increase in market share in these two categories relative to other competitors reflects the substitution of Australian products for U.S. products. This substitution effect suggests that raising tariffs would challenge U.S. market share.

Composition of Korea's Beef Imports

In 2017, Korea imported nearly $2.5 billion in beef and beef products.[9] The primary sources for these imports are the United States and Australia, which together represented roughly 92 percent of Korea's 2017 beef imports, both in terms of quantity and value (Figure 2). The United States has the larger share, with 45.9 percent of the total quantity and 51.2 percent of the value. Australia's share is 45.7 percent of the total quantity and 42.7 percent of the value. Korea's beef imports are largely composed of three types: boneless cuts, both fresh/chilled (HS 020130) and frozen (HS 020230); frozen bone-in cuts (HS 020220); and edible offal (HS 0206 and 021020). Frozen beef represents roughly 70 percent of total imports in terms of value (Table 3).

In 2003, Korea's beef imports reached a record high, and imports accounted for 73 percent of supply. The United States, which had been a large and growing supplier of beef to South Korea, supplied about two-thirds of Korea's beef imports in 2003.

Figure 2. Korean Beef Import Quantity Shares (%) by Country, 2017



Then, in response to the discovery of BSE, U.S. beef imports were banned from 2004 to 2006. Australia had been the largest source of Korea's beef imports in every year from 2004 to 2016. Beginning in early 2008, several bilateral agreements have been instrumental in reopening the Korean market to U.S. beef. The U.S. share of the Korean beef market has steadily recovered since 2008. However, imports remain below pre-ban levels (see Figure 3). Nevertheless, Korea resumed its position as the second largest foreign market for U.S. beef in 2017 ($1.15 billion), representing 18.6 percent of all U.S. beef exports.[10]

Table 3. Korea's Beef Imports by Types, 2010-2016

Unit: USD million, (%)

	2010	2012	2014	2016
Fresh or chilled (HS 0201)	271.3 (24.5)	316.6 (22.5)	401.8 (21.8)	547.1 (24.0)
Frozen (HS 0202)	808.7 (72.8)	943.5 (67.0)	1,271.6 (68.9)	1,544.5 (67.7)
Offal (HS 0206, 021020)	30.2 (2.7)	148.6 (10.5)	172.1 (9.3)	189.8 (8.3)
Total	1,110.7 (100.0)	1,408.7 (100.0)	1,845.4 (100.0)	2,281.3 (100.0)

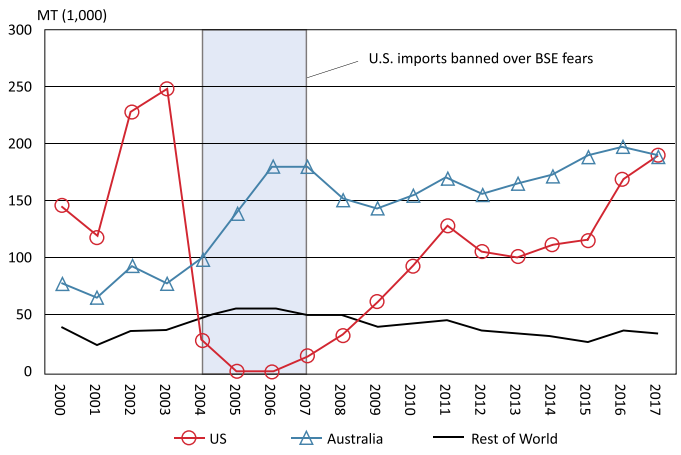
Note: Figures in parenthesis imply its shares of total imports. / Source: Trade Statistics Service, Korea Trade Statistics Promotion Institute

Table 4. Beef Tariff in Korea's FTAs with the U.S., Australia, and New Zealand

		Chilled Beef (0201)			Frozen Beef (0202)		
	MFN Tarrif	U.S.	Australia	New Zealand	U.S.	Australia	New Zealand
2011	40.0	40.0	40.0	40.0	40.0	40.0	40.0
2012	40.0	37.3	40.0	40.0	37.3	40.0	40.0
2013	40.0	34.6	40.0	40.0	34.6	40.0	40.0
2014	40.0	32.0	37.3	40.0	32.0	37.3	40.0
2015	40.0	29.3	34.6	37.3	29.3	34.6	37.3
2016	40.0	26.6	32.0	34.6	26.6	32.0	34.6
2017	40.0	24.0	29.3	32.0	24.0	29.3	32.0
2018	40.0	21.3	26.6	29.3	21.3	26.6	29.3
2019	40.0	18.6	24.0	26.6	18.6	24.0	26.6
2020	40.0	16.0	21.3	24.0	16.0	21.3	24.0
2021	40.0	13.3	18.6	21.3	13.3	18.6	21.3
2022	40.0	10.6	16.0	18.6	10.6	16.0	18.6
2023	40.0	8.0	13.3	16.0	8.0	13.3	16.0
2024	40.0	5.3	10.6	13.3	5.3	10.6	13.3
2025	40.0	2.6	8.0	10.6	2.6	8.0	10.6
2026	40.0	0.0	5.3	8.0	0.0	5.3	8.0

Source: Yes FTA, Korea Customs Service, http://www.customs.go.kr/kcshome/site/index.do?layoutSiteId=engportal

Figure 3. Korea's beef imports by exporting country, 2000-2017



Free Trade Agreements

Korea has offered preferential access to its beef and beef offal market through bilateral free trade agreements with the U.S., Australia, New Zealand, and other countries. Table 4 details tariff reduction commitments made by Korea under several major FTA agreements. U.S. beef currently receives a 21.3 percent import tariff, which is the lowest among the three highest beef exporting countries to Korea: the U.S., Australia, and New Zealand.[11]

Demand Elasticities for Beef Imports in Korea

In this section, the demand elasticities for Korea's beef imports by exporting country and product are examined. The details of the procedure used to derive the elasticities is in the appendix. The demand for beef imports in Korea using a framework that accounts for differences in beef products across exporting source (source heterogeneity) is examined.[12] To account for the competition across products, beef imports are disaggregated

into two distinct product groups using the Harmonized System (HS) of commodity classification: fresh and chilled beef (HS 0201) and frozen beef (HS 0202), the two largest groups of beef imports in South Korea. Since the United States and Australia account for most of Korea's beef imports, these two countries are focused on, with the remaining exporting countries aggregated into a rest of world (ROW) category.

To avoid estimation difficulties due to U.S. trade disruptions during the BSE-ban period and recovery years, the estimation data period is limited to January 2009 to December 2017. Monthly import and price data from the Korea Custom Service is used to estimate demand for beef imports in South Korea by product and exporting source. To estimate total import demand (aggregate expenditure), the beef consumer price provided by the National Agricultural Cooperative Federation of Korea is used as the domestic price. Import values are in U.S. dollars, quantities in kilograms (kg), and prices in U.S. dollars per kg.

The summary of the statistics used is reported in Table 5. From January 2009 to December 2017, Australia was the largest beef exporter to Korea, averaging 9,973 metric tons of frozen beef and 2,794 metric tons of chilled beef per month. In terms of market share, chilled and frozen beef from Australia accounted for the largest share of Korea's beef imports on average (72 percent and 49 percent, respectively). Overall, U.S. beef is relatively more expensive than Australian beef, where chilled beef is $0.31 more per kg and frozen beef is $1.25 more per kg, on average. Additionally, chilled beef tends to be more expensive than frozen beef from all sources.

Table 5. Summary Statistics: January 2009 – December 2017

	Chilled			Frozen		
	U.S.	Australia	ROW	U.S.	Australia	ROW
Monthly quantity (metric ton)						
Mean	1,245	2,794	30	7,893	9,973	2,549
SD	1,009	508	32	2,425	2,376	613
Minimum	226	1,581	0.1	3,099	4,246	1,267
Maximum	4,945	4,887	124	15,756	20,684	4,361
Monthly value ($ millions)						
Mean	10.77	22.19	0.22	43.47	42.50	9.46
SD	9.41	5.90	0.21	16.09	14.62	2.26
Minimum	1.25	8.30	0.00	15.06	18.02	4.78
Maximum	44.83	45.14	0.95	88.24	99.99	15.29
Price ($/kg)						
Mean	8.19	7.88	11.55	5.44	4.19	3.79
SD	1.39	1.30	6.08	0.90	0.70	0.73
Minimum	4.92	4.45	4.64	3.98	2.60	1.99
Maximum	10.40	9.79	26.00	7.90	5.65	5.47
Market share (%)						
Mean	27.5	71.7	0.78	38.2	48.9	13.0
SD	13.0	12.9	0.87	6.26	5.36	4.01
Minimum	7.6	35.6	0.00	22.5	23.2	5.95
Maximum	63.7	92.1	3.86	64.9	60.0	24.2

Note: SD is the standard deviation. ROW is rest of world.

The conditional import demand estimates are reported in Table 6. Estimates of the marginal import shares (first column) are all positive and significant at the 0.01 level, reflecting the direct relationship between total expenditures and individual imports. The significant difference in estimates across products for each country supports the notion that import preferences differ by product as well as by source. For U.S. imports, the marginal share estimate for frozen beef (0.2088) is almost more than two times the estimate for chilled beef (0.0979). The own-price estimates are presented along the diagonal in Table 6, all of which are negative, which is consistent with demand theory. Four own-price estimates are significant: chilled beef from all sources and U.S. frozen beef. The cross-price estimates (off-diagonal elements) suggest that U.S. and Australian beef are substitutes by product; however, there is no evidence of substitution between chilled and frozen beef.

The expenditure (ϵ^*_{gi}), domestic price $(n_{g_{ip}})$, and conditional and unconditional own-price elasticities are reported in Table 7. Four of six conditional own-price elasticities are significant at the 0.10 level or lower: Australian chilled (-0.49), U.S. chilled (-0.96), ROW chilled (-0.68), and U.S. frozen (-0.82) beef. The unconditional own-price elasticities are relatively larger in magnitude for Australian (-0.99) and U.S. (-1.02) frozen beef, but are otherwise similar to the corresponding conditional elasticities. The expenditure elasticities for frozen beef (ranging from 1.73 to 1.76) are significantly larger than the estimates for chilled beef (ranging from 0.24 to 0.51) and reflect the relative growth in frozen beef imports during the period covered by data. Since the domestic price elasticity is proportional to the expenditure elasticity, a rise in domestic prices should coincide with a rise in frozen imports.

Table 6. Conditional Import Demand Estimates

Product/ Country	Marginal Share (θ_{gi})	Price Estimates (π_{gihj})					
		Chilled			Frozen		
		Australia	U.S.	ROW	Australia	U.S.	ROW
Chilled							
Australia	0.1254 (0.0231)[a]	-0.2011 (0.0955)[b]	0.1580 (0.0052)[a]	0.0040 (0.0103)	-0.0080 (0.0633)	0.0121 (0.0457)	0.0348 (0.0326)
U.S.	0.0979 (0.0167)[a]		-0.1487 (0.0882)[a]	0.0052 (0.0112)	0.0286 (0.0475)	-0.0449 (0.0461)	0.0021 (0.0326)
ROW	0.0094 (0.0023)[a]			-0.0214 (0.0081)[a]	0.0043 (0.0086)	-0.0018 (0.008)	0.0098 (0.0067)
Frozen							
Australia	0.4278 (0.1757)[a]				-0.1323 (0.0842)[c]	0.1242 (0.0434)[a]	-0.0171 (0.0321)
U.S.	0.2088 (0.0179)[a]					-0.0854 (0.0455)[c]	-0.0040 (0.0302)
ROW	0.1307 (0.0162)[a]						-0.0253 (0.0244)
Equation R^2		0.76	0.63	0.36	0.82	0.62	0.66

Note: Homogeneity and symmetry are imposed on the model. Asymptotic standard errors are in parentheses. Superscripts, a, b, and c denotes the 0.01, 0.05, and 0.10 significance level, respectively. System R^2 is 0.96.

Table 7. Conditional and Unconditional Estimates

	Conditional		Unconditional	
	Expenditure	Own-price	Domestic Price	Own-price
Chilled				
U.S.	0.56 (0.12)[a]	-0.84 (0.28)[a]	0.39 (0.25)	-0.88 (0.35)[a]
Australia	0.41 (0.08)[a]	-0.37 (0.18)[b]	0.30 (0.21)	-0.43 (0.23)[b]
ROW	0.28 (0.09)[b]	-0.57 (0.23)[a]	0.19 (0.13)	-0.58 (0.26)[a]
Frozen				
U.S.	1.46 (0.14)[a]	-0.74 (0.41)[c]	1.17 (0.77)[c]	-0.98 (0.45)[b]
Australia	1.69 (0.09)[a]	-0.42 (0.31)	1.28 (0.78)[c]	-0.89 (0.43)[b]
ROW	1.53 (0.12)[a]	-0.30 (0.33)	1.21 (0.74)[c]	-0.42 (0.35)

Note: Asymptotic standard errors are in parentheses. Superscripts, a, b, and c denotes the 0.01, 0.05, and 0.10 significance level, respectively. ROW is rest of world.

Effects of Tariff Changes on Korea's Beef Imports

To project the effect of tariff changes on Korea's beef imports, the import values averaged over 2015 to 2017 are used as the baseline under the assumption that there is no change in beef tariffs of Korea. Then, the effect of tariff changes on potential trade is traced. Tariff changes as a result of the reopening of KORUS FTA talks are assumed to be the following two cases: scenario 1, which is a return to the original 40 percent MFN tariff; and scenario 2, which represents an additional 5 percent tariff reduction schedule. Scenario 1 reflects a breakdown of negotiations and the U.S. withdrawal from the agreement. Scenario 2 represents the drawdown of tariffs under the KORUS FTA as they are currently scheduled. All simulated results are reported in Table 8 and 9.

In the scenario 1, the prevailing outcome of policy simulations is substitution toward Australian chilled and frozen beef and away from U.S. chilled and frozen beef. Imports of Australian chilled and frozen beef increases by $38 and $53 million, respectively, while imports of U.S. chilled and frozen beef fall sharply. The biggest loss for the United States is nearly $120 million in frozen beef. The expected loss for U.S. chilled beef in Korea is $40 million. Overall, the U.S. share of Korean imported beef market decreases to 40.6 percent from 46.9 percent (to $810 million from $964 million in value). There is a projected 3.0 percent decrease in total beef imports, valued at $62.4 million. These results confirm that Korean consumers will substitute toward Australian beef when the relative price of U.S. beef rises.

In scenario 2, U.S. chilled and frozen beef exports to Korea increase by $ 5.1 and $ 11.8 million, while Australian chilled and frozen beef exports to Korea decreases slightly by $ 3.2 and $ 9.9 million. There is a projected 0.4 percent increase in total beef imports, valued at $9.2 million. Overall, the U.S. share of the Korean imported beef market increases slightly to 47.8 percent from 46.9 percent (to $987 million from $964 million in value).

Table 8. Import Projections Given Tariff Changes on U.S. Beef: Scenario 1

	Baseline		Scenario 1		Difference	
	Value ($ millions)	Share (%)	Value ($ millions)	Share (%)	Value ($ millions)	ΔShare (%)
Chilled Beef						
U.S.	252.6	44.1	212.2	37.2	-40.4	-16.0
Australia	317.8	55.5	355.9	62.4	38.1	12.0
ROW	2.6	0.5	2.6	0.45	0.0	0.0
Sub-Total	573.0	100.0	570.7	100.0	-2.3	-0.4
Frozen Beef						
U.S.	717.8	48.0	597.9	42.0	-119.9	-16.7
Australia	657.4	44.3	710.0	49.9	52.6	8.0
ROW	114.6	7.7	115.8	8.1	1.2	1.0
Sub-Total	1,483.8	100.0	1,423.6	100.0	-60.2	-4.1
Chilled/Frozen						
U.S.	964.4	46.9	810.1	40.6	-154.3	-16.0
Australia	975.2	47.4	1,065.9	53.4	90.7	9.3
ROW	117.2	5.7	118.3	5.9	1.1	0.9
Total	**2,056.8**	**100.0**	**1,994.4**	**100.0**	**-62.4**	**-3.0**

Note: Asymptotic standard errors are in parentheses. Superscripts, a, b, and c denotes the 0.01, 0.05, and 0.10 significance level, respectively. ROW is rest of world.

Table 9. Import Projections Given Tariff Changes on U.S. Beef: Scenario 2

	Baseline		Scenario 2		Difference	
	Value ($ millions)	Share (%)	Value ($ millions)	Share (%)	Value ($ millions)	ΔShare (%)
Chilled Beef						
U.S.	252.6	44.1	257.7	44.8	5.1	2.0
Australia	317.8	55.5	314.6	54.7	-3.2	-1.0
ROW	2.6	0.5	2.6	0.4	0.0	0.0
Sub-Total	573.0	100.0	574.9	100.0	1.9	0.3
Frozen beef						
U.S.	717.8	48.0	729.6	48.9	11.8	1.6
Australia	657.4	44.3	647.5	43.4	-9.9	-1.5
ROW	114.6	7.7	114.1	7.6	-0.5	-0.4
Sub-Total	1,483.8	100.0	1,491.1	100.0	7.3	0.5
Chilled/Frozen						
U.S.	964.4	46.9	987.3	47.8	22.9	2.4
Australia	975.2	47.4	962.2	46.6	-13.0	-1.3
ROW	117.2	5.7	116.6	5.6	-0.6	-0.5
Total	**2,056.8**	**100.0**	**2,066.0**	**100.0**	**9.2**	**0.4**

Note: Asymptotic standard errors are in parentheses. Superscripts, a, b, and c denotes the 0.01, 0.05, and 0.10 significance level, respectively. ROW is rest of world.

Conclusion

South Korea is the second largest foreign market for U.S. beef. In turn, the United States is an important source of beef for Korea. Korean demand for beef has grown over the past decade, but domestic production has only been able to fulfill less than 40 percent of demand, the remainder being filled by imports. Beef imports grew steadily until early 2000s, though the discovery of BSE was linked to a decline in beef consumption and bans on imports from the United States and Canada. However, imports from North America have gradually increased since then, and the United States is increasing its exports and market share in Korea. By 2017, the U.S. recaptured its previous position as the largest supplier of imported beef in South Korea.

Econometric estimations of import demand by country of origin confirm that significant price competition exists between beef imports from the United States and Australia. The KORUS FTA, which took effect on March 15, 2012, provided a preferential tariff for U.S. beef that is phased out over 15 years. If the KORUS FTA talks broke down and the U.S. withdrew from the agreement, assuming no other events intervene to influence trade, Australian beef imports would rise by $90.7 million over baseline values, while U.S. beef imports would fall by about $154.3 million. U.S. beef exporters would have likely faced a significant financial loss if beef tariffs were targeted as part of the KORUS FTA talks.

The estimates in this paper demonstrate that competition between U.S. and Australian beef in Korea is such that relative price changes lead to substitution when one country becomes relatively less competitive than the other. Thus, it finds that the breakdown of the KORUS FTA renegotiations would have led to significant gains for Australian beef at the expense of U.S. beef, highlighting the importance of the deal for the U.S.

Appendix: Import Demand Model

Following Muhammad et al.,[13] to model beef demand in Korea by product and exporting country, the production version of Rotterdam demand system is introduced. I focus on imports, and do not include domestically produced beef products given data limitations and strong consumer differentiation between domestic and imported beef in Korea.

Assume a Korean firm that imports *m* beef products from *n* countries in a two-stage procedure. First, the firm decides how to allocate aggregate expenditure on beef imports across products and source countries given import prices. Second, given import and domestic beef prices, the firm determines the aggregate expenditure on beef imports. Let *q* and *p* denote quantity and price, and the subscripts *g* and *h* denote product category, and *i* and *j* denote the exporting country. The demand for product *g* from exporting country *i* at time *t* can be expressed as follows:

(1) $$\bar{W}g_{it}\,\Delta q_{g_{it}} = \theta_{g_i}\Delta Q_t + \sum_{h=1}^{m}\sum_{j=1}^{n}\pi_{g_i h_j}\,\Delta\, p_{h_j\,t} + \mu_{g_i t}$$

Δ is the log-difference operator, where for any variable $\Delta x_t = logx_t - logx_{t-1}$. I use the 12th log difference to correct for seasonal variation in demand. $W g_i$ is the expenditure share of product *g* from country *i* in total beef imports and is derived as follows: $W g_i = [\, p_{g_i} q_{g_i} \,/\, \sum_g \sum_i p_{g_i}\, q_{g_i}\,]$. $\bar{W} g_i$ is the two-period average of $W g_i$: $\frac{1}{2}(W g_i t + W g_{i\,t-1})$. ΔQ_t is the finite version of the Divisia volume index, which is a measure of aggregate expenditure (in real terms) on all beef imports and is derived as: $\Delta Q_t = \sum_g \sum_i \bar{W} g_i \Delta q_{g_{it}}$.

The parameter θ_{g_i} is the marginal import share, which measures the share of an additional dollar of total expenditures allocated to product *g* from country *i*, and the parameter $\pi_{g_i h_j}$ is the conditional price effect which measures how the price of product *h* in country *j* affects imports of product *g* from country *i*. $\mu_{g_i t}$ is a random error term.

Demand theory suggests the following restrictions on the parameters: $\sum_g \sum_i \theta_{g_i} = 1$ and $\sum_g \sum_i \pi_{g_i h_j} = 0$ (adding up); $\sum_h \sum_j \pi_{g_i h_j} = 0$ (homogeneity); and $\pi_{g_i g_j} = \pi_{g_j g_i}\ \forall g, \pi_{g_i h_i} = \pi_{h_i g_i}\ \forall i$, and $\pi_{g_i h_j} = \pi_{h_j g_i}$ (symmetry). Additionally, the matrix of conditional price effects $\prod = [\pi_{g_i h_j}]$ should be negative semidefinite (negativity), which implies that $\pi_{g_j g_i} \le 0, \forall g_i$. The import demand system defined by equation (1) satisfies adding-up by construction. The homogeneity and symmetry constraints must be imposed on the parameters. Negativity is verified by inspection.

From equation (1), the conditional expenditure elasticity, which is the percentage change in imports of product *g* from country *i* with respect to a percentage change in the aggregate expenditure on total imports can be derived as: $\epsilon^*_{g_i} = \frac{\Delta q_{g_{it}}}{\Delta Q_t} = \frac{\theta_{g_i}}{\bar{W} g_i}$

Similarly, the conditional own and cross-price elasticity, which is the percentage change in imports of product *g* from country *i* with respect to a percentage change in the price of product *h* in country *j* can be derived as: $n^*_{g_i h_j} = \frac{\Delta q_{g_{it}}}{\Delta p_{h_j}} = \frac{\pi_{g_i h_j}}{\bar{W} g_i}$

Following Theil,[14] the aggregate expenditure (total import demand) is expressed by the following Divisia index equation:

(2) $$\Delta Q_t = \frac{\gamma\,\varphi}{\gamma - \varphi}\,[\Delta p^*_t - \Delta p'_t\,]$$

The variable p^* denotes the domestic price and $\Delta p_t'$ is the Frisch import price index defined as follows:

(3) $$\Delta p_t^{'} = \sum_h \sum_j \theta_{h_j} \Delta p_{h_j t}$$

The term $\left(\frac{\gamma\,\varphi}{\gamma-\varphi}\right)$ is the Frisch price effect and is assumed constant for estimation. φ can be interpreted as a measure of cost-function curvature and is derived as: $\frac{1}{\varphi} = 1 + \left(\frac{1}{\gamma^2}\right)\left(\frac{\partial^2 \log C}{(\partial \log Y)^2}\right)$.

Y is firm output, C is total import cost, and γ is the elasticity of cost with respect to output. Equation (2) shows that aggregate import expenditures are a function of the domestic price deflated by the Frisch import price index. Since the domestic price represents the resale value of imports, an increase in the domestic price should lead to increased spending on imports, ceteris paribus, and a positive Frisch price effect. Note that a positive Frisch price effect also indicates an inverse relationship between the import price level and aggregate expenditure.

If we substitute equation (3) for the Frisch import price index in equation (2), and then substitute this into equation (1), we get the demand for an individual import with respect to the output price p^* and import prices p_{h_j}:

(4) $$\bar{W} g_i \, \Delta q_{g_i} = \Theta \theta_{g_i} [\, \Delta p^* - \sum_{h=1}^{m} \sum_{j=1}^{n} \theta_{h_j} \Delta p_{h_j} \,] + \sum_{h=1}^{m} \sum_{j=1}^{n} \pi_{g_i h_j} \Delta p_{h_j}$$

The errors *t* and subscripts are omitted for convenience and $\Theta = \frac{\gamma\,\varphi}{\gamma-\varphi}$ is the Frisch price effect. From equation (4) we can derive the unconditional own and cross-price elasticity, which is the percentage change in imports of product *g* from country *i* with respect to a percentage change in both the domestic price and the price of product *h* in country *j*: $n^*_{g_i p} = \frac{\Delta q_{g_i}}{\Delta p^*} = \frac{\Theta \theta_{g_i}}{\bar{W} g_i}$ and $n^*_{g_i h_j} = \frac{\Delta q_{g_i}}{\Delta p_{h_j}} = \left[-\frac{\Theta \theta_{g_i} \theta_{h_j}}{\bar{W} g_i}\right] + \left[\frac{\pi_{g_i h_j}}{\bar{W} g_i}\right]$

Note that the cross-price elasticity is composed of two effects. The first term is the indirect effect $\left[-\frac{\Theta \theta_{g_i} \theta_{h_j}}{\bar{W} g_i}\right]$, which is the effect of prices on imports through changes in the aggregate total expenditure. The second term is the relative-price effect as measured by the conditional price elasticity $\left[\frac{\pi_{g_i h_j}}{\bar{W} g_i}\right]$, which accounts for the substitution effect of a price change and reflects the competitiveness of an exporting country or product. These two effects are analogous to the income and substitution effects in consumer theory, but in the context of international trade, they respectively represent trade creation and diversion.

Import Demand Forecasting

Using the domestic price elasticity and unconditional own and cross-price elasticity, the impact of tariff reductions is projected using an elasticity-based forecasting equation.[15]

(5) $$q_{g_i(1)} = \left\{ n_{g_i p} \left[\frac{p^*_{(1)} - p^*_{(0)}}{p^*_{(0)}}\right] + \sum_h \sum_j n_{g_i h_j} \left[\frac{p_{h_j(1)} - p_{h_j(0)}}{p_{h_j(0)}}\right] \right\} q_{g_i(0)} + q_{g_i(0)}$$

Equation (5) states that imports of product *g* from country *i* in the projection period 1 is a function of the quantity imported in the base period 0, and the percentage change in the domestic price and product and source-specific import prices from period 0 to period 1.

Estimation and Model Estimates

I estimate the demand for imported beef in Korea using the generalized Gauss-Newton method in GSUSS software package, which is a maximum likelihood procedure for equation systems. The demand system as specified by equation (1) is singular and requires *mn* - 1 equations for estimation. Estimates from the removed equation can be recovered using the adding-up property. As noted by Barten (1969),[16] estimates should be the same regardless of which equation is removed. A likelihood ratio test indicated that the errors in equation (1) are not random, but follow a first-order autoregressive process. Thus, I use a full-maximum likelihood procedure for singular equation systems that corrects for autocorrelation.[17] Kastens and Brester (1996)[18] indicate that homogeneity and symmetry-constrained demand models provide more accurate forecasts than unconstrained models, even when rejected statistically. Since the goal of this study is to forecast imports, I impose homogeneity and symmetry on the model, even though both properties were rejected.

I added constant terms to the model to account for import trends, which are significant and positive for all U.S. beef products and negative for chilled and frozen beef from Australia. The constants measure the average annual change in each import holding total expenditures and prices constant. The results indicate an upward trend in imports of all U.S. beef, unexplained by prices or total import expenditures, which has come at the expense of chilled and frozen beef from Australia.

Endnotes

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[9] This indicates fresh, chilled (HS 0201), and frozen(HS 0202) beef, plus the beef offal products (some parts of HS 0206 and 0210).

[10] According to FAS/USDA (GATS Home), the total value of beef and veal (fresh, chilled, and frozen) exports in 2017 was $6.18 billion. Japan is the largest exports market for the US, $1.53 billion (24.8 percent) and Korea was ranked as the second largest exports market for the US as $1.15 billion (18.6 percent).

[11] Korea's tariff reduction commitment is same for those three countries, which is a phase out over 15 years. Since the KORUS FTA took effect earlier than the other two bilateral FTAs, a relatively low tariff is applied to imported beef from the U.S.

[12] The aggregate (non-source differentiated) demand studies implicitly assume that beef from different sources are homogeneous with single prices. However, ignoring source of origin, which might be viewed as an intrinsic beef quality attribute, might lead to biased elasticity estimates that might not reflect the true demand responses. In particular, with the rapid globalization of Korea's domestic beef sector, the beef market of Korea has become increasingly complex and fragmented. Understanding the demand for source differentiated beef in Korea and the factors shaping it would help in both understanding this complex consumer market and quantifying the impact of renegotiations of the KORUS FTA.

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