

DISSERTATION

THE VALUE OF U.S. BEEF EXPORTS AND THE TRACEABILITY OF PORK IN  
COUNTRIES OUTSIDE NORTH AMERICA

Submitted by

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## ABSTRACT

### THE VALUE OF U.S. BEEF EXPORTS AND THE TRACEABILITY OF PORK IN COUNTRIES OUTSIDE NORTH AMERICA

Variation exists within beef cuts produced by U.S. beef packers for domestic and foreign markets, due to differences in consumer expectations and use of the product. The objective of this study was to conduct an industry-wide survey to identify commonality among and between U.S. beef processor specifications, as well as to identify differences between products sent to varying countries, and to determine a more accurate value of beef export. Countries that have an Export Verification program require suppliers to be certified with the United States Department of Agriculture and submit information about exported products. The EV information was collected and used to determine the countries that were receiving the highest volume of U.S. product, as well as the meat cuts common in each country. The data was also used to assign prices to individual products to ascertain export value. These documents do not show individual differences between how companies cut beef products. Four countries that represent significant U.S. beef export markets (Japan, Mexico, Hong Kong, and Taiwan) were visited. During these visits, product was visually checked and compared to known Institutional Meat Processor Specification (IMPS). Animal diseases and related food safety issues have become concerns to many people in the last decade and traceability is becoming increasingly important throughout the world as a way to control disease outbreaks before they have devastating effects on a country's livestock industries. The objective of this review was to discuss swine identification and traceability systems outside North America.

Key words: Beef, pork, export, trade, value, traceability

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## **Chapter 1: Objective of Dissertation**

The objective of this study was to better elucidate the type of beef cuts, grades, and primals typically exported and to provide a more accurate estimate of the value of beef exports to selected countries from the United States of America based on data from a select period of time. This dissertation also examines pork traceability in countries outside of North America.

## **Chapter 2: Review of literature**

### **US beef trade**

#### *Introduction*

While domestic demand for beef decreased in the United States, US beef exports increased to approximately 2.3 billion pound in 2010 (USDA-ERS, 2011). Although the US is a major exporter of beef, it is a net importer on a tonnage basis (Jones and Shane, 2009). The US tends to export high quality, high-grade beef products while importing lower quality beef products for processing, particularly for hamburger (Jones and Shane, 2009). The leading markets for US beef exports were Mexico and Canada, which represent about 40% of all beef exported in 2010, followed by Japan and Korea (USMEF, 2011a).

As Brester, Mintert, and Hayes (1997) explain, United States beef exports increased greatly between the mid-1980s and 1997 due to depreciation of the US dollar, the development of technology to transport chilled rather than frozen product, the relaxation of tariff and quota restrictions, increased per capita incomes, and changes in dietary preferences in importing countries. The beef export product of the US includes many types of variety meat, of which Japan, Taiwan, Egypt, and Mexico are major markets (Brester et al., 2003).

Beef by-products are an important source of revenue for beef packers. These include both edible by-products such as tongue, liver, gelatin, tallow, etc., and inedible by-products that are typically used in the pharmaceutical and manufacturing industries. In addition, beef by-products such as bone and blood meal are sold for use in non-ruminant livestock feed. The value of beef by-product exports actually exceeded that of beef export values until 1991, and the value has continued to trend upward (Brester et al., 2003). Prior to 2003, exports traditionally

accounted for approximately 25% of the rendered by-products such as oils, fats, and bone and blood meal sold (Swisher, 2006).

Export volume can be affected by a number of factors including exchange rate, currency value, the price and availability of substitutes such as pork or poultry, the price and availability of domestic products, and seasonal variation.

*Currency value, exchange rate, and market recovery*

The value of the US dollar can have a major affect on the US beef trade. In 2002 the dollar began to depreciate against countries such as Australia, Canada, and the United Kingdom. This trend continued with most of the beef trading partners of the US (Jones, 2006; Trosle, 2008). When the dollar is weak relative to other currencies, it encourages exportation because US products are less expensive to trading partners. Conversely, when the dollar is strong, US products become more expensive (Jones, 2006). Even so, if consumers find that a product from a particular country has desirable characteristics, that product will respond less to changes in dollar value than products that have close substitutes from a different country of origin (Jones and Shane, 2009).

When the exchange rate is not favorable, there is a negative effect on US beef demand (Miljkovic et al., 2002). Some countries, such as Canada or Japan, are more responsive to changes in exchange rate than other countries, such as Mexico or Korea (Miljkovic et al., 2003). Response to exchange rate fluctuations is buffered if exporters lower prices to maintain market share in a country experiencing a depreciated exchange rate (Miljkovic and Zhuang, 2007). Jones (2006) provided four reasons why market recovery from an incident like a recession is slow. First, consumer habits change. Second, many export agreements are contractual. Third,

price competition may affect the consumer, especially if there is a close substitute that is also affected by currency value. Fourth, consumers must be reassured about the safety of the product.

### *Elasticity*

Elasticity is the measure of change in one variable with relation to another variable. A good is considered “elastic” if the elasticity of demand is greater than 1 (i.e. an increase in price results in a reduction in revenue) and “inelastic” if it is less than 1 (i.e. an increase in price results in an increase in revenue). If the demand for a good is elastic, a small change in price will cause a greater change in demand. Luxury goods are often considered elastic, while necessities are considered inelastic (Goodwin et al., 2009). Research has found the own-price elasticity (the elasticity of demand with regards to the good’s own price, rather than the price of another good) of beef to be between -0.420 to -0.78 (Piggott et al., 2007; Susanto et al., 2008; Rhoads et al., 2008; Tonsor et al., 2009). Poultry is typically more inelastic than beef, while pork is more elastic (Brester and Shroeder, 1995; Tonsor and Marsh, 2007; Tonsor et al., 2009). When supply drops, due to changes in availability, price is expected to increase. If a good is inelastic, such as beef, this has a minimal effect. Beef exports are far more responsive to price (Van Eenoo et al., 2000), which is likely due to its position as a luxury good in many countries. Short-run elasticities measure the immediate responsiveness to a price change while long-run elasticity measures the response to a price change after there has been time for consumers to adapt (Goodwin et al., 2009). Items tend to be inelastic if there are few substitutes, if it is something consumers feel they need rather than just want, and/or if it represents a small part of their budget (Goodwin et al., 2009). The proportion of beef expenditures relative to total consumer expenditures has been declining over time, which suggests that beef will be even less responsive to price change in the future (Mintert et al., 2009).

Substitutions can also have an effect. A substitute good is one that can be used in the place of another good (Goodwin et al., 2009). When the price of one item rises relative to a similar product, buyers may alternatively shift to the relatively cheaper, yet similar product (Goodwin et al., 2009). Pork, turkey, and chicken act as substitutes of beef domestically (Hahn and Mathews, 2007; Susanto et al., 2008), although not all grades of beef and cuts of meat are substitutes for each other.

There is a lack of data on commodity elasticities, as beef is treated as a commodity good (simply “beef”) in most of the literature. Thus, there is a dearth of information on the elasticities of different markets for beef as well as different primals. Van Eenoo et al. (2000) pointed out that “varying types of beef are involved in US beef exports, but the price/quantity data collected by the Foreign Agricultural Service in the US Department of Agriculture offer little detail on quantity or price by category of product. Exporters complete a form that shows weight and total value of the shipment, with no detail on the exact product mix in the shipment.” The forms show shipments as frozen or chilled boneless or bone-in beef or variety meats with no further information, which has been problematic for other researchers (Purcell and Lusk, 2003; Hahn and Mathews, 2007). Because of this, in previous research on beef demand, beef has been treated as an undifferentiated commodity, at most separating products into ground beef and beef cuts, and rarely addresses variety meats.

#### *Bovine Spongiform Encephalopathy*

Beef exports in the US peaked in 2003, just prior to the discovery of a single Washington dairy cow that had contracted bovine spongiform encephalopathy (BSE). BSE is a chronic, degenerative central nervous system disease that causes the animal’s condition to worsen until it dies or is destroyed (Mattson et al., 2005). It is suspected that BSE is the causative agent of

variant Creutzfeldt-Jacob disease in humans, an incurable degenerative nervous system disease that can cause psychiatric symptoms such as visual hallucinations, head pain, and unsteadiness in a wide range of age groups (Lorains et al., 2001; Ghani et al., 2002). The original case in Washington was followed by two additional cases in June 2005 and March 2006 (Obara et al., 2010). Although over 95% of all BSE cases have been documented in the UK, it has been discovered in other European countries, as well as Canada and Japan (Mathews et al., 2006). In May 2005, the World Animal Health Organization (OIE) announced a set of BSE risk categories for countries: “Negligible BSE Risk”, “Controlled BSE Risk”, and “Undetermined BSE Risk”. It was determined that the United States fell into the Controlled BSE Risk category (OIE, 2011).

Piggott and Marsh (2004) found that although poultry and pork were able to serve as interchangeable substitutes during food safety crisis (i.e., if pork had a food safety outbreak, consumers would switch to poultry), a food safety problem with beef reduced the pre-committed quantities of all meats. Domestically, some consumers temporarily decided beef was less safe and the US experienced a one to two week reduction in fresh and frozen beef purchases, once seasonality and established trends were taken into account (Kuchler and Tegene, 2006). The estimated response to food safety events domestically is small, relative to price and household dynamic effects (Piggott and Marsh, 2004; Tonsor et al., 2009). Tonsor et al. (2009) found that beef was more sensitive to own-product and spillover effects than pork or poultry.

These findings stand in contrast to analyses of foreign markets in which demand for US beef was affected by a far greater margin (Marsh et al., 2007). Beef demand as a whole dropped sharply in countries affected by BSE. Great Britain experienced an immediate market share reduction of beef and veal, while demand for pork and poultry increased in 1990 during widespread publicity of BSE cases, which continued for several years (Burton and Young, 1996).

The European Union also experienced sharp drops in beef consumption after each of the United Kingdom's three major crises in 1988, 1996, and 2000, and while consumption rates eventually recovered, prices remained low (Mathews et al., 2003).

Almost immediately after the BSE cases in 2003, all major international markets closed their borders to US beef products and the market essentially disappeared. Beef exports (including variety meats) went from 1.2 million metric tons with a value of \$3.86 billion down to 0.3 million metric tons with a value of \$810 million (USMEF, 2009). Fed cattle prices declined from around \$97 per hundredweight in early December 2003 to \$76 per hundredweight in late January 2004, likely due to export market closure (Marsh et al., 2007). The export share of US beef was 8.71% in 2002, but fell to 1.72% in 2004 (Marsh et al., 2007) as market shares were not regained. Beef by-products had a 76.9% drop in export volume due to BSE (Tsigas et al., 2008).

Pritchett et al. (2007) investigated whether domestic consumers would substitute cuts portrayed as having a lower risk of BSE for "higher risk" cuts, as well as the substitution of pork or chicken for beef. Researchers found that ground beef, which was portrayed by the media as having the greatest risk for BSE, experienced the greatest drop in demand, while the demand for ribeyes was not reduced. Meanwhile demand for pork was positive, indicating that consumers substituted pork for beef products, although the substitution effect lessened over time.

### **Livestock Mandatory Reporting Act**

The Livestock Mandatory Reporting Act (LMRA) was passed into law on October 22, 1999, as an amendment to the Agriculture Marketing Act of 1946, with Livestock Mandatory Reporting starting on April 2, 2001. Plants that slaughter at least 125,000 head a year for five years, or that did not slaughter cattle during the preceding five years but were still considered a

plant by the Secretary of Agriculture, were required to report data including how the animal was purchased (i.e. imported from domestic market, negotiated purchase, formula marketing arrangement and forward contract), the weight, quality grade, and any premiums and discounts applied to the carcass. Packers also were required to report on boxed weight including the price per hundredweight, the quantity sold, whether it was a domestic vs. export sale, type of beef cut, trim specification, and USDA quality grade. Refusal to submit information or failure to submit it on time carried a penalty of \$10,000 per violation (Federal Register, 2008).

Prior to the LMRA, price information reported to AMS was voluntary and only six packers submitted weekly reports (Fausti et al., 2008), potentially limiting the quantity and quality of information. By requiring packers who slaughter over 125,000 head a year to submit data, the price information now reflected more of the total population. Thus, the LMRA greatly increased both the quality and the quantity of beef data available.

### **Beef grades**

There are two grading measures for beef in the United States: quality grades and yield grades. Yield grades are determined by four characteristics: 1) amount of external fat, 2) amount of kidney, pelvic, and heart fat, 3) ribeye area, and 4) carcass weight. Yield grades are numbered between one and five, with 5 representing the fattest cattle (USDA, 1997). Beef quality grades are based primarily on marbling and maturity. Quality grades include Prime (which has reflects the highest degree of marbling and lowest maturity score), Choice, Select, Standard, Commercial, Utility, Cutter, and Canner (which reflects the lowest degree of beef marbling and greatest maturity score). Prime products are typically purchased by upscale restaurants or are exported. Select and Choice grades are purchased by the export, hotel, restaurant, and

institutional sectors, or grocery stores. Animals that would grade in the lowest four categories are usually not graded and are purchased by processed meat or animal feed producers (Hahn and Mathews, 2007; Ferrier and Lamb, 2007). Grading standards changed dramatically in 1976 by lowering the amount of marbling needed for a Choice grade, and changing of the name “Good” to “Select” in 1987 (USDA, 1997).

Not all beef products are graded. A study by Dutton et al. (2007) found that between 36.7% to 50% of steak products were ungraded while 75.4 to 78.4% of ground beef products were ungraded in stores throughout Tulsa, Oklahoma City, and Denver. It was suggested that beef quality grades are declining (i.e. more Select-grade carcasses and less Prime and Choice-grade carcasses) (Hughes, 2002). Rhodes et al. (2008) argued this trend is due to more cattle being graded than previously. For example, in the past, if a carcass was unlikely to grade Choice or better, it was not graded at all (“no-rolled”) with the thought that consumers might see this beef as “failed Choice” (Hahn and Mathews, 2007). But, currently, plants are grading a higher percentage of total carcasses. Over 90% of all graded beef was Choice in the late 1980s, while about 57% of graded beef was Choice in 2001 (with 39% receiving a Select grade) (Lusk and Norwood, 2003). The Choice-grade price spread has been regularly published since 1942 (Mathews et al., 1999).

Ward et al. (2008) found significant price premiums for USDA Choice and Prime roasts and steaks compared with those with no grade designations. Their research found prices for USDA Choice roasts and steaks were \$0.70 higher, and USDA Prime roasts and steaks were \$1.37 higher than ungraded products. These results were similar to Killinger et al. (2004), who found that only consumers in Chicago were willing to pay more for highly marbled steaks (\$0.24 per 0.45 kg) compared to consumers in San Francisco who were not. Killinger et al. (2004)

found that consumers rated high-marbled steaks significantly higher in flavor, juiciness, and overall acceptability, even when tenderness values were the same. Dransfield et al. (1998) concluded that a third of consumers preferred higher priced steaks, even with no knowledge of eating quality, with the higher price insinuating high quality. Even though price has a positive effect on perception of quality, it has a negative effect on perceived value and willingness to buy for American consumers (Dodds et al., 2000). In a study of Danish consumers, price was not a significant marker of quality (Bredahl, 2003). It was concluded that this is likely due to market differences—i.e., Denmark is highly price competitive, consumers are used to high quality product being discounted (Bredahl, 2003), while consumers in other countries might not have this expectation. A study of consumers in the United Kingdom, Germany, Ireland, Spain, and Italy had similar findings—price was not a helpful indicator of quality (Glitsch, 2000). Lyford et al. (2010) found that consumers in Australia, the US, Japan, and Ireland were all willing to pay more for higher quality beef, although the study was based on beef graded through Meat Standards Australia rather than the USDA. Overall demographic factors and meat consumption patterns did not affect willingness to pay for beef quality, although consumers tended to be willing to pay a lower premium for meat quality as they got older (Lyford et al., 2010).

Beef demand is heterogeneous; different consumers have different beef preferences. For example, not all consumers like higher marbling content. Killinger et al. (2004) found that in Chicago, while 25.6% of consumers liked highly marbled samples and were willing to pay \$1.13/0.45 kg more, 7.7% actually preferred the low-marbled samples and were willing to pay \$1.40/0.45 kg more in those cases, as well. A similar trend was observed in San Francisco (\$1.47/0.45 kg for those who prefer high-marbling, \$1.94/0.45 kg for those who prefer low-marbling). Some consumers prefer Choice beef, associating it with positive sensory

characteristics, while some consumers prefer lower grades because of health concerns (Cox et al., 1990). Using a survey of 635 consumers, Lusk and Fox (2000) found that slight marbling (Select grade) was the most preferred marbling level. This directly contradicted USDA grading predictions and indicated that consumers do not understand the connection between taste and intramuscular fat content, a finding confirmed by Bredahl (2003). Unnevehr and Bard (1993) found that buyers significantly discounted external and seam fat but did not consistently place value on intramuscular fat. Sensory characteristics such as tenderness, juiciness, and overall acceptability can be influenced by the amount of marbling (Feuz et al., 2004). Killinger et al. (2004) also observed that if consumers were not familiar with the taste of US Choice beef, they found low marbling more acceptable.

#### *Branded beef programs*

Branded beef programs help to distinguish products and add value to commodity products. They also allow customers to select products with which they have had good experiences in the past. After successful branding, consumers may become less sensitive to changes in the price of beef at retail (Purcell and Lusk, 2003). The USDA's Agricultural Marketing Service administers branded beef programs, although the standards and trademark are owned and controlled by the private company that formulates the product (Ferrier and Lamb, 2007). Branded programs exist for Prime through Utility/Commercial graded beef products (USDA-AMS, 2010). As of February 2010 USDA-AMS had 30 branded beef programs (USDA-AMS, 2010).

Martinez et al. (2007) described three types of branded beef programs including (1) breed specific programs which only select beef from a specified breed such as Certified Angus Beef (CAB); (2) company specific programs, which select beef from all breeds but focus on another

criteria such as antibiotic-free or grass-fed, i.e., Laura's Lean Beef; and (3) store brands which are branded by a grocery store company. Branded meat products are how some grocery stores, such as Food Lion, differentiate themselves from competitors (Martinez, 2007). Branded beef programs do have a significant effect on elasticity, increasing demand for beef and for meat as a whole (Brester and Schroeder, 1995).

Often, grocery store brand-label beef is ungraded and would be graded Select or less (Cox et al., 1990). Ward et al. (2008) found that branded products were priced at a significant premium to generic or unbranded roasts and steaks in 66 grocery stores in Oklahoma City, Tulsa, and Denver. Some consumers find the branding itself to be an indication of quality, which might influence the need for increased price (Dodds et al., 2000; Bredahl, 2003). Consumers are sensitive to price changes for brands, often finding similar beef brands easy to substitute (Zimmerman and Schroeder, 2011).

## **Markets**

### *Overview*

Although the US exported beef to 118 countries in 2007, five countries (Canada, Mexico, South Korea, Taiwan, and Japan) represented 86% of the export quantity and 84% of the export value of US beef (Jones and Shane, 2009). The value of American beef in comparison to domestic beef differs dramatically among countries. In Japan and Korea, U.S. beef products are valued lower than domestic beef (Chung et al., 2009; Aizaki et al., 2006).

### *Asia and ASEAN*

Asian countries are important markets for US beef. Japan and Korea are considered high-end markets for the US and import mostly Choice and Prime grade beef. Japan, Korea, Hong Kong, China, and Taiwan closed to US beef immediately after discovery of the BSE cow

in December 2003. Trade with Japan did not resume until the Japanese Food Safety Committee reported to the Japanese government that US beef had minimal risk if processors followed set procedures, and trade resumed in December 2005 for cattle that are under 20 months of age (Obara et al., 2010). Trade with Japan stopped again in January 2006 with the discovery of a bone chip in a shipment of veal and did not resume again until July 2006. Hong Kong and Taiwan resumed trade in January 2006, although they currently only accept boneless product from animals less than thirty months of age.

The Association of Southeast Asian Nations (ASEAN) is comprised of 10 Southeast Asian countries including Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. It is an important market for US beef, representing about 7% of all beef exported in 2010 (USMEF, 2011). The leading markets in ASEAN are Vietnam, the Philippines, and Indonesia (USMEF, 2011). In 2003, most of ASEAN closed their borders to US beef product. Malaysia, Singapore, and Thailand lifted their bans on imports of US beef under 30 months of age in January 2006, and the Philippines and Indonesia have since lifted their bans on all US beef and beef products (USMEF, 2008a). The ASEAN is a particularly important market of halal for the Muslim beef market (USMEF, 2008a).

Japan and Korea are considered to be indicators of dietary change in developing Asian countries (Pingali, 2006). As incomes rise, meat consumption also tends to rise, while grain consumption falls (Pingali, 2006). For example, in China, where per capita red meat consumption is 40% higher in urban areas than in rural areas, grain consumption is only one-third the amount (Hsu et al., 2002).

Japan— Japan has high disposable income and low domestic agricultural production, making it an attractive market for high quality beef exports. Japan also is a net importer of food products,

importing approximately 60% of all food calories consumed, with the remaining 40% consisting primarily of rice (Clemens, 2007), and is the world's second leading food importer by value, behind the United States (Obara et al., 2010). Japan imports the vast majority of their beef from the US, Canada, New Zealand, and Australia (Miljkovic and Zhuang, 2007). Historically, the Japanese diet was mainly comprised of soybean products, rice, vegetables, and fish, but food preferences have changed in the last few decades. Japanese rice consumption has decreased by almost half since its peak in 1962, while meat and poultry consumption has risen with a concurrent decrease in fish and shellfish consumption (Chern et al., 2003) Despite these fluctuations, Japan still has a lower amount of meat consumption than other countries such as the those in the European Union, Canada, Brazil, China, or Mexico (Obara et al., 2010). Increased per capita income is believed to be a major factor in the accelerated meat consumption in Japan (Chern et al., 2003) as beef is eaten both at home and away from home (Obara et al., 2010). Beef is an inelastic (0.80, Sasaki, 1995; -0.485, Tonsor and Marsh, 2007) product in Japan (Sasaki, 1995), although it became own-price elastic during the BSE crisis (Yeboah and Maynard, 2004). Pork (1.29), poultry (1.42), and other meat products (2.10) are elastic (Sasaki, 1995). This would indicate that beef is less responsive to changes in price than other meat products, although the declining availability of beef has resulted in Japanese consumers substituting pork and poultry (Obara et al., 2010).

Japan saw a fall in beef demand after BSE was discovered in the Chiba prefecture in September 2001, and a rise in the demand for fish, chicken, and pork, which are all seen as substitutes for beef (Ishida et al., 2006; Peterson and Chen, 2005). Within two months, Japanese beef consumption fell 70% (Saghaian et al., 2005), and although demand recovered some, it is likely that some of the BSE impact is permanent (Ishida et al., 2010).

Fears about BSE have resurfaced during other food safety scares in Japan, such as Bird Flu. During the latest Bird Flu outbreak, beef demand fell, while pork and fish demand rose (Ishida et al., 2006). Schroeder et al. (2007) surveyed 1,001 Japanese consumers about the safety of beef. When asked about beef consumption, 55% of Japanese surveyed said they had reduced their beef consumption. About a quarter of those had virtually eliminated beef from their diet. More than 50% of Japanese surveyed rated BSE as “high” or “very high” risk. The majority (63%) of Japanese surveyed were risk adverse, disagreeing with the question “eating beef is worth the risk.” Peterson and Chen (2005) found that US beef was more price inelastic than domestic beef (both Wagyu and dairy) and Australian beef, suggesting that US beef was more of a staple item to the Japanese consumer.

Korea— Korea is a densely populated country with a high GNP and almost no feed grain production. Korea relies on imports to meet most beef demand. Between 1996 and 2003, Korea’s self-sufficiency decreased from 53.6% to 36.3% as meat imports doubled (Park et al., 2008). Imported beef is considerably cheaper than domestic beef in Korea, even after accounting for tariffs (Chung et al., 2009). Prior to 2003, the US was the largest supplier of beef to Korea, supplying 69% of beef (Umberger and Calkins, 2008; Jurenas and Mayin, 2011), making Korea the third largest market for US beef (Jurenas and Mayin, 2011). As of 2010, the level of beef exports to Korea was only two-thirds of what it had been in 2003 (Jurenas and Mayin, 2011).

Park et al. (2008) found that animal disease outbreaks overseas affect the Korean domestic meat market in two ways, both decreasing consumer confidence and disrupting supply. After Korea banned imports of US beef in 2003, beef consumption dropped 16% due to decreases in supply and demand, and continued to decrease through 2005 (Park et al., 2008). The BSE scare not only caused a decline in demand for US beef, but for beef as a whole (Umberger

and Calkins, 2008). Pork imports increased 185% from 2003 to 2005, which suggested that pork is a substitute for beef in Korea (Park et al., 2008).

Korea has never had a reported domestic BSE outbreak. Although Korea agreed to import boneless beef in 2006, importation was interrupted eight times in 2007 (Kim, 2009). On June 30<sup>th</sup>, 2007, Korea and the US signed a free trade agreement (KORUS) that will eventually eliminate tariffs on beef, which will go into effect on March 15<sup>th</sup>, 2012 (USTR, 2012). It is estimated that this agreement could increase the US share of South Korean beef imports from 0.21% in 2006 to 36% in 2016 (Fabiosa et al., 2008). Even so, some consumers still have a negative perception of US beef, and consider Australian beef to be more environmentally friendly, clean, and to have higher standards than US beef (Umberger and Calkins, 2008). Nevertheless, South Korean consumers seem to prefer American grain-fed beef to Australian grass-fed beef (Henneberry and Hwang, 2007). Umberger and Calkins (2008) found that the US has a comparative advantage to Korean beef in terms of tenderness and price. Chung et al. (2009) provided similar results, finding that in willingness-to-pay experiments, Korean customers valued domestic beef more than American beef (+\$14.63) and beef from other countries (+\$14.38). Older Koreans tended to value Korean beef more highly than younger Koreans, and homemakers also perceived Korean beef as having higher quality and safety than imported beef (Chung et al., 2009).

#### *Other major markets*

The Caribbean represented 2.4% of the US export market in 2010 (USMEF, 2011a). The Caribbean markets are strongly tied to tourism and buy both high and low value cuts (USMEF, 2008b).

Central and South America represented less than 1% of the export market in 2010 (USMEF, 2011a). However, on May 28, 2004, the US signed the Central America-Dominican Republic Free Trade Agreement (CAFTA). This agreement facilitated duty-free, quota-free trade among member nations. Value cuts and variety meats are popular in Central and South America, as well as higher value cuts for the hotel, restaurant, and institutional industry (USMEF, 2008c). The US-Columbia Trade Promotion Agreement was passed in October, 2011 which eliminated duties on beef (USTR, 2012). Although consumers in Central and South America see US beef as a very high quality item, they are very price sensitive (USMEF, 2008c).

### **Beef Export Verification**

Beef export verification (BEV) is a program administered by the USDA to help facilitate international trade. The program is voluntary but required if a company wants to export to BEV countries and applies to slaughterers, producers, fabricators, and processors (USDA-AMS, 2009). There are specific rules and regulations to follow for each country. To qualify for the BEV program, a company must have either an approved Quality Systems Verification program or a Process Verified Program in place (USDA-AMS, 2011). Only eligible suppliers who have met all the BEV requirements, passed a successful audit, and are included on the USDA-AMS list of suppliers may export to BEV countries. Only these eligible products are issued export certificates by the USDA-FSIS. The export certificate provides conformity assessment assurances that the product is fit for export, and includes the FSIS establishment number, the establishment name and location, the type of facility, the product name, the product code, and a description of the product (USDA-AMS, 2006).

### **Chapter 3: Materials and Methods**

In July of 2007, personnel from Colorado State University traveled to the USDA-AMS offices in Washington, DC for data collection. Data from both Export Verification and Export Certification documents were collected for beef exported between March 2006 and August 2007. Data was sanitized to protect the interests of private companies. The information included monthly data on destination (Barbados, Cayman Islands, Costa Rica, Dominican Republic, El Salvador, Guatemala, Egypt, Hong Kong, Japan, Korea, Lebanon, Malaysia, Panama, Peru, Philippines, Singapore, St. Kitts-Nevis, St. Lucia, Taiwan, Thailand, Ukraine, and Vietnam), USDA Quality Grade (Prime, Choice, Select, and No Roll), product description, shipment weight and whether the shipment was marketed as Certified Angus Beef. Only information from countries for which the Bovine Export Verification programs were required was included for analysis, excluding countries that do not require EV compliance. Information on each individual EV program is included in Appendix 1. .

This data was used to determine which countries imported the highest volumes of differing type/cuts of beef products. These data were then used to construct survey questions posed to industry officials. Four countries with a high volume of US beef imports (Japan, Hong Kong, Taiwan, and Mexico) were visited. Data collected in each country included product description, harvest date, pack date, cut type (boneless/bone-in), storage condition (chilled or frozen), USDA quality grade, box weight, number of packages in each box, the number of pieces in each package, Institutional Meat Purchasing Specifications (IMPS), and any deviations from the specification. Pictures also were taken for further elucidation of cuts with no IMPS. Data were collected at three importers in Tokyo, Japan during three days in February, 2008; four

importers in Nuevo Laredo and Columbia, Mexico during four days in March, 2008; five importers in Hong Kong were visited over three days in April, 2008; and three importers in Taipei, Taiwan over one day in April, 2008.

Each meat cut from the export verification data was assigned a value based on product description and grade. Prices of beef cuts, when available, were obtained from the LS form files on Choice, Select, Prime, Branded, and No Roll obtained from USDA-AMS Market News located in Des Moines, Iowa. This information was based on the month of export, for example if the collected data showed a ribeye exported in September, 2006 to a particular country, it was assigned the average price of ribeyes in September, 2006. Prices not available through the USDA, such as variety meat prices, were obtained either from a cooperating major beef packing company or the United States Meat Export Federation. Prices for Certified Angus Beef were obtained from Certified Angus Beef headquarters.

Occasionally, obtained product descriptions were incomplete. If trimmed product prices were not available, it was assumed to be 1.1 times the amount of the untrimmed product so that labor costs could be factored into the price, as suggested by USDA-AMS Livestock and Grain News. When more detail was not available, researchers made the following assumptions:

- Skirts were assumed the outside wing of the diaphragm and denuded, as it was determined through talks with USMEF to be the most common style of skirt exported.
- Briskets assumed to be boneless, as most countries in the sample were not importing bone-in beef at the time.
- Rib-eyes were assumed to be cut into 5.1 cm x 5.1 cm, light weight, and boneless. Most of the countries in the same were not importing bone-in beef at the time and talks with importers revealed a preference for light weight cuts.

- Striploins were assumed to be 2.5 cm x 2.5 cm, light weight, and boneless. Most of the countries in the same were not importing bone-in beef at the time and talks with importers revealed a preference for light weight cuts.
- All products were assumed to be light weight if more detail was not given and price was dependent on heavy/light. Talks with importers revealed a preference for light weight cuts.
- If fat thickness was not specified, products were priced at the higher trim level, as talks with foreign importers stated a preference for more highly trimmed product.
- Short ribs were priced as chuck short ribs if origin was not specified, as chuck short ribs were the most common variety of short ribs when importers were surveyed.

Products that would typically become trim were assigned trim prices according to their primal (ground round, ground chuck, etc.).

All products were given a dollar value which was multiplied by the volume of the product to determine the value of each product that was exported to each country. The amount of all beef exported to each country was then summed and divided by the value of all beef exported to arrive at a value of dollars per pound exported to each country.

The total pounds exported to each country were gathered from the Meat and Livestock Meat Trade Data gathered by the USDA-Economic Research Service. The calculated dollar amount was multiplied by total pounds exported to each country in 2010 to determine the total value of US beef exports to that country. Top exported products were verified through major packers and the United States Meat Export Federation to confirm that collected data was representative of current exports.

All beef (excluding variety meats) shipped to a particular country in a given month were separated into primals (brisket, chuck, flank, loin, plate, rib, round, or other) and quality grades (Prime, Choice, Select, and No grade) by both value and pounds exported. Those were then figured into percentages and reported.

## **Chapter 4: The Value of US Beef Exports Results and Discussion**

### **Introduction**

One of the biggest problems with estimating the value of US beef exports is the lack of detailed data. There are no product descriptions given when export volumes are reported; rather, they are described as “beef” or “beef variety meat.” There also is very little published literature on the specifics of beef export, such as the type of beef actually being exported to a particular country. When export value is calculated, an average price is typically set, and all exported weights are multiplied by that price to compute a total value. There are inherent problems with this estimation method. One problem is that it does not take into account the difference in value between cuts—for example, a striploin and chuck short ribs are of greatly different value. It also does not take grading into account. Some countries import a large amount of Prime, branded, and Choice product while other countries do not. Naturally, the overall export value for these distinct countries would be very different. This research generated a more accurate calculation of beef export value by taking into account product description, primal, and grade.

### **Export Verification Data Results**

#### **Asia**

*Chinese Taiwan and Hong Kong*—Beef exports to Chinese Taiwan were valued at about \$200 million, which is slightly lower than the USMEF estimate of \$216 million (USMEF, 2011a), while US beef exports to Chinese Hong Kong were estimated at \$636 million dollars, substantially different than the USMEF estimate of \$159 million (Table 1). This difference is likely due to the beef products being valued individually and the much higher average price per kg of beef exported to Hong Kong (\$2.17/kg) when compared to Taiwan (\$0.74/kg). Hong Kong

mainly imports high priced loin and rib cuts (Table 3). This is not a surprise, as China is widely considered a quickly expanding market as urbanization and a shift from a carbohydrate-rich diet to a higher protein diet drives the demand for beef up (Huang et al., 1999; Pingali et al., 2006). Neither Hong Kong or Taiwan imported any US beef variety meats during the time studied (Table 4).

Both Taiwan and Hong Kong imported similar percentages of various primals—43.61% and 46.85% chuck, 20.96% and 22.44% rib, and 15.62% and 14.5% plate, differing mainly in the amount of round (14.68% and 0.08%) and loin (1.52% and 18.9%) imported (Table 5). Even though the loin was only 18.9% of beef imported in Hong Kong, it represented 45.06% of the beef export value (Table 6). These results were to be expected, as Chinese consumers tend to favor cuts that are less desirable in the US, such as round and plate cuts (Wang et al., 1998). Both Hong Kong and Taiwan imported about 50% Choice product, although Hong Kong imported a greater percentage of Prime beef (25.03% rather than 10.46%) (Table 6\7). In Hong Kong, the Prime beef represented the highest percentage by value, while in Taiwan Choice beef was the highest value (Table 8). Both the high volumes of loin and rib cuts exported, as well as the Prime products, were likely driven by the hotel and restaurant industry. The majority of beef exported to Taiwan (79.46%), Hong Kong (64.79%) was frozen rather than chilled (Table 9).

*Japan*—Japan has a high disposable income and low domestic agricultural production, making it an attractive market for high quality beef exports. Japan also is a net importer of food products, importing approximately 60% of all food calories consumed, with the remaining 40% consisting primarily of rice (Clemens, 2007). Japan is currently the world’s second leading food importer by value, behind the United States (Obara et al., 2010). Japan imports the vast majority of their beef from the US, Canada, New Zealand, and Australia (Miljkovic and Zhuang, 2007).

Historically, the Japanese diet was mainly comprised of soybean products, rice, vegetables, and fish, but food preferences have changed. Rice consumption has almost halved from its peak in 1962, and meat and poultry consumption has risen with a concurrent decrease in fish and shellfish consumption (Chern et al., 2003). Despite this, Japan still consumes less meat than other countries such as the European Union, Canada, Brazil, China, or Mexico (Obara et al., 2010). Increased per capita income is believed to be a major factor in the accelerated meat consumption in Japan (Chern et al., 2003) as beef is eaten both at home and away from home (Obara et al., 2010). As Japan has one of the highest per capita incomes in Asia, it often is seen as an indicator of what may happen in other Asian countries as their per capita income increases. US beef exports to Japan were valued at approximately \$488 million, which is lower than the USMEF estimate of \$639 million dollars (Table 1). This relatively low average price was mainly due to the high volume of chuck (36.49%) and plate (44%) imports (Table 5), items of low demand in the US that are of high demand in Japan (Obara et al., 2010), which lead to a low average beef price of \$0.63/kg for beef meat and \$1.32/kg for beef variety meats (Table 2). The high price of beef variety meats exported to Japan is mainly driven by a high volume of tongue and hanging tender products being exported, which command a relatively high price (Table 4). The three main beef products exported were plates, navels, and chuckeye rolls (Table 3).

In accordance with previous reports (Miljkovic et al., 2002; Obara et al., 2010), we found the majority of beef exported to Japan was derived from Choice carcasses (51.77%), although about a third of the beef was from ungraded carcasses (35.54%) (Table 7). About half of the meat exported was frozen while about half was chilled (Table 9).

*South Korea*—South Korea is a densely populated country with a high GNP and almost no feed grain production. South Korea relies extensively on imports to meet beef demand. Between

1996 and 2003, South Korea's self-sufficiency decreased from 53.6% to 36.3% as meat imports doubled (Park et al., 2008). Imported beef is considerably cheaper than domestic beef in South Korea, even after accounting for tariffs (Chung et al., 2009). Prior to 2003, the US was the largest supplier of beef to South Korea, supplying 69% (Umberger and Calkins, 2008, Jurenas and Mayin, 2011) and South Korea was the third largest market for US beef (Jurenas and Mayin, 2011). As of 2010, the level of beef exports to South Korea was only at two-thirds the level it was in 2003 (Jurenas and Mayin, 2011). The South Korean beef market is expected to continue to grow in the future (Henneberry and Hwang, 2007).

South Korea imports were valued at about \$523 million, which was similar to the USMEF estimate of \$518 million (Table 1). The average price of beef exported to South Korea was \$0.86/kg (Table 2). The highest volume of beef exported was chuck short ribs and brisket (Table 3). This value was comparatively low because a large proportion of beef exported to South Korea was relatively low-priced chuck (60.3%), brisket (13.58%), and plate (6.04%) rather than comparatively higher value loin cuts (Table 5). This agrees with Henneberry and Hwang (2007) who estimated that 88% of US exports to South Korea were from the rib and chuck. The majority of beef exported to South Korea in both volume (86.18%) and value (84.3%) was graded Choice, which agreed with reports suggesting South Korean consumers consider marbling a very important characteristic (Umberger and Calkins, 2008) and are willing to pay more for more marbling (Chung et al., 2009).

Although South Korea agreed to import boneless beef in 2006, importation was stopped eight times in 2007 (Kim, 2009). On June 30<sup>th</sup>, 2007, Korea and the US signed a free trade agreement (KORUS) that will eventually eliminate tariffs on beef, which will go into effect on March 15<sup>th</sup>, 2012 (USTR, 2012). Even so, some consumers still have a negative image of US

beef and consider Australian beef to be more environmentally friendly, clean, and to have higher standards than US beef (Umberger and Calkins, 2008). Nevertheless, South Korean consumers seem to prefer American grain-fed beef to Australian grass-fed beef (Henneberry and Hwang, 2007).

## **ASEAN**

The Association of Southeast Asian Nations (ASEAN) is comprised of 10 Southeast Asian countries including Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. It is an important market for US beef, representing about 7% of beef exported in 2010 (USMEF, 2011a). The leading beef markets in ASEAN are Vietnam, the Philippines, and Indonesia (USMEF, 2011a). In 2003, most of ASEAN closed their borders to US product. Malaysia, Singapore, and Thailand lifted their bans on imports of US beef under 30 months of age in January 2006, and the Philippines and Indonesia lifted their bans on all US beef and beef products (USMEF, 2008a). The ASEAN is a particularly important market of halal beef for the Muslim market (USMEF, 2008a).

The ASEAN countries range in the total value of beef exports, with Vietnam being a real standout at approximately \$201 million, along with having the highest volume of US beef exports outside of the Far East (Table 1). This data fit with the idea that Vietnam is an up-and-coming export destination, with a growing demand among the Vietnamese (USMEF, 2009). Singapore imports mostly Choice beef (61.41%) and beef from the chuck (59.12%), rib (18%), and loin (22.09%) (Table 5), which lead to a high average price of \$2.23/kg (Table 2). This was to be expected as Singapore is one of the wealthiest markets in Asia, is a key location for expatriate families, and imports almost all of its food and drink (Stanton, 2011). Thailand also

had a high average price at \$3.23/kg, which was likely due to the large amounts of loin and rib cuts imported (Table 3). Vietnam (81.97%) and Singapore (50.98%) primarily imported frozen beef, while Malaysia (100%) and Thailand (82.89%) primarily imported chilled product (Table 9).

Japan and Korea are considered indicators of dietary change in developing Asian countries such as Malaysia and Thailand (Pingali, 2006). As incomes rise, meat consumption also tends to rise, while grain consumption falls (Pingali, 2006). For example, in China, per capita red meat consumption is 40% higher in urban areas than in the rural provinces, while grain consumption is only one-third the amount (Hsu et al., 2002). The popularity of chuck short ribs in Vietnam and other ASEAN countries could be attributed to this (Table 3).

## **The Caribbean**

The Caribbean represented 2.4% of the US export market in 2010 (USMEF, 2011). The Caribbean markets are strongly tied to tourism and buy both high-value cuts and lower value cuts (USMEF, 2008b). Most of the Caribbean countries do not produce their own beef and import most of their meat from the United States and Australia (Collie, 1999)

Most of the Caribbean countries were worth less than \$7 million in US beef exports, with the Dominican Republic standing out with a export value of \$63 million (Table 1). The high value of the Dominican Republic is likely due to the high average beef value of \$2.52/kg (Table 2), which is due almost entirely to outside skirts (Table 3).

The market in Barbados, the Cayman Islands, St. Lucia, and St. Kitts-Nevis was varied, importing about half ungraded beef and half Choice (Table 7) as opposed to the Dominican Republic where the majority of beef was from the plate (91.87%) and ungraded (96.67%)

(Tables 5 and 7). The majority of beef exported to Barbados, St. Kitts-Nevis, and St. Lucia was loin meat (47.99%, 41.10%, and 57.55%, respectively), while the majority of beef exported to the Cayman Islands was from the round. The majority of beef exported from the US to the Caribbean is relatively expensive and caters primarily to middle and higher end retailers and the tourist sector, with loin cuts being the most popular (Collie, 1999), which agrees with the collected data. The Caribbean also imported a sizeable percentage of ground beef (17.29% to St. Kitts-Nevis and 31.34% to St. Lucia). The vast majority of beef exported to St. Kitts-Nevis (100%), St. Lucia (100%), the Dominican Republic (100%), and Barbados (82.19%) was chilled, which makes sense as these countries are relatively close to the United States and would not require nearly as much transport time as other countries (Table 9).

### **Central and South America**

Central and South America represented less than 1% of the export market in 2010 (USMEF, 2011). On May 28, 2004, the US signed the Central America-Dominican Republic Free Trade Agreement (CAFTA), which was followed by the US-Columbia Trade Promotion Agreement was passed in October, 2011 which eliminated duties on beef (USTR, 2012). . This agreement facilitated duty-free, quota-free trade among member nations. Value cuts and variety meats are popular in Central and South America, as well as higher value cuts for the hotel, restaurant, and institutional industry (USMEF, 2008c). Although consumers in Central and South America see US beef as a very high quality item, they are very price sensitive (USMEF, 2008c).

The Central American countries ranged in primals and grades imported. Over half the meat exported to Guatemala and El Salvador was from the plate (53.73% and 78.74%,

respectively), while Costa Rica imported a majority of loin (50.89%) and rib (24.75%) cuts, as did Panama (Table 5). Guatemala (100%) and El Salvador (80.45%) imported mostly Choice grade beef, while Costa Rica and Panama were split between Choice and ungraded beef (approximately 1/4 Choice imports for Costa Rica and 1/3 choice for Panama) (Table 7). Panama (100%) exported a majority chilled beef while Guatemala exclusively frozen beef (100%) (Table 9).

The only South American country included was Peru. Peru had a high average beef price of \$2.27/kg (Table 2), although only about 19% of the US beef imported was beef meat rather than variety meat. The vast majority of imported beef was Choice (96.97%) (Table 5) and was split between rib (38.75%), loin (17.69%), plate (14.92%), and chuck (28.64%) primals (Table 7). A majority of the beef imported was chilled (81.68%) (Table 9).

### **The Middle East**

Lebanon and Egypt were the only two Middle Eastern countries included in the data set. Lebanon was worth over \$18 million dollars and Egypt was worth over \$7 million dollars (Table 1). Egypt almost exclusively imported US variety meats, primarily livers (Table 4). Lebanon had one of the highest average prices (\$3.68/kg), which was due to the large amount of tenderloins and ribeyes imported (Table 3). Lebanon imports about 2/3 Choice beef and 1/3 ungraded beef (Table 7), with slightly over half of the exported beef being rib and the rest loin (Table 5).

### **Importer visit survey results**

Table 10 includes all information from the importer survey visits.

## **Mexico**

Seventy individual beef cut products from seven companies were surveyed in Mexico. Most of the products (83%) were not part of a branded program, were chilled rather than frozen (80%), and boneless (97.1%). Fourteen percent of the products were variety meats, including tongues, trip, hears, and oxlips. Eighteen beef products were not graded while 27 were either Select or Select or higher, and 25 were Choice or higher. Most items were from the chuck (21.4%) or round (35.7%), while variety meats represented 14.3% of the products by number of items evaluated. Eleven products were not represented in the IMPS. Seven of the products were variety meats that did not have IMPS numbers, such as lips, hearts, and cheek meat. Other novel products included trip with the honeycomb attached, trimmings, and tongue trimmings (the difference between a full tongue and a trimmed tongue). Other products without IMPS numbers included rosemeat from the plate, back ribs with the rib fingers removed, and a bone-in neck-off chuck roll, which had the neck removed but included the ribs.

## **Taiwan**

Thirty-seven individual beef cut products from seven companies were assessed in Taiwan. All products were boneless and most were chilled (78.4%). Approximately a quarter (27%) of the products were in branded programs. Most products were graded and 18.9% were Prime, 64.9% were Choice or higher and 2.7% were Select or higher; 13.5% were “not graded”. The ungraded products were rib fingers and heel muscle.

About half of the products were represented by IMPS (56.8%). Sixteen products did not have IMPS numbers. Five of the products without IMPS were plate-eyes, five were triangle-cut chuck short ribs, and two were heel muscles. Two items were mislabeled—chuck roll was labeled as a chuckeye roll and an edge roast was labeled as chuck short ribs. The other two items

included a split ribeye (an IMPS 112A cut in half) and a lip-on ribeye that was not cut at the 12/13 rib interface.

## **Japan**

In Japan, 74 individual beef cut products were assessed from eight companies. All products were boneless, most were chilled (92.1%), and only about a fifth were branded products (17.6%). The majority of items were cut to IMPS (79.8%). The fifteen items that did not have specifications included short ribs with an attached chuck flap (3), plate-eyes (3), and triangle-cut chuck short ribs (3). Another four of the products were chuck rolls that were labeled incorrectly as chuckeye rolls. The other products included a shoulder clod without the Teres major and an IMPS 180 striploin cut in half.

## **Hong Kong**

Eight companies and 30 individual beef products were evaluated in Hong Kong. Nearly one-half (46.7%) of the cuts were frozen, rather than chilled, and all but two products were boneless. Almost all of the products were either Prime (46.7%) or Choice or higher (46.7%). The remaining two ungraded products were bone-in short ribs and rib fingers. Most of the products (53.3%) were in branded programs. The majority were from the loin (40%), rib (26.6%), or chuck (26.6%), with the remaining items being from the round or navel. Seventy percent of the products had IMPS numbers. The remaining items included triangle-cut chuck short ribs (4), two chuckeye rolls that were actually chuck rolls, and a ribeye that had rib fingers attached. The other two novel items were a piece of navel that was labeled as “beef for super pastrami” and a set of bone-in short ribs, full cut, that had extra meat on them beyond IMPS 123.

## **Conclusion**

Export research is typically only focused on the largest markets such as Japan, Mexico, and Canada. This research gave insight into those countries but also into smaller markets such as those in Central America and the Caribbean. This research also provides a more accurate measure of value because it takes individual cut, primal, and grade into account when calculating the total value of exports. Variety meats are also rarely included in value estimates even though they represent a very large amount of exported beef. Exports are worth an extremely large amount of money to the beef cattle industry and the US economy as a whole. This research provided a more accurate estimate of beef export value because it took grade, primal, and individual cut into account instead of just using an overall average.

Table 1: The value of beef and beef variety meat exports to selected countries

Country	Beef volume exported from the US in 2010 (metric tons)	Beef projected value in 2010 (\$1000)	Beef variety meat projected value in 2010 (\$1000)	Total value of exports (\$1000)
Barbados	903.99	4,199.07	41.82	4,240.89
Cayman Islands	1,568.17	5,922.10	172.50	6,094.60
Costa Rica	756.18	784.75	2,917.64	3,702.39
Dominican Republic	5,170.06	63,025.81	0.00	63,025.81
El Salvador	231.76	1,951.52	0.00	1,951.52
Guatemala	2,073.17	18,660.96	0.00	18,660.96
Egypt	39,212.17	31.84	7,312.34	7,344.18
Hong Kong	60,632.64	636,464.34	0.00	636,464.34
Japan	159,541.14	451,414.98	36,550.87	487,965.85
Lebanon	1,045.23	18,627.27	0.00	18,627.27
Malaysia	136.33	1,243.97	0.00	1,243.97
Panama	920.00	6,080.10	0.00	6,080.10
Peru	905.80	1,878.15	110.19	1,988.34
Philippines	6,649.01	42,148.51	5,042.61	47,191.12
Singapore	3,300.58	35,575.87	0.00	35,575.87
South Korea	125,956.00	523,264.79	0.00	523,264.79
St. Kitts-Nevis	121.42	1,198.93	0.00	1,198.93
St. Lucia	606.25	4,494.28	0.00	4,494.28
Taiwan	55,841.31	199,970.74	0.00	199,970.74
Thailand	269.93	4,218.17	0.00	4,218.17
Ukraine	650.62	0.00	130.12	130.12
Vietnam	51,931.67	177,865.66	23,088.82	200,954.48
Grand Total				2,274,388.72

<sup>1</sup>Average value in US dollars of beef exported to the specified country

<sup>2</sup>Average value in US dollars of beef variety meat exported to the specified country

Table 2: The Average Price per Kilogram of Beef and Beef Variety Meat Exported from the United States to Selected Countries

Country	Beef			Beef Variety Meat		
	Average price per (\$/kg)	Standard deviation (\$/kg)	Percentage of total volume	Average price per pound (\$/kg)	Standard deviation (\$/kg)	Percentage of total volume
Barbados	1.97	1.48	48.6%	0.04	*	51.4%
Cayman Islands	0.86	0.40	91.2%	0.57	1.56	8.8%
Costa Rica	2.38	1.28	9.0%	1.93	1.73	91.0%
Dominican Republic	2.52	*	100.0%	0.51	*	0.0%
El Salvador	1.74	0.17	100.0%	0.00	0.00	0.0%
Guatemala	1.86	*	100.0%	0.00	0.00	0.0%
Egypt	3.69	3.35	0.01% <sup>1</sup>	0.09	0.01	100.0%
Hong Kong	2.17	1.18	100.0%	0.00	0.00	0.0%
Japan	0.63	0.09	92.1%	1.32	1.15	7.9%
Lebanon	3.68	2.21	100.0%	0.00	0.00	0.0%
Malaysia	1.89	0.22	100.0%	0.00	0.00	0.0%
Panama	1.37	0.81	100.0%	0.00	0.00	0.0%
Peru	2.27	1.25	18.9%	0.07	*	81.1%
Philippines	1.91	0.91	68.4%	1.09	1.25	31.6%
Singapore	2.23	1.46	100.0%	0.00	0.00	0.0%
South Korea	0.86	0.13	100.0%	0.00	0.00	0.0%
St. Kitts-Nevis	2.04	0.94	100.0%	0.00	0.00	0.0%
St. Lucia	1.53	0.79	100.0%	0.00	0.00	0.0%
Taiwan	0.74	0.36	100.0%	0.00	0.00	0.0%
Thailand	3.23	0.48	100.0%	0.00	0.00	0.0%
Ukraine	0.00	0.00	0.0%	0.09	1.91	100.0%
Vietnam	0.88	0.52	80.5%	1.04	2.01	19.5%

<sup>1</sup>Value was less than 0.01% of the total

\*Only one data point so standard deviation could not be calculated

Table 3: The percent of beef cuts sent to selected countries

Destination	Primal	Product description	Percentage of total
Barbados	brisket	NAMP 120: brisket bnls <sup>1</sup>	8.52
	chuck	NAMP 114: clod	13.40
	chuck	NAMP 114D: top blade	2.48
	ground	Ground beef	1.87
	loin	NAMP 180: striploin	11.44
	loin	NAMP 184: top sirloin butt	7.01
	loin	NAMP 184: top sirloin butt heavy	7.07
	loin	NAMP 189A: tenderloin peeled	1.12
	loin	NAMP 189A: tenderloin peeled heavy	30.91
	round	NAMP 171C: eye of round	16.17
Cayman Islands	brisket	NAMP 120A: brisket flat	0.29
	chuck	NAMP 113C: chuck, neck off, semi bnls	0.94
	chuck	NAMP 114D: top blade	0.65
	chuck	NAMP 115: chuck 2 piece bnls	0.47
	chuck	NAMP 116A: chuck roll	1.84
	chuck	NAMP 116B: chuck tender	4.06
	chuck	NAMP 130: short rib bone-in	3.26
	flank	NAMP 193: flank steak	1.05
	loin	NAMP 174: shortloin 0x1	1.25
	loin	NAMP 180: striploin	0.18
	loin	NAMP 180: striploin 0x1	2.67
	loin	NAMP 184: top sirloin butt	1.21
	loin	NAMP 184: top sirloin butt heavy	0.77
	loin	NAMP 185B: ball tip heavy	1.61
	loin	NAMP 189A: tenderloin peeled	0.28
	loin	NAMP 189A: tenderloin peeled heavy	1.96
	rib	NAMP 109E: ribeye bone-in	0.44
	rib	NAMP 112A: ribeye	0.27
	rib	NAMP 112A: ribeye lip on heavy	1.84
	rib	NAMP 112D: rib cap	2.50
	rib	NAMP 124: back rib fresh	1.51
	round	NAMP 161: round shank off bnls	1.85
	round	NAMP 167A: knuckle peeled	2.89
	round	NAMP 169: inside round	2.80
	round	NAMP 169: inside round 1/4 trim	13.98

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Cayman Islands (con't)	round	NAMP 169: inside round defatted	2.09
	round	NAMP 171B: outside round	34.70
	round	NAMP 171C: eye of round	7.85
	round	Shanks bone-in	4.81
Costa Rica	chuck	Chuck short rib bnls <sup>2</sup>	1.84
	chuck	NAMP 116D: chuckeye roll	0.65
	flank	NAMP 193: flank steak	2.44
	loin	NAMP 180: striploin	0.65
	loin	NAMP 180: striploin 0x1	0.25
	loin	NAMP 180: striploin 0x1 light	7.58
	loin	NAMP 180: striploin 1x1 heavy	0.31
	loin	NAMP 184: top sirloin butt	3.03
	loin	NAMP 184: top sirloin butt heavy	9.15
	loin	NAMP 185C: tri tip untrimmed	9.38
	loin	NAMP 189A: tenderloin peeled heavy	20.56
	plate	NAMP 121C: outside skirt	17.52
	rib	NAMP 112A: ribeye	1.04
	rib	NAMP 112A: ribeye lip on	14.27
	rib	NAMP 112A: ribeye lip on heavy	9.44
	round	NAMP 161: round peeled bnls	0.93
round	NAMP 167A: knuckle peeled	0.98	
Dominican Republic	loin	NAMP 180: striploin	3.33
	loin	NAMP 189A: tenderloin peeled	4.80
	plate	NAMP 121C: outside skirt	91.87
Egypt	loin	NAMP 180: striploin 1x0	33.33
	loin	NAMP 189A: tenderloin peeled heavy	66.67
El Salvador	loin	NAMP 180: striploin	3.42
	loin	NAMP 184: top sirloin butt	8.73
	loin	NAMP 184D: culotte	0.62
	plate	NAMP 121C: outside skirt	10.46
	plate	NAMP 121D: inside skirts	68.29
	rib	NAMP 112A: ribeye lip on bnls	8.48
Guatemala	loin	NAMP 184: top sirloin butt	9.58
	plate	NAMP 121C: outside skirt	53.73
	rib	NAMP 112A: ribeye lip on	20.21
	round	NAMP 171C: eye of round	16.48

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Hong Kong	brisket	NAMP 120: brisket bnls	0.18
	brisket	NAMP 120: brisket heavy	0.32
	chuck	Chuck short rib bnls	40.59
	chuck	NAMP 114D: top blade	0.09
	chuck	NAMP 114F: clod tender	0.21
	chuck	NAMP 116A: chuck roll	0.49
	chuck	NAMP 116A: chuck roll 0x1	0.31
	chuck	NAMP 116G: chuck flap	1.91
	flank	NAMP 193: flank steak	0.34
	loin	NAMP 180: strip 1 in 1/2 pack	0.09
	loin	NAMP 180: striploin	1.97
	loin	NAMP 180: striploin 0x1	0.18
	loin	NAMP 180: striploin 0x1 1/2 pack	0.24
	loin	NAMP 180: striploin 1x1	5.22
	loin	NAMP 180: striploin 1x1 1/2 pack	0.15
	loin	NAMP 180: striploin 1x1 heavy	4.78
	loin	NAMP 184D: top sirloin butt cap	0.17
	loin	NAMP 189A: tenderloin peeled	1.14
	loin	NAMP 189A: tenderloin peeled heavy	5.23
	plate	Short plate bnls	15.62
	rib	NAMP 112: ribeye lip on 1/2 pack	1.86
	rib	NAMP 112: ribeye lip on heavy 1/2 pack	0.06
	rib	NAMP 112: ribeye roll	0.01
	rib	NAMP 112A: ribeye 2x2	0.06
	rib	NAMP 112A: ribeye lip on	3.70
	rib	NAMP 112A: ribeye lip on 2 in 1/2 cut	0.13
	rib	NAMP 112A: ribeye lip on 2x2	8.57
	rib	NAMP 112A: ribeye lip on 2x2 heavy	1.20
	rib	NAMP 112A: ribeye lip on bnls	0.09
	rib	NAMP 112A: ribeye lip on heavy	1.97
	rib	NAMP 112A; ribeye lip on heavy 1/2 pack	0.03
	rib	Rib meat, unexplained	0.01
	rib	Rib short rib bnls	2.98
	round	NAMP 169A: inside round cap off	0.08
Japan	brisket	NAMP 120: brisket	0.24
	chuck	Chuck short rib bnls	8.16
	chuck	NAMP 114: clod	0.12
	chuck	NAMP 114A: clod center cut	0.00

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Japan (con't)	chuck	NAMP 114D: top blade	0.57
	chuck	NAMP 116A: chuck roll	0.59
	chuck	NAMP 116A: chuck roll 0x1	2.23
	chuck	NAMP 116A: chuck roll 0x2	1.35
	chuck	NAMP 116A: chuck roll 0x3	0.68
	chuck	NAMP 116A: chuck roll 0x4	0.35
	chuck	NAMP 116A: chuck roll 1x1	2.47
	chuck	NAMP 116B: chuck tender	0.00
	chuck	NAMP 116D: chuckeye roll	11.16
	chuck	NAMP 116D: chuckeye roll 0x1	2.40
	chuck	NAMP 116D: chuckeye roll 1x0	0.79
	chuck	NAMP 116D: chuckeye roll 1x1	1.13
	chuck	NAMP 116G: chuck flap	2.66
	chuck	NAMP 116G: chuck flap tail	0.03
	chuck	NAMP 130: short rib bone-in	1.99
	chuck	Rib meat, unexplained	0.12
	flank	NAMP 193: flank steak	0.01
	loin	Loin meat, unexplained	0.48
	loin	NAMP 176: loin tail	0.33
	loin	NAMP 176: loin tail cap on	1.30
	loin	NAMP 176: loin tail untrimmed	1.07
	loin	NAMP 180: striploin	0.03
	loin	NAMP 180: striploin 0x1	0.21
	loin	NAMP 180: striploin 0x1 1/2 pack	0.00
	loin	NAMP 180: striploin 1x1	0.00
	loin	NAMP 180: striploin steak ready	0.15
	loin	NAMP 180: striploin steak ready 0x1	0.02
	loin	NAMP 184: top sirloin butt	0.01
	loin	NAMP 185A: loin flap	0.22
	loin	NAMP 185D: tri tip peeled	0.07
	loin	NAMP 189A: tenderloin peeled	0.06
	loin	NAMP 189A: tenderloin peeled heavy	0.03
	plate	NAMP 121C: outside skirt	5.30
	plate	Navel, bnls	17.70
	plate	Plate eye <sup>3</sup>	2.10
	plate	Plate fingers <sup>4</sup>	0.27
Japan	plate	Plate, bnls	10.79
	plate	Short plate, bnls	7.81
	rib	NAMP 112: ribeye lip on 1/2 pack	0.00
	rib	NAMP 112A: ribeye 1x1	0.03

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Japan (con't)	rib	NAMP 112A: ribeye lip on	0.09	
	rib	NAMP 112A: ribeye lip on 2x2	0.06	
	rib	NAMP 112A: ribeye lip on bnls	0.06	
	rib	NAMP 112A: ribeye lip on heavy	0.03	
	rib	NAMP 112A: ribeye lip on slice ready	0.00	
	rib	NAMP 112D: rib cap	5.77	
	rib	NAMP 124A: rib fingers	2.33	
	rib	Rib meat, unexplained	2.87	
	rib	Rib short rib bnls	3.20	
	round	NAMP 167A: knuckle peeled	0.01	
	round	NAMP 169: inside round	0.17	
	round	NAMP 169A: inside round cap off	0.20	
	round	NAMP 170: gooseneck	0.14	
	round	NAMP 171B: outside round	0.01	
	round	Shank bnls	0.01	
	South Korea	brisket	NAMP 120: brisket bnls	1.89
		brisket	NAMP 120: brisket heavy	11.69
		chuck	Chuck short rib bnls	28.14
chuck		NAMP 114A: clod center cut	0.47	
chuck		NAMP 114D: top blade	7.57	
chuck		NAMP 116A: chuck roll	1.63	
chuck		NAMP 116A: chuck roll 0x1	5.74	
chuck		NAMP 116A: chuck roll 0x2	0.09	
chuck		NAMP 116A: chuck roll 0x3	0.47	
chuck		NAMP 116A: chuck roll 0x4	0.47	
chuck		NAMP 116A: chuck roll 0x5	0.17	
chuck		NAMP 116B: chuck tender	0.90	
chuck		NAMP 116D: chuckeye roll	0.27	
chuck		NAMP 116D: chuckeye roll 0x1	3.26	
chuck		NAMP 116D: chuckeye roll 1x1	8.44	
chuck		NAMP 116G: chuck flap	1.05	
chuck		NAMP 116G: chuck flap tail	2.12	
loin		NAMP 184: top sirloin butt	1.34	
loin		NAMP 185D: tri tip peeled	0.08	
loin		NAMP 189A: tenderloin peeled	0.34	
plate		Plate fingers	1.90	
plate		Plate short ribs, bnls	0.12	
plate		Short plate, bnls	4.02	
rib		NAMP 112A: ribeye lip on	1.68	
rib		NAMP 112A: ribeye lip on bnls	0.48	

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South Korea			
(con't)	rib	NAMP 112A: ribeye lip on heavy	1.01
	rib	NAMP 112A: ribeye lip on slice ready	2.76
	rib	NAMP 124A: rib fingers	5.83
	rib	Rib short rib bnls	6.05
Lebanon	loin	NAMP 1173: porterhouse steak	1.22
	loin	NAMP 1174: T-bone steak	1.43
	loin	NAMP 180: striploin	1.83
	loin	NAMP 180: striploin 1x1	7.35
	loin	NAMP 189A: tenderloin peeled	1.55
	loin	NAMP 189A: tenderloin peeled heavy	30.89
	rib	NAMP 112A: ribeye 2 in	15.14
	rib	NAMP 112A: ribeye lip on	16.14
	rib	NAMP 112A: ribeye lip on 2x2	24.46
Malaysia	chuck	Chuck short rib bnls	3.24
	loin	NAMP 180: striploin	29.08
	loin	NAMP 180: striploin 1x0	7.17
	loin	NAMP 189A: tenderloin peeled	4.95
	rib	NAMP 112A: ribeye	7.48
	rib	NAMP 112A: ribeye lip on	48.08
Panama	chuck	NAMP 116D: chuckeye roll	47.17
	loin	NAMP 180: striploin	23.93
	loin	NAMP 189A: tenderloin peeled heavy	11.50
	rib	NAMP 112A: ribeye lip on bnls	17.40
Peru	chuck	Chuck short rib bnls	59.08
	loin	NAMP 180: striploin 0x1	5.12
	loin	NAMP 185A: loin flap	4.49
	loin	NAMP 185D: tri tip peeled	0.97
	loin	NAMP 189A: tenderloin peeled heavy	1.08
	plate	NAMP 121C: outside skirt	10.11
	rib	NAMP 109E: ribeye bone-in, heavy	4.87
	rib	NAMP 112A: ribeye lip on	12.51
	rib	NAMP 112A: ribeye lip on heavy	1.76
Philippines	brisket	NAMP 120: brisket	0.49
	chuck	Chuck short rib bnls	4.27
	chuck	NAMP 114D: top blade	12.02

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Philippines			
(con't)	chuck	NAMP 116A: chuck roll	0.54
	chuck	NAMP 116B: chuck tender	0.02
	chuck	NAMP 116D: chuckeye roll	1.34
	chuck	NAMP 116G: chuck flap	0.01
	flank	NAMP 193: flank steak	0.27
	loin	NAMP 180: striploin	0.40
	loin	NAMP 180: striploin 0x1	4.09
	loin	NAMP 180: striploin 1x1	0.65
	loin	NAMP 180: striploin 1x1 heavy	1.80
	loin	NAMP 180: striploin 1x1 light	0.81
	loin	NAMP 185D: tri tip peeled	0.67
	loin	NAMP 189A: tenderloin peeled	2.63
	loin	NAMP 189A: tenderloin peeled heavy	2.73
	plate	Short plate	15.02
	rib	NAMP 112: ribeye roll	0.38
	rib	NAMP 112A: ribeye	0.64
	rib	NAMP 112A: ribeye lip on	21.37
	rib	NAMP 112A: ribeye lip on heavy	28.43
	rib	NAMP 124A: rib fingers	1.24
	rib	Rib short rib bnls	0.01
	round	NAMP: 171F: heel	0.18
Singapore			
	brisket	NAMP 120A: brisket flat	0.02
	chuck	Chuck short rib bnls	54.96
	chuck	NAMP 114D: top blade	0.25
	chuck	NAMP 116D: chuckeye roll 0x1	3.43
	chuck	NAMP 116G: chuck flap	0.48
	flank	NAMP 193: flank steak	0.02
	loin	NAMP 180: striploin	1.99
	loin	NAMP 180: striploin 0x1	3.04
	loin	NAMP 180: striploin 0x1 1/2 pack	2.88
	loin	NAMP 180: striploin 1x1	3.77
	loin	NAMP 180: striploin 1x1 heavy	0.39
	loin	NAMP 184B: top sirloin cap off	0.10
	loin	NAMP 184E: top butt center cut 2-piece	4.69
	loin	NAMP 185D: tri tip peeled	0.09
	loin	NAMP 189A: tenderloin peeled	0.23
	loin	NAMP 189A: tenderloin peeled heavy	4.33
	loin	NAMP 189A: tenderloin peeled light	0.57
	plate	Short plate	0.73

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Singapore (con't)	rib	NAMP 112: ribeye roll	2.47
	rib	NAMP 112: ribeye roll 1/2 pack	3.98
	rib	NAMP 112A: ribeye 2 in, heavy	2.13
	rib	NAMP 112A: ribeye lip on	2.27
	rib	NAMP 112A: ribeye lip on 2x2 heavy	0.60
	rib	NAMP 112A: ribeye lip on light	4.23
	rib	NAMP 112A: ribeye lip on, 1x1	0.10
	rib	Rib short rib bnls	2.22
	round	NAMP: 171F: heel	0.02
St. Kitts-Nevis	brisket	NAMP 120A: brisket flat	5.12
	ground	CAB chuck patty 6oz	17.29
	loin	NAMP 180: striploin	15.30
	loin	NAMP 180: striploin 1x0	6.78
	loin	NAMP 180: striploin 1x1	2.12
	loin	NAMP 180: striploin 1x1 heavy	5.50
	loin	NAMP 189A: tenderloin peeled	12.55
	loin	NAMP 189A: tenderloin peeled heavy	5.75
	rib	NAMP 112A: ribeye lip on	13.08
	rib	NAMP 112A: ribeye lip on heavy	7.68
	rib	NAMP 112A: ribeye lip on light	1.80
	round	NAMP 169: inside round	7.04
St. Lucia	brisket	NAMP 120: brisket	1.50
	ground	Ground beef	22.20
	ground	Ground chuck 81/19 fine	9.14
	loin	NAMP 174: shortloin 0x1	0.98
	loin	NAMP 180: striploin	20.27
	loin	NAMP 180: striploin 0x1	0.67
	loin	NAMP 180: striploin 1x1	10.70
	loin	NAMP 189A: tenderloin peeled	6.35
	loin	NAMP 189A: tenderloin peeled heavy	2.14
	rib	NAMP 112A: ribeye	7.46
	round	NAMP 160: steamship round	0.52
	round	NAMP 169: inside round	18.09
Taiwan	chuck	Chuck short rib bnls	20.03
	chuck	NAMP 114D: top blade	1.75
	chuck	NAMP 116A: chuck roll 0x1	0.21
	chuck	NAMP 116A: chuck roll 1 in	6.29
	chuck	NAMP 116A: chuck roll 1x1	0.45

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Taiwan (con't)	chuck	NAMP 116B: chuck tender	0.01
	chuck	NAMP 116D: chuckeye roll	1.65
	chuck	NAMP 116D: chuckeye roll 1x0	0.03
	chuck	NAMP 116G: chuck flap	15.19
	chuck	NAMP 116G: chuck flap tail	0.01
	loin	Butt tender, peeled <sup>5</sup>	0.12
	loin	NAMP 180: striploin	0.07
	loin	NAMP 180: striploin 0x1	0.14
	loin	NAMP 180: striploin 1x1	0.07
	loin	NAMP 180: striploin steak ready	0.07
	loin	NAMP 180: striploin steak ready 0x1	0.01
	loin	NAMP 184: top sirloin butt	0.04
	loin	NAMP 185D: tri tip peeled	0.18
	loin	NAMP 189A: tenderloin peeled	0.40
	loin	NAMP 189A: tenderloin peeled heavy	0.36
	plate	Plate eye	0.77
	plate	Plate fingers	2.58
	plate	Plate, bnls	2.83
	plate	Short plate, bnls	10.23
	rib	NAMP 112: ribeye roll	0.01
	rib	NAMP 112A: ribeye	0.03
	rib	NAMP 112A: ribeye 1x1	0.07
	rib	NAMP 112A: ribeye lip on	1.43
	rib	NAMP 112A: ribeye lip on 2x2	1.19
	rib	NAMP 112A: ribeye lip on 2x2 heavy	0.32
	rib	NAMP 112A: ribeye lip on bnls	0.60
	rib	NAMP 112A: ribeye lip on bnls 1/2 pack	0.03
	rib	NAMP 112A: ribeye lip on heavy	1.30
	rib	NAMP 112A: ribeye lip on, 1x1	0.03
	rib	NAMP 124A: rib fingers	13.45
	rib	Rib short rib bnls	3.78
	round	NAMP: 171F: heel	14.27
Thailand	chuck	NAMP 114D: top blade	1.97
	loin	NAMP 180: striploin	21.91
	loin	NAMP 180: striploin 1x1	14.29
	loin	NAMP 189A: tenderloin peeled	7.99
	loin	NAMP 189A: tenderloin peeled heavy	26.76
	rib	NAMP 112: ribeye roll	8.03
	rib	NAMP 112A: ribeye lip on	11.71

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Thailand (con't)	rib	NAMP 112A: ribeye lip on 2x2	4.11
	rib	NAMP 112A: ribeye lip on heavy	3.23
Vietnam	brisket	NAMP 120: brisket bnls	0.05
	brisket	NAMP 120B: brisket point	0.25
	chuck	Chuck short rib bnls	11.07
	chuck	NAMP 113: chuck	0.07
	chuck	NAMP 114C: clod trimmed	0.17
	chuck	NAMP 114D: top blade	0.51
	chuck	NAMP 116A: chuck roll	0.10
	chuck	NAMP 116A: chuck roll 1 in	0.20
	chuck	NAMP 116B: chuck tender	0.02
	chuck	NAMP 116D: chuckeye roll	4.53
	chuck	NAMP 116G: chuck flap	0.01
	chuck	NAMP 130: short rib bone-in	52.42
	loin	NAMP 174: short loin bone-in	0.31
	loin	NAMP 180: striploin	0.75
	loin	NAMP 180: striploin 1x1	0.17
	loin	NAMP 180: striploin 1x1 heavy	0.03
	loin	NAMP 189A: tenderloin peeled	0.14
	loin	NAMP 189A: tenderloin peeled heavy	0.19
	plate	Short plate	17.60
	rib	NAMP 112A: ribeye 2 in	0.01
	rib	NAMP 112A: ribeye lip on	1.07
	rib	NAMP 112A: ribeye lip on 2x2	0.42
	rib	NAMP 112A: ribeye lip on bnls	0.02
	rib	NAMP 112A: ribeye lip on heavy	0.03
	rib	NAMP 123B: rib short rib bone-in	1.76
	rib	NAMP 124A: rib fingers	8.11

<sup>1</sup>Bnls=boneless product

<sup>2</sup>Chuck short ribs bnls follows the natural seam of the Transversalis coli that runs diagonally away from the 5/6 rib chuck separation. This will remove the heavy seam fat from the short ribs. The dorsal side of the triangle short rib will be fabricated the same as a normal chuck short rib and will be separated based on the size of the chuckeye roll tail and the width of the chuck flap

<sup>3</sup>Plate eye fabrication--Beginning with the 121 Beef Plate Primal, separated from the 103 Beef Rib Primal, remove the rib bones from the external lean via the natural seam. On the anterior end, make a cut approximately 8 inches ventral to the rib/plate separation and perpendicular to the chuck/plate separation at the most dorsal point of the Obliquus abdominus externi. Remove the Deep Pectoral and Cutaneous trunci muscle from the Obliquus abdominus externi via the natural seam so as to have only the Obliquus abdominus externi muscle remaining. Square off the ventral portion of the Obliquus abdominus externi approximately 5 inches from the dorsal side of the Obliquus abdominus externi so as to produce an item approximately 5 inches wide. Square off the ends of the Obliquus abdominus externi so as to produce an item approximately 10 inches long.

<sup>4</sup>Plate fingers are cut from between plate short ribs

<sup>5</sup>Butt tender is the butt end of a beef tenderloin

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Table 4: The percent of beef variety meat products sent to selected countries

Barbados	Suet	100.00%
Cayman Islands	Oxtail	84.38%
	Tripe, honeycomb	3.13%
	Tripe, scalded	12.50%
Costa Rica	Livers	59.74%
	Tongues, Swiss-cut	4.61%
	Tongues	35.65%
Dominican Republic	Sweetbreads	100.00%
Egypt	Hearts	2.64%
	Kidneys	4.17%
	Livers	93.19%
Japan	Hanging tender	40.95%
	Hearts	0.01%
	Leg tendons	1.96%
	Liver	19.02%
	Oxtail	0.01%
	Tongues	28.39%
	Tongues, Swiss-cut	9.66%
Peru	Hearts	100.00%
Philippines	Hanging tenders	15.57%
	Leg tendons	0.02%
	Liver	31.41%
	Tongue	1.50%
	Tripe, scalded	51.50%
Ukraine	Liver	100.00%
Vietnam	Hearts	14.99%
	Leg tendon	15.02%
	Tongue	0.28%
	Tripe, scalded	69.71%

Table 5: Percentage of each primal volume exported to various countries, in pounds

Region	Country	Brisket	Chuck	Flank	Loin	Rib	Round	Plate	Ground	Total (1000 kg)
Middle East	Lebanon	0.00%	0.00%	0.00%	44.26%	55.74%	0.00%	0.00%	0.00%	68.28
ASEAN	Philippines	0.55%	18.93%	0.31%	15.43%	48.46%	0.20%	16.11%	0.00%	137.67
	Malaysia	0.00%	0.00%	0.00%	48.91%	51.09%	0.00%	0.00%	0.00%	6.93
	Thailand	0.00%	1.97%	0.00%	70.95%	27.08%	0.00%	0.00%	0.00%	4.96
	Vietnam	0.30%	69.10%	0.00%	1.59%	27.28%	1.69%	0.05%	0.00%	20179.83
	Singapore	0.02%	59.12%	0.02%	22.09%	18.00%	0.02%	0.73%	0.00%	58.09
Central America							16.48%			
	Guatemala El Salvador	0.00%	0.00%	0.00%	9.58%	20.21%	53.73%	0.00%	0.00%	0.34
	Panama	0.00%	47.17%	0.00%	35.43%	17.40%	0.00%	0.00%	0.00%	1.98
	Costa Rica	0.00%	2.49%	2.44%	50.89%	24.75%	1.91%	17.52%	0.00%	0.78
South America	Peru	0.00%	59.08%	0.00%	11.66%	19.15%	0.00%	10.11%	0.00%	9.87
Caribbean	St. Kitts-Nevis	5.12%	0.00%	0.00%	47.99%	22.55%	7.04%	0.00%	17.29%	3.71
	St. Lucia	1.50%	0.00%	0.00%	41.10%	7.46%	18.61%	0.00%	31.34%	20.48
	Barbados	8.52%	15.88%	0.00%	57.55%	0.00%	16.17%	0.00%	1.87%	4.85
	Cayman Islands	0.29%	11.21%	1.05%	9.92%	6.56%	70.96%	0.00%	0.00%	22.54
	Dominican Republic	0.00%	0.00%	0.00%	8.13%	0.00%	0.00%	91.87%	0.00%	6.02
Asia										118929.34
	Japan	0.25%	36.49%	0.01%	4.05%	14.66%	0.55%	44.00%	0.00%	
	Hong Kong	0.50%	43.61%	0.34%	18.90%	20.96%	0.08%	15.62%	0.00%	352.23
	Taiwan	0.00%	46.85%	0.00%	1.52%	22.44%	14.68%	14.50%	0.00%	1126.43
	South Korea	13.58%	60.80%	0.00%	1.76%	17.81%	0.00%	6.04%	0.00%	167.10

Table 4: Percentage of each primal value exported to various countries, in dollars

Region	Country	Brisket	Chuck	Flank	Loin	Rib	Round	Plate	Ground	Total value (per \$1000)
Middle East										
	Lebanon	0.00%	0.00%	0.00%	47.80%	52.20%	0.00%	0.00%		88425.10
ASEAN										
	Philippines	0.27%	8.88%	0.27%	26.20%	62.95%	0.07%	1.36%	0.00%	128103.29
	Malaysia	0.00%	0.00%	0.00%	46.37%	53.63%	0.00%	0.00%	0.00%	1004.02
	Thailand	0.00%	0.31%	0.00%	76.11%	23.57%	0.00%	0.00%	0.00%	8611.10
	Vietnam	0.11%	74.73%	0.00%	7.07%	13.55%	0.00%	4.54%	0.00%	44395.63
	Singapore	0.01%	26.09%	0.02%	44.32%	29.47%	0.01%	0.08%	0.00%	44934.82
Central America										
	Guatemala	0.00%	0.00%	0.00%	6.95%	30.66%	6.80%	55.60%	0.00%	302.85
	El Salvador	0.00%	0.00%	0.00%	12.67%	9.78%	0.00%	77.55%	0.00%	1549.60
	Panama	0.00%	21.29%	0.00%	59.83%	18.88%	0.00%	0.00%	0.00%	662.53
	Costa Rica	0.00%	0.71%	1.89%	54.16%	27.07%	0.65%	15.52%	0.00%	10339.83
South America										
	Peru	0.00%	28.64%	0.00%	17.69%	38.75%	0.00%	14.92%	0.00%	3870.83
Caribbean										
	St. Kitts-Nevis	2.50%	0.00%	0.00%	64.49%	23.76%	3.18%	0.00%	6.07%	3778.15
	St. Lucia	0.61%	0.00%	0.00%	65.58%	10.92%	9.35%	0.00%	13.54%	14901.25
	Barbados	2.68%	5.33%	0.00%	83.68%	0.00%	7.63%	0.00%	0.68%	4492.40
	Cayman Islands	0.36%	7.87%	1.68%	25.40%	9.58%	55.10%	0.00%	0.00%	10567.44
	Dominican Republic	0.00%	0.00%	0.00%	10.28%	0.00%	0.00%	89.72%	0.00%	7333.62
Asia										
	Japan	0.24%	44.36%	0.03%	7.39%	16.99%	0.63%	30.37%	0.00%	261644.55
	Hong Kong	0.17%	16.94%	0.39%	45.06%	35.81%	0.04%	1.59%	0.00%	279791.18
	Taiwan	0.00%	43.21%	0.00%	7.72%	30.51%	13.46%	5.11%	0.00%	382110.98
	South Korea	8.60%	59.74%	0.00%	3.84%	25.75%	0.00%	2.07%	0.00%	75126.97

Table 7: Percentage of the volume of each USDA grade exported to various countries

Region	Country	No grade	Select	Choice	Prime	Total (1000 kg)
Middle East	Lebanon	34.76%	0.00%	63.70%	1.55%	68.28
ASEAN	Philippines	0.99%	15.35%	81.03%	2.63%	137.67
	Malaysia	100.00%	0.00%	0.00%	0.00%	6.93
	Thailand	6.11%	0.00%	73.90%	19.99%	4.96
	Vietnam	51.72%	0.19%	41.17%	6.92%	20179.83
	Singapore	5.32%	1.83%	76.40%	16.44%	58.09
Central America	Guatemala	0.00%	0.00%	100.00%	0.00%	0.34
	El Salvador	19.55%	0.00%	80.45%	0.00%	1.98
	Panama	76.07%	0.00%	23.93%	0.00%	0.78
	Costa Rica	67.09%	1.62%	31.29%	0.00%	9.87
	Peru	3.03%	0.00%	96.97%	0.00%	5.93
Caribbean	St. Kitts-Nevis	49.04%	0.00%	50.96%	0.00%	3.71
	St. Lucia	56.18%	0.00%	43.82%	0.00%	20.48
	Barbados	54.84%	6.67%	38.49%	0.00%	4.85
	Cayman Islands	3.08%	1.40%	94.68%	0.84%	22.54
	Dominican Republic	96.67%	0.00%	3.33%	0.00%	6.02
Asia	Japan	35.54%	9.78%	51.77%	2.91%	118929.3399
	Hong Kong	25.64%	0.60%	48.74%	25.03%	352.23
	Taiwan	31.20%	9.42%	48.92%	10.46%	1126.43
	Korea	2.74%	12.66%	84.30%	0.31%	167.10
South America	Peru	3.03%	0.00%	96.97%	0.00%	

Table 8: Percentage of each beef grade exported to selected countries, in value

Region	Country	No grade	Select	Choice	Prime	Total value (per \$1000)
Middle East						
	Lebanon	27.41%	0.00%	63.50%	9.09%	88425.10
ASEAN						
	Philippines	0.38%	17.55%	78.09%	3.98%	128103.29
	Malaysia	100.00%	0.00%	0.00%	0.00%	1004.02
	Thailand	3.91%	0.00%	70.43%	25.66%	8611.10
	Vietnam	57.99%	0.22%	35.37%	6.42%	44395.63
	Singapore	4.63%	0.64%	67.93%	26.80%	44934.82
Central America						
	Guatemala	0.00%	0.00%	100.00%	0.00%	302.85
	El Salvador	23.93%	0.00%	76.07%	0.00%	1549.60
	Panama	64.35%	0.00%	35.65%	0.00%	662.53
	Costa Rica	58.34%	1.74%	39.92%	0.00%	10339.83
	Peru	5.61%	0.00%	94.39%	0.00%	3870.83
Caribbean						
	St. Kitts-Nevis	36.35%	0.00%	63.65%	0.00%	3778.15
	St. Lucia	48.13%	0.00%	51.87%	0.00%	14901.25
	Barbados	81.09%	2.15%	16.76%	0.00%	4492.40
	Cayman Islands	4.31%	0.00%	93.96%	1.73%	10567.44
	Dominican Republic	97.27%	0.00%	2.73%	0.00%	7333.62
Asia						
	Japan	35.54%	9.78%	51.77%	2.91%	261644.55
	Hong Kong	12.02%	0.76%	30.62%	56.61%	279791.18
	Taiwan	19.71%	12.30%	47.08%	20.91%	382110.98
	Korea	1.19%	12.07%	86.18%	0.56%	75126.97
South America						
	Peru	5.61%	0.00%	94.39%	0.00%	3870.83

Table 9: Percentage of Products Shipped to Selected Countries That is Fresh or Frozen

Country	Chilled	Frozen	Unknown
Barbados	82.19%	17.81%	0.00%
Cayman Islands	6.46%	84.73%	8.81%
Costa Rica	14.95%	0.00%	85.05%
Dominican Republic	100.00%	0.00%	0.00%
El Salvador	31.71%	0.00%	68.29%
Egypt	0.00%	1.52%	98.48%
Guatemala	0.00%	100.00%	0.00%
Hong Kong	34.34%	64.79%	0.87%
Japan	45.27%	52.05%	2.68%
Korea	0.00%	3.62%	96.38%
Lebanon	0.00%	0.00%	100.00%
Malaysia	100.00%	0.00%	0.00%
Panama	100.00%	0.00%	0.00%
Peru	81.68%	15.12%	3.20%
Philippines	1.47%	22.81%	75.72%
St. Kitts-Nevis	100.00%	0.00%	0.00%
St. Lucia	100.00%	0.00%	0.00%
Singapore	44.61%	50.98%	4.41%
Taiwan	16.60%	79.46%	3.94%
Thailand	82.89%	0.00%	17.11%
Ukraine	0.00%	100.00%	0.00%
Vietnam	0.31%	81.97%	17.72%

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program	Box Wt.	IMPS	Difference From Specification
Hong Kong	Short Rib 9 in Bone-in AFG No Roll BOV VP	.	1/25/2008	BI	C	NG	N	70.8	123	
Hong Kong	Striploin, Steak-ready 0x1	.	3/13/2008	BL	C	Pr	N	19.6	180	
Hong Kong	Strip 10/up 1x1	.	3/6/2008	BL	C	Pr	Y	20.2	180	
Hong Kong	Strip 1x1 11/up	.	3/21/2008	BL	C	Ch+	Y	27.9	180	
Hong Kong	Strip 10/up 1x1	.	2/18/2008	BL	C	Pr	N	20.7	180	
Hong Kong	Striploin 1x1	.	11/2/2006	BL	F	Ch+	Y	42.9	180	
Hong Kong	Striploin 1x1	.	11/28/2007	BL	F	Ch+	Y	63.7	180	
Hong Kong	Striploin 1x1	.	3/21/2008	BL	C	Pr	Y	24.8	180	
Hong Kong	Tenderloin, PSMO	.	3/21/2008	BL	C	Pr	Y	30.9	189	
Hong Kong	Tenderloin PSMO 5/up	.	3/10/2008	BL	C	Pr	N	23.1	190	
Hong Kong	Ribeye Lip-On 2x2	.	3/10/2008	BL	C	Pr	Y	33.6	112a	
Hong Kong	Ribeye Lip-On 2x2	.	2/15/2008	BL	C	Pr	Y	29.7	112a	
Hong Kong	Ribeye Lip-On 2x2	.	3/21/2008	BL	C	Ch+	N	31.3	112a	
Hong Kong	Ribeye Lip-on, 2x2	.	10/13/2007	BL	F	Pr	N	41.5	112a	
Hong Kong	Ribeye Lip-on	.	3/21/2008	BL	C	Pr	Y	26.7	112a	
Hong Kong	Chuck Flap	.	7/26/2007	BL	F	Ch+	Y	24.4	116g	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Hong Kong	Intercostal Meat (finger meat)	.	1/30/2008	BL	C	NG	N	33.5	124a	
Hong Kong	Inside Round C-off	.	3/21/2008	BL	C	Ch+	Y	27.7	169a	
Hong Kong	Tender, 5/up 189a	.	3/6/2008	BL	C	Pr	Y	30.2	189A	
Hong Kong	Tender, 5/up 189a	.	1/16/2008	BL	C	Pr	N	28.4	189a	
Hong Kong	Tenderloin, Peeled, S/T	.	10/17/2007	BL	F	Ch+	Y	46.7	189a	
Hong Kong	Short Ribs	.	10/6/2006	BL	F	Ch+	N	32.4	N/A	Triangles
Hong Kong	Chuckeye Roll H/O S/T	.	12/26/2007	BL	F	Ch+	N	39.3	N/A	Chuck roll, not chuckeye
Hong Kong	Short Ribs	.	11/12/2007	BL	F	Ch+	Y	55.6	N/A	Triangles
Hong Kong	Chuckeye Roll BSR	.	10/31/2007	BL	F	Ch+	Y	51.5	N/A	Chuck roll, not chuckeye
Hong Kong	Ribeye Lip-on	.	9/1/2007	BL	F	Pr	Y	62.3	N/A	Rib fingers on
Hong Kong	Short Ribs	.	12/4/2007	BL	F	Pr	N	30.3	N/A	Triangles
Hong Kong	Beef for Super Pastrami	.	1/30/2007	BL	F	Ch+	N	40.5	N/A	
Hong Kong	Short Ribs	.	8/30/2007	BL	F	Ch+	N	36.6	N/A	Triangles
Hong Kong	B/I Short Ribs, Full Cut	.	11/28/2008	BI	F	Ch+	N	67.6	N/A	Extra meat
Japan	0x1 Neck-off Chuckeye Roll	.	12/27/2007	BL	C	Pr	N	30.45	116	
Japan	0x1 Neck-off Chuckeye Roll	.	1/2/2008	BL	C	Ch	N	35.8	116	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Japan	0x1 Chuck Roll	.	12/26/2007	BL	C	Ch+	N	35.3	116a	
Japan	Brisket	.	12/22/2007	BL	C	Ch+	N	28.2	120	
Japan	Brisket TDO	.	12/20/2007	BL	.	Ch	Y	82.7	120	
Japan	Brisket	.	1/28/2007	BL	C	Se	N	44.9	120	
Japan	Brisket	.	1/2/2008	BL	C	Ch	N	41.1	120	
Japan	Short Ribs, Chuck	.	12/22/2007	BL	.	Ch+	N	21.5	130	
Japan	Short Ribs, Chuck	.	12/21/2007	BL	.	Ch+	Y	22.3	130	
Japan	Short Ribs, Chuck	.	12/21/2007	BL	.	Ch+	N	26.7	130	
Japan	Short Ribs, Chuck	.	1/2/2007	BL	C	Ch	N	47.5	130	
Japan	Short Ribs, Chuck	.	12/19/2007	BL	.	Ch+	N	22.1	130	
Japan	Short Ribs, Chuck	.	12/21/2007	BL	.	Ch	Y	45.8	130	
Japan	Short Ribs, Chuck	.	12/14/2007	BL	.	Ch+	N	21.5	130	
Japan	Hanging Tender	.	12/31/2007	BL	.	NG	N	30.2	140	
Japan	Hanging Tender	.	7/31/2007	BL	F	NG	N	36.6	140	
Japan	Hanging Tender	.	12/26/2007	BL	.	Ch	N	30	140	
Japan	Striploin, Steak-ready 0x1	.	1/2/2007	BL	C	Ch	N	24.45	180	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Japan	Striploin, Steak-ready 0x1	.	12/20/2007	BL	.	Ch+	N	20.7	180	
Japan	Striploin, Steak-ready 0x1	.	12/21/2007	BL	.	Ch+	N	22.9	180	
Japan	Striploin, Steak-ready 0x1	.	12/26/2007	BL	C	Ch+	N	21.4	180	
Japan	Striploin 0x1 XT	.	1/2/2007	BL	C	NG	N	47.7	180	
Japan	Striploin, Steak-ready 0x1	.	12/21/2007	BL	C	Ch+	N	18.9	180	
Japan	Striploin 0x1 XT	.	12/21/2007	BL	.	Ch	N	50.3	180	
Japan	Striploin, Steak-ready 0x1	.	12/22/2007	BL	.	Ch+	Y	17.6	180	
Japan	Tenderloin PSMO	.	12/21/2007	BL	.	NG	N	52.5	190	
Japan	Tongue	.	12/21/2007	BL	.	NG	N	8.2	1710	
Japan	Tongue	.	12/28/2007	BL	.	NG	N	13.7	1710	
Japan	Tongue, fresh, VP, #1 Black	.	12/21/2007	BL	.	NG	N	10	1710	
Japan	Tongue, premium trim	.	5/1/2007	BL	F	NG	N	25	1710	
Japan	Tongue, #1, Special Trim	.	8/3/2007	BL	F	NG	N	18.5	1710	
Japan	Ribeye Lip-On 2x2	.	12/27/2007	BL	.	Ch+	Y	27.6	112a	
Japan	Ribeye Lip-On 2x2	.	1/4/2008	BL	C	Ch+	N	41.1	112a	
Japan	Ribeye Lip-on	.	12/21/2007	BL	.	NG	Y	58.1	112a	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Japan	Chuckeye roll, 0x1, neck off	.	12/27/2007	BL	C	Ch+	N	26	n/a	Chuck roll, not chuckeye
Japan	Chuckeye Roll Neckoff 1x1	.	12/28/2007	BL	.	Ch+	Y	30.6	116a	
Japan	Chuckeye Roll H/O S/T	.	12/19/2007	BL	C	Ch+	N	38.8	116a	Chuck roll, not chuckeye
Japan	Chuckeye Roll H/O S/T	.	12/31/2007	BL	C	Ch+	N	37.4	116a	Chuck roll, not chuckeye
Japan	Chuckeye Roll	.	1/2/2007	BL	C	Ch	N	35.5	N/A	Chuck roll, not chuckeye
Japan	Chuck roll 0x1	.	12/21/2007	BL	.	Ch+	N	26.7	116a	
Japan	Chuck Roll	.	12/21/2007	BL	.	Ch+	N	29.1	116a	
Japan	Chuckeye Roll	.	12/27/2007	BL	.	Ch+	N	37.9	116h	
Japan	Chuck Tail Flap Meat	.	12/22/2007	BL	.	Ch+	N	24.6	116g	
Japan	Chuck Flap Meat, Trimmed	.	12/28/2007	BL	.	Ch+	Y	23.8	116g	
Japan	Chuck Flap	.	12/21/2007	BL	C	Ch+	N	34.3	116g	
Japan	Chuck Flap	.	12/26/2007	BL	C	NG	N	24.8	116g	
Japan	Chuck Tail Flap Meat	.	12/19/2007	BL	.	Ch+	N	25.4	116g	
Japan	Short Plate	.	1/2/2007	BL	C	Pr	N	63.7	121a	
Japan	Outside Skirt	.	12/27/2007	BL	.	Ch+	Y	30	121c	
Japan	Outside Skirt	.	12/19/2007	BL	.	Se+	N	32.4	121c	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Japan	Outside Skirt	.	12/31/2007	BL	.	NG	N	29.1	121c	
Japan	Outside Skirt	.	12/28/2007	BL	.	Ch+	N	33.6	121c	
Japan	Skirt Diaphragm	.	12/26/2008	BL	C	Ch	N	48.9	121c	
Japan	Outside Skirt	.	12/27/2007	BL	.	Se	N	29.8	121c	
Japan	Short Rib, Rib	.	12/27/2007	BL	C	Ch+	N	36.95	123a	
Japan	Short Rib, Chuck	.	12/21/2007	BL	.	Ch+	N	23.5	130	
Japan	Rib Fingers	.	12/21/2007	BL	.	NG	Y	46.1	124g	
Japan	Tenderloin, Peeled, 5/up	.	12/26/2007	BL	.	Ch+	Y	26.1	189a	
Japan	Tenderloin, Peeled, 5/up	.	12/26/2007	BL	C	NG	N	51.7	189a	
Japan	Tenderloin 5/up	.	12/26/2007	BL	C	Ch+	N	45.6	189a	
Japan	Chuck short ribs with chuck flap	.	12/27/2007	BL	C	Ch+	N	32.9	N/A	Shorts ribs and chuck flap
Japan	Chuck Short Ribs with Chuck Flap	.	1/2/2008	BL	C	Ch+	Y	34.9	N/A	Shorts ribs and chuck flap
Japan	Chuck Short Ribs with Chuck Flap	.	12/27/2007	BL	C	Pr	N	25.6	N/A	Shorts ribs and chuck flap
Japan	Rib Short Ribs	.	1/2/2007	BL	C	Ch	N	33.6	123c	
Japan	Short Plate	.	1/2/2007	BL	C	Ch	N	55.8	N/A	Plate-eye
Japan	Short Plate	.	1/2/2008	BL	C	Se	Y	52.7	N/A	Plate-eye

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Japan	Plate Yakiniku Plate-eye	.	12/18/2007	BL	C	Ch+	N	29.2	N/A	Plate-eye
Japan	Short Ribs	.	12/18/2007	BL	C	Ch+	N	30.9	N/A	Triangle cut
Japan	Ribeye Lip-on E	.	1/2/2007	BL	C	NG	N	58.2	N/A	Triangles
Japan	Short Ribs	.	12/26/2007	BL	C	Se	N	22.6	N/A	Triangles
Japan	Shoulder Clod XT	.	12/20/2007	BL	.	Ch	N	57.8	N/A	No teres
Japan	Strip 0x1 Half-cut	.	12/19/2007	BL	C	Se+	N	21.1	N/A	Strip loin, cut in half
Japan	Chuck Flap	.	12/26/2007	BL	C	Ch+	N	26	116g	
Japan	Hanging Tender	.	12/27/2007	BL	.	Pr	N	32.95	140	
Mexico	Shoulder Clod	2/25-3/2/08	3/3/2008	BL	C	Ch+	N	61	114	
Mexico	Shoulder Clod	2/20-3/3/08	3/3/2008	BL	C	NR	N	69.5	114	
Mexico	Shoulder Clod	2/20-3/3/08	3/3/2008	BL	C	Se+	N	72.2	114	
Mexico	Shoulder Clod	2/20-3/3/08	3/3/2008	BL	C	NR	N	69.5	114	
Mexico	Shoulder Clod XT S/T	2/21-2/27/08	2/29/2008	BL	C	Se	N	80	114	
Mexico	Shoulder Clod	2/15-2/27/08	2/25/2008	BL	C	Se	N	76.4	114	
Mexico	Shoulder Clod	2/25-2/27/08	2/28/2008	BL	C	Se	N	68.9	114	
Mexico	Shoulder Clod	2/25-2/27/08	2/28/2008	BL	C	Se	N	78.1	114	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Mexico	Shoulder Clod	2/22-3/3/08	3/4/2008	BL	C	Ch+	N	79.5	114	
Mexico	Shoulder Clod	2/22-2/28/08	2/28/2008	BL	C	Ch+	Y	56.1	114	
Mexico	Shoulder Clod	2/18-2/29/08	2/29/2008	BL	C	Se+	N	80.3	114	
Mexico	Brisket	2/20-2/29/08	2/27/2008	BL	C	Ch+	N	90.3	120	
Mexico	Brisket	2/18-2/27/08	2/25/2008	BL	C	Se+	N	88.7	120	
Mexico	Backribs (vacuum pack)	2/21-2/27/08	2/29/2008	BI	C	Se	N	42.1	124	
Mexico	Top Round S/T	2/15-2/21/08	2/25/2008	BL	C	Ch+	N	66.7	168	
Mexico	Top Round S/T	2/21-2/27/08	2/25/2008	BL	C	Se	Y	71.1	168	
Mexico	Inside Round	2/22-2/29/08	3/3/2008	BL	.	Ch+	N	65	168	
Mexico	Inside Skirt	2/22-3/3/08	2/29/2008	BL	C	Se+	N	59.6	121d	
Mexico	Top Round S/T	2/27-2/28/08	2/29/2008	BL	C	Se	N	74.9	168	
Mexico	Inside Round	2/14-2/28/08	2/29/2008	BL	C	Ch+	Y	60.2	168	
Mexico	Inside Round	2/19-2/25/08	2/26/2008	BL	C	Se+	N	75.3	168	
Mexico	Inside Round	2/13-2/27/08	2/27/2008	BL	C	NG	Y	55.9	168	
Mexico	Inside Round	2/25-2/27/08	2/28/2008	BL	C	Se	N	65	169	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Mexico	Top Round S/T	2/20-2/26/08	2/27/2008	BL	C	Se	N	69	169	
Mexico	Inside Round	2/19-2/26/2008	2/26/2008	BL	C	Ch+	Y	54.8	169	
Mexico	Inside Round	2/27-3/4/08	2/29/2008	BL	C	Ch+	N	59	169	
Mexico	Inside Round	2/19-2/28/08	2/27/2008	BL	C	Ch+		60.4	169	
Mexico	Peeled Knuckle	2/19-2/28/08	2/26-2/29-08	BL	C	Ch+		90.1	167a	
Mexico	Inside Round	2/19-2/26/2008	2/27/2008	BL	C	Ch+	N	67.2	169	
Mexico	Bottom Round	2/19-2/26/08	2/27/2008	BL	C	NG	N	55.6	170	
Mexico	Bottom Round	2/19-2/26/08	2/26/2008	BL	C	Se	Y	64.1	170	
Mexico	Bottom Round	2/26-2/28/08	2/29/2008	BL	C	Se	N	61.8	170	
Mexico	Bottom Round	2/25-2/27/08	2/28/2008	BL	C	Se	Y	51.5	170	
Mexico	Bottom Round	2/21-2/26/08	2/26/2008	BL	C	Se	N	59.2	170	
Mexico	Gooseneck Round	2/20-2/29/08	3/3/2008	BL	C	Se+	N	66.4	170	
Mexico	Gooseneck Round	2/20-2/29/08	2/29/2008	BL	C	Ch+	N	44.1	170	
Mexico	Gooseneck Round	2/20-2/29/08	2/28/2008	BL	C	NR	Y	52.5	170	
Mexico	Striploin, 11up, 0x1	2/27-3/4/08	3/3/2008	BL	C	Ch+	N	72.2	180	
Mexico	Sirloin, 1-piece, Top Butt	2/14-2/28/08	2/29/2008	BL	C	Ch+	Y	66.9	184	

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Mexico	Top Sirloin	2/20-3/3/08	2/29/2008	BL	C	Ch+	N	77.6	184	
Mexico	Sirloin Top Butt	2/18-2/27/08	2/26/2008	BL	C	Se+	N	71.7	184	
Mexico	Tenderloin, peeled, 5/up, S/T	2/15-2/21/08	2/25/2008	BL	C	Ch+	N	70.9	190	
Mexico	Tongue, special trim, black	2/4-2/19/07	2/20/2008	BL	F	NG	N	27.9	1710	
Mexico	Scalded Tripe	2/13-2/15/08	2/14/2008	BL	F	NG	N	60	1737	
Mexico	Scalded Tripe (RC-PB)	2/5-2/21/08	2/6/2008	BL	F	NG	N	50	1737	
Mexico	Scalded Tripe	2/22-2/28/08	2/22/2008	BL	F	NG	N	60	1737	
Mexico	Chuckeye	2/20-2/29/08	2/27/2008	BL	C	Ch+	N	62.9	116h	
Mexico	Chuckeye	2/19-2/27/08	2/28/2008	BL	C	NG	Y	70.2	116h	
Mexico	Chuckeye Roll	2/25-2/27/08	2/29/2008	BL	C	Se	N	64.9	116h	
Mexico	Chuckeye	2/14-2/28/08	2/27/2008	BL	C	Ch+	Y	56.9	116h	
Mexico	Inside Skirt	10/19/07-2/22/08	10/22/2007	BL	F	Ch+	N	85.7	121d	
Mexico	Skirt Plate (Inside Skirt)	2/21-2/27/08	2/26/2008	BL	C	NG	N	52.5	121d	
Mexico	Plate Inside Skirt-- Transverse abdominus	2/14-2/28/08	2/26/2008	BL	C	Ch+	Y	45.6	121d	
Mexico	Inside Skirts-- Transverse Abdominis	2/18-2/27/08	2/25/2008	BL	C	Se+	N	71.7	121d	

Mexico	Plate Inside Skirt	2/11-2/25/08	2/22/2008	BL	C	Ch+	N	74.4	121d	
Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Mexico	Inside Skirt--	2/11-2/25/08	2/25/2008	BL	C	Ch+	N	68.7	121d	
	Transverse abdominis									
Mexico	Knuckles, Peeled	2/18-2/26/08	2/28/2008	BL	C	Se	N	56.7	167a	
Mexico	Knuckles, Peeled	2/20-2/29/08	2/29/2008	BL	C	Se+	N	78.2	167a	
Mexico	Bottom Round Bottom Flat	2/16-2/21/08	.	BL	F	Ch+	N	20.5	171b	
Mexico	Cheek Meat	2/18-2/21/08	2/2/2008	BL	F	NG	N	60	N/A	Cheek meat
Mexico	Tripe, Honeycomb Attached	10/19/07-2/22/08	2/20/2008	BL	F	NG		63.7	N/A	Ruman with reticulum attached
Mexico	Tongue Trimmings	12/12/07-2/29/08	12/12/07-2/29/08	BL	F	NG	N	60	N/A	Trim from trimmed tongue
Mexico	Back Ribs	2/1-2/27/08	2/7/2008	BI	F	Ch+	N	45.9	N/A	Fingers removed
Mexico	Lips, unscalded	2/13-2/28/08	2/28/2008	BL	F	NG	N	60	N/A	Lips
Mexico	Cheek Meat	1/8-1/11/08	1/11/2008	BL	F	NG	N	60	N/A	Cheek meat
Mexico	Ox Lips	2/13-2/27/08	2/20/2008	BL	F	NG	N	60	N/A	Lips
Mexico	Chuck Bone-in Chuck Roll Neck-off	2/18-2/26/08	2/26/2008	BI	C	Se+	N	55.8	N/A	114E with neck bones
Mexico	Trimming 65:35	2/7-3/3/08	3/3/2008	BL	C	Se+	N	20	N/A	Trim
Mexico	Hearts, Bones removed	2/11-2/18/08	2/18/2008	BL	F	NG	N	60	N/A	Deboned heart
Mexico	Plate Navel Rosemeat	2/19-2/27/08	2/27/2008	BL	C	Se+	N	49.9	N/A	Navel rosemeat

Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Taiwan	Striploin, Steak-ready 0x1	.	2/22/2008	BL	C	Pr	N	18.1	180	
Taiwan	Tenderloin, PSMO, 5/up	.	2/25/2008	BL	C	Ch+	N	23.2	190	
Taiwan	Short Ribs 105a	.	3/4/2008	BL	C	Ch+	N	60.2	105a	
Taiwan	Ribeye Lip-on 12/up	.	3/10/2008	BL	C	Pr	N	28.5	112a	
Taiwan	Ribeye Lip-on	.	2/22/2008	BL	C	Ch+	N	32.1	112a	
Taiwan	Ribeye Lip-on	.	2/15/2008	BL	C	Ch+	Y	58.1	112a	
Taiwan	Ribeye Lip-on 2x2 14.5/up	.	2/20/2007	BL	F	Ch+	Y	44.4	112a	
Taiwan	Chuck Top Blade	.	3/7/2008	BL	C	Ch+	Y	30.1	114d	
Taiwan	Chuck Top Blade	.	3/4/2008	BL	C	Ch+	N	49.7	114d	
Taiwan	Shoulder Clod (Top Blade Muscle) S/T	.	5/17/2007	BL	F	Ch+	N	36.1	114d	
Taiwan	Chuckroll 0x1	.	2/25/2008	BL	C	Ch+	N	38.3	116a	
Taiwan	Chuck Tail Flap Meat	.	3/4/2008	BL	C	Ch+	Y	24.3	116g	Edge roast
Taiwan	Chuck Flat	.	1/22/2008	BL	F	Ch+	N	23.6	116g	Edge roast
Taiwan	Chuck 116G (Zabuton)	.	2/25/2008	BL	C	NG	Y	38.1	116g	
Taiwan	Chuckeye Log	.	2/21/2008	BL	C	Pr	N	39.6	116h	

Taiwan	Rib Finger Meat (COV)	.	12/26/2007	BL	F	Se+	N	20.1	124a	
Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Taiwan	Rib Finger Meat	.	3/3/2008	BL	C	Ch+	Y	29.1	124a	
Taiwan	Rib Fingers	.	2/25/2008	BL	C	NG	N	47.6	124a	
Taiwan	Rib Fingers	.	3/5/2008	BL	C	NG	N	42.3	124a	
Taiwan	Rib Fingers	.	3/4/2008	BL	C	NG	N	36.3	124a	Packaged for direct sale
Taiwan	Knuckles, Peeled	.	2/22/2008	BL	C	Ch+	N	57.4	167a	
Taiwan	Ribeye Lip-On	.	2/26/2008	BL	F	Pr	N	52.8	N/A	8 ribs, not cut at the 12/13th rib
Taiwan	Plate Plate-eye	.	3/5/2008	BL	C	Ch+	N	24.4	N/A	Plate-eye
Taiwan	Short Rib, Rib	.	3/6/2008	BL	C	Ch+	Y	30.3	N/A	Triangle
Taiwan	Round Heel Muscle	.	3/5/2008	BL	C	Ch+	Y	25.6	N/A	Heel muscle
Taiwan	Plate Plate-eye	.	11/15/2007	BL	F	Ch+	N	28.1	N/A	Plate-eye
Taiwan	Chuck Short Rib SC	.	3/3/2008	BL	C	Ch+	Y	54.1	N/A	Chuck flap
Taiwan	Ribeye Lip-on Split	.	2/15/2008	BL	C	Ch+	N	62.6	N/A	112a, split in half
Taiwan	Plate	.	3/3/2008	BL	C	Ch+	N	32	N/A	Plate-eye
Taiwan	Chuck Short Rib	.	2/13/2008	BL	C	Ch+	N	40.9	N/A	Triangles
Taiwan	Short Ribs	.	2/28/2008	BL	C	Pr	Y	64	N/A	Triangles

Taiwan	Plate (PAS)	.	2/29/2008	BL	C	Pr	N	35.9	N/A	Plate-eye
Country	Product	Slaughter Date	Pack Date	BI <sup>1</sup> /BL <sup>2</sup>	C <sup>3</sup> /F <sup>4</sup>	QG <sup>5</sup>	Special program ?	Box Wt.	IMPS Specification	Difference From Specification
Taiwan	Plate (PAS)	.	2/22/2008	BL	C	Ch+	N	35.9	N/A	Plate-eye
Taiwan	Round Heel Muscle	.	3/5/2008	BL	C	NG	N	35.9	N/A	Heel muscle
Taiwan	Chuckeye Roll	.	3/5/2008	BL	C	Pr	N	34.1	N/A	Chuck roll, not chuckeye
Taiwan	Chuck Short Ribs	.	1/25/2008	BL	F	Ch+	N	55.3	N/A	Triangles
Taiwan	Chuck Short Ribs	.	7/31/2007	BL	F	Ch+	N	34.5	N/A	Triangles

BI<sup>1</sup>=Bone-in  
 BL<sup>2</sup>=Boneless  
 C<sup>3</sup>=Chilled  
 F<sup>4</sup>=Frozen  
 QG<sup>5</sup>=Quality grade  
 NR=No roll, NG=No grade  
 Se=Select, Se+=Select or higher  
 Ch=Choice, Ch+=Choice or higher  
 Pr=Prime

## **Chapter 5: Review of Swine Traceability Systems in Selected Countries Outside of North America.**

### **Introduction**

There are approximately 966 million domesticated pigs in the world (FAO-STAT, 2012), with the United States, Canada, Brazil and China as the largest swine producers. Major pork importing countries include Japan, Mexico, China/Hong Kong, and Canada (USMEF, 2011b). Some of these countries require traceability programs for swine and pork, while other countries maintain voluntary programs.

Traceability is becoming increasingly important around the world for both domestic and export markets. Traceability is defined by the ISO 9000:2000 as the ability to “trace the history, application, or location of that which is under consideration”. Although this definition seems clear, many countries have their own interpretations of what traceability means.

According to Jensen and Hayes (2006), there are different methods of traceability. One such method, known as “farm to retail traceability,” is described as being able to maintain the identity of an individual animal from the farm, through slaughter and distribution, to the consumer. To maintain farm to retail traceability, the animal is traceable from the farm through processing with all of the cuts of a carcass kept in a container that is tracked with the animal’s identification number when the carcass is cut. When those cuts are packaged, they are marked with the individual carcass number and can be linked to the last farm the animal was at prior to the harvest chain. A second method is “batch traceability,” where the animal is traceable from the farm to the carcass, but the individual identification is lost at some point on the carcass processing line. Instead of individual identification, a batch or lot identification number is used

at harvest. When batch identification is utilized, the day is typically separated so that batches contain fewer carcasses (Jensen and Hayes, 2006).

According to Liddell and Bailey (2001), transparency and assurance are equally important as traceability. Traceability, as defined by Liddell and Bailey (2001), is the ability to track the inputs used to make food products backward to their source at different levels in the marketing chain. Transparency refers to procedures and practices that are used to produce a product while assurance is the ability to create and validate safety and quality standards at each level of the marketing chain (Liddell and Bailey, 2001). Although traceability programs are mandatory for cattle in many countries, swine/pork traceability is considerably less common.

This review describes swine traceability programs for countries outside North America. Specifically, this paper discusses two commonly used traceability programs: (1) birth to harvest, and (2) farm to retail. Birth, movement, and termination records and identification methods in countries with mandatory and non-mandatory swine tracing programs are discussed below. The remainder of the paper will analyze each country individually, beginning with the U.S., followed by Canada, and then Mexico. Specifically, discussions are presented on the original mandate for animal identification programs, followed by a review of the literature in regards to the identification programs for cattle, sheep, and swine within each country.

## **Review and Discussion**

### *Birth to Harvest Traceability*

Some traceability programs, such as in the European Union or New Zealand, have the ability to trace an animal from birth to harvest, including all animal location movements in between.

*The EU, a “one step up, one step down” traceability program.*

The European Union (EU) is a conglomeration of 27 member countries that operate and negotiate as a unit. Even though the EU only has 7% of the world's population, it accounts for about 20% of global import and export (European Union, 2012). Traceability became a concern for the EU in the 1990's because of worries about Bovine Spongiform Encephalopathy (BSE), animal feed contaminated with dioxin, and adulterated food products. The European Union has the ability to set regulations for all industries that all member countries must abide by, including food and agriculture (European Union, 2006). When new countries join the EU they are given time to upgrade their processing plants to comply with EU standards. Until the upgrade occurs, food can only be sold in the country in which it was produced, and has an indicator stamped on the package that shows that it does not comply with EU standards (European Commission, 2004).

Regulation (EC) No 178/2002, which went into effect on January 1, 2005, is the legal definition and regulation concerning traceability in the EU (European Union, 2002). The regulation defines traceability as "The ability to trace and follow a food, feed, food-producing animal or substance intended to be or expected to be incorporated into a food or feed, through all stages of production, processing, and distribution" and applies to all food and feed except primary production for private domestic use or private domestic consumption. All food and feed companies are legally bound to have traceability systems (European Union, 2002).

Regulation EC 178/2002 Article 18 states that: (1) all food, feed, and food-producing animal or substance are to be traceable at all times, (2) food and feed business operators shall be able to identify all of their suppliers, willing to provide that information to the authorities if asked, and to be able to identify all businesses they have supplied with product, and (3) food and feed that is on the market or is likely to be on the market should be labeled or identified in a

traceable way (European Union, 2002). The producer must know enough information (i.e., keep sufficient records) to be able to trace forward one step and trace back one step.

Article 11 adds that all food and feed imported into the EU for placement on the market must be at least equal to the EU standards (European Union, 2002). This means that, to export to the EU, a product must be traceable in the same way that products are traceable in the EU. This regulation has caused all countries that want to export pork to the EU to develop traceability programs that are compatible with the EU system.

According to Hayes and Meyer (2003), pork plants in the EU are smaller in size and use slower chain speeds than the US, making traceability technology more easily adopted. Hayes and Meyer (2003) indicated that much of the EU pork industry sells primals or half-sides and the further processing takes place in a butcher shop, rather than processing the carcasses to retail cuts in the processing plant. This allows retailers to meet requirements by keeping information on a primal or carcass, rather than on a cut. It is difficult to find specific information on how EU processing plants are maintaining or providing traceability, so it is likely that different processing plants are using different methods to trace their product.

Although Europeans assume that their animals (and meat) are traced from “farm to retail” this type of traceability is not commonly used in the EU (Jensen and Hayes, 2006). The most common form of traceability in the EU is birth to harvest traceability. Although all EU member countries have to adhere to EU guidelines, some countries, such as the United Kingdom (UK) and Denmark, have further traceability requirements, or have given specific instructions on how to fulfill the EU requirements in their country.

United Kingdom--In the UK there is a mandatory traceability process that is set by the Department for Environment, Food, and Rural Affairs (**DEFRA**) and is described in the *Guide*

*for pig keepers* (DEFRA, 2011). Before moving any pig to their property, a producer has to obtain a County Parish Holding number for the land where the pigs will be kept. This is a 9-digit number in which the first two digits refer to the county where the pigs will be kept, the next three digits refer to the parish in which the pigs will be located, and the last four digits are a unique code for the producer. The producer must obtain a general license and the pigs must be accompanied by a movement document, the Animal Movement License 2 (AML2), for traceability, which can be in paper format (accepted until March 31, 2012) or electronic format (the eAML2). With the paper format, both the buyer and seller must keep copies for their records. In addition, a copy of the AML2 must be sent to the local standards animal health department within three days of the pigs arriving at the property. The buyer must keep their copy on file for at least six months (DEFRA, 2004). Using the electronic format the keeper needs to pre-notify all movements either on the internet or on the telephone. When the pigs are loaded, the keeper's summary/movement documents (HS/MD) are given to the haulier and confirmation is sent via SMS text or online. The destination abattoir/farm/market confirms the animals arriving online. The completed documents are uploaded nightly into the government database. All electronic HS/MD move records will be stored electronically for 3 years (DEFRA, 2011).

When new pigs are brought on the receiving property, there is a mandatory 20-day standstill period for any other pigs that may have already been on the farm and a 6-day standstill for cattle, sheep, and goats on the property. During this time, other animals cannot be moved off the holding. This is to protect against new pigs disseminating disease (DEFRA, 2004). When cattle, sheep, or goats are brought onto the property, a 6-day standstill applies to the pigs already on the property. Once the pigs arrive at the holding for the first time, the herd (however small,

even if it's one pig) need to be registered with DEFRA by contacting the local AHVLA regional office. A herd mark is then created. The herd mark is 1 or 2 letters followed by 4 digits (DEFRA, 2011).

Farm records (either electronic or written) must be kept and include the following information: (1) date of movement, (2) type of identification mark, such as eartag, (3) herdmark, (4) number of pigs, (5) holding from which they were moved, and (6) holding to which they were moved (DEFRA, 2011). The movements on and off the property must be recorded within 36 hours. Once a year, the maximum number of pigs that are normally present on the property must be recorded. Records are to be kept by the producer and can only be removed six years after a producer ceases raising pigs. The records are to be made available to an inspector if requested (DEFRA, 2011).

DEFRA (2011) has approved several methods of identification for pigs including: (1) ear tags, (2) tattoos, (3) slapmarks, and (4) temporary paint marks. If ear tags are the ID method used, the ear tags have to be flame-proof plastic or metal when the pig is slaughtered, while ear tags for movement between holdings can be plastic. Ear tags cannot be handwritten—they must be stamped or printed and include the letters UK followed by the producer's herdmark. A tattoo of the producer's herdmark is placed on each ear (the letters UK are not needed). Slapmarks are a tattoo of the herdmark (the letters UK are not needed) that is applied to each front shoulder. For movements between holdings, a pig can be identified with a temporary paint mark which must remain legible until the pig reaches its destination. A license must also be issued by the local AHDO to take pet pigs for walks on an approved route (DEFRA, 2011).

Traceability information must be collected with any byproduct or fallen stock (National Fallen Stock Company, 2006). The EU Animal By-Products Regulation requires that producers

keep records for animals that are incinerated on-farm as well as those that are sent off the farm for disposal (DEFRA, 2011). These regulations also prohibit on-farm burial of fallen stock (DEFRA, 2011).

Britain also has specific programs, like British Quality Assured Pork (BQAP), that have traceability standards of their own. In addition to quality and specification standards, BQAP requires independent full traceability checks from the farm to the plant. They also require an independent check of the paperwork and spot checks on product, in addition to the EU and UK standards (British Meat Processors Association, 2006).

Denmark Denmark is the largest pork processing country in the European Union, making up 17% of the world's exported pork (Harmann, 2006). Pork exports make up about half of all Danish agricultural exports (DAFC, 2012).

In Denmark, all pig farms have a herd number from the Danish Ministry of Food, Agriculture, and Fisheries' Central Husbandry Register (**CHR**) (FVST, 2012)). In addition to the herd number, the CHR also contains the name and telephone number of the keeper, the name, address, and telephone number of the owner of the pigs, the address of the farm housing the swine herd as well as its geographical coordinates, the species of animal, as well as the production type (such as weanling pigs), average number of animals, the name, address, and telephone number of the local veterinarian tending to the herd, and the 5-figure supplier number that is applied to the pigs before they leave for slaughter (Lauristen, 2006).

According to Lauristen (2006), there is a specific chain of tagging in Denmark to which the swine producer should adhere. First, the pigs must have an ear-tag before they leave their birth herd. The ear tag must have the CHR number on it and must have been approved by the Danish Veterinary and Food Administration. Second, the producer must record which pigs are

entering and leaving the farm, as well as document the use of medicine and which animals were treated. When a pig leaves the farm, it is marked on its gammon (ham) with a 5-digit number. The pig is also accompanied by a certificate that has information on the health status of the original herd, a transport document containing the CHR number, the name and address of the buyer and seller, the name and address of the transporter, the number of animals, and the date of transfer. Third, the slaughterhouse receives pigs directly from the producers, through a contract with the transporter (Lauristen, 2006).

After slaughter and before or at weighing of the carcass, the identification number on the gambrel is automatically read and linked to the supplier number and stored in a computerized system (Lauristen, 2006). Data such as the weight of the carcass, lean meat percentage, occurrence of colored follicles (pigs with colored hair follicles are not used for skin-on products), and veterinary observations are linked to the gambrel in the computerized system. These data are used to calculate the payment for the pig producer. After the veterinarian has declared the carcass fit for human consumption, the carcass is stamped with the number of the slaughterhouse, which is assigned by the Danish Veterinary and Food Administration. If the carcass is processed at a plant other than the one at which it was slaughtered, the carcass must be stamped with the slaughter numbers of both plants (slaughter and processing plants). If the animal was slaughtered and processed in the same plant, only one number is required. Following this, the meat cuts and meat products must be identified by their lot number. The retail-packed meat must be labeled with the name of the distributor or the packager (Lauristen, 2006).

New Zealand--New Zealand produces over 700,000 pigs for slaughter per year and is focused mostly on domestic trade (Ministry of Agriculture and Forestry, 2006). According to the New Zealand Food Safety Authority (**NZFS**A), a 2005 amendment to the 1999 Animal Products Act

made an Animal Status Declaration (**ASD**) mandatory for every movement of a pig (NZFSA, 2006a). Prior to this amendment, only pigs that were sent to slaughter needed the required form. The forms cost A\$25.00 for 25 forms if ordered from the New Zealand Pork Industry Board, or are free if downloaded from the NZFSA website (NZFSA, 2006b).

The ASD form has several sections (NZFSA, 2006b). The first section asks for information on the number, type, and tattoo/brand/ear tag numbers of the pigs. This is followed by a section for the name and physical address to whom the pigs are being supplied. Next, information concerning health treatments, date when medication was last administered, and when the withholding period was complete is documented. The next section is concerned about animal movements. This is followed by questions about porcine somatotropin, leptospirosis control, and quality assurance programs. The form also asks if the pigs were ever fed meat, food waste, or porcine material in their lifetime. The producer is then asked to sign and date the form under the statement “I am the person in charge of these pigs and I declare that I have read and understand the requirements of this *ASD for Pigs* and the information is true and accurate”. The ASD form also asks for the name of the transport company, including the driver’s name and signature, the vehicle and trailer registration numbers, and the time loaded. The ASD allows the pigs to be traced from the farm until slaughter (NZFSA, 2006b).

According to the ASD form (NZFSA, 2006b); the ASD is to be completed by the person who has the authority and knowledge to answer all the questions, which could be the owner, manager, or sale-yard operator. The person who signs the ASD must keep a copy on file for one year while the individual who receives the pigs must keep a copy of the ASD for the entire time they have the pigs and an additional year after they leave. Processing companies are required to keep their copies of the signed ASDs for four years from receipt of the pig. If a producer or

processor receives pigs with no ASD, they must keep them separated from other pigs until the ASD arrives at the processing plant. In the event there is no ASD, the pigs must be returned to their place of origin (NZFSA, 2006b). According to the ASD form, giving a false or misleading declaration on the ASD could result in a fine of up to A\$30,000 for an individual or A\$100,000 for a company.

#### *Farm to Retail Traceability*

A farm to retail traceability program would trace an animal from birth to an individual package bought at the retail level. Although there are no countries that mandate farm to retail traceability for pork, some private companies are finding marketing opportunities by having a farm to retail traceability programs in place.

One such company is Nippon Meat Packers, a meat processor and packer that produces traceable beef, pork, and chicken in Japan. Since 2004, consumers have been able to trace meat purchases from the pork package to the pig farm via the internet (Nippon Ham, 2004). Although the computer-based systems were extremely popular when introduced, they are not commonly used anymore (Clemens, 2003). Even so, customers do not want them removed and feel more confident in the product because the information is available (Clemens, 2003). Domestic pork traceability has been considered over the years in Japan, but has not been implemented as a mandatory regulation for swine.

#### *Countries without Government Regulated Traceability*

There are some major pork producing countries that do not have mandatory pork traceability programs. Examples include most South American countries, as well as Australia.

South American countries differ greatly in the amount of pork they produce and export. In reviewing available literature, no South American country has a mandatory swine/pork

traceability program at this time. Brazilian and Chilean pork producers have some ability to trace swine, although traceability is voluntary (USDA-FAS, 2006b; BRAZIL CITATION!!). Both Brazil and Chile benefit from having a vertically integrated pork industry, which simplifies traceability.

Brazil--Brazil is a major exporter of pork. Brazil is expected to be very competitive in price-sensitive markets such as Russian and Asian countries other than Japan and South Korea (USDA, 2012). Brazil has recently significantly improved its competitiveness in pork exports by reducing production cost and increasing global market share (Talamini and Malafala, 2010). There are private firms in Brazil that have been contracted by the government to assist with traceability (Stroade et al., 2007). Traceability in Brazil is for the export market, especially by the Brazilian Export Pork Meat Chain (BEPMC). Talamini and Malafaia (2010) suggested that most of the traceability is conducted either through company audits. Pork that is in the BEPMC agreement can usually be traced to the producer level, although there is no government regulation for this (Talamini and Malafaia, 2010). Talamini and Malafaia (2006) stated that the information producers collect is often superficial and does not allow for clear identification of the exact traceability process. Using the traceability, transparency, safety assurance, and quality assurance rating score of Liddell and Bailey (2001) to look at the effective implementation of the traceability, transparency, and quality assurance system, BEPMC received only five points out of a possible 15—receiving a zero in traceability and quality assurance. Even so, the authors pointed out that the framework is in place and if all the programs available were implemented, Brazil would have received 11 points on the scale (Talamini and Malafaia, 2006).

Chile--Another major pork producer quickly becoming a major pork exporter is Chile. Pork exports from Chile were 140,000 metric tons in 2011, up from 59,000 metric tons in 2002, and

more than doubling their exports in three years (USDA-FAS, 2006a; USDA-FAS, 2011). Chile has most of the traceability framework in place to trace their swine and pork. This is because of a stable government, relative geographic isolation that helps keep the country disease-free, and a pork industry that is “efficient, concentrated, and vertically integrated” (USDA-FAS, 2006b). The largest five producers in Chile are totally vertically integrated and account for 75% of all pork production. Chile primarily exports to Japan, South Korea, Mexico, and the EU (USDA-FAS, 2006b). Although Chile must be tracing some of these pork products because they are selling to the EU, there is no government mandate requiring traceability and it remains voluntary.

Australia--Australia is produced about two million metric tons of pork in 2010 (USDA-FAS, 2011). Pork production in Australia is currently limited because of a strong Australian dollar, falling carcass weights, and high domestic demand (USDA-FAS, 2011). This has caused exports to countries like the US and Japan to fall and forced Australia into new markets such as Russia (USDA-FAS, 2011).

The PigPass was introduced into export abattoirs in 2006. The Australian Quarantine and Inspection Service (AQIS) started certifying pork for export beginning in 2007. Producers can register on the PigPass system and receive PigPass National Vendor Declaration (NVD) books. The NVD includes information on the pigs (number of pigs, description, type of pigs, any special risks), the producer (name, address, phone number, property identification code, and tattoo numbers), husbandry information (information about medicine, withdrawal times, and quality assurance programs), and transportation (DAFF, 2012)

## **Implications**

Swine and pork traceability programs differ greatly from country to country. This review discusses traceability programs in swine and pork that are currently being used throughout the

world and provides a depiction of how swine traceability can be accomplished. Certain countries, like countries in the EU, have the ability to trace pigs all the way from the farm to the harvest and packaging of pork. In other countries, such as Chile and Japan, private companies are voluntarily tracing swine for export.

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## APPENDIX I

Beef Export Verification Export Requirements (all are required to be produced under the applicable AMS EV program and subject to individual labeling and documentation requirements)

### Barbados:

- Eligible: All fresh, frozen, or chilled beef and beef products (beef products includes offal, variety meats, and processed beef) derived from cattle slaughtered on or after January 16, 2008. Fresh/frozen beef and beef products imported from Australia may be exported to Barbados.

### Cayman Islands

- Eligible: Beef and beef products. Meat and meat products legally imported into the US from Australia, New Zealand, or Canada. Canned, boneless meat legally imported into the United States.

### Costa Rica

- Eligible: Fresh/frozen bone-in and boneless beef including further processed products and beef tongues, kidneys, livers, and hearts.

### Dominican Republic:

- Eligible: Beef and beef products, including offal, derived from cattle less than 30 months of age.

### El Salvador

- Eligible: Beef meat products derived from cattle less than 30 months of age. Ruminant meat originating from Australia and New Zealand is eligible for export to El Salvador.

### Egypt

- Eligible: Beef and beef products.

### Guatemala

- Eligible: Red meat and red meat products, including beef and beef products, beef trim, and tallow.

## Hong Kong

- Eligible: Fresh/frozen red meat and red meat products, including fresh/frozen boneless beef, hanging tenders, dry aged boneless beef, beef inside skirts, and further processed boneless beef derived from cattle less than 30 months of age
- Ineligible: Bone-in beef, ground beef, beef trimmings, other boneless beef from skeletal muscle indistinguishable from beef trimmings, beef diaphragm other than hanging tenders, beef cheek and head meat, beef offal, and beef derived from advanced meat recovery systems.

## Japan

- Eligible: Fresh/frozen beef and beef offal derived from animals 20 months of age or younger. Spinal cord and spinal column (excluding the transverse process of the thoracic and lumbar vertebra, the wings of the sacrum, and the vertebrae of the tail) must be removed.
- Ineligible: Beef heads (hygienically removed tongues and cheek meat are eligible), processed beef products and veal products, ground beef and ground veal, and advanced meat recovery products containing beef or veal.

## Korea

- Eligible: Beef or beef products derived from (1) cattle born and raised in the United States, (2) cattle imported into the United States, for example from Canada, and raised in the United States for at least 100 days prior to slaughter, or (3) cattle legally imported into the United States from a country deemed eligible by the Korean government to export beef or beef products to Korea. Presently limited to Mexico, Australia, and New Zealand. Korean beef importers and US exporters have reached a commercial understanding that, as a transitional measure, only US beef from cattle less than 30 months of age will be shipped to Korea. Eligible beef and beef products, including bone-in beef, deboned beef, offal, and variety meats must be derived from animals slaughtered on or after the QSA program approval date of the slaughter establishment. Beef tallow does not require an EV program
- Ineligible: Beef and beef products derived from cattle imported from Canada for immediate slaughter are ineligible. Beef and beef products derived from cattle imported from Canada that were resident in the US less than 100 days prior to slaughter are ineligible. Imported beef and beef products are not eligible for direct export or for export after processing in the US. Processed beef products (e.g., any product that has added ingredients) are ineligible at this time.

## Lebanon

- Eligible: Meat and meat products, including bone-in and boneless beef products.

## Malaysia

- Eligible: Beef and beef products including canned beef products. The vertebral column (including the transverse process of the thoracic and lumbar vertebra, the wings of the sacrum, and the vertebrae of the tail) must be removed from animals 30 months of age and older.

## Mexico

- Eligible: Fresh/frozen beef meat and beef meat products, including bone-in and boneless beef products, further processed products, tripe, trimmings, hearts, kidneys, lips, diaphragms, tongue, cheek meat, livers, feet, and thymus (sweetbreads) derived from animals less than 30 months of age. Bone-in and boneless beef trimmings, tongue, and tripe imported from establishments in Canada, and beef and beef products imported from Australia and New Zealand are eligible for export.
- Ineligible: Beef meat products containing advanced meat recovery, mechanically separated meat and ground meat.

## Panama

- Eligible: Beef and beef products including canned beef products. The vertebral column (including the transverse process of the thoracic and lumbar vertebra, the wings of the sacrum, and the vertebrae of the tail) must be removed from animals 30 months of age and older.

## Peru

- Eligible: Beef and beef products. The vertebral column (including the transverse process of the thoracic and lumbar vertebra, the wings of the sacrum, and the vertebrae of the tail) must be removed from animals 30 months of age and older. Also the meat cannot be derived from animals imported from Canada for immediate slaughter. Fresh/frozen bovine meat of Australian origin.

## Philippines

- Eligible: Meat and meat products. All beef, beef offals, and processed beef products are eligible for export to the Philippines regardless of production date.

#### St. Kitts-Nevis

- Eligible: Beef and beef products. Effective for beef and beef products derived from cattle slaughtered on or after June 14, 2009, all age restrictions and product restrictions have been removed.

#### St. Lucia

- Eligible: Boneless beef and boneless beef products derived from cattle less than 30 months of age.

#### Singapore

- Eligible: Fresh/frozen boneless beef derived from animals less than 30 months of age. Beef derived from cattle imported from Canada is not eligible. Knives, steels, and other tools, excluding carcass splitting saws, used to sever and remove the spinal cord must be used exclusively on carcasses of animals less than 30 months of age.
- Ineligible: Beef and beef products, including offal, hanging tenders, are ineligible, with the exception of fresh/frozen boneless beef from animals slaughtered in the United States and collagen casings derived from bovine hides. Products imported into the US from third countries are not eligible to be exported to Singapore, with the exception of natural casings. Beef and beef products imported from Canada are not eligible for direct re-export or for re-export after processing in the US.

#### Taiwan

- Eligible: Deboned and bone-in beef derived from (1) cattle born and raised in the United States, (2) cattle raised in the United States for at least 100 days prior to slaughter, or (3) cattle legally imported into the United States from a country deemed eligible by Taiwan to export deboned beef to Taiwan (Presently, Australia and New Zealand can export directly to Taiwan with no restrictions). The following fresh and/or frozen beef products: bones with meat, hanging tenders, tongues, penis, testes, tails, tendons, and skirts, derived from cattle less than 30 months of age slaughtered on or after April 1, 2010. Beef or beef products of cattle from Canada fed less than 100 days prior to slaughter in the United States is limited at this time to deboned beef derived from animals less than 30 months of age. Protein-free beef tallow (this product does not have to be produced under an EV program).
- Ineligible: Beef and beef products of cattle from Canada other than those identified above. The following beef products: skull, brain, eyes, spinal cords, internal organs, and ground beef.

## Thailand

- Eligible: Boneless beef.

## Ukraine

- Eligible: Beef and beef products, including bone-in, boneless, offal, and processed products, derived from cattle less than 30 months of age.

## Vietnam

- Eligible: Beef meat, including bone-in and boneless, from animals less than 30 months of age. Beef offal products from animals less than 30 months of age slaughtered before July 15<sup>th</sup> 2010. Beef heart, liver, and kidney products from animals less than 30 months of age slaughtered on or after May 4<sup>th</sup>, 2011.
- Ineligible: Any other beef offal not identified in the “Eligible section” above. Beef offal products from animals slaughtered on or after July 15<sup>th</sup>, 2010 and before May 3, 2011 are not eligible for export.