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# Factors Shaping Expanding U.S. Red Meat Trade

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## Abstract

U.S. imports and exports of red meats—beef, pork, lamb, and mutton—have expanded rapidly over the last several decades, linking livestock sectors of the United States to those of several major trading partners. Factors driving this trade growth include not only rising incomes, but also the preference of U.S. and foreign consumers for a greater variety of red meat cuts, facilitated by the expansion of free trade agreements. Changes in currency values, including the recent depreciation of the U.S. dollar against the currencies of key trading partners, have also been important influences in expanding trade in U.S. red meat products. Domestic production continues to provide the main share of beef and pork consumed in the United States, while the share of U.S. lamb consumption from imports has increased significantly. While the red meat (and poultry) markets have been punctuated by animal disease issues over the last few years, the integration of trade is expected to continue.

**Keywords:** Trade, red meats, beef, pork, lamb and mutton, exchange rates, trade agreements, disease shocks, market share.

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## Introduction

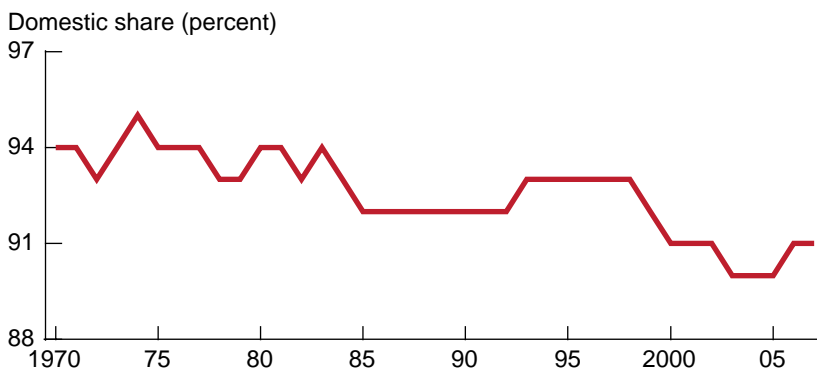
U.S. imports and exports of red meats—beef, pork, lamb, and mutton—have shown strong growth over the last several decades, increasing the interdependence between the U.S. livestock sector and the livestock sectors of major U.S. trading partners. Rising incomes—a key driver of meat demand—have been an important factor, leading to consumer preferences for certain kinds and qualities of red meat. Along with rising demand and changing preferences, a set of bilateral and regional free trade agreements, such as the North American Free Trade Agreement (NAFTA), have facilitated growth in two-way trade and fostered product specialization, consistent with comparative production advantage. As a result, U.S. red meat exports increasingly differ in quality from imports, reflecting different consumer preferences in the United States and abroad. U.S. producers have tended to specialize in high-value cuts, while imports have been of lower value. As a consequence, prices for U.S. domestic red meat have tended to increase relative to prices for imported meat.

Fluctuations in the exchange rate of the U.S. dollar have also shaped the growth and direction of the U.S. red meat trade. When the dollar is strong relative to currencies of major red meat trading partners, as in the mid-1990s, U.S. exports have contracted. Most recently, the depreciation of the dollar against trade-partner currencies has encouraged U.S. exports of high-valued meats, especially beef.

While U.S. exports and imports of red meat have expanded rapidly over the last several decades—and U.S. red meat consumption has grown about 20 percent since 1970—there has been little change in the share of U.S. meat consumption of meat produced domestically.<sup>1</sup> About 91 percent of U.S. beef, pork, lamb, and mutton consumption was of U.S.-produced meat in 2007, compared with about 94 percent in 1970 (fig. 1). The shares of U.S. consumption of domestic meat have tended to decline significantly since the mid-1990s. Since 1996, the share of U.S. consumption from domestically produced meat has declined by 3 percent for beef, 2 percent for pork, and 43 percent for lamb and mutton.

Figure 1

### Share of red meat consumed in the U.S. from domestic animals has trended downward



Source: U.S. Department of Agriculture, Economic Research Service, FATUS Data Set, 2008.

<sup>1</sup>Consumption trends are based on USDA estimates of domestic disappearance of red meats. Disappearance, which is calculated based on USDA estimates of production, trade, and changes in stocks, is a proxy for actual consumption data, which are not available. See box, “USDA Red Meat Domestic Disappearance Estimates,” page 5.

## The Expanded U.S. Red Meat Trade

### *U.S. Exports*

Since 1970, the quantity of U.S. red meat exported has increased more than 3,200 percent—beef and veal by 2,700 percent, pork by 3,500 percent, and lamb by 1,500 percent. In 2007, the United States exported beef to 118 countries, pork to 103 countries, and lamb to 39 countries (see appendix tables 1, 2, and 3). Accelerating world market integration has led to growth in U.S. red meat trade with many countries.<sup>2</sup> At the same time, there has been a clear increase in the concentration of trade, with most U.S. red meat imported from, and exported to, a handful of countries. More than 80 percent of U.S. beef exports and more than 75 percent of pork exports went to just five countries, Canada, Mexico, Russia, South Korea, and Japan, and 85 percent of lamb and mutton exports went to Mexico, Canada, Bermuda, the Bahamas, and Jamaica (table 1). In the case of beef and pork, trade agreements facilitated trade growth with Canada, Mexico, and Japan, three of our major markets. Significant exports of all three red meats go to Canada and Mexico, reflecting dependency on a few large markets and the importance of the North American Free Trade Agreement (NAFTA) in facilitating trade between our neighboring countries.

<sup>2</sup>See appendix tables 1-3 for a list of all the countries that trade red meats with the United States.

Table 1

#### **Most U.S red meat exports are to a few countries (2007 data)**

	Export quantity	Export value
	<i>Million pounds</i>	<i>Million dollars</i>
<b>Beef</b>		
Total exports	1,434.0	2,186.8
Canada	339.1	576.1
Mexico	586.4	737.4
South Korea	77.9	124.2
Taiwan	70.7	108.3
Japan	159.4	293.9
<i>Share of total</i>	<b>86%</b>	<b>84%</b>
<b>Pork</b>		
Total exports	3,141.2	3,019.6
Japan	1,072.8	1,203.0
Mexico	451.4	331.3
Canada	367.6	545.8
South Korea	264.9	216.5
Russia	244.3	166.3
<i>Share of total</i>	<b>76%</b>	<b>82%</b>
<b>Lamb</b>		
Total exports	9.3	10.8
Mexico	4.9	3.6
Canada	1.7	2.0
Bermuda	1.0	2.5
Bahamas	0.3	0.4
Jamaica	0.03	0.05
<i>Share of total</i>	<b>85%</b>	<b>79%</b>

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

## *U.S. Imports*

Red meat imports have increased by more than 75 percent since 1970, with dramatic increases from the mid-1990s to 2003. As with exports, U.S. imports of red meat were concentrated in a few countries. In 2007, both U.S. beef and pork imports came from 21 countries, and lamb and mutton imports came from 5 countries. But over 90 percent of all beef and veal imports came from Australia, New Zealand, Canada, Brazil, and Uruguay; more than 95 percent of all pork came from Canada, Denmark, Mexico, and Poland; and nearly all lamb and mutton—99 percent—was imported from Australia and New Zealand (table 2). Imports from other countries were usually processed specialty products.

The United States has consistently been a net importer of beef and lamb and mutton (fig. 2). Despite the growth in exports, since 1995 U.S. beef imports have exceeded exports. For the same period, pork exports have exceeded imports, and, in 2007, were at record-high levels. Improved market access, industry expansion, and improved efficiency have helped the United States remain a net exporter of pork.

Table 2

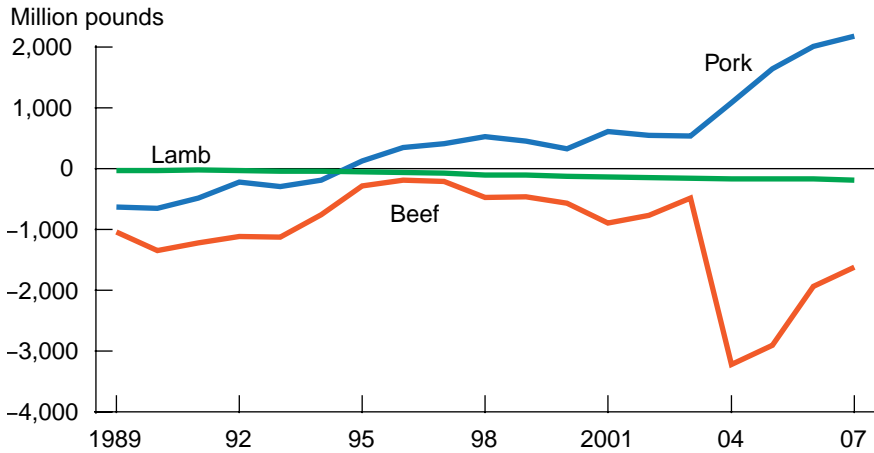
### **More than 90 percent of U.S red meat imports came from six or fewer countries in 2007**

	Import quantity	Import value
	<i>Million pounds</i>	<i>Million dollars</i>
<b>Beef</b>		
Total Imports	3052.2	3284.6
Australia	887.6	999.8
Canada	789.5	840.0
New Zealand	507.7	527.8
Uruguay	355.2	303.0
Brazil	280.8	332.4
<i>Share of total</i>	<b>92%</b>	<b>91%</b>
<b>Pork</b>		
Total Imports	968.4	1188.8
Canada	764.8	825.3
Denmark	98.9	179.2
Mexico	42.8	38.3
Poland	28.0	40.4
Italy	10.8	57.5
<i>Share of total</i>	<b>98%</b>	<b>96%</b>
<b>Lamb and mutton</b>		
Total Imports	202.6	453.4
Australia	152.2	319.7
New Zealand	49.6	133.0
Canada	0.8	0.2
Iceland	0.1	0.5
<i>Share of total</i>	<b>100%</b>	<b>100%</b>

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

Figure 2

**Net trade of U.S. red meats, 1990-2006**



Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

**USDA Red Meat Domestic Disappearance Estimates**

The Economic Research Service (ERS) compiles and publishes supply and disappearance tables quarterly and annually for beef, veal, pork, and lamb and mutton. These tables provide estimates of the meat available for human consumption, including fresh and processed meat sold through grocery stores and used in restaurants. Disappearance is calculated based on carcass-weight equivalent. It is often difficult to tell how much of a carcass is actually consumed, but due to the paucity of true consumption data, researchers often interchange disappearance and consumption by assuming that the entire carcass is consumed. While disappearance is commonly used as a proxy for consumption, it is important to recognize that disappearance is an indicator of consumption, and not actual consumption. Disappearance data are computed from production, trade, and stocks.

The formula for calculating domestic disappearance is:

$$\text{Domestic Disappearance} = \text{Production} + \text{Beginning Stocks} + \text{Imports} - \text{Exports} - \text{Ending Stocks}$$

Meat production data come from three sources: slaughter under Federal inspection, other commercial slaughter, and slaughter on farms. Production data are on a carcass-weight basis in pounds of product at the slaughter plant. Commercial stocks data on meat that are held in cold storage are from USDA’s National Agricultural Statistics Service (NASS). These stocks are calculated at the beginning (beginning stocks) of the reporting period and at the end (ending stocks). Trade data (imports and exports) are collected by the Department of Commerce and are available on a product-weight basis. ERS converts trade data into carcass weight for use in the supply and disappearance balance sheets to ensure that all components of the disappearance are measured in the same units. The conversion factors for the different types of meat vary, and ERS periodically changes the conversion factors to reflect these changes. The changes may occur due to genetic changes within the animals, changes in cutting characteristics, or to changes in feed regimen.

## Factors Driving Trade Growth

With incomes growing rapidly both in the U.S. and abroad, consumers demand an ever-broadening range of products, including a variety of red meats. Expanding incomes, combined with increasing openness of markets and global market integration, continue to fuel trade growth. However, international trade in each type of red meat is affected by different market dynamics.

### U.S. Beef Trade

While the United States is both the largest producer and consumer of beef in the world, it is a net importer of beef. This is because most beef produced by the United States is grain-finished, high-value beef. The domestic market is the largest taker of this high-end beef, consuming just under 95 percent of domestic production in 2007. Most U.S. beef exports also are more expensive, choice-grade cuts. U.S. beef exports have increased steadily since the early 1980s and, despite setbacks due to the discovery of bovine spongiform encephalopathy (BSE) in late 2003, accounted for about 5 percent of total U.S. beef production in 2007.

As U.S. high-value beef exports have increased, so have lower quality beef imports. The United States uses a large amount of lower grade beef in its processed meat products, resulting in heavy dependence on imported beef. Most of the beef the United States imports for processing is grass-fed, destined primarily for hamburger. U.S. beef and veal imports have grown steadily since the early 1980s and represented just over 10 percent of 2007 U.S. beef consumption.

### U.S. Pork Trade

Productivity gains have allowed the pork industry to increase the percentage of U.S. commercial production that is exported. Since the mid-1980s, the U.S. hog industry gradually has shifted to larger operations, with increased contracting and vertical coordination to optimize year-round slaughter capacity. This restructured U.S. hog industry produces more pork at prices that are competitive in many markets. In 2007, pork exports equaled 14 percent of U.S. commercial production, with Japan being by far the largest customer, followed by Mexico and Canada.

Most of the pork imported by the United States comes from Canada, Mexico, Denmark, and Poland. While U.S. pork imports from Canada and Mexico involve a wide variety of cuts, pork imports from Denmark and Poland are specialized pork products. Danish pork imports represent about 5 percent of U.S. pork consumption, while Polish imports represent less than 2 percent.

The restructuring of the U.S. pork industry has resulted in both a significant increase in the number of live hog imports from Canada and a shift in the makeup of the imports (Haley, 2004). Prior to 1990, nearly all live hog imports from Canada were slaughter hogs that went directly to pork processing plants. A rapid shift in the live-import mix occurred in the mid-1990s after the North American Free Trade Agreement was implemented and as the domestic industry shifted toward increased contracting. Now, the U.S.

and Canadian hog industries are closely integrated, with Canada exporting increasing numbers of hogs and pigs to the United States for finishing and/or slaughter (Hahn et al., 2005). This integration resulted, in part, from a rollback of subsidy supports for agriculture by Canadian federal and provincial governments, a consequence of NAFTA, which created incentives for the expansion of the Canadian hog sector and a shift in the structure of U.S. production. Since 2005, more than 60 percent of U.S. live hog imports have been feeder pigs from Canada, to be fed to their slaughter weight in the United States. These foreign-born hogs later form part of U.S. production.

## **U.S. Lamb and Mutton Trade**

U.S. lamb production has slowed since the mid 1970s, while per capita consumption has remained stable. As a result, not only have lamb and mutton imports significantly increased to supplement domestic supply, but since the mid-1980s, U.S. per capita consumption of imported lamb has increased sharply as well. Unlike beef imports, lamb imports are high-quality, high-value cuts. Lamb imports, which currently account for more than half of U.S. lamb and mutton consumption, are overwhelmingly from Australia and New Zealand, which together account for 99 percent of all U.S. imports. While U.S. lamb and mutton production has been declining, the export share of production has increased rapidly since the early 1980s, although from a small base. Because U.S. consumers prefer high-quality and high-value cuts, a large share of U.S. exports is lower-valued mutton.

Although the three red meats have different production dynamics, trade factors play an increasingly important role in the share of U.S. production consumed domestically. Australia and New Zealand are export-oriented economies that are highly competitive in the lamb and beef trade. The growing U.S. beef processing market continues to create export opportunities for these and other countries with grass-fed systems. Other foreign countries have significantly increased their market share in the United States by capitalizing on specialty exports.

## **The Role of Trade Agreements**

The post WWII era has been characterized by increasing globalization, which has also influenced trade growth in meats and other agricultural products. Improvements in communication and transportation have allowed increasing specialization of production and the broader separation of production locales from markets. Business interests have also brought increasing pressure to reduce trade barriers to allow for the economies of scale that can be achieved with greater openness to trade.

Free trade agreements—bilateral, regional, and multilateral—are reducing agricultural trade barriers and have played important roles in expanding red meat trade. Several free trade agreements have been especially important in the evolution of the red meat trade:

- ***U.S.-Japan Beef and Citrus Agreement (1988)*** – With this agreement, the United States and Japan strengthened their beef and citrus trade. Prior to 1988, Japan had a quota on beef that restricted imports to very low levels. The 1988 agreement eliminated Japan's beef quota and substituted a

pattern of declining tariffs on imported beef, resulting in Japan's becoming a major market for U.S. beef exports.

- **Canada-U.S. Free Trade Agreement (CAFTA, 1989)** – The CAFTA removed each country from the other's meat product quotas and eliminated bilateral tariffs on beef, pork, and lamb. While the tariffs were relatively small, this agreement provided the impetus, or actual legal basis, for the integration of the red meat industry that has subsequently occurred between Canada and the United States.
- **North American Free Trade Agreement (NAFTA, 1994)** – The NAFTA further expanded the U.S.-Canadian liberalization of animal and red meat trade to Mexico. Under the agreement, Mexico reduced the 25-percent tariff on U.S. and Canadian beef to zero. Further, the agreement established a 10-year tariff-rate quota (TRQ) on certain pork products. For these products, the in-quota tariff was phased out over 10 years. Additionally, tariffs with 10-year phaseouts and special safeguards were implemented for slaughter hogs, pork, and hams. The NAFTA created the legal basis for expanding the cross-border integration of the beef and pork industry to Mexico, resulting in a dramatic increase in the importance of both Canada and Mexico in the U.S. red meat trade.
- **Uruguay Round (UR) Agreement on Agriculture (1994)** – The UR Agreement, which established the World Trade Organization (WTO), had important consequences for the red meat trade. The U.S. replaced its quota on beef, mutton, and goat meat with a tariff-rate quota. Over-quota tariffs were initially set at 31 percent in 1995. By 2006, the in-quota tariff was set at 4.9 percent, and the over-quota tariff was required to be reduced to 26.4 percent. Side agreements were negotiated with Argentina and Uruguay to grant them access above the global tariff-rate quota limit for fresh, chilled, and frozen beef after they established an area free of foot-and-mouth disease. There were further tariff reductions for pork in trade with Japan (Obara, Dyck, and Stout, 2003). A side agreement between the United States and Japan, which became part of the overall UR agreement, applies equally to all WTO members exporting pork to Japan. It was in effect in 1995, 1996, 1997, 2001, and 2002 and is specific to pork imports. A similar side arrangement was made for beef. First, it lowered the Most Favored Nation tariff rate for beef to 38.5 percent by 2000. Second, it placed a safeguard provision, stipulating that if beef import quantity in a year or any quarterly period within that year exceeds the quantity in the same period of the previous year, Japan can raise the tariff to as much as 50 percent for the rest of the year, or for the first quarter of the following year (if the provision is triggered after fourth quarter). The agreement was drawn up separately for chilled and frozen beef.
- **Bilateral trade agreements** – Although the agreements with Canada, Mexico, and Japan have been the most significant ones for U.S. and global red meat trade, a substantial number of other bilateral free trade agreements have been negotiated since 1988 that include some reduction in trade barriers for red meats. The agreement accompanying China's accession to the WTO in 2001 led to a reduction of Chinese restrictions on imports of agricultural goods. While the agreement facilitated U.S. exports of beef and pork to China, with pork exports increasing twelvefold between 2001 and 2007, much of the growth was largely due to increased imports in response to disease-related shortfalls in China's pork production.



## Relative Prices Affect Market Share

Changes in the price of imported meats relative to domestic products can also influence incentives for imports and exports.<sup>3</sup> Depending on how sensitive meat consumers are to changes in prices of each product, an increase in the price of imported red meat relative to domestic products may reduce the demand for imports. If consumers perceive that either the domestic or imported product has desirable special characteristics, then consumer demand may respond little to a change in relative prices. However, if consumers view the imported and domestic products as close substitutes, then prices may significantly affect import demand and trade.

U.S. beef imports are generally lower-valued products than domestically produced beef (fig. 3). Since U.S. cow slaughter is insufficient to fully supply the market for processing meat, the United States imports processing-grade beef. Prior to 1995, an absolute quota placed on imported beef by the United States limited imports, a restriction that has been eased by the TRQ negotiated in the WTO Uruguay Round. Most-Favored-Nation TRQ suppliers pay 4.4 cents per kilogram of in-quota tariff, with out-of-quota imports assessed a tariff of 26.4 percent. Despite these import restrictions, lean beef imports from Australia, New Zealand, and Uruguay remain price-competitive with U.S. products, partly explaining the increasing use of imported beef by U.S. processors.

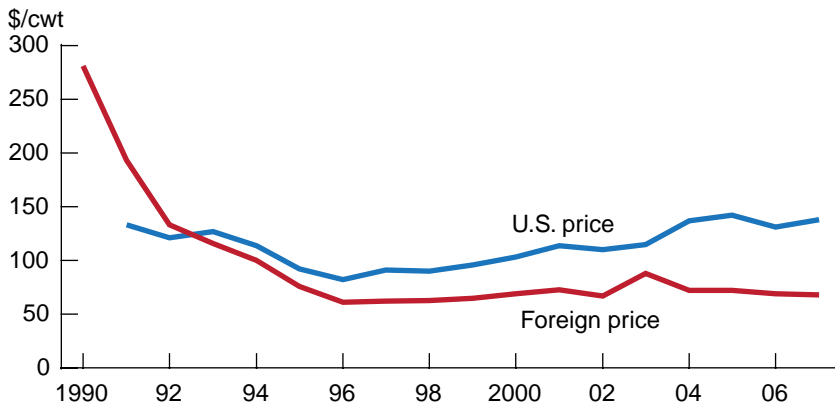
Unlike beef prices, U.S. and foreign prices for pork moved together throughout the 1990-2006 period (fig. 4), suggesting that imported and domestic pork products may be of similar quality in the eyes of consumers. However, in this case, while competitive U.S. prices bolster exports, an incentive for expanding imports may be that the imported pork is of specialty, value-added products that consumers differentiate from domestic products. In other cases, geographic proximity to population centers may confer transportation cost advantages to imported pork.

Unlike prices for beef and pork, foreign and U.S. prices for lamb and mutton have converged over time (fig. 5). In the early 1990s, the price spread was in the range of 40 to 50 cents per pound, with the foreign price being significantly lower and providing the incentive for the expansion of U.S. imports. Prices have since converged, with foreign prices surpassing domestic prices briefly in 2004 and 2005. This convergence in price may be because the United States is a large consumer of high-valued lamb, and U.S. demand exceeds domestic supply.

<sup>3</sup>For this analysis, U.S. prices are on a wholesale carcass-weight basis, and import prices are trade-weighted prices for major trading partners.

Figure 3

**Central U.S. price (90 percent lean beef) and imported beef prices, 1990-2007**

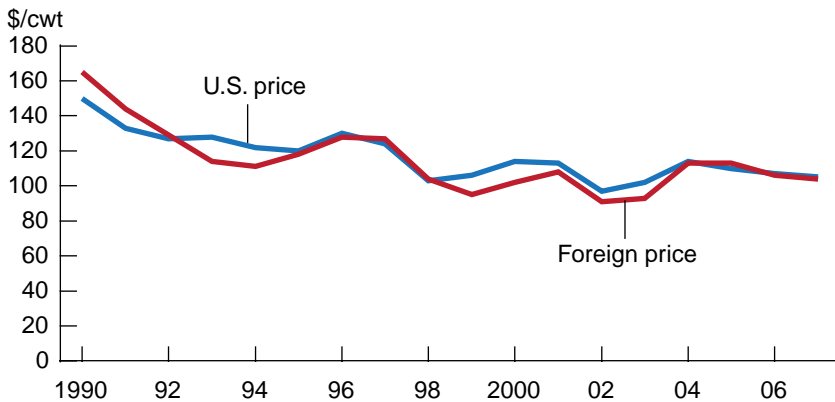


Note: Foreign beef price is a trade-weighted real price from all of the major importers. The trade-weighted price was formulated by taking the unit import value from the countries from which it is imported and dividing by the respective country's consumer price index. The consumer price index is divided by its 2000 value (2000=100 is the base year). The import price for each country is then multiplied by the share of imports from each country to get a trade-weighted import price. The combined foreign price for beef is the sum of the weighted average price of all the major countries in table 2 from which the country imports beef. The import price is assumed to be a wholesale-level price. The U.S. price is the Central U.S. price for 90% lean beef, which is comparable to the imported beef price.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

Figure 4

**U.S. wholesale pork price and imported pork prices, 1990-2007**

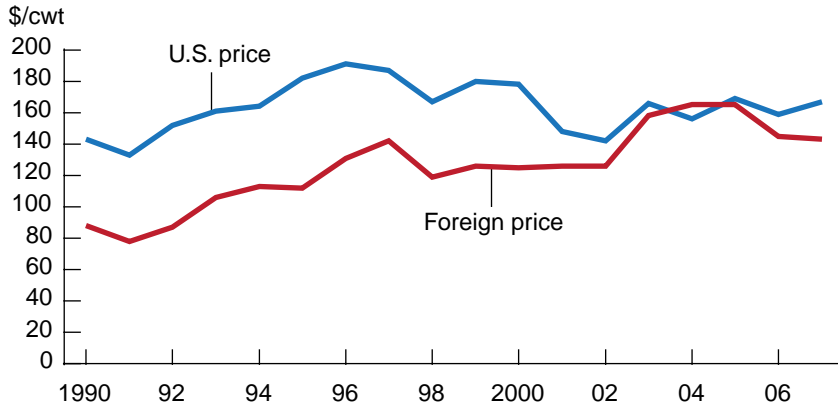


Note: Foreign pork price is a trade-weighted real price from all of the major importers. The trade-weighted price was formulated by taking the unit import value from the countries from which it is imported and dividing by the respective country's consumer price index. The consumer price index is divided by its 2000 value (2000=100 is the base year). The import price for each country is then multiplied by the share of imports from each country to get a trade-weighted import price. The combined foreign price for pork is the sum of the weighted average price of all the countries from which the country imports pork. The import price is assumed to be a wholesale-level price. The U.S. price is a wholesale price.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

Figure 5

**U.S. wholesale lamb price and imported lamb prices, 1990-2007**



Note: Foreign lamb price is a trade-weighted real price from all of the major importers. The trade-weighted price was formulated by taking the unit import value from the countries from which it is imported and dividing by the respective country's consumer price index. The consumer price index is divided by its 2000 value (2000=100 is the base year). The import price for each country is then multiplied by the share of imports from each country to get a trade-weighted import price. The combined foreign price for each lamb is the sum of the weighted average price of all the countries from which the country imports lamb. The import price is assumed to be a wholesale-level price. The U.S. price is a wholesale price.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

## The Role of Exchange Rates

Changes in exchange rates alter U.S. export prices in foreign markets, as well as U.S. competitor export prices relative to those of the United States, playing a significant role in the red meat trade. A U.S. dollar appreciation (depreciation) reduces (increases) the costs of imports for the United States, changing the international competitive environment for U.S.-produced substitute products. An appreciation (depreciation) of the U.S. exchange rate would lead to an increase (decrease) in the quantity imported. Because the foreign market for each commodity has a different composition of countries and is subject to competition from different suppliers, the importance of changes in exchange rates has varied by commodity.

The behavior of the U.S. currency relative to a few key countries has had an important influence on the U.S. red meat trade since 1990, continuing into the present, for all three red meats.<sup>4</sup>

### Effects of Exchange Rates on Beef Trade

In 2007, about 72 percent of U.S. beef imports were from Australia, New Zealand, and Canada, and changes in the exchange rates of these three countries are potentially the most important to U.S. beef trade (table 3). Until 2006, the currencies of Australia (US\$0.50-US\$0.87 range), New Zealand (US\$0.40-US\$0.71), and Canada (US\$0.64-US\$0.84) were fairly stable, trading within narrow ranges in relation to the U.S. dollar. The Canadian dollar depreciated most significantly against the U.S. dollar during 1992-2002 (fig. 6), and, during the 1990s, the share of U.S. beef imports from Canada showed an uptrend. By the mid-2000s, however, U.S. beef imports

<sup>4</sup>The analysis here uses real trade-weighted exchange rate indexes computed for each red meat: beef, pork, and lamb. With this approach, the exchange rate of each trading country and the share of imports from each country influence the resulting trade-weighted exchange rates. The movements in the exchange rates of the largest trading partners have the greatest influence on changes in the indexes.

Table 3

#### U.S. beef imports are primarily from a few countries

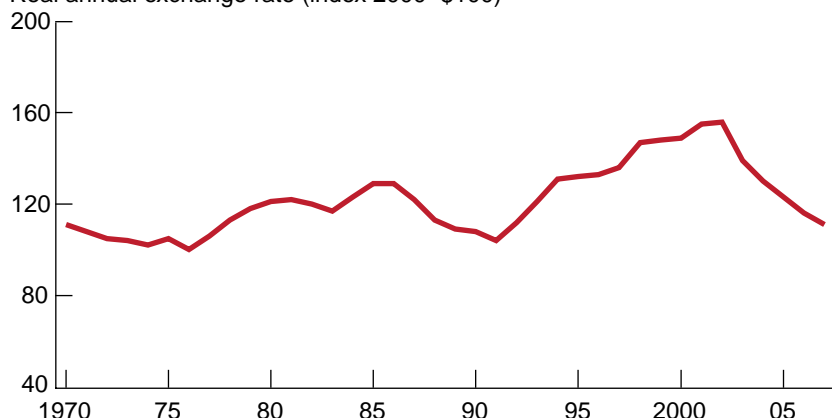
Year	Canada	Mexico	Uruguay	Argentina	Australia	New Zealand	Rest of World
<i>Percent of imports (by quantity)</i>							
1989	11.0	0.0	0.4	8.7	37.6	29.9	12.3
1990	9.5	0.1	0.8	8.9	46.1	24.4	10.2
1991	9.6	0.1	1.0	10.9	43.0	26.2	9.2
1992	14.3	0.0	0.9	8.3	40.7	24.9	10.8
1993	18.1	0.2	0.6	7.1	35.9	22.7	15.6
1994	19.9	0.2	0.5	6.1	36.3	22.1	15.0
1995	21.6	0.3	0.4	8.3	31.8	26.9	10.6
1996	28.5	0.5	3.4	7.4	26.2	24.2	9.8
1997	31.2	0.4	2.9	6.3	27.0	23.8	8.4
1998	31.4	0.3	1.9	4.7	32.2	22.2	7.2
1999	33.2	0.4	2.3	5.5	30.0	19.4	9.3
2000	30.6	0.4	2.0	4.3	33.9	20.5	8.2
2001	32.0	0.4	1.3	3.3	35.0	20.4	7.7
2002	34.6	0.5	0.4	2.8	34.6	18.4	8.7
2003	23.0	0.5	3.6	3.0	37.9	22.3	9.7
2004	29.1	0.5	10.9	3.2	30.0	17.7	8.6
2005	30.4	0.8	15.8	3.2	24.5	16.5	8.9
2006	28.8	1.3	9.9	2.8	28.8	18.3	11.6
2007	25.9	1.6	11.6	2.2	29.1	16.6	13.0

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

Figure 6

**The Canadian dollar had over a decade of depreciation against the U.S. dollar, until 2002**

Real annual exchange rate (index 2000=\$100)



Source: ERS exchange rate data set: [www.ers.usda.gov/data/exchangerates/](http://www.ers.usda.gov/data/exchangerates/)

from Canada had leveled off as the Canadian dollar appreciated against the U.S. dollar. By 2007, the Australian and New Zealand currencies had likewise strengthened considerably and diverged from previously stable trading ranges with the U.S. dollar.

Mexico, Argentina, and Uruguay are also among the top 10 suppliers of beef to the United States. However, these countries combined accounted for less than 20 percent of U.S. beef imports. Currencies in the Latin America countries have been less stable. Brazil has had a history of macroeconomic instability involving high rates of inflation and large foreign debt, resulting in multiple currency crises. A floating exchange-rate regime was initiated in 1990, but inflation remained a problem through 1997, and the Brazilian currency was dramatically devalued in 1999 amid a currency crisis. U.S. beef imports from Brazil, comprised of thermo-processed products, also fluctuated significantly during this period.

Argentina also experienced chronic inflation and dramatic changes in currency value, which led to several currency regimes aimed at stabilizing domestic prices. Because of the volatility of Argentina's exchange rate and continued restrictions on imports of fresh, chilled, and frozen beef, the United States imports a declining share of its beef from Argentina, from 4.3 percent in 1999 to 2.2 percent in 2007.

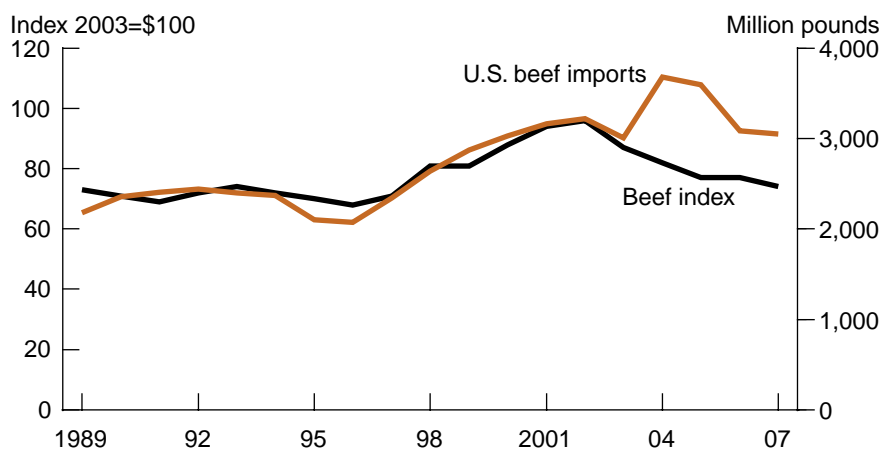
Although Uruguay also experienced an economic downturn in the late 1990s, it became a more reliable meat trading partner. However, Uruguay's trade was affected by the limitations on exports of fresh, chilled, and frozen beef in the early 2000s prior to its regaining status as free of foot-and-mouth disease. Uruguay's share of the U.S. meat import market was less than 4 percent in 2003, but had risen to over 10 percent by 2004.

Figure 7 shows the trade-weighted beef exchange rate index<sup>5</sup> and beef imports. In periods when the U.S. dollar is appreciating, imported products become cheaper in dollar terms, encouraging U.S. firms to increase imports. The beef index and beef imports consistently moved together throughout

<sup>5</sup>For a complete set of trade-weighted commodity exchange rates, go to: [www.ers.usda.gov/data/exchangerates/](http://www.ers.usda.gov/data/exchangerates/)

Figure 7

### U.S. beef imports and trade-weighted beef exchange rate index



Note: A trade-weighted exchange rate index is comprised of exchange rates—relative, in this case, to the U.S. dollar—across a set of market countries, weighted by their shares of trade for a commodity. Each country's real exchange rate is converted into an index, and the indexes are then averaged using the trade weights. The resulting exchange rate index fluctuates according to the movements of the countries that are the most important in the trade of the commodity.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

the 1990s, primarily because the beef import shares from three of the major countries, Canada, Australia, and New Zealand, had not changed significantly in the previous three decades, and their relative currency values also moved together (table 3 ). However, while the relative import shares remained stable, the overall quantity of imported beef varied with changes in the overall meat trade-weighted exchange rate. Imports from Mexico, Argentina, and Uruguay, countries with histories of unstable currencies, make up less than 15 percent of U.S. total beef imports (table 3). The beef index and beef imports were relatively flat until 1997, even though the dollar began strengthening around 1992. Since 2003, the beef trade-weighted exchange rate index and beef imports have diverged. The trade-weighted index appreciated against the currencies of Canada, Australia, and New Zealand, while imports continued to increase. This may be an indication that, while exchange rate changes may be a component of beef trade with these countries, cow slaughter in the United States and changes in production in the supplier countries are also major determinants of U.S. imports.

### Effects of Exchange Rates on Pork Trade

Pork imports are primarily from Canada, followed to a lesser extent by imports from Denmark, Poland, and Hungary (table 4). These three countries participate in the European monetary system, where their currencies are pegged within narrow horizontal bands. Pork imports from Canada have trended upward since 1989, from almost 50 percent of imports to over 80 percent in 2007. Growth in the Canadian hog industry, as well as participation in regional trade agreements like NAFTA, has fostered increased market integration, leading to expanded trade. Some of the increase, however, may be attributed to the relative strength of the U.S. dollar vs. the Canadian dollar during much of the 1980s and 1990s. During the same period, the Danish

currency strengthened relative to the U.S. currency, and the Danish share of U.S. imports declined.

Figure 8 shows the trade-weighted pork exchange rate index and the volume of pork imports, which have consistently moved together since 1989. Until the early 1990s, a relatively weak U.S. dollar pulled down the pork index,

Table 4

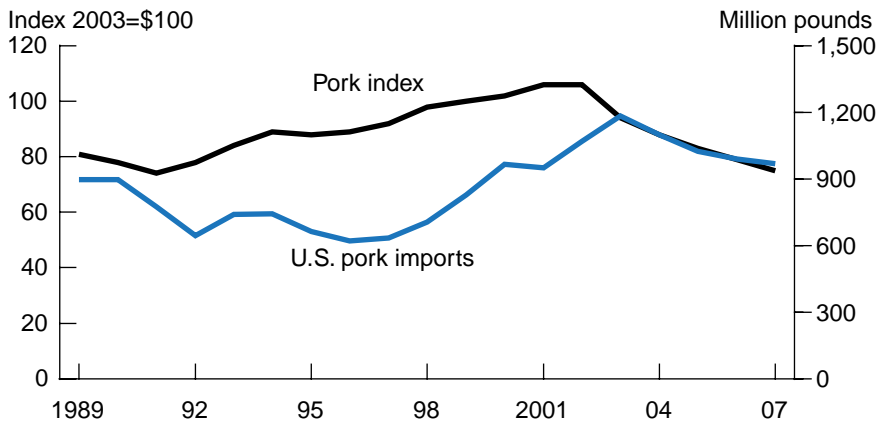
**Canada has increasingly become the source of U.S. pork imports**

Year	Canada	Denmark	Hungary	Poland	Rest of World
<i>Percent of imports (by quantity)</i>					
1989	50.4	22.4	2.9	12.5	11.8
1990	48.8	30.4	3.7	7.3	9.8
1991	52.2	31.7	5.0	2.8	8.3
1992	60.6	26.2	3.3	2.0	7.8
1993	54.8	31.2	4.0	1.8	8.2
1994	57.1	32.6	2.4	1.5	6.3
1995	68.4	21.7	1.6	1.8	6.5
1996	70.6	19.8	1.4	1.7	6.5
1997	68.7	19.5	1.4	2.4	8.1
1998	69.5	19.2	1.5	2.8	7.0
1999	74.5	16.2	0.7	2.8	5.8
2000	76.3	15.3	0.9	2.5	5.0
2001	80.7	12.5	0.7	2.6	3.6
2002	82.2	11.5	0.4	2.3	3.6
2003	82.0	12.4	0.5	1.9	3.3
2004	80.5	12.6	0.2	2.2	4.4
2005	81.7	9.8	0.3	2.5	5.7
2006	80.1	10.4	0.2	2.5	6.8
2007	78.9	10.2	0.1	2.8	8.0

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

Figure 8

**U.S. pork imports and trade-weighted pork exchange rate index**



Note: A trade-weighted exchange rate index is comprised of exchange rates—relative, in this case, to the U.S. dollar—across a set of market countries, weighted by their shares of trade for a commodity. Each country’s real exchange rate is converted into an index, and the indexes are then averaged using the trade weights. The resulting exchange rate index fluctuates according to the movements of the countries that are the most important in the trade of the commodity.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

resulting in more expensive imports and a corresponding decrease in the quantity imported. After 1992, pork imports increased with the strengthening of the U.S. dollar until 2000, when the U.S. dollar weakened relative to the currencies of some of the major pork suppliers, especially Canada. This suggests that in the absence of shifts in the structure of the sector, changes in exchange rates might be a significant determinant in fluctuations in trade of pork products.

## Effects of Exchange Rates on Lamb and Mutton Trade

Lamb and mutton imports are primarily from Australia and New Zealand, with Australia commanding about two-thirds of U.S. imports and New Zealand supplying most of the rest (table 5). Australia and New Zealand have floating exchange rate systems that have moved together. Although New Zealand's exchange rates have fluctuated more than Australia's since 1989, the additional volatility appears to have had little impact on U.S. import shares. In contrast to NAFTA's trade-expanding effects on Canada's beef and pork industries, lamb and mutton imports from Canada remain negligible.

Figure 9 shows the trade-weighted lamb exchange rate index and the volume of lamb and mutton imports. Despite fluctuations in the exchange rate index, lamb and mutton imports trended upward, with a relatively steep increase after 1995. This increase was fueled by the strong U.S. currency, relative to the currencies of Australia and New Zealand, during the mid- to late-1990s, which pushed up the lamb index and made imported lamb less expensive to U.S. purchasers. Import growth from Australia and New Zealand continued after 2000, however, despite a weakening of the U.S. dollar, suggesting that the trade-dependence effects outweighed the exchange rate effects. Table 6 shows a Pearson partial matrix of correlations over a 17-year span between exchange rates of the U.S. dollar and the currencies of countries that import U.S. red meat.

Table 5

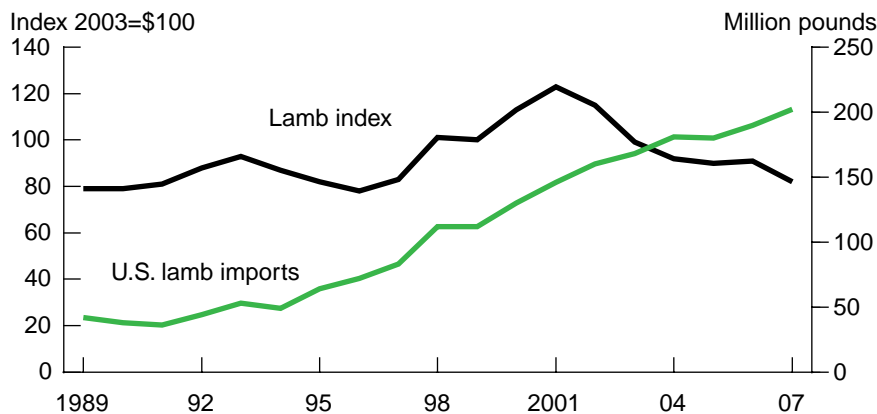
### Australia dominates U.S. lamb and mutton imports

Year	Canada	Australia	New Zealand	Rest of World
<i>Percent of imports (by quantity)</i>				
1989	0.4	70.5	29.0	0.2
1990	0.1	69.8	30.1	0.0
1991	0.3	70.5	28.6	0.5
1992	0.0	70.3	29.7	0.0
1993	0.0	65.0	35.0	0.0
1994	0.1	63.2	36.2	0.5
1995	0.2	62.9	36.1	0.8
1996	0.1	63.6	36.0	0.4
1997	0.3	65.3	33.4	1.0
1998	0.3	66.7	32.7	0.3
1999	0.2	69.1	30.5	0.2
2000	0.2	71.0	27.8	0.9
2001	0.2	72.0	27.3	0.5
2002	0.2	67.5	32.2	0.1
2003	0.1	61.7	38.1	0.1
2004	0.3	63.5	36.1	0.2
2005	0.2	72.5	27.1	0.3
2006	0.2	74.6	25.1	0.1
2007	0.3	75.1	24.5	0.1

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.



Figure 9

**U.S. lamb imports and trade-weighted lamb exchange rate index**

Note: A trade-weighted exchange rate index is comprised of exchange rates—relative, in this case, to the U.S. dollar—across a set of market countries, weighted by their shares of trade for a commodity. Each country's real exchange rate is converted into an index, and the indexes are then averaged using the trade weights. The resulting exchange rate index fluctuates according to the movements of the countries that are the most important in the trade of the commodity.

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics, and U.S. Department of Agriculture, Economic Research Service.

Table 6

**Exchange rate correlation from major U.S. red meat-importing countries, 1989-2006**

Pearson Correlation Coefficients, N = 216

Prob &gt; |r| under H0: Rho=0

	Canada	Mexico	Argentina	Brazil	Uruguay	Australia	New Zealand	Denmark	Hungary	Poland
Canada	1.00000	-0.22654 (0.0008)	-0.15199 (0.0255)	0.64303 (0.0001)	-0.31331 (0.0001)	0.81967 (0.0001)	0.64547 (0.0001)	0.67766 (0.0001)	-0.14594 (0.0320)	-0.45899 (0.0001)
Mexico		(0.0008)	-0.04282 (0.5313)	-0.53816 (0.0001)	-0.16858 (0.0131)	-0.55888 (0.0001)	-0.62656 (0.0001)	-0.49812 (0.0001)	0.23278 (0.0006)	0.27706 (0.0001)
Argentina		1.00000	1.00000	0.31671 (0.0001)	0.77740 (0.0001)	0.03470 (0.6120)	-0.01419 (0.8358)	0.06140 (0.3691)	-0.05550 0.4170	0.30366 (0.0001)
Brazil				1.00000	0.36996 (0.0001)	0.76013 (0.0001)	0.61395 (0.0001)	0.51347 (0.0001)	-0.46813 (0.0001)	-0.45970 (0.0001)
Uruguay					1.00000	-0.04196 (0.5396)	-0.01712 (0.8025)	-0.07459 (0.2751)	-0.12997 (0.0565)	0.26900 (0.0001)
Australia						1.00000	0.91504 (0.0001)	0.82578 (0.0001)	-0.13011 (0.0562)	-0.38836 (0.0001)
New Zealand							1.00000	0.86874 (0.0001)	0.11500 (0.0918)	-0.19737 (0.0036)
Denmark								1.00000	0.27827 (0.0001)	-0.08928 (0.1912)
Hungary									1.00000	0.72921 (0.0001)
Poland										1.00000

Source: ERS exchange rate data set: [www.ers.usda.gov/data/exchangerates/](http://www.ers.usda.gov/data/exchangerates/)

## Disease Shocks Affect Market Shares

While economic growth, consumer preferences, trade policy, and currency values affect U.S. trade in red meats and other commodities (Gehlhar and Vollrath, 1997), disease shocks can also have important impacts on red meat imports, exports, and market shares (Blayney, 2005; Mathews et al., 2006). Concerns about a disease such as BSE can adversely affect beef, lamb, and mutton trade, while having a positive impact on consumption of pork and other red meat substitutes and thus on trade in these meats. This appears to be what happened after December 2003, when a dairy cow in Washington State (imported from Canada) became the first confirmed U.S. BSE case (Jones, 2006). Total U.S. red meat exports had grown steadily for more than two decades to more than 4 billion pounds in 2002, but dropped to less than 3 billion pounds in 2004 because of concerns about BSE by nearly all U.S. trading partners. Although Canada and Mexico quickly resumed importing beef from the United States, Japan and South Korea were more hesitant in reopening their markets. In 2006, U.S. beef exports remained at less than half of 2003 levels, and because less beef was being exported, the share of U.S. production that was consumed domestically increased. By 2007, U.S. beef exports had recovered somewhat because the BSE problem in the United States was contained.

Disease issues have not negatively affected trade in all red meats. Pork trade appears to have expanded at least partly due to trade partner concerns with BSE in beef, as well as because of concerns with Avian Influenza (AI) outbreaks that have affected the poultry meat trade. Pork and beef are strong substitutes for each other in many markets. Pork exports, which were increasing before the BSE case in December 2003, increased even more rapidly afterwards, rising by nearly 75 percent between 2003 and 2007 (FATUS data). AI outbreaks, which limited fresh poultry exports from Thailand and China, also contributed to increased demand for U.S. pork exports. Much of the increase in U.S. pork exports associated with substitution for poultry meat went to Japan and South Korea, suggesting that for these countries, the BSE and AI issues resulted in a substitution of pork imports for beef and poultry.

Foot-and-mouth disease (FMD) status has also been an important influence on patterns of the beef and pork trade. For instance, when FMD rocked the Taiwanese hog industry in 1997, it eliminated Japan's single largest source of imported pork and created market opportunities for other exporters, especially the United States. Since 1997, U.S. pork exports to Japan have trended upward and, by 2007, had more than doubled their level preceding Taiwan's FMD episode. Since Taiwan remains an FMD-infected area, it is not expected to regain the Japanese market share in the near future. FMD-induced restrictions also prevent Brazil and Argentina from exporting fresh, chilled, and frozen beef to North American markets—the United States, Canada, and Mexico—as well as to Japan, South Korea, and Taiwan. U.S. lean beef imports from Uruguay resumed in 2003 after Uruguay achieved FMD-free vaccination status. Because of Uruguay's competitive prices, even at over-quota tariff rates, U.S. import volume from that country increased almost fourfold between 2003 and 2007.

## Conclusion

As a result of robust global income growth, expanding consumer demand for a broader range of products, and product specialization induced by increased openness and integration of markets worldwide, the United States is exporting more of its red meat production, while at the same time importing more from other countries. Expanding, more open trade has increased interdependence between livestock sectors of the United States and its major trading partners, enhancing the role played by factors such as increased incomes, more demanding consumer preferences, specialization in production, price differentials, and exchange rates in shaping the meat trade and the returns to livestock producers. The analysis presented here highlights the sensitivity of U.S. red meat production, consumption, and trade to changes—and potential volatility—in U.S. prices and currency exchange rates relative to those of trading partners, as well as to potential shocks from animal diseases and food safety concerns. As consumer incomes in foreign markets, particularly in emerging market economies, continue to grow, the trend of increasing trade in red meats—and increasing interdependence between U.S. and foreign markets—will likely continue.

The growth in the role of two-way trade in the U.S. red meat sector corresponds with rising U.S. meat consumption, but with a small decline in the share of U.S. total consumption of red meat derived from animals slaughtered in the United States. The contribution of imports to U.S. red meat consumption was about 9 percent in 2007, compared with about 6 percent in 1970. However, the contribution of imports appears to have quickened since the mid-1990s, with future growth likely to hinge on factors such as new trade agreements, changes in relative prices and exchange rates, and animal disease developments that affect incentives for red meat trade.

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## Appendix

Appendix table 1

### Average value of U.S. beef trade, 2003-06

Export destinations (value = \$1,000)				Sources of imports (\$1,000)	
Mexico	577,452	Colombia	609	Argentina	63
South Korea	374,882	Australia	606	Republic of South Africa	63
Japan	309,032	Macao (Macau)	595	Gabon	63
Canada	260,758	Lebanon	576	Tonga	59
Taiwan	70,862	France	538	Macedonia (Skopje)	55
Hong Kong	20,736	Malaysia	523	Seychelles	52
Bahamas	13,731	Romania	487	Georgia	49
Kuwait	11,854	Equatorial Guinea	456	Cambodia	46
Bermuda	7,832	El Salvador	436	Ivory Coast	44
Saudi Arabia	6,457	Poland	422	Guadeloupe	42
United Arab Emirates	6,246	Greece	412	Namibia	40
Switzerland	5,548	Marshall Islands	406	Tunisia	39
Indonesia	5,393	Brazil	393	Martinique	39
Dominican Republic	5,082	Kazakhstan	390	Mozambique	36
Philippines	4,852	Pakistan	390	Congo(Brazzville)	32
Germany	3,440	Palau	389	Kyrgyzstan	29
Egypt	2,900	Latvia	384	Oman	23
Jamaica	2,859	St. Kitts-Nevis	321	Guinea	23
Singapore	2,853	St. Vincent and the Grenadines	291	Slovenia	22
Vietnam	2,737	Peru	270	Anguilla	21
Guatemala	2,590	Nigeria	263	Tuvalu	19
Russia	2,444	Uruguay	253	Israel	18
China	2,404	Bangladesh	227	Sierra Leone	17
Netherlands	2,401	Luxembourg	213	Central African Republic	16
Svalbard and Jan Mayen Islands	2,043	Cuba	209	Ghana	16
Cayman Islands	1,933	Chile	190	Iceland	15
Trinidad and Tabago	1,789	Micronesia, Federated States	186	Slovakia	14
Barbados	1,696	New Zealand	177	Armenia	14
United Kingdom	1,317	Nicaragua	164	Cyprus	13
Costa Rica	1,238	Panama	149	Kenya	13
Thailand	1,174	Suriname	144	Sudan	11
Aruba	1,077	Malta and Gozo	138	Uzbekistan	10
Vatican City	1,065	Venezuela	132	Guyana	10
Italy	1,035	Haiti	126	Ireland	8
Netherlands Antilles	1,014	French Polynesia	125	Ukraine	7
Turks and Caicos Islands	885	Afghanistan	124	Ethiopia	7
Bahrain	855	Senegal	117	Guinea-Bissau	6
Denmark	831	Grenada	113	Cameroon	6
Spain	811	Portugal	106	Iraq	6
Qatar	803	Dominica	100	Bolivia	5
St. Lucia	775	Sweden	99	Pitcairn Island	5
Belgium	753	Belize	87	Niger	4
Antigua & Barbuda	737	Albania	85	Togo	4
Honduras	724	Finland	83	St Helena	3
Turkey	706	Yemen	77		
Angola	669	Ecuador	77		
Bulgaria	664	British Virgin Islands	73		
Jordan	610	Norway	71		

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

**Average value of U.S. pork trade, 2003-06**

Export destinations (value = \$1,000)				Sources of imports (\$1,000)			
Japan	956,855	Belize	387	Georgia	66	Canada	926,527
Mexico	344,024	Marshall Islands	381	Samoa	65	Denmark	189,914
Canada	307,070	Costa Rica	381	Pakistan	64	Italy	41,459
South Korea	117,755	Nicaragua	331	Armenia	55	Poland	32,324
Russia	57,826	St. Vincent and the Grenadine	326	Jamaica	54	Mexico	13,955
Taiwan	34,610	Moldava	298	Macao (Macau)	51	Netherlands	11,696
China	29,838	Denmark	279	Kenya	49	Ireland	11,104
Australia	29,002	Israel	277	British Virgin Islands	48	Spain	7,091
Romania	20,160	Republic of South Africa	272	Sweden	46	United Kingdom	6,639
Hong Kong	16,751	Nigeria	251	Bangladesh	44	Germany	5,090
United Kingdom	11,037	Micronesia, Federated States	247	Suriname	43	Finland	4,735
Honduras	9,987	St. Lucia	237	New Caledonia	41	Hungary	2,800
Guatemala	8,551	Greece	225	Guyana	39	Belgium	2,562
Cuba	7,648	Grenada	224	Saudi Arabia	38	Sweden	1,814
New Zealand	7,365	Portugal	223	Serbia and Montenegro	37	Chile	1,235
Bahamas	6,952	Palau	212	Uzbekistan	33	France	565
Philippines	5,219	Turks and Caicos Islands	208	Argentina	31	Iceland	161
Germany	4,269	Barbados	201	Qatar	30	Australia	48
Colombia	3,830	Cyprus	192	Montserrat	29	China	42
Netherlands	3,782	Antigua & Barbuda	187	Morocco	28	Brazil	36
Dominican Republic	3,438	Spain	187	France	28	Iran	30
Trinidad and Tabago	3,068	Turkey	176	Algeria	27	New Zealand	28
Panama	2,461	Malaysia	170	Kyrgyzstan	26	Lithuania	21
Singapore	2,431	Azerbaijan	156	Finland	26	Uruguay	17
El Salvador	2,032	Venezuela	147	Sierra Leone	26	Russia	16
Poland	1,583	Greenland	131	Niger	26	Ukraine	6
Netherlands Antilles	1,370	Estonia	129	Tonga	25	Bolivia	3
Bulgaria	1,341	St. Kitts-Nevis	129	Albania	24		
Kuwait	1,313	Lebanon	125	Norway	20		
Cayman Islands	1,268	Bahrain	108	Namibia	20		
Belgium	1,223	Vietnam	103	Brazil	18		
French Polynesia	1,019	Thailand	96	India	15		
Italy	960	Switzerland	93	Central African Republic	12		
Ecuador	784	Equatorial Guinea	93	Malta and Gozo	11		
United Arab Emirates	691	Oman	91	Anguilla	10		
Aruba	607	Uruguay	87	Fiji	7		
Jordan	499	Dominica	78	Liberia	7		
Chile	493	Latvia	72	Afghanistan	6		
Bermuda	470	Peru	72	Slovenia	6		
Macedonia (Skopje)	463	Bolivia	68	Ghana	6		
Haiti	449			Mongolia	4		
Indonesia	401			Monaco	4		
Angola	395			Guadeloupe	3		
Lithuania	389						

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

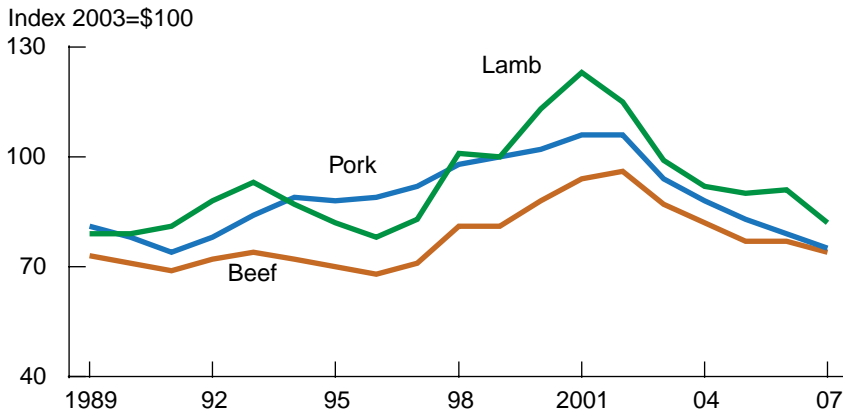
**Average value of U.S. lamb and mutton trade, 2003-06**

Export destinations (value = \$1,000)		Sources of imports (\$1,000)			
Mexico	5,807	Hong Kong	25	Australia	279,572
Bermuda	1,681	Slovakia	24	New Zealand	154,962
Canada	1,517	France	24	Iceland	773
Bahamas	921	Costa Rica	23	Canada	164
Russia	416	New Zealand	21	Dominican Republic	115
Germany	341	Netherlands Antilles	19	Mexico	84
Japan	248	Bahrain	19	Chile	80
Australia	193	United Arab Emirates	17	Russia	47
Jamaica	150	Nicaragua	17	Vietnam	3
Spain	141	Panama	16		
Italy	118	Belize	15		
Dominican Republic	95	Vietnam	15		
Cayman Islands	93	Taiwan	13		
Angola	87	Sweden	13		
Ukraine	81	El Salvador	12		
Greece	81	Norway	12		
Barbados	69	Guadeloupe	12		
Denmark	69	Uruguay	10		
Aruba	69	Saudi Arabia	10		
St. Lucia	60	Anguilla	9		
Turks and Caicos Islands	59	Suriname	9		
Netherlands	51	Grenada	9		
Honduras	51	Portugal	7		
Trinidad and Tobago	50	Haiti	7		
South Korea	41	Iceland	7		
United Kingdom	41	Peru	6		
Kuwait	41	Chile	6		
Antigua & Barbuda	37	Ireland	4		
St. Vincent and the Grenadines	35	Qatar	4		
Finland	35	Guyana	4		
Ecuador	35	Malaysia	4		
St. Kitts-Nevis	34	Dominica	3		
Guatemala	34	Argentina	3		
Equatorial Guinea	29	Republic of South Africa	3		
British Virgin Islands	28	Jordan	3		
Singapore	27				

Source: U.S. Department of Commerce, Census Bureau, Foreign Agricultural Trade Statistics.

Appendix figure 1

### Real trade-weighted exchange rate indexes for all three red meats move together



Note: Indexes for each red meat were formulated by taking the real exchange rates from the countries from which each is imported and converting them into an index by dividing each of the series by its 2003 value (2003=100 is the base year). The real exchange rate was then multiplied by the share of imports (share of imports from each country is based on the average imports between 2000 and 2005) from each country to get a trade-weighted index. The combined index for each meat is the sum of the weighted average of all the countries from which the meat is imported.

Source: ERS exchange rate data. Annual average of monthly observations:  
<http://www.ers.usda.gov/Data/ExchangeRates/Data/RealMonthlyCountryExchangeRates.xls>