

USDA

United States
Department
of Agriculture

LDPM-259-01
January 2016



A Report from the Economic Research Service

www.ers.usda.gov

Tariff Reforms and the Competitiveness of U.S. Beef in Japan

Andrew Muhammad, Kari Heerman, Alex Melton,
and John Dyck

Abstract

Japan is one of the largest beef importing countries in the world and an important destination market for the United States. In 2014, it ranked third among all beef-importing countries, with total beef and beef offal imports exceeding \$3.5 billion—47 percent of that total coming from Australia and 44 percent, from the United States. Although, in 2004-06, Japan banned most U.S. beef due to the discovery of bovine spongiform encephalopathy, the country’s imports of U.S. beef and beef offal significantly increased after 2006. In 2014, the United States shipped 221,000 metric tons of beef and beef offal to Japan, 38 percent of all Japanese beef imports. In this report, we examine how Japanese importers view U.S. beef vis-à-vis imports from Australia and other countries and how imports differ across beef products (chilled, frozen, and offal). We also assess the effect—on the Japanese beef market—of market access reform through the Japan-Australia Economic Partnership Agreement (JAEPA). Projections show that JAEPA could lead to significant gains for Australian beef at the expense of U.S. beef in Japan. If Japan opens up its beef market to the United States in an agreement similar to JAEPA, projections indicate a \$130 million net gain for U.S. beef, about 8 percent of current U.S. beef exports to Japan.

Acknowledgments

The authors thank Mark Jekanowski and Gopinath Munisamy, USDA, Economic Research Service (ERS), and Shayle Shagam, USDA, World Agricultural Outlook Board, for their comments. The authors also thank the following peer reviewers: Jim Hansen, ERS; Jason Carver, USDA, Foreign Agricultural Service; Ivan T. Kandilov, North Carolina State University; and Dragan Miljkovic, North Dakota State University. Thanks also to ERS editor Maria Williams and ERS designer Cynthia A. Ray.

Contents

Introduction.....	1
Japanese Beef Consumption Trends	4
Japanese Beef Production	6
Import Sources	7
Japan’s Import Policies	9
Demand Elasticities for Beef Imports in Japan ..	14
Effects of Market Access Changes on Japanese Beef Imports	18
Conclusion	21
References	22
Appendix 1—Import Demand Model	26
Appendix 2—Policy Simulations and Import Demand Forecasting	28
Appendix 3—Estimation and Model Estimates. . .	29

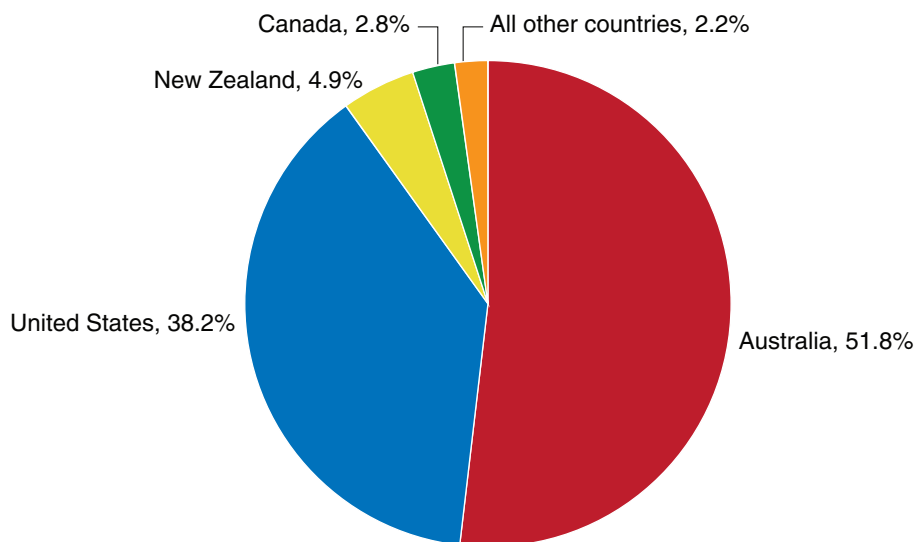
Approved by USDA’s
World Agricultural
Outlook Board

Introduction

With its large population and limited space for agricultural land, Japan has persisted as one of the world's largest importers of food products, including beef. In 2014, Japan imported nearly \$3.5 billion of beef and beef products,¹ making it the third-largest beef importer in the world. The primary sources for these imports are the United States and Australia, which together represented roughly 90 percent of Japan's 2014 beef imports in terms of both quantity and value (fig. 1). Australia has the larger share, with 51.8 percent of the total quantity of beef and beef offal products imports and 46.8 percent of the value. The U.S. share of this valuable market, at 38.2 percent of quantity and 43.6 percent of value in 2014, has steadily recovered since 2004-06 when Japan banned imports of most U.S. beef in response to the discovery of bovine spongiform encephalopathy (BSE). However, imports remain below levels of pre-ban years (see fig. 2). Nevertheless, Japan resumed its position as the largest foreign market for U.S. beef in 2014 (\$1.6 billion), representing over 20 percent of all U.S. beef exports (USDA, FAS, 2015).

These considerable export flows are in spite of high trade barriers on beef and beef products. The Japanese Government includes beef among five "sensitive sectors" for which it has consistently sought exemptions from full trade reforms agreed under the World Trade Organization (WTO) and bilateral trade agreements. Japan has agreed to limited tariff relief under bilateral trade agreements with Chile and Mexico (Cooper and Manyin, 2013; Dyck and Arita, 2014; Obara et al., 2010). However, these two countries represent a relatively small share of Japanese beef imports. More importantly, the Japan-Australia Economic Partnership Agreement (JAEPA), signed in 2014, includes significant and immediate tariff reductions for imports of Australian beef (Farrell, 2014). Despite perceived differences by Japanese consumers, the United States and Australia are close

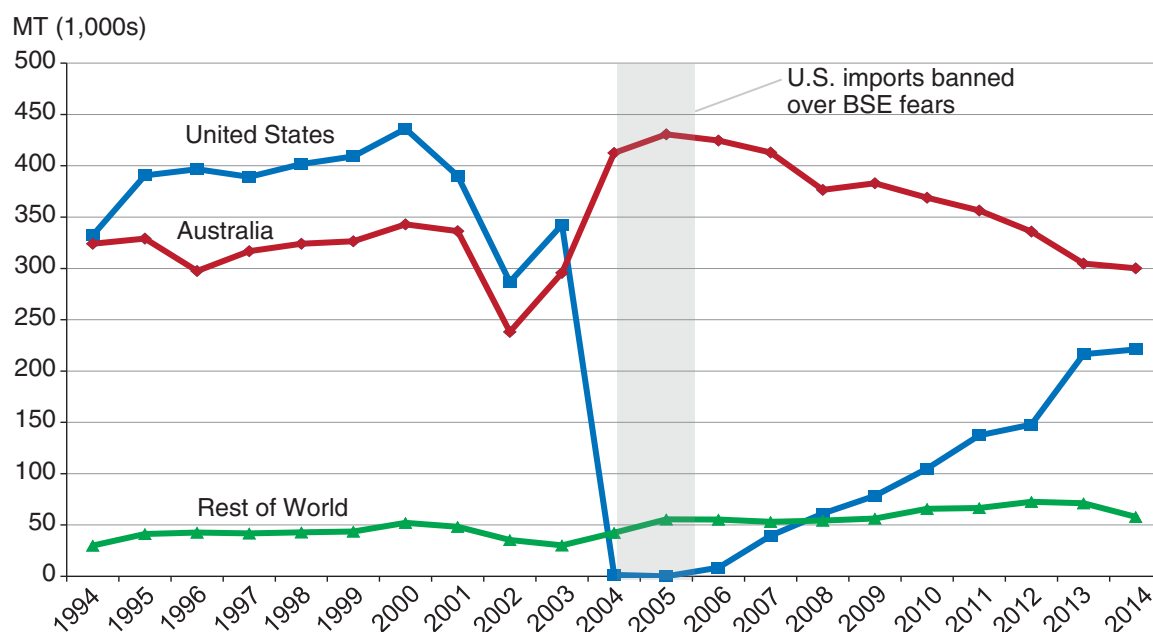
Figure 1
Japanese beef import quantity shares (percent) by country, 2014



Source: Global Trade Atlas.

¹This total includes fresh, chilled, and frozen beef, plus the beef offal products included in our study.

Figure 2
Japanese beef imports by exporting country, 1994-2014



Note: BSE = bovine spongiform encephalopathy. MT = metric tons.
 Source: Global Trade Atlas.

competitors in the Japanese beef market, and the implementation of JAEPA gives Australia a significant competitive advantage. Industry experts have projected that Australia’s beef exports to Japan could even double over the next two decades (Farrell, 2014).

Despite the importance of the trade relationship between the United States and Japan, no agreement establishes trade rules between these two countries outside of the WTO. However, both countries are a part of the Trans-Pacific Partnership (TPP), a concluded but yet to be ratified trade agreement, which also includes Australia, Chile, and Mexico as well as seven other countries: Brunei, Canada, Malaysia, New Zealand, Peru, Singapore, and Vietnam. Successful implementation of the TPP could bring down trade barriers and facilitate economic activity among member nations (Burfisher et al., 2014; Cooper and Manyin, 2013). The extent of Japan’s tariff reforms for U.S. beef relative to those that benefit Australia under JAEPA will be a central factor in the ongoing competitiveness of U.S. beef in the Japanese market.

The implementation of JAEPA raises questions about the future of Japanese beef imports. First, what trade gains for Australian beef and trade losses for U.S. beef should be expected under the agreement? Second, given JAEPA’s implementation beginning in 2015, how important is tariff reform for keeping U.S. beef competitive? To address these questions, we examine beef import demand in Japan using a framework that accounts for differentiation by source country and across beef products. We explore the potential effects of JAEPA and market access issues on the nature of beef import demand in Japan, as well as on the relative competitiveness of Australia, the United States, and other exporters.

Because Australia and the United States account for the vast majority of Japan’s beef imports, we focus on these two countries and aggregate the remaining exporters into a “rest of the world” (ROW) category. Our treatment of beef and beef products as distinct by source country is advantageous

because U.S. and Australian beef are viewed as such by Japanese consumers. In particular, U.S. beef exports to Japan are primarily grain-fed beef—a more heavily marbled product than Australian grass-fed beef and a preferred ingredient for many traditional dishes (Obara et al., 2010).

Also, our treatment of chilled beef, frozen beef, and beef offal products as distinct, even within source countries enables us to explore how tariff reforms under JAEPA may affect the composition of Japanese imports. Our approach captures differences in Japanese consumer preferences across products and shows how additional imports of one product can be offset by losses for others, even from the same country. We disaggregate beef imports into product groups using the Harmonized System (HS) of commodity classification.² Beef offal is an aggregation of the following HS categories: chilled offal (HS 020610), frozen tongues (HS 020621), and other frozen offal (HS 020629).

Our analysis reveals price competition between exporting countries, the intensity of which varies markedly across beef products. For instance, all countries face significant price competition for chilled beef but not for frozen beef or offal. Overall, our results show that JAEPA could significantly increase Japanese imports of beef from Australia and decrease those from the United States. However, similar tariff reductions granted to the United States could eliminate the decline in U.S. imports and even deliver a net increase in the Japanese market for both the United States and Australia.³

²Chilled beef is HS 0201 and frozen beef is HS 0202.

³The analysis in this report is based on tariff reductions in the JAEPA. Deeper tariff cuts are proposed in the TPP. Whereas in this analysis, the tariffs on the two main products, chilled and frozen beef, decline from 38.5 percent (Most Favored Nations rate) to 23.5 and 19.5 percent, respectively. Under TPP, these tariffs fall to 9 percent for both U.S. and Australian beef (See: Agriculture-Related Provisions of the TPP: Detailed Summary, <http://www.fas.usda.gov/data/agriculture-related-provisions-tpp-detailed-summary>). The implications of the results in this report are still the same; similar tariff reductions granted to the United States and Australia could eliminate the decline in U.S. imports due to JAEPA and even deliver a net increase in the Japanese market for both the United States and Australia.

Japanese Beef Consumption Trends

Japanese beef consumption has exceeded 1 million metric tons (MT) carcass weight equivalent (CWE) every year since 1989 and totaled 1.26 million MT CWE in 2014 (USDA, PSD, 2015).⁴ This corresponds to over 20 pounds of beef per person, per year. However, declining population and relatively weak economic growth are expected to constrain Japanese demand for beef in the future. Japanese population growth has been negative in every year since 2009: the estimated 2014 population of 127.1 million people is less than it was in 2001. Declining population will hamper demand for beef because it means fewer total buyers.

However, the population's declining numbers may be partly offset by the fact that it is aging. As of 2013, more than 25 percent of the Japanese population was over 65. In comparison, just under 14 percent of the U.S. population is in this age cohort. Recent research on food demand by age cohorts in Japan suggests that demand for meat per person may increase in the future, counteracting the population decline (Mori et al., 2015).

There is some evidence that beef demand is price elastic in Japan. Obara et al. (2010) and Thompson (2004) estimate that Japanese consumers respond to a 1-percent price decrease with about a 1.3-percent increase in total beef consumption. Those studies also found a significant cross-price elasticity for pork, showing that beef is a substitute for pork.

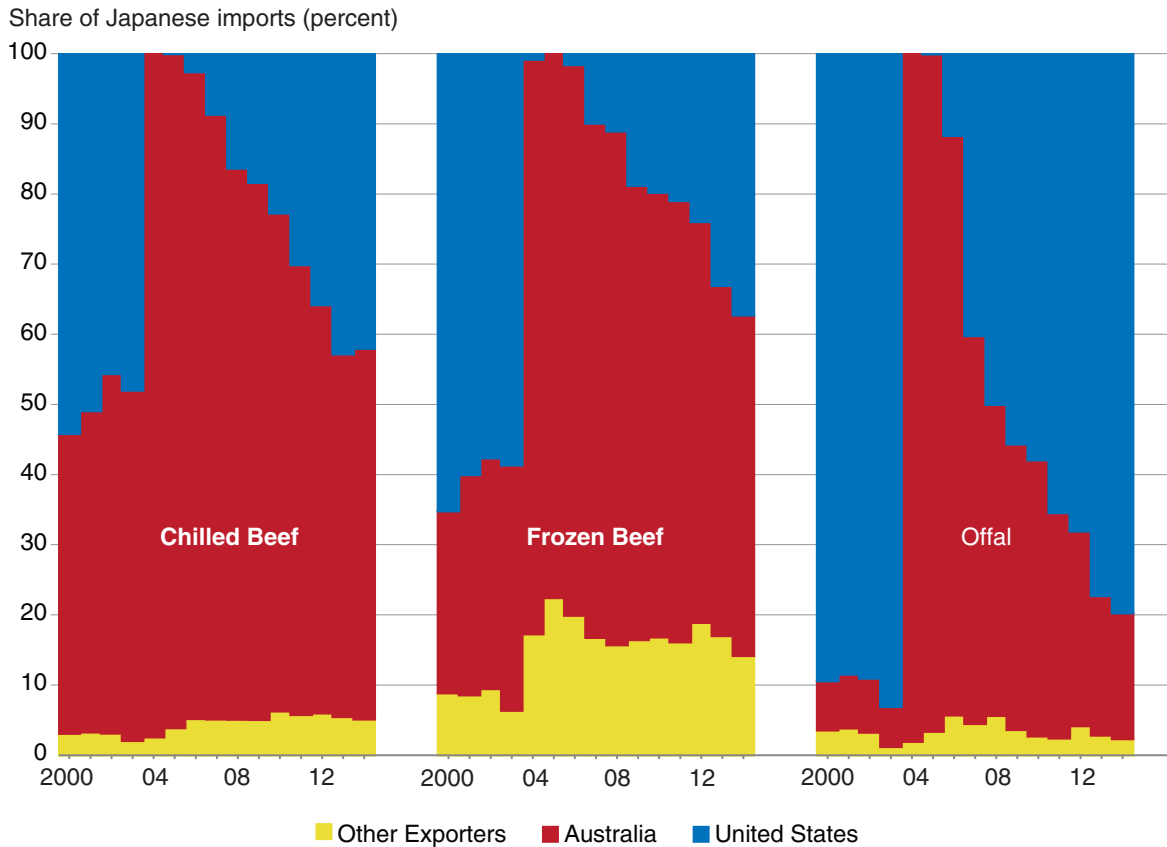
Demand in the Japanese beef market is highly segmented. High-quality domestic beef, known as wagyu, is usually far more expensive than imported beef but is sought after for its unique characteristics, while U.S. and Australian beef is less expensive. Each type has its own role in Japanese cooking. Wagyu beef is tender and highly marbled, cooks very quickly, and is also eaten raw (Obara et al., 2010). It is typically served on special occasions and in upmarket restaurants, such as those serving traditional yakiniku and shabu-shabu dishes. In these restaurants, beef is served raw then lightly cooked by customers at their tables. Yakiniku dishes are cooked over an open flame, while shabu-shabu dishes are cooked in boiling broths.

Imported beef in Japan is more often used in family and fast-food restaurants and in home cooking. Although U.S. and Australian beef generally compete for market share in Japan, Japanese 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 Japanese consumers. Grain-fed beef is more heavily marbled than grass-fed beef, and marbled beef is preferred for Japanese dishes such as gyudon, a beef bowl served in sauce over rice, which is a common fast food. Such uses have made Japan a good market for U.S. beef "end cuts," which have a lower value when used in the United States (Reed and Saghaian, 2004; Obara et al., 2010). Ground beef is a key element of Japanese beef consumption, eaten both at fast-food restaurants and in the home. Beef for hamburgers is typically either frozen grass-fed beef imported from Australia or domestic meat from culled dairy cows (Obara et al., 2010).

⁴Beef in the USDA Production, Supply, and Distribution (PSD) database is measured in metric tons carcass weight equivalent (CWE). CWE is used in this report when comparing domestic production and consumption. The CWE for beef is roughly 1.4 times product weight but varies depending on the type of product. More information on CWE conversions can be found at <http://www.ers.usda.gov/data-products/livestock-meat-international-trade-data/documentation.aspx#conversion>.

Japanese consumers substitute 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 Japanese market for frozen beef, chilled beef, and beef offal rose markedly during the 2004-06 ban on imports from the United States following the BSE discovery in 2004 (fig. 3). Although total imports declined somewhat during this period, Australia's disproportionately larger increase in market share in all three categories relative to other competitors reflects the substitution of Australian products for U.S. products. The readiness of this substitution suggests that lower tariffs on Australian beef directly challenge U.S. market share.

Figure 3
Australia's share of Japanese imports skyrocketed during North America's BSE crisis



Note: BSE = bovine spongiform encephalopathy.
 Source: Global Trade Atlas.

Japanese Beef Production

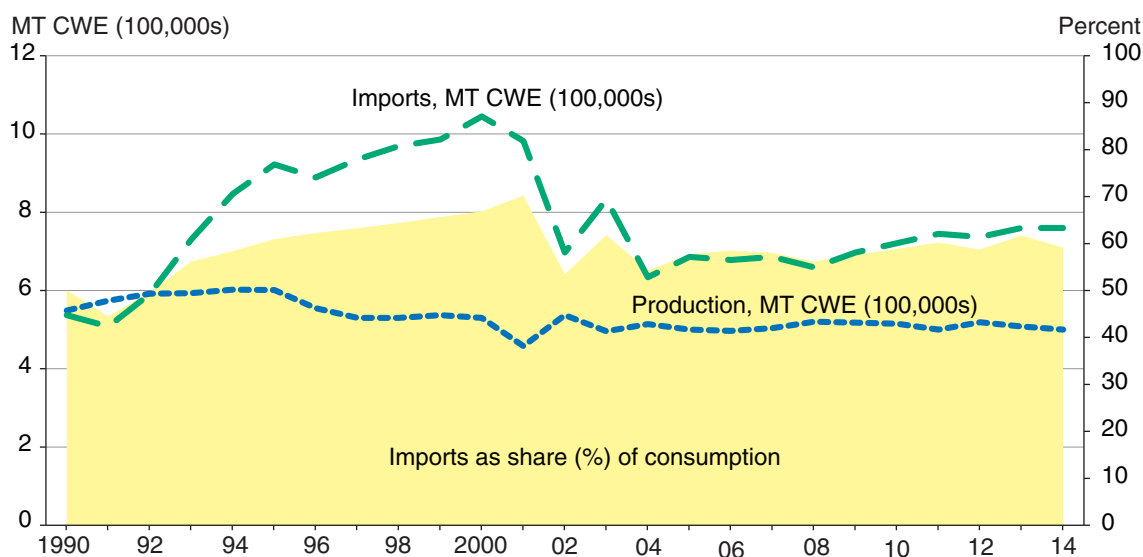
The Japanese beef industry is globally renowned for producing extremely high-quality beef. Beef products with names such as Matsuzaka, Kobe, and Omi (collectively known as wagyu beef) are considered delicacies in many of the world's restaurants. However, Japan exports very little of this beef, and beef production in Japan has gradually declined over the last two decades (fig. 4). In 2014, Japan produced 502,000 MT CWE of beef, with only 1,800 MT CWE sold for export.

Wagyu beef is produced primarily from Japanese Black cattle, which represent roughly 90 percent of the country's beef cattle supply. Japanese Brown cattle, Japanese Shorthorn cattle, and Polled cattle varieties together make up the remaining 10 percent (Japanese MAFF, 2013).

Wagyu cattle produce a distinctive beef, both because of genetic attributes and because of intensive grain feeding. Intra-muscular fat marbling—the goal of Japanese high-quality beef producers—requires longer and more intensive feed regimes than those in the United States, Australia, and most other beef-producing nations (Obara et al., 2010). Pasture is scarce in Japan, and even cow-calf operations rely on grain as the chief feed. Because Japan has little available agricultural land, virtually all feed grain is imported. Wagyu beef cattle thus have a longer lifecycle than other cattle and a higher cost of production. Obara et al. (2010) report total expenses for raising a wagyu steer of 879,078 yen per animal, compared with 366,218 yen per animal for Holstein cattle.⁵

The higher cost of production for wagyu relative to Holstein cattle is reflected in the wholesale price. Japan's Ministry of Agriculture, Forestry, and Fisheries (MAFF) estimates the average 2012 wholesale cost of wagyu beef ranged from 1,488 yen/kilogram (kg) to as high as 2,206 yen/kg, depending on gender and quality grade. Cross-bred beef was less costly, from 996 to 1,044 yen/kg. Beef from dairy cattle was priced at a much lower range of 309 to 542 yen/kg (Japanese MAFF, 2013).

Figure 4
Japanese beef production and imports, 1990-2014



Note: MT CWE = metric ton carcass weight equivalent.

Source: USDA, Foreign Agricultural Service, Production, Supply, and Distribution Online.

⁵The exchange rate during this period averaged about 90 yen per U.S. dollar.

Import Sources

Japan's imports of beef have exceeded its total domestic production of beef since 1993 (see fig. 4). In 2014, beef and beef offal imports totaled 579,000 MT, representing nearly 61 percent of domestic consumption. Historically, the United States and Australia have been the primary sources for Japan's beef imports, with additional imports coming mostly from New Zealand, Canada, and Mexico. Imports from Australia and the United States were near equal until the BSE discovery late in 2003 caused Japan to ban imports of U.S. beef for roughly 2 years and severely limit them until 2013 (Dyck and Johnson, 2013). Since 2005, the quantity of U.S. beef exports to Japan has risen by an average of 33 percent annually, despite continuing BSE-related restrictions, although the United States has not regained its pre-ban market share (see fig. 2) (GTIS, 2014).

Imports from Australia

Japan imported 300,000 MT of beef and beef offal from Australia in 2014, accounting for 51.8 percent of Japan's total beef imports. According to a detailed report by Meat and Livestock Australia (MLA), a producer-owned marketing and research organization, 56 percent of Australia's 2014 beef exports to Japan were grass-fed. The majority of the grass-fed beef was frozen (77 percent), while grain-fed beef exports were mostly chilled (68 percent). On the whole, roughly 57 percent of Australian beef exports to Japan are shipped frozen. The majority of frozen beef exports are classified as "manufacturing beef," which is used primarily for hamburger. The largest category of Australia's beef not classified as manufacturing beef was brisket, which accounted for 16.5 percent of Australia's beef exports to Japan.

Japan imports roughly 20,000 MT of beef offal products from Australia per year. The largest single item in the offal category is frozen beef tongue, of which Japan imported 9,000 MT in 2014. Chilled beef tongue accounted for a further 2,000 MT. The remaining beef offal imports comprise frozen or chilled internal organs, a small amount of cheek meat, frozen liver, and items from the head (GTIS, 2014).

Imports From the United States

In 2014, Japan imported 221,000 MT of beef and beef offal from the United States, accounting for 38 percent of all Japanese beef imports. This figure represents just under two-thirds of the average annual quantity imported from the United States between 2001 and 2003, before the BSE-motivated ban on U.S. imports. Before the ban, Japan tended to import more frozen than chilled beef. However, Japanese imports of chilled beef recovered faster than frozen beef after trade restrictions were loosened in 2005 (see fig. 3). Imports of chilled beef exceeded frozen beef from 2005 through 2012, but frozen beef imports surpassed chilled imports in 2013 and 2014. Unlike Australia, the United States does not supply a significant amount of manufacturing beef to Japan, and most U.S. beef is grain-fed. By volume, two-thirds of Japan's imports of manufacturing beef from the United States in 2014 were in the brisket and plate categories (GTIS, 2014). By cut, most imports supplied by the United States are short plate, followed by short ribs (Obara et al., 2010).⁶

⁶The plate cut (also known as the short plate) is from the belly area, just below the rib cut.

Beef offal products represent a much larger share of imports from the United States than from Australia. Unlike the United States, Japan classifies muscles around the diaphragm (hanging tender and outside skirts) as “internal organs” and thus as offal. Diaphragm meat is used in Japanese foods in place of other beef muscle cuts, and not as organ meat like a heart or liver. However, because of its classification in the offal category, diaphragm meat has long faced a lower tariff than other muscle meats (Khan et al., 1990). The import categories in which it is placed may contain other offal imports, but most of the 35,000 MT imported by Japan in these categories in 2014 is likely to have been diaphragm meat. In 2014, the United States provided roughly 54 percent of Japan’s total beef offal imports, and Australia, 32 percent (GTIS, 2014). Before the BSE ban, Japanese imports of U.S. beef offal often exceeded 80,000 MT per year. Although the quantity shipped has been far smaller in recent years, the United States has regained its position as the leading exporter of beef offal products to Japan, shipping 33,000 MT in 2014. Chilled internal organs other than tongues represent the largest share of Japan’s beef offal imports from the United States: 12,400 MT were imported in 2014, along with 2,400 MT of their frozen counterparts. Imports of frozen tongue from the United States totaled 10,000 MT, and chilled tongue imports were another 7,600 MT.

Japan's Import Policies

Although Japan has historically been one of the largest beef importers, its high trade policy barriers have long inhibited trade. Before 1989, a restrictive import quota system was in place. Quotas were phased out by 1991 and replaced by a 70-percent tariff, which was later lowered to 50 percent (OECD, 2009). Since 2000, a 38.5-percent tariff has been applied on almost all imports of fresh, chilled, and frozen beef. Tariffs applied to beef offal products are generally lower, from 12.8 percent on fresh and frozen organs and tongues to 21.3 percent on other frozen offal. High 50-percent tariffs remain only on fresh and frozen cheek meat.

Japan additionally protects domestic beef producers through a global safeguard on beef imports secured under the WTO Agreement on Agriculture. Under the safeguard, Japan can “snap back” the tariff rate to as high as 50 percent if imports exceed 117 percent of the quantity imported in the previous fiscal year on a cumulative quarter basis (USTR, 2013; OECD, 2009; Obara et al., 2010). The snapback is in effect for the rest of Japan’s fiscal year (April 1-March 31) or—if triggered in the fiscal year’s final quarter—for the first quarter of the next fiscal year. The safeguard was last applied to chilled beef imports in 2003-04 (OECD, 2009).

Sanitary Measures

Sanitary measures—especially those put in place to prevent the spread of foot and mouth disease (FMD) and BSE—are perhaps the main impediments to accessing Japan’s beef market. The steepest barriers to U.S. beef exports in recent years have been measures designed to prevent exposure of Japanese consumers to BSE. Under the WTO Agreement on Sanitary and Phytosanitary Measures, Japan is obligated to impose only science-based sanitary restrictions under guidance from international organizations such as the World Organization for Animal Health (OIE). However, the United States and other beef exporters have often argued that the measures Japan imposes are disproportionate to the risk (Dyck and Arita, 2014).

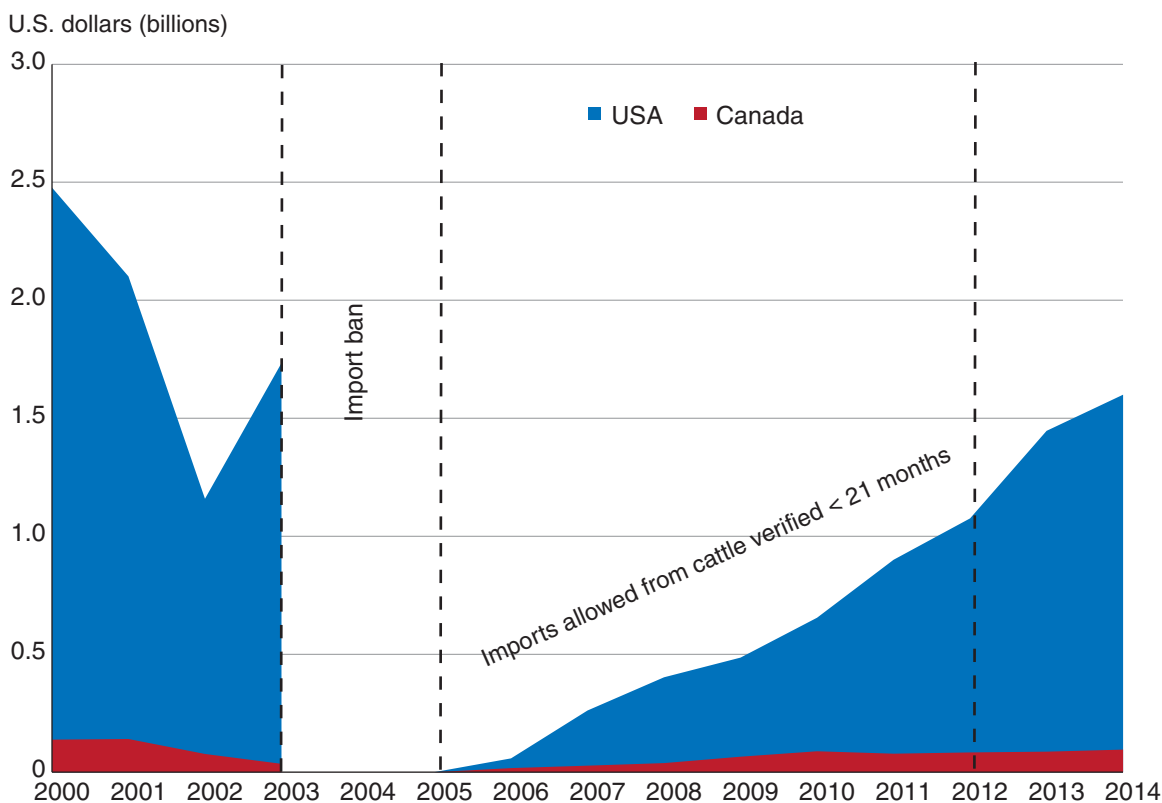
Free from FMD from 1907 to 2000, Japan has long banned all imports of uncooked beef from countries not recognized as FMD-free by the OIE. This policy effectively restricts the set of exporters to the United States, Canada, Mexico, Australia, and New Zealand. Notably, given the large volumes of beef Brazil and Argentina export elsewhere, Japan’s FMD measures exclude South American beef exporters like Brazil and Argentina from the Japanese market (Obara et al., 2010; Blayney et al., 2006).

After BSE was detected in U.S. and Canadian cattle in 2003, Japan imposed a comprehensive ban on beef imports from these countries as well. Exports were allowed to resume after 2005 with strict requirements on the age of cattle at slaughter. From 2005 to 2013, beef imported from the United States and Canada was required to be certified as coming from cattle less than 20 months at slaughter. In February 2013, the age limit was lifted to 30 months, in line with OIE recommendations (Dyck and Johnson, 2013).

In 2005, when U.S. firms resumed exporting beef products to Japan, they had to certify that their products met age and other criteria under an export verification program⁷ operated by the Grading and Verification Division of the USDA Agricultural Marketing Service. Cattle age can be verified either by a USDA official's inspection of the carcass at slaughter or by cattle production records. The process of inspection at slaughter for cattle less than 20 months tends to qualify only cattle aged 17 months or younger, which are usually available only on a seasonal basis. Age certification through production records must be managed through third-party-operated, USDA-approved programs known as Quality Systems Assessment (QSA) Programs (Halsted and Mark, 2006). Carcass inspection and other costs and efforts for producers to enter a QSA 20-month program represented a real impediment to U.S. exports, and exports rose markedly in 2013 after the age limit was raised to 30 months (fig. 5).

A European BSE outbreak caused Japan to suspend all beef imports from European Union (EU) countries⁸ beginning in 2001. Unlike North American imports, imports from most EU countries have remained prohibited for the past 13 years. In February 2013, Japan agreed to ease restrictions on beef and beef products from France, the Netherlands, and Ireland, subjecting them to a verification system similar to the one for U.S. and Canadian exports.

Figure 5
BSE impact on North American beef exports to Japan



Note: From 2005 to 2012, Japan restricted its beef imports from North America to products from animals younger than 21 months that were verified to be free of bovine spongiform encephalopathy (BSE).
 Source: Source: Global Trade Atlas.

⁷The export verification program currently in force is the QSA LT30 Program for Japan, Korea, and Taiwan. It replaced the Export Verification Program for Japan in February 2013.

⁸With the exception of Hungary.

Free Trade Agreements

In recent years, Japan has offered limited preferential access to its beef and beef offal market as part of bilateral trade agreements, referred to as Economic Partnership Agreements (EPAs) (table 1). Only the agreements with Mexico, Chile, and Australia cover beef products. Japan is also negotiating an EPA with Canada, in which market access for beef could be a key issue, as Japan has been an important export market for Canadian beef. Beef is excluded from EPAs with Singapore, Malaysia, Brunei-Darussalam, Vietnam, and Peru. These countries export little if any beef except to immediate-neighboring countries.

EPAs with Mexico and Chile entered into force in April 2005 and September of 2007, respectively. Under both agreements, access to the Japanese beef market increased under a tariff rate quota (TRQ) regime and a provision that Japan waive the right to apply its global safeguard on within-quota imports from these countries. The EPA with Chile sets separate TRQs for frozen beef and beef offal. The EPA with Mexico sets an inclusive TRQ for all chilled and frozen beef and beef offal. TRQs were set to expand over a 5-year implementation period, with a commitment to re-negotiate the size of the quota in subsequent periods. Notably, these agreements were concluded while North American beef imports were highly restricted due to disease concerns about the U.S. and Canadian herds.

In-quota tariffs after the first 2 years of implementation are largely the same under both agreements (see table 1). TRQs are not always filled, and tariff reductions do not always lead to increased trade. Note that chilled beef products were excluded from the Chile-Japan EPA although Chile

Table 1

Japanese beef product tariff schedule

HS tariff line	Product	MFN rate ad valorem (%)	Mexico ad valorem within quota (%)	Chile ad valorem within quota (%)	Australia ad valorem within quota (%)
0201	Meat of bovine animals, chilled	38.5	30.8 ¹	-	32.5 ²
0202	Meat of bovine animals, frozen	38.5	30.8 ¹	30.8	30.5 ²
020610	Offal of bovine animals, chilled				
	Cheek meat	50	50	50	30
	Internal organs and tongues	12.8	7.6	12.8	7.6
	Other	21.3	21.3	21.3	12.7
020621	Tongues of bovine animals, frozen	12.8	7.6	7.6	7.6
020629	Other offal of bovine animals, frozen				
	Cheek meat	50	30	50	30
	Other	12.8	7.6	7.6	7.6

Note: HS = Harmonized System (an international product nomenclature developed by the World Customs Organization).
MFN = Most Favored Nations.

¹The tariff on bone-in chilled beef and some cuts of frozen beef is 34.6 percent.

²Chilled and frozen beef is unrestricted by a tariff rate quota.

Source: Ministry of Foreign Affairs, Japan.

has exported a minimal amount of these products to Japan (GTIS, 2014). Imports from Mexico expanded rapidly in the wake of the Japan-Mexico EPA (fig. 6). Mexico has exported beef products over its TRQ in almost every year while Chile's exports have remained well within their quota.

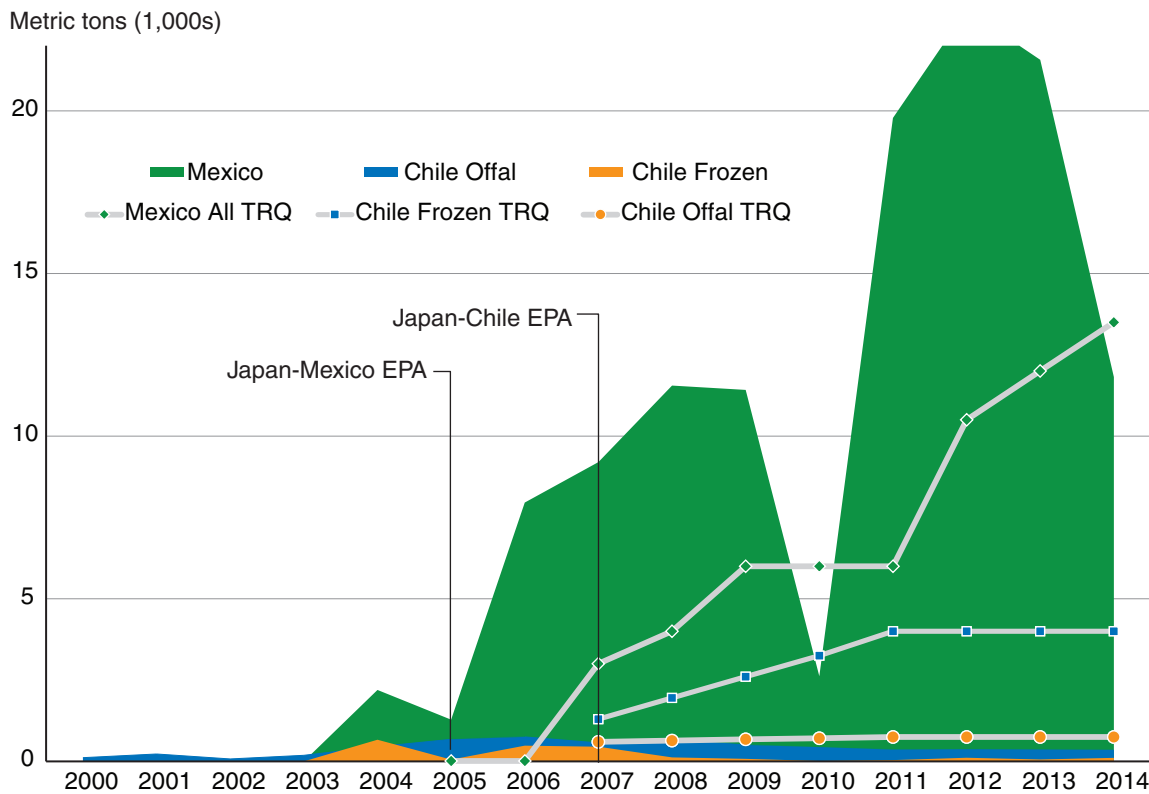
The Japan-Australia Economic Partnership Agreement (JAEPA), finalized in July 2014 and in effect since January 15, 2015, offers unprecedented access to Australian beef exporters. It is Japan's first EPA with a major source of beef imports and the first to cut tariffs on chilled and frozen beef without an accompanying TRQ regime. It affords Australian exporters a price advantage over U.S. beef exporters.

Table 2 details the market access commitments made by Japan under JAEPA. Tariffs on frozen beef are set to fall to 19.5 percent over 18 years. Tariffs on chilled beef will fall to 23.5 percent over 15 years. A large share of the tariff cuts will take place in the first 2 years of the implementation period, giving Australian exporters an immediate, significant price advantage over the United States. By the third year of the agreement, Australian chilled beef will enter Japan at a tariff rate of 30.6 percent, and frozen beef will enter at 27.5 percent while U.S. exports continue to be levied at 38.5 percent. Moreover, Japan will retain the right to restrict U.S. imports by imposing its global safeguard.

As in the EPAs with Chile and Mexico, Japan agreed to not impose its global safeguard on chilled and frozen beef imports from Australia. However, the agreement does include a special JAEPA

Figure 6

Effect of Mexico's and Chile's EPAs With Japan on Japanese Beef Imports



Note: EPA = Economic Partnership Agreement. Tariff rate quota (TRQ) amounts denote the maximum weights of products accepted by Japan at lower tariff rates.
Source: Source: Global Trade Atlas.

Table 2

Beef provisions of the Japan-Australia Economic Partnership Agreement

Year	Chilled beef (0201)		Frozen beef (0202)		Beef offal and beef preparations		
	Tariff	Safeguard trigger	Tariff	Safeguard trigger	Tariff-rate quota	Tariff on internal organs (HS 0206.10.019 and 0206.29.010)	
	<i>Percent</i>	<i>Metric tons</i>	<i>Percent</i>	<i>Metric tons</i>	<i>Metric tons</i>	<i>Percent</i>	
						In quota	Over quota
2015	32.5	130,000	30.5	195,000	17,000	7.6	12.8
2016	31.5	131,700	28.5	196,700	17,400	7.6	12.8
2017	30.5	133,300	27.5	198,300	17,800	7.6	12.8
2018	29.9	135,000	27.2	200,000	18,200	7.6	12.8
2019	29.3	136,700	26.9	201,700	18,600	7.6	12.8
2020	28.8	138,300	26.7	203,300	19,000	7.6	12.8
2021	28.2	140,000	26.4	205,000	19,400	7.6	12.8
2022	27.6	141,700	26.1	206,700	19,800	7.6	12.8
2023	27.0	143,300	25.8	208,300	20,200	7.6	12.8
2024	26.4	145,000	25.6	210,000	20,600	7.6	12.8
2025	25.8	145,000	25.3	210,000	21,000	7.6	12.8
2026	25.3	145,000	25	210,000	21,000	7.6	12.8
2027	24.7	145,000	24.1	210,000	21,000	7.6	12.8
2028	24.1	145,000	23.2	210,000	21,000	7.6	12.8
2029	23.5	145,000	22.3	210,000	21,000	7.6	12.8
2030	23.5	145,000	21.3	210,000	21,000	7.6	12.8
2031	23.5	145,000	20.4	210,000	21,000	7.6	12.8
2032	23.5	145,000	19.5 1/	210,000	21,000	7.6	12.8
2033	23.5	145,000	19.5	210,000	21,000	7.6	12.8

Notes: HS = Harmonized System (an international product nomenclature developed by the World Customs Organization).

Source: Australian Government, Department of Foreign Affairs and Trade.

<http://www.dfat.gov.au/trade/agreements/jaepa/official-documents/Pages/official-documents.aspx>. Accessed April 8, 2015.

safeguard, which has a more generous quantity trigger than the global safeguard and permits a snap-back up to a 38.5 percent tariff rather than the 50 percent tariff ceiling in the global safeguard. For chilled beef, the safeguard trigger in the first year is 130,000 MT, which steadily expands to 145,000 MT in the JAEPA's 10th year of implementation. To give context, the average annual quantity of chilled beef imported from Australia in 2012-14 was 123,265 MT. For frozen beef, the safeguard begins at 195,000 MT and expands to 210,000 MT in JAEPA's 10th year. The average annual quantity of frozen beef imported from Australia in 2012-14 was 171,790 MT.

Australian exporters will also benefit from significant tariff cuts on beef offal, but these cuts will be subject to a TRQ regime with increasing quotas over an implementation period. The TRQ for all offal categories begins at 17,000 MT at the start of the implementation period and expands steadily until the 11th year, when it reaches 21,000 MT. For context, Australia's total exports of both chilled and frozen offal were just over 19,000 MT in 2014.

Demand Elasticities for Beef Imports in Japan

In this section, we report the demand elasticities for Japanese beef imports by exporting country and product. The details of the procedure used to derive the elasticities are in appendix 1 (pp. 27-29) and appendix 3 (pp. 31-32). We examine beef import demand in Japan using a framework that accounts for differences in beef products across exporting source (source heterogeneity). Our analysis does not include imports of pork or other possible beef substitutes. Previous research has found pork consumption responds significantly to changes in beef prices (Obara et al., 2010; Thompson, 2004). In addition to the beef import scenarios we consider, changes in beef import prices are expected to further affect Japan's pork imports, consumption, and domestic beef production. Although our main focus is the competition among imported beef products, our analysis does not imply that meat products and imported and domestic beef are independent. We assume only that meat-product groups (beef, pork, etc.) compete with one another at the group level, and that the competition across product groups does not depend on the individual products within groups.⁹ Because Australia and the United States account for most of Japan's beef imports, our results focus on these two countries, and we aggregate the remaining exporting countries into an ROW category. Source heterogeneity is likely because of several differences between U.S. and Australian beef:

- U.S. beef is grain fed, and Australian beef is mostly grass-fed beef. Grain-fed beef is more heavily marbled than grass-fed beef and is preferred by Japanese consumers for traditional dishes (Obara et al., 2010).
- Shipping times to Japan from Australia are shorter than from the United States, giving Australian chilled beef a longer shelf-life in Japan than U.S. chilled beef.
- The larger size of the U.S. market enables importers to source individual cuts more easily from U.S. suppliers than from Australian suppliers.

To account for the competition across products, we disaggregate beef imports into three distinct product groups using the Harmonized System (HS) of commodity classification: chilled beef (HS 0201), frozen beef (HS 0202), and offal. Offal is an aggregate of the following HS categories: chilled offal (HS 020610), frozen tongues (HS 020621), and other frozen offal (HS 020629).¹⁰ To avoid estimation difficulties due to U.S. trade disruptions during the BSE-ban period and recovery years, we limited the estimation data period to January 2009-December 2014.

Annual growth rate estimates, marginal share estimates, and expenditure elasticities are reported in table 3. Average annual growth in imports of U.S. beef has been approximately 10-11 percent for all three products. The size of the upward trend suggests that it originates from factors other than changes in relative prices or total Japanese expenditures on imported beef—factors like the reestablishment of trade relationships after the BSE ban. The growth in U.S. beef imports, not due

⁹We also assume a similar group-wise relationship between imported and domestic beef because Japanese consumers have been shown to distinguish between the two. These assumptions allow us to focus only on beef products for the analysis.

¹⁰Unit values are used as proxies for import prices. This could be an issue for the offal category due to the aggregation across the three HS classifications: chilled offal, frozen tongues, and other frozen offal. If the composition of "offal" is relatively stable, then using unit values is not an issue. Overall, the offal composition shares remained relatively stable. Deviations from mean shares were at most 22 percent. Other frozen offal from the ROW was the only exception where the maximum deviation was about 28 percent for a few months.

Table 3

Import growth rates and demand elasticities

Beef Product	Country	Growth rate	Marginal share	Expenditure elasticity	Own-price Elasticity
Chilled	Australia	-6.59 (1.71)***	0.09 (0.03)***	0.29 (0.10)***	-0.92 (0.30)***
	U.S.	11.33 (1.79)***	0.08 (0.02)***	0.54 (0.10)***	-1.13 (0.27)***
	ROW	-0.13 (2.11)	0.00 (0.00)	0.13 (0.12)	-1.18 (0.29)***
Frozen	Australia	-5.16 (2.17)**	0.39 (0.03)***	1.75 (0.12)***	-0.74 (0.38)*
	U.S.	9.46 (4.81)**	0.19 (0.03)***	1.98 (0.28)***	-0.71 (0.41)*
	ROW	0.13 (3.66)	0.16 (0.01)***	2.41 (0.20)***	-0.90 (0.58)
Offal	Australia	-1.98 (2.06)	0.03 (0.01)***	0.67 (0.12)***	-0.50 (0.21)**
	U.S.	9.64 (3.26)***	0.04 (0.01)***	0.63 (0.19)***	-1.50 (0.27)***
	ROW	-1.75 (2.56)	0.02 (0.00)***	0.86 (0.15)***	-0.30 (0.26)

Note: *, **, and *** denote the 0.10, 0.05, and 0.01 significance levels, respectively. Standard errors are in parentheses. The own-price elasticities are derived using the unconditional elasticity equation in appendix 1. ROW = rest of the world.

Source: USDA, Economic Research Service estimates

to prices or expenditures, coincides with negative trends in imports from other suppliers, notably, chilled and frozen beef from Australia where the annual growth rates are -6.59 percent and -5.16 percent, respectively.

With the exception of ROW chilled beef, the marginal import share estimates are all positive and significant. These estimates measure how a dollar increase in total expenditures is allocated across products and exporting sources. Frozen beef is the most responsive to total expenditures. Given an additional dollar in total Japanese expenditures on imported beef, frozen beef from Australia, the United States, and ROW will increase by \$0.39, \$0.19, and \$0.16, respectively, indicating that only \$0.26 will be allocated to the remaining six products (that is, to chilled beef and offal from each of the three geographic designations).

The conditional expenditure elasticities, which measure the percentage responsiveness of an import to a percentage change in total import expenditures, are largest for frozen beef and range from 1.75 for Australia to 2.41 for ROW. The remaining products are expenditure inelastic, particularly chilled beef, for which a percentage increase in imports leads to only a 0.29-percent and a 0.54-percent increase in Australian and U.S. chilled beef imports, respectively.

The own-price elasticities show that beef demand in Japan is elastic for U.S. offal (-1.50), around -1.0 for chilled beef from all sources, and -0.7 for both Australian and U.S. frozen beef. Of the significant estimates, Australian offal imports are the least responsive to price (-0.5). ROW frozen beef and offal do not have a significant response to changes in their own price.

The cross-price elasticities are reported in table 4. Japanese beef imports by source and product mostly compete based on price or are unrelated, reflecting the tendency for Japanese consumers to import more Australian beef products when the price of U.S. beef rises and vice versa (Obara et al.,

Table 4

Unconditional cross-price elasticities

Product/country		Chilled			Frozen			Offal		
		Australia	U.S.	ROW	Australia	U.S.	ROW	Australia	U.S.	ROW
Chilled	Australia		0.38 (0.15)**	0.12 (0.05)***	0.25 (0.24)	0.21 (0.15)	0.22 (0.15)	-0.15 (0.07)**	-0.10 (0.10)	-0.06 (0.05)
	U.S.	0.74 (0.29)**		0.14 (0.07)**	0.07 (0.28)	-0.56 (0.18)***	-0.21 (0.18)	0.08 (0.10)	0.54 (0.13)***	0.22 (0.06)***
	ROW	1.34 (0.51)***	0.78 (0.37)**		-0.05 (0.38)	0.30 (0.26)	-0.41 (0.30)	-0.32 (0.22)	-0.33 (0.25)	-0.15 (0.17)
Frozen	Australia	0.33 (0.31)	0.05 (0.19)	-0.01 (0.05)		0.03 (0.18)	-0.24 (0.17)	0.14 (0.08)*	0.16 (0.12)	-0.05 (0.05)
	U.S.	0.67 (0.46)	-0.90 (0.29)***	0.09 (0.08)	0.06 (0.44)		0.44 (0.26)*	0.24 (0.13)*	-0.16 (0.21)	-0.11 (0.08)
	ROW	1.01 (0.68)	-0.49 (0.42)	-0.17 (0.13)	-0.85 (0.60)	0.64 (0.39)*		-0.13 (0.20)	0.35 (0.29)	0.07 (0.14)
Offal	Australia	-0.89 (0.43)**	0.22 (0.29)	-0.17 (0.12)	0.61 (0.34)*	0.44 (0.23)*	-0.17 (0.25)		0.11 (0.19)	0.22 (0.12)*
	U.S.	-0.44 (0.43)	1.22 (0.30)***	-0.14 (0.10)	0.53 (0.41)	-0.23 (0.29)	0.34 (0.27)	0.08 (0.14)		0.01 (0.10)
	ROW	-0.82 (0.57)	1.41 (0.42)***	-0.18 (0.20)	-0.51 (0.47)	-0.44 (0.32)	0.18 (0.37)	0.48 (0.26)*	0.02 (0.28)	

Note: *, **, and *** denote the 0.10, 0.05, and 0.01 significance levels respectively. Standard errors are in parentheses. ROW is the rest of the world.

Source: USDA, Economic Research Service estimates

2010; Mangino, 2014).¹¹ The results show a particularly strong competitive relationship for chilled beef across all sources where a price increase in one country leads to an increase in chilled beef imports from the other two sources, holding other factors constant. The effect of Australian chilled beef prices on U.S. and ROW chilled beef imports is particularly strong: a percentage increase in the Australian price would cause imports of U.S. and ROW chilled beef to increase by 0.74 percent and 1.34 percent, respectively. Although not as strong, the effect of increased U.S. chilled beef prices would cause imports of Australian and ROW chilled beef to rise, and increased ROW chilled beef prices would lead to higher imports of Australian and U.S. beef. Among sources of frozen beef, competition occurs only between the United States and ROW, and among sources of offal, competition occurs only between Australia and ROW. The most significant competition across products is between U.S. chilled beef prices and imports of ROW offal (1.41) and U.S. offal (1.22). The latter cross-price elasticity indicates that improved market access for U.S. chilled beef would negatively affect U.S. offal in Japan, holding other factors constant. Given the longstanding use of U.S. diaphragm beef, imported at a lower tariff rate, to replace beef cuts imported at the beef tariff rate of 38.5 percent, this substitution effect is to be expected. The two complementary relationships—

¹¹U.S. and Australian beef have not always been seen as substitutes. Citing surveys conducted on behalf of the U.S. Meat Export Federation, Miljkovic and Jin (2006) found that Japanese consumers saw clear differences between Australian and U.S. products in taste, tenderness, and freshness.

between Australian chilled beef prices and Australian offal imports (-0.89) and U.S. frozen beef prices and U.S. chilled imports (-0.56)—indicate that improved market access for Australian chilled beef would have a positive effect on imports of Australian offal and improved market access for U.S. frozen beef would have significant positive effect on imported U.S. chilled beef.

Effects of Market Access Changes on Japanese Beef Imports

To project the effect of tariff reductions on Japanese beef imports, we use the import values averaged over 2012-14 as the baseline and then trace the effect of the tariff changes in the JAEPA on potential trade. The JAEPA tariffs on Australian beef result in a lower price to Japanese importers than when Australian beef was subject to MFN tariffs. Given the JAEPA results, we then apply these same tariff reductions to U.S. and ROW beef products (full market access).¹² All results are reported in table 5.

The outcome of the JAEPA scenario is that Japanese consumers substitute Australian beef products for U.S. beef products. Under JAEPA, Australia's total beef exports increase in value by \$105.91 million, while U.S. exports fall by \$105.07 million. The biggest loss for the United States is \$58.03 million in chilled beef. From the perspective of Japanese consumption, under JAEPA, little changes. Neither the total value nor composition of beef products is significantly altered. These results confirm that when U.S. beef prices increase relative to Australian beef prices, Japanese consumers substitute toward lower priced Australian beef, but the overall growth in beef imports is a fairly modest at \$3.1 million.

If tariff reductions are applied to all countries (hypothetically, applying the JAEPA tariff cuts to all suppliers), total Japanese beef imports significantly increase, and the composition of imported beef products changes. The growth in beef imports under this equal-market-access scenario is more than 20 times the increase under JAEPA and entails a significant shift toward frozen beef. The share of frozen beef in total imports increases from 38.5 to 40.2 percent while the share of chilled beef and offal each decline by a little less than 1.0 percent. The increase in frozen beef imports offsets declines in imports of Australian chilled beef and offal. Small increases in chilled and frozen beef compensate for significant declines in U.S. offal exports. The value of frozen beef imports from ROW increases by nearly 9.7 percent.

Unlike under the JAEPA scenario, under the equal-market-access scenario (compared to the baseline), the total value of beef imports increases for each exporting source. The U.S. increase is the largest at \$26.45 million; Australia's value increases by \$17.44 million; and beef imports from ROW increase by \$19.92 million. These changes represent a small shift in market share toward the United States and a slightly larger shift toward sources in ROW. Australia remains the primary source of beef imports with 49 percent of the market.

JAEPA entered into force January 2015. Therefore, to evaluate the opportunity provided by future improved market access for U.S. beef in Japan, the relevant comparison is not to the baseline but to the JAEPA scenario. This comparison reveals the lost opportunity for the United States without tariff reductions in future agreements. The biggest difference between the JAEPA and equal-market-access scenarios is in imports of U.S. chilled and frozen beef, up 16.6 percent and 14.3 percent, respectively. Australia's lower valued beef products enable it to maintain a larger market share than the United States in all products except offal. However, JAEPA causes Australia's market share to rise to 53 percent, while reducing the U.S. share to 36 percent. In the equal-market-access scenario, Australia's total market share is 49 percent, while the U.S. share is 39 percent.

¹²Discounting the tariff reductions for ROW products to account for Japan's EPAs with Mexico and Chile result in minor changes to the overall results.

Table 5

The effects of market access on Japanese beef imports by product and source

Product	Country	Baseline		JAEPA		Difference		
		Value (\$ million)	Share (%)	Value (\$ million)	Share (%)	Value (\$ million)	Value (%)	Share (%)
Chilled	Australia	\$823.82	24.96	\$885.38	26.80	\$61.55	7.47	1.84
	U.S.	610.70	18.50	552.67	16.73	-58.03	-9.50	-1.77
	ROW	83.87	2.54	73.94	2.24	-9.93	-11.84	-0.30
Frozen	Australia	658.45	19.95	696.10	21.07	37.64	5.72	1.12
	U.S.	400.56	12.13	362.03	10.96	-38.53	-9.62	-1.18
	ROW	211.70	6.41	214.84	6.50	3.14	1.48	0.09
Offal	Australia	153.56	4.65	160.29	4.85	6.72	4.38	0.20
	U.S.	288.67	8.75	280.18	8.48	-8.50	-2.94	-0.27
	ROW	69.59	2.11	78.63	2.38	9.04	12.98	0.27
	Total	3,300.93	100.00	3,304.04	100.00	3.11	0.09	0.00
		Baseline		Equal market access (all countries)		Difference		
Chilled	Australia	\$823.82	24.96	\$794.11	23.60	-\$29.72	-3.61	-1.36
	U.S.	610.70	18.50	644.18	19.15	33.48	5.48	0.64
	ROW	83.87	2.54	80.43	2.39	-3.43	-4.09	-0.15
Frozen	Australia	658.45	19.95	709.08	21.07	50.63	7.69	1.13
	U.S.	400.56	12.13	413.70	12.30	13.15	3.28	0.16
	ROW	211.70	6.41	232.32	6.90	20.61	9.74	0.49
Offal	Australia	153.56	4.65	150.10	4.46	-3.47	-2.26	-0.19
	U.S.	288.67	8.75	268.50	7.98	-20.18	-6.99	-0.77
	ROW	69.59	2.11	72.33	2.15	2.74	3.94	0.04
	Total	3,300.93	100.00	3,364.75	100.00	63.82	1.93	0.00
		JAEPA		Equal market access (all countries)		Difference		
Chilled	Australia	\$885.38	26.80	\$794.11	23.60	-\$91.27	-10.31	-3.20
	U.S.	552.67	16.73	644.18	19.15	91.52	16.56	2.42
	ROW	73.94	2.24	80.43	2.39	6.49	8.78	0.15
Frozen	Australia	696.10	21.07	709.08	21.07	12.98	1.87	0.01
	U.S.	362.03	10.96	413.70	12.30	51.68	14.27	1.34
	ROW	214.84	6.50	232.32	6.90	17.47	8.13	0.40
Offal	Australia	160.29	4.85	150.10	4.46	-10.19	-6.36	-0.39
	U.S.	280.18	8.48	268.50	7.98	-11.68	-4.17	-0.50
	ROW	78.63	2.38	72.33	2.15	-6.29	-8.01	-0.23
	Total	3,304.04	100.00	3,364.75	100.00	60.71	1.84	0.00

Note: Baseline values are 3-year averages (2012-14). All values are at baseline prices. ROW is the rest of the world.

Source: USDA, Economic Research Service estimates

We do not consider full trade liberalization (all tariffs fall to zero) because we mainly examine what has been negotiated in the JAEPA and not the ideal trade scenario. Consequently, our results are not as significant as the expected outcome of complete liberalization. Nonetheless, given the expected gains and losses for Australia and the United States from implementation of JAEPA, our results show that similar tariff concessions for U.S. beef would at least mitigate these losses.

Conclusion

Japan is the largest foreign market for U.S. beef. In turn, the United States is a very attractive and important source of beef supply for Japan. Japan's beef market as a whole is highly segmented, with very expensive, high-quality uses, such as the wagyu beef, at one end of the price spectrum, and ground beef preparations like hamburgers at the other. Consistent with the levels of recent decades, domestic beef production currently supplies less than 40 percent of Japan's beef demand and is sourced from three components: wagyu beef animals, dairy (Holstein) beef animals, and a herd sired by wagyu and birthed by Holstein that blends characteristics of the two parent types.

Growth in beef demand has been filled by imported beef. Beef imports grew strongly until 2001, coming from Australia, the United States, New Zealand, and Canada. The discovery of BSE, first in Japan and, then, in Canada and the United States, was linked to a decline in beef consumption and bans on imports from the United States and Canada. Gradually, imports from North America have resumed, and the United States is increasing its exports and market share, year by year.

Econometric estimation of import demand by country of origin confirm that significant price competition exists between beef imports from Australia and the United States, overall. Japan's ground meat markets are supplied overwhelmingly by Australian frozen beef. Japan's offal imports are an area of particular U.S. strength. Otherwise, Australian and U.S. beef cuts compete strongly in Japan's market.

The Japan-Australia Economic Partnership Agreement (JAEPA), which took effect at the beginning of 2015, provides tariff reductions for Australian beef that are phased in over a 15-year period. Using the coefficients estimated for this study, we construct a scenario that evaluates the full implementation of JAEPA in comparison to recent trade conditions. Assuming that no other events intervene to influence trade, the scenario indicates that imports of Australian beef would rise by \$100 million over baseline values, while imports of U.S. beef would fall by about \$100 million. U.S. imports would absorb a significant loss in potential trade, unless tariffs facing U.S. beef are also lowered. If Japan opens up its beef market to the United States as it did with Australia under JAEPA, projections indicate a \$130 million net gain for U.S. beef, about 8 percent of current U.S. beef exports to Japan.

References

- Alston, J.M., C.A. Carter, and L.S. Jarvis. 1990. Discriminatory Trade: The Case of Japanese Beef and Wheat Imports. *Canadian Journal of Agricultural Economics* 38(2): 197-214.
- Anderson, K. 1983. The Peculiar Rationality of Beef Import Quotas in Japan. *American Journal of Agricultural Economics* 65(1): 108-112.
- Barten, A.P. 1969. Maximum likelihood estimation of a complete system of demand equations. *European Economic Review* 1(1): 7-73.
- Beach, C.M., and J.G. MacKinnon. 1979. Maximum Likelihood Estimation of Singular Equation Systems with Autoregressive Disturbances. *International Economic Review* 20(2): 459-464.
- Blayney, D.P., J.D., and D. Harvey. 2006. Economic effects of animal diseases linked to trade dependency. *Amber Waves* 4(2): 23-29.
- Burfisher, M.E., J. Dyck, B. Meade, L. Mitchell, J. Wainio, S. Zahniser, S. Arita, and J. Beckman. 2014. *Agriculture in the Trans-Pacific Partnership*. U.S. Department of Agriculture, Economic Research Service. Economic Research Report Number 176. Washington, D.C.
- Capps, O. Jr., R. Tsai, R. Kirby, and G.W. Williams. 1994. A Comparison of Demands for Meat Products in the Pacific Rim Region. *Journal of Agricultural and Resource Economics* 19(1): 210-224.
- Clements, K.W., and H. Theil. 1978. A Simple Method of Estimating Price Elasticities in International Trade. *Economics Letters* 1(2): 133-137.
- Cooper, W.H., and M.E. Manyin. 2013. *Japan Joins the Trans-Pacific Partnership: What Are the Implications?* Congressional Research Service. Report R42676. Washington, D.C.
- Dyck, J., and S. Arita. 2014. *Japan's Agri-Food Sector and the Trans-Pacific Partnership*. U.S. Department of Agriculture, Economic Research Service. Economic Information Bulletin Number 129. Washington, D.C.
- Dyck, J., and R. Johnson. 2013. *Japan Announces New Rules for Imports of U.S. Beef*. U.S. Department of Agriculture, Economic Research Service. Report LDP-M-225SA. Washington, D.C.
- Farrell, R. 2014. *Australia Trade Policy Monitoring Annual*. U.S. Department of Agriculture, Foreign Agricultural Service. GAIN Report AS1430. Washington, D.C.
- Global Trade Information Services (GTIS), Inc. 2014. Global Trade Atlas database.
- Gustavsen, G.W. and K. Rickertsen. 2003. Forecasting Ability of Theory-Constrained Two-stage Demand Systems. *European Review of Agricultural Economics* 30: 539-558.
- Hall, B.H. and C. Cummins. 2005. TSP International Reference Manual Version 5.0. TSP International, Palo Alto, California.

- Halstead, M., and D.R. Mark. 2006. Beef Export Verification Program for Japan. *Cornhusker Economics*. Paper 259. http://digitalcommons.unl.edu/agecon_cornhusker/259.
- Ishida, T., N. Ishikawa, and M. Fukushige. 2010. Impact of BSE and Bird Flu on Consumers' Meat Demand in Japan. *Applied Economics* 42(1-3): 49-56.
- Japanese Ministry of Agriculture, Forestry, and Fisheries (MAFF).2013. *Statistical Yearbook of Ministry of Agriculture, Forestry, and Fisheries*, various issues.
- Jin, H.J., and W.W. Koo. 2003. The Effect of the BSE Outbreak in Japan on Consumers' Preferences. *European Review of Agricultural Economics* 30(2): 173-192.
- Kastens, T.L. and G.W. Brester. 1996. Model Selection and Forecasting Ability of Theory-constrained Food Demand Systems. *American Journal of Agricultural Economics* 76:301-312.
- Kawashima, S., and D. Sari. 2010. Time-Varying Armington Elasticity and Country-of-Origin Bias: From the Dynamic Perspective of the Japanese Demand for Beef Imports. *Australian Journal of Agricultural and Resource Economics* 54(1): 27-41.
- Khan, L., S. Ramaswami, and S.G. Sapp. 1990. "Meat Marketing in Japan," in D. Hayes, ed., *Meat Marketing in Japan; A Guide for U.S. Meat Exporting Companies*. Midwest Agribusiness Trade Research and Information Center.
- Laitinen, K. 1980. *A Theory of the Multiproduct Firm*. Amsterdam: North-Holland Publishing Company.
- Laitinen, K., and H. Theil. 1978. Supply and Demand of the Multiproduct Firm. *European Economic Review* 11(2): 107-154.
- Lee, J.C. 1988. Nested Rotterdam Model Applications to Marketing Research with Special Reference to Telecommunications Demand. *International Journal of Forecasting* 4: 193-206.
- Mangino, E. 2014. *Small Intestine – Big Impact for U.S. Beef Exports to Japan*. U.S. Department of Agriculture, Foreign Agricultural Service. Gain Report JA4027. Washington, D.C.
- McCluskey, J.J., K.M. Grimsrud, H. Ouchi, and T. Wahl. 2005. Bovine Spongiform Encephalopathy in Japan: Consumers' Food Safety Perceptions and Willingness to Pay for Tested Beef. *The Australian Journal of Agricultural and Resource Economics* 49(2): 197-209.
- Miljkovic, D., and H. Jin. 2006. Import Demand for Quality in the Japanese Beef Market. *Agricultural and Resource Economics Review* 35(2): 276-284.
- Miljkovic, D., J.M. Marsh, and G.W. Brester. 2002. Japanese Import Demand for U.S. Beef and Pork: Effects on U.S. Red Meat Exports and Livestock Prices. *Journal of Agricultural and Applied Economics* 34(3): 501-512. http://digitalcommons.unl.edu/agecon_cornhusker/259
- Meat and Livestock Australia (MLA). 2015. Australian Beef Exports to Japan Steady in 2014. <http://www.mla.com.au/Prices-and-markets/Market-news/Australian-beef-exports-to-Japan-steady-in-2014>. (accessed February 24, 2015)

- Mori, H., Y. Saegusa, and M. Tanaka. 2015.3. Augmented Cohort Analysis—A Practical Way to Predict Future At-home Consumption of Selected Food Products. *Economic Bulletin of Senshu University*, Vol. 49(3): 111-135.
- Muhammad, A. 2007. The Impact of Increasing Non-Agricultural Market Access on EU Demand for Imported Fish: Implications for Lake Victoria Chilled Fillet Exports. *European Review of Agricultural Economics* 34: 461–477.
- Muhammad, A., W.A. Amponsah, and J.H. Dennis. 2010. The Impact of Preferential Trade Arrangements on EU Imports from Developing Countries: The Case of Fresh Cut Flowers. *Applied Economic Perspectives and Policy* 32(2): 254–274.
- Muhammad, A., L. McPhail, and J. Kiawu. 2012. Do U.S. Cotton Subsidies Affect Competing Exporters? An Analysis of Import Demand in China. *Journal of Agricultural and Applied Economics* 44: 235-249.
- Obara, K., McConnell, M., and Dyck, J. 2010. *Japan's Beef Market*. U.S. Department of Agriculture, Economic Research Service. LDP-M-194-01. Washington, D.C.
- OECD. 2009. *Evaluation of Policy Reforms in Japan*. Organisation for Economic Co-operation and Development, Paris.
- Oro, K., and B. Pritchard. 2011. The evolution of global value chains: displacement of captive upstream investment in the Australia–Japan beef trade. *Journal of Economic Geography* 11(4): 709-729.
- Peterson, H., and Y. Chen. 2005. The Impact of BSE on Japanese Retail Meat Demand. *Agribusiness* 21(3): 313-327.
- Pritchard, B. 2006. The Political Construction of Free Trade Visions: The Geo-Politics and Geo-Economics of Australian Beef Exporting. *Agriculture and Human Values* 23: 37-50.
- Reed, M.R. and S.H. Saghaian. 2004. Measuring the Intensity of Competition in the Japanese Beef Market. *Journal of Agricultural and Applied Economics* 36(1): 113-121.
- Theil, H. 1980. *The System-Wide Approach to Microeconomics*. Chicago: University of Chicago Press.
- Theil, H. 1977. The Independent Inputs of Production. *Econometrica* 45(6): 1303–1327.
- Theil, H., and K.W. Clements. 1978. A Differential Approach to US Import Demand. *Economics Letters* 1(3): 249–252.
- Thompson, W. 2004. Using Elasticities from an Almost Ideal Demand System? Watch Out for Group Expenditure! *American Journal of Agricultural Economics* 86(4): 1108-1116.
- UN Comtrade. 2015. United Nations Commodity Trade Statistics Database. <http://comtrade.un.org/db/>.
- USDA FAS. 2015. Foreign Agricultural Service's Global Agricultural Trade System. <http://apps.fas.usda.gov/gats/default.aspx>.

- USTR. 2013. *2013 National Trade Estimate Report on Foreign Trade Barriers*. Office of the United States Trade Representative. Washington, DC.
- Washington, A.A., and R.L. Kilmer. 2002. The Production Theory Approach to Import Demand Analysis: A Comparison of the Rotterdam Model and the Differential Production Approach. *Journal of Agricultural and Applied Economics* 34(3): 431-443.
- Weatherspoon, D., and J. Seale, Jr. 1995. Do the Japanese Discriminate against Australian Beef Imports? Evidence from the Differential Approach. *Journal of Agricultural and Applied Economics* 27(2): 536-543.
- Yang, S.R., and Koo, W.W. 1994. Japanese Meat Import Demand Estimation with the Source Differentiated Aids Model. *Journal of Agricultural and Resource Economics* 19: 396-408.

Appendix 1—Import Demand Model

Following Clements and Theil (1978), Muhammad et al. (2010), and Muhammad et al. (2012), we use the production version of the Rotterdam demand system to model the import allocation decision and determination of total import expenditures for Japanese beef imports. Unlike the consumer-based Rotterdam model, this version is based on the differential approach to the multiproduct firm (Theil, 1977; Laitinen, 1980). The model estimates are used to derive unconditional import demand elasticities and assess the impact of tariff reductions on source and product-specific beef imports in Japan.

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

$$\text{Equation (A1): } \bar{w}_{gi} \Delta q_{gi} = \theta_{gi} \Delta Q_i + \sum_{h=1}^m \sum_{j=1}^n \pi_{gihj} \Delta p_{hj} + \mu_{gi}.$$

Δ is the log-difference operator, where for any variable x_t , $\Delta x_t = \log x_t - \log x_{t-12}$. We use the 12th log difference to correct for seasonal variation in demand (Lee, 1988). w_{gi} is the expenditure share of product g from country i in total beef imports and is derived as follows: $w_{gi} = \frac{p_{gi} q_{gi}}{\sum_g \sum_i p_{gi} q_{gi}}$. \bar{w}_{gi} is the two-period average of w_{gi} : $\frac{1}{2}(w_{g,t} + w_{g,t-12})$. ΔQ is the Divisia volume index, which is a measure of total expenditures (in real terms) on all beef imports and is derived as follows: $\Delta Q_t = \sum_g \sum_i \bar{w}_{gi} \Delta q_{gi}$. The parameter θ_{gi} is the marginal import share which measures the share of an additional dollar of total expenditures allocated to product g from country i , and π_{gihj} is the conditional price effect which measures how the price of product h in country j affects imports of product g from country i . The terms θ_{gi} and π_{gihj} are assumed constant for estimation and μ_{gi} is a random error term. Equation (A1) represents a nine-equation system that shows how total import expenditures are allocated across beef products and exporting sources.¹³

Demand theory suggests the following restrictions on θ_{gi} and π_{gihj} : $\sum_g \sum_i \theta_{gi} = 1$ and $\sum_g \sum_i \pi_{gihj} = 0$ (adding up); $\sum_h \sum_j \pi_{gihj} = 0$ (homogeneity); and $\pi_{gigi} = \pi_{gigi} \forall g$, $\pi_{gihj} = \pi_{higi} \forall i$ and $\pi_{gihj} = \pi_{hjgi}$ (symmetry). Additionally, the matrix of conditional price effects $\Pi = [\pi_{gihj}]$ should be negative semidefinite (negativity), which implies that $\pi_{gigi} \leq 0 \forall gi$ (Laitinen, 1980). The import demand system defined by equation (A1) satisfies adding-up by construction. The homogeneity and symmetry constraints must be imposed on the parameters. Negativity is verified by inspection.

Following Theil (1977), the aggregate expenditure (total import demand) for a profit-maximizing firm is expressed by the following Divisia index equation:

$$\text{Equation (A2): } \Delta Q_t = \Theta \left[\Delta p_t^* - \Delta P_t' \right] + \epsilon_t.$$

¹³Given the three products (chilled beef, frozen beef, and offal) and three exporting countries (Australia, United States, and ROW), there are nine products in total.

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

$$\text{Equation (A3): } \Delta P'_t = \sum_h \sum_j \theta_{hj} \Delta p_{hj,t}.$$

Θ is the Frisch price effect and is assumed constant for estimation. ϵ is a random disturbance term. All other terms and variables are as previously defined. Equation (A2) 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 import expenditures.

If we substitute equation (A3) for the Frisch import price index in equation (A2), and then substitute this into equation (A1), we get the demand for an individual import with respect to the output price p^* and import prices p_{hj} :

Equation (A4):

$$\bar{w}_{g_i} \Delta q_{g_i} = \Theta \theta_{g_i} \left[\Delta p^* - \sum_{h=1}^m \sum_{j=1}^n \theta_{hj} \Delta p_{hj} \right] + \sum_{h=1}^m \sum_{j=1}^n \pi_{g_i h j} \Delta p_{hj}.$$

Note that the errors t and subscripts are omitted for convenience.

Solving equation (A4) for $\frac{\Delta q_{g_i}}{\Delta p_{hj}}$, 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 the price of product h from country j :

$$\text{Equation (A5): } \eta_{g_i, h_j} = \frac{-\Theta \theta_{g_i} \theta_{hj}}{\bar{w}_{g_i}} + \frac{\pi_{g_i h_j}}{\bar{w}_{g_i}}.$$

Note that equation (A5) is composed of two effects. The first term is the indirect effect, which is the effect of prices on imports through changes in total expenditures. The second term is the direct effect as measured by the conditional price elasticity, 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 effect of a price change in consumer theory, but in the context of international trade, they respectively represent the trade creation and diversion effect of prices.

Appendix 2—Policy Simulations and Import Demand Forecasting

Following Kastens and Brester (1996), we simulate the impact of tariff reductions using an elasticity-based forecasting equation. Past studies have compared the forecast accuracy of an elasticity-based approach versus model-based forecasts and concluded that elasticity-based forecasts were superior (Kastens and Brester, 1996; Gustavsen and Rickertsen, 2003; Muhammad, 2007).

Following these studies, the elasticity-based forecasting equation is as follows:

$$\text{Equation (A6): } q_{g_i(1)} = \left(\sum_h \sum_j \eta_{g_i h_j} \left[\frac{p_{h_j(1)} - p_{h_j(0)}}{p_{h_j(0)}} \right] \right) q_{g_i(0)} + q_{g_i(0)}.$$

Note that we use the unconditional price elasticities because they account for the total effect of a price change on imports. Equation (A6) 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 changes in the product and source-specific import prices.

Our import projections are based on changes in import prices resulting from tariff reductions. From the perspective of the importer, tariffs are already incorporated into prices. Assume that a tariff change does not affect the export price, which is not always the case when an importer is a large country. However, we maintain this assumption as an upper bound on the change in import prices. The elasticity forecasting equation can be restated in terms of tariff rates:

$$\text{Equation (A7): } q_{g_i(1)} = \left(\sum_h \sum_j \eta_{g_i h_j} \left[\frac{t_{h_j(1)} - t_{h_j(0)}}{(1 + t_{h_j(0)})} \right] \right) q_{g_i(0)} + q_{g_i(0)}.$$

We use equation (A7) to assess the impact of market access reform on Japan's beef imports.¹⁴

¹⁴Note that t_{hj} is the product and source-specific ad valorem tariff rate.

Appendix 3—Estimation and Model Estimates

We use monthly data to estimate beef import demand in Japan differentiated by product and exporting source. The data are provided by the World Trade Atlas ® Database, Global Trade Information Services, Inc. To avoid estimation issues from excessive zero observations and unstable parameters due to the BSE-ban period and recovery years, we limit the data period to January 2009–December 2014. Since Australia and the United States account for most beef imports in Japan, we focus on these two countries and aggregate the remaining exporting countries into the ROW category. Beef is also disaggregated into three product groups: chilled beef, frozen beef, and offal. Import values are measured in U.S. dollars, quantities in kg, and prices in U.S. dollars per kg. We use Japan’s beef CPI, provided by the Statistics Bureau of Japan, as the domestic price to estimate total import demand, equation (A2).

We estimate the demand for imported beef in Japan using the generalized Gauss-Newton method in TSP (version 5.0), which is a maximum likelihood procedure for equation systems (Hall and Cummins, 2005). The demand system as specified by equation (A1) 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), estimates should be the same regardless of which equation is removed. A likelihood ratio test indicated that the errors in equation (A1) are not random, but follow a first-order autoregressive process. Thus, we use a full-maximum likelihood procedure for singular equation systems that corrects for autocorrelation (Beach and MacKinnon, 1979). Kastens and Brester (1996) indicate that homogeneity and symmetry-constrained demand models provide more accurate forecasts than unconstrained models, even if when rejected statistically. Since our goal is to forecast imports, we impose homogeneity and symmetry on the model, even though both properties were rejected.

The import demand estimates are reported in table A1. We 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.¹⁵ 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.

The conditional own-price estimates are presented along the diagonal in table A1. All of the estimates are negative, which is consistent with demand theory, and significant at the 0.10 level or lower for six of the nine products considered. The cross-price estimates (off-diagonal estimates) indicate that beef imports by source and product are mostly substitutes or unrelated in the Japanese market, reflecting the tendency for Japanese consumers to substitute toward Australian beef products when the relative price of U.S. beef rises and vice versa (Obara, McConnell, and Dyck, 2010; Mangino, 2014). The most significant price competition is among chilled beef where a price increase in one country leads to an increase in chilled beef imports from the other two sources, *ceteris paribus*. There is also significant cross-product competition between U.S. chilled beef and offal (0.083), U.S. chilled beef and ROW offal (0.033), Australian frozen beef and offal (0.034), and U.S. frozen beef and Australian offal (0.024). There are two complementary relationships for different products from the same country: Australian chilled beef and offal (0.045) and U.S. chilled and frozen beef (0.082).

¹⁵Note that a constant in a log-differenced model is the trend estimate in the levels model; if $\log y_t = a + bt$ where b is the growth rate, then $\log y_t - \log y_{t-k} = kb$.

Table A1

Demand model estimates for Japanese beef imports by product and source

Product	Country	Constant	Marginal import share	Chilled		Frozen		Offal					
				Australia	US	Australia	US	Australia	US	ROW	ROW		
Chilled	Australia	-0.020 (0.005)***	0.086 (0.029)***	-0.271 (0.091)***	0.114 (0.044)***	0.037 (0.014)***	0.080 (0.069)	0.066 (0.043)	0.067 (0.044)	-0.045 (0.022)**	-0.029 (0.029)	-0.019 (0.014)	
	U.S.	0.017 (0.003)***	0.082 (0.015)***	-0.170 (0.040)***	0.022 (0.010)**	0.017 (0.041)	-0.082 (0.027)***	-0.029 (0.027)	0.012 (0.015)	0.083 (0.020)***	0.012 (0.015)	0.083 (0.020)***	0.033 (0.010)***
	ROW	0.000 (0.001)	0.003 (0.003)	-0.033 (0.008)***	-0.033 (0.008)***	-0.001 (0.010)	0.008 (0.007)	-0.012 (0.008)	-0.009 (0.006)	-0.011 (0.008)	-0.009 (0.006)	-0.009 (0.006)	-0.004 (0.005)
Frozen	Australia	-0.012 (0.005)**	0.389 (0.027)***				-0.136 (0.077)*	0.020 (0.038)	-0.043 (0.036)	0.034 (0.017)**	0.039 (0.027)	-0.011 (0.011)	
	U.S.	0.009 (0.005)**	0.187 (0.026)***					-0.060 (0.038)	0.047 (0.024)*	0.024 (0.012)**	-0.014 (0.020)	-0.010 (0.007)	
	ROW	0.000 (0.002)	0.155 (0.013)***					-0.053 (0.037)	-0.053 (0.037)	-0.007 (0.013)	0.024 (0.018)	0.005 (0.009)	
Offal	Australia	-0.001 (0.001)	0.034 (0.006)***							-0.025 (0.011)**	0.006 (0.010)	0.011 (0.006)*	
	U.S.	0.006 (0.002)***	0.043 (0.012)***							-0.100 (0.018)***	-0.100 (0.018)***	0.000 (0.007)	
	ROW	-0.000 (0.001)	0.020 (0.003)***									-0.007 (0.006)	

Note: ***, **, and * denote the 0.01, 0.05, and 0.10 significance level respectively. Standard errors are in parentheses. ROW = rest of the world. Homogeneity and symmetry are imposed on the model, and the error structure is AR(1).

Source: USDA, Economic Research Service estimates.