World Trade Impacts of Foot and Mouth Disease in Taiwan

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EXECUTIVE SUMMARY

An outbreak of foot and mouth disease (FMD) in Taiwan has prompted an indefinite ban on pork exports from that country. This will have a significant impact on pork trade patterns and world pork prices. Taiwan has accounted for over 15 percent of world pork exports in recent years and is the predominant exporter to Japan, the world's largest pork importer. This paper analyzes the price and trade effects of this export ban. The study was conducted using the FAPRI (Food and Agricultural Policy Research Institute) modeling system, a simulation model that enables examination of the interaction among pork, other meats, feed grains, and protein meal feeds.

The primary scenario analyzed assumes that Taiwan will not reenter the pork export market in the next 10 years. Japan, which traditionally imports almost the entirety of Taiwan's exports, is likely to be extra cautious to avoid any potential health risks to its large domestic swine herd. The results of the analysis indicate that the shortfall of 337 thousand metric tons (tmt)—the remaining portion of the baseline's projected exports for Taiwan in 1997—in world export supplies will increase the world price of pork by 5 percent in the first year.

In response to higher prices, other major importers, in aggregate, will reduce imports by 70 tmt. Of this quantity, the decline in Japanese imports is only 6 tmt, as the Japanese market is buffered from world price fluctuations by their gate price policy. Consequently, only 267 of the 337 tmt of pork removed from the market will be supplied by the other pork exporting countries. Because of its cost advantage and available processing capacity, the United States is projected to increase exports by 210 tmt, capturing nearly 78 percent of the export opportunities made available. Canadian exports, limited by processing capacity, grow by 37 tmt. The increase from the EU is even more modest at 7 tmt because Denmark is the only country with any significant exports to Japan. The present swine fever problem in the Netherlands may further affect export growth in the European Union. Expansion in production capacity induced by the price increase in 1997 leads to a supply increase over the next several years, dampening world prices, bringing them closer to the baseline levels in later years.

As exporters and importers adjust to these moderating prices, the United States continues to increase and retain the major share of the export opportunities arising from Taiwan's ban on pork exports. Lower pork production in Taiwan reduces their import demand for feed. However, grain prices weaken only mildly because expanding pork production in the United States increases domestic use.

An alternative scenario is also analyzed under the assumption that Taiwan resumes exports at 8 percent of the baseline level in the year 2000, increasing to 53 percent of the baseline by 2004. This additional supply, over and above the increase due to adjustments initiated in other exporting countries during the previous 3 years, causes world prices to fall marginally below the baseline levels in 2000, 2001, and 2002.

Exports from the United States are the most affected by Taiwan's reentry into the pork export market. The United States reduces its exports by 167 tmt in 2006 compared to the previous scenario, while Taiwan increases its exports to nearly 280 tmt. It is also argued that the absence of Taiwan in the Japanese pork market is likely to have a moderating influence on the within-year trade fluctuations experienced in the recent past due to the Japanese gate price mechanism; however, no attempt is made to quantify the possible implications of reduced trade volatility.

Introduction

The recent ban on pork exports from Taiwan resulting from an outbreak of foot and mouth disease (FMD) in March 1997 will significantly alter future world trade patterns in pork, both in the short and long run. Despite accounting for just over 1.0 percent of world annual pork production, estimated at over 74 million metric tons (mmt), Taiwan has played a major role in world trade because of its large market share in Japan, the world's single largest pork importer. Japan was projected to import 904 thousand metric tons (tmt) of pork in 1997, with 40.6 percent of Japan's imports expected to come from Taiwan. Since Taiwan is no longer able to export pork, other major exporters will be vying for Taiwan's share of Japan's pork imports. In addition, as a major supplier in the Japanese pork market, Taiwan has been an important contributor in recent years to the excessive volatility in trade patterns spawned by Japan's "snap-back" provision. Given the significant nature of this event to world pork markets, rigorous analysis is needed to gain a better understanding of the magnitude of its impact on world pork prices and its implications for pork trade patterns.

The objective of this study is to provide an in-depth analysis of the price and trade effects created by the recent outbreak of FMD in Taiwan. Specifically, we seek to answer the following questions.

1. What will be the impact of Taiwan's exit from the pork export market on U.S. pork and grain prices?
2. How will Taiwan''s share of the Japanese import market be divided among the remaining pork exporters?
3. How will adjustments in world markets affect countries not directly involved in pork trade with Taiwan or Japan?

The analysis is performed using the Food and Agricultural Policy Research Institute's (FAPRI) model of world agricultural production and trade to simulate the removal of Taiwan's pork exports from world markets. The resulting prices and trade flows are compared to FAPRI's 1997 baseline projections (FAPRI 1997) to ascertain the impact of this shock to the pork sector on world prices and trade volumes. The results are reported as follows. First, important details of the outbreak of FMD in Taiwan are presented, and the reactions by pork importing nations are placed in context. Second, the important characteristics of Taiwan's livestock sector are discussed, followed by a brief description of Japan's pork import market. Third, specific modeling assumptions important to the analysis are outlined, and the simulation results for specific countries are discussed. Finally, this report concludes with a brief summary.

The FMD Outbreak in Taiwan

On March 14, 1997, the first case of FMD in swine was reported in Hsinchu Prefecture, in the northwest part of the island of Taiwan. The Taiwan Health Research Institute confirmed the diagnosis as an FMD case on March 19, 1997. As of March 21, clinical cases were observed in the western 10 prefectures, but the full extent of the outbreak is still not certain. While FMD does not pose a serious health threat to pork consumers, this contagious viral disease spreads by air, and an epidemic can be disastrous to the entire swine industry of any country.

Although effective vaccines are available, vaccination is generally not cost effective as a routine preventive measure. Also, vaccination will not eradicate the disease. As such, the effective countermeasure in case of an outbreak is the "stamping-out" or slaughter of infected herds and emergency vaccination of herds predisposed to infection (*Microsoft Encarta 96, Encylopedia* 1995). Along with the adoption of a nationwide vaccination measure, Taiwan announced an indefinite ban of pork exports on March 21, 1997. Within the first few weeks of the export ban, reportedly nearly 400,000 animals from over 1,000 infected farms (of a total 250,000 farms) were destroyed, and another 500,000 are expected to be slaughtered. It is speculated that the required slaughter may be as high as 1.6 million head of the total 10.5 million in the herd.

To avoid FMD infection of its domestic swine herds, it is a common practice among

FMD-free countries to allow imports only from other FMD-free countries. Table 1 provides a list of countries declared free of FMD by the World Organization of Animal Health (OIE), an independent international organization founded in 1924 to monitor and disseminate information about animal diseases throughout the world. Taiwan's FMD-free status was suspended by OIE due to the recent outbreak of the disease. The country's main export markets, namely, Japan, Korea, and Singapore, followed suit by imposing a ban on pork imports from Taiwan. This action by countries that are FMD free is consistent with the provisions of the World Trade Organization's "Agreement on the Application of Sanitary and Phytosanitary Measures," which allows countries to adopt and enforce measures necessary to protect human, animal, or plant life or health.

Taiwan's Livestock and Feed Industries[1]

Agriculture contributes only 3.5 percent to Taiwan's total economic output (the service sector contributes 60.2 percent and industry 36.3 percent). In the agricultural sector, the leading commodities are pork and poultry, accounting for 22 and 10 percent respectively of the value of agricultural production. Pork production alone comprises 63 percent of the value of animal production. The country's emphasis on less land-intensive agricultural commodities is a reflection of the land constraint faced in Taiwan, a country where only 24 percent of the 3.6 million hectares of total land area is cultivated due to the steep slope of its terrain. Also, its proximity to high-income markets for value-added livestock products in Japan, Hong Kong, Korea, and Singapore is an advantage to the livestock sector.

In Taiwan, the supply and demand structure of livestock and poultry products varies significantly. Beef is the lowest per capita consumption at 3.16 kg. And beef is the most import dependent of the three meats—beef, pork and poultry. Domestic beef production constitutes only 8 percent (6 tmt) of total supply (75 tmt) and the other 92 percent is imported. Beef imports account for 2.64 percent of total agricultural imports. The United States, Australia, and New Zealand are the major suppliers of beef to Taiwan. The beef import market is very segmented based on product differentiation. The United States captures 21.4 percent of Taiwan's beef import market with exports primarily composed of special quality beef (SQB). Australia dominates the market for shin, shank, and intercostal cuts, and New Zealand leads in cheaper steak cuts. A preferential tariff is granted to SQB. Poultry is second in per capita consumption at a level of 30 kg, but the domestic industry, with production of 655 tmt, can generally meet domestic demand. Poultry meat imports are insignificant primarily because of the ban against chicken imports.

Pork, on the other hand, has the highest per capita consumption level, 39.76 kg. and is the only sector with substantial exports at 21 percent of Taiwan's production. In 1995, there were 26,153 hog farms and 55,317 persons employed in pork production, retailing, meat processing, and feed production. The 1996 beginning hog inventory is estimated at 10.5 million head (USDA), 14 percent of which are breeding animals (Taiwan Agricultural Yearbook 1996). In the same year, 14.6 million head were slaughtered, implying a turnover rate of 1.39. Pork exports account for 27.96 percent of total agricultural exports. This amounted to 270 tmt (retail weight) valued at $1.58 billion.

Taiwan's cost of production is very competitive at $1,427 to $1,744 per mt compared with the wholesale price of $1,390 in the United States, $1,690 in Denmark, and $4,848 in Japan. Of Taiwan's total pork exports in 1996,

[1] Data in this section were collected from The Republic of China Yearbook 1996, Taiwan Agricultural Yearbook 1996, and various attaché reports on agriculture, livestock, and poultry.

Table 1. FMD-free countries as per Resolution no. XII of OIE

Australia	Czech Republic	Hungary	Malta	Slovakia
Austria	Denmark**	Iceland	Mexico	
Belgium	Estonia	Indonesia	Netherlands	Slovenia
Bulgaria*	Finland	Ireland	New Caledonia	Spain
Canada**	France	Italy	New Zealand	Sweden
Chile	(Serbia and Montenegro)*	Japan	Norway	Switzerland
Costa Rica	Germany	Korea	Poland	Taiwan*
Croatia	**Greece**	Lithuania	Portugal	United Kingdom
Cuba	Haiti	Luxembourg	Romania	United States**
Cyprus	Honduras	Madagascar	Singapore	Uruguay

* FMD–free status suspended due to recent occurrence.

** Major suppliers of pork to Japan.

SOURCE: OIE 1996a.

99.4 percent went to Japan, 0.39 percent to Hong Kong, 0.19 percent to Korea, and a negligible amount to Singapore. Taiwan also imports both live hogs and pork, the former coming from the United States, Finland, and Ireland, primarily for breeding purposes. Taiwan's exports of live hogs for breeding purposes generally go to Hong Kong, but it is believed they are often subsequently shipped to Mainland China.

Pork and poultry feed make up 47 and 45 percent, respectively, of the total and commercial and farm processed feeds in Taiwan.[2] The other 8 percent is fed to cattle and aquaculture. In 1995, total feed production was 8.87 million tons from 9.89 million tons of ingredients. As shown in Table 2, the composition of compound feeds consists of 28 percent protein (2.79 million tons protein meal), 67 percent grain (6.60 million tons grains), and 5 percent starch, fats and oils, and other ingredients (0.51 million tons).

The 6.2 mmt of corn consumed annually in Taiwan is essentially used for feeds; moreover, 95.5 percent of the total corn supply is imported. The United States holds a dominant 99 percent share of the corn import market. Barley is a substitute for corn in animal feeds, and the quantity of barley fed would increase with higher corn prices. Around two-thirds of the 0.3 million tons of barley Taiwan consumes annually is used for feeds, the rest is for brewing and food. Australia, Russia, and the United States are
Taiwan's primary barley suppliers. Taiwan produces soymeal locally but imports close

[2] Data in the following discussion were collected from various USDA Foreign Agriculture Service attache reports on oilseeds, products, and grain and feed categories.

Table 2. Use of feed ingredients by sector in Taiwan

Feed Ingredient	Livestock Sector					
	Swine	Poultry	Cattle	Aquaculture	Other	Total
			(tmt)			
Soybean Meal	886	811	36	52	19	1,804
Other Protein Meal	431	445	18	83	9	986
Grain (Corn/Barley)	3,128	2,984	122	305	64	6,603
Others*	243	173	7	82	3	505
Total	4,685	4,413	183	522	95	9,898

* Others include starch, fat and oil, and other ingredients.
SOURCE: USDA-FAS, TW 6045.

to 100 percent of the soybean raw material. Only an additional 5 percent of total meal requirement is imported. Canada, Thailand, Vietnam, and the United States are suppliers of soybeans, with the United States holding 99 percent of the market. This configuration in the soybean complex is expected to remain in the future since Taiwan has no duty on soybean imports but a 3 percent duty on soymeal imports.

Japan's Pork Import Market and Price Stabilization Policy[3]

In the 1990s, the share of Japanese pork consumption from imports doubled, reaching 33.72 (0.70 million tons) percent compared to the 15.85 percent in the 1980s (0.28 million tons). Japan has four main suppliers of pork, namely, the United States, Canada, Taiwan, and Denmark. A breakdown of import shares by country and product type is found in Table 3. In terms of total pork supply, Canada's share has remained in the 5-6 percent range. Denmark's share declined from 32 in 1992 to 18.21 percent in 1996, while the shares of the United States and Taiwan showed some gains at 21 and 38 percent, respectively. Over time the share of fresh and chilled pork imported by Japan has increased from 24 percent in 1992 to 31 percent in 1995. The 1996 decline in fresh and chilled imports to 26 percent may be a result of the safeguard provision that promotes excess imports of frozen pork in the first quarter of the Japanese fiscal year (i.e., April–June) in anticipation of a higher gate price[4]. In the fresh and chilled pork import category, only the United States has substantially gained market share, increasing from 29 percent in 1992 to 42 percent in 1996. Taiwan's share has declined from 68 percent to 44 percent over the same period, while Denmark is not a big supplier in frozen pork imports. In the past five years, Taiwan's share of frozen pork imports increased initially then declined to a share of 36 percent, while Denmark's share declined from 42 to 24 percent.

Japan has a price stabilization policy on beef and pork products that is supported by selective border protection measures. In the

[3] Data for this section were collected from USDA Foreign Agriculture Service attache reports on livestock and the LIPC Monthly Statistics.

[4] The gate-price mechanism is described in more detail on the following pages.

Table 3. Market share of major pork suppliers to Japan by product type

Product/Year	Exporting Country					
	US	Canada	Taiwan	Denmark	Other	Total
			Percent			
Chilled						
1992	29.33	0.98	68.37	0.02	1.30	100
1993	36.54	1.57	60.32	0.11	1.46	100
1994	38.09	2.55	57.25	0.40	1.71	100
1995	47.27	2.96	47.69	0.09	1.99	100
1996	42.12	4.25	44.42	0.04	9.18	100
Frozen						
1992	9.51	7.12	35.85	42.10	5.42	100
1993	7.05	8.14	38.83	39.88	6.10	100
1994	5.94	6.69	44.34	36.65	6.38	100
1995	8.34	6.35	45.97	29.38	9.96	100
1996	13.19	6.57	35.69	24.42	20.14	100
Total						
1992	14.33	5.63	43.77	31.86	4.42	100
1993	14.95	6.38	44.58	29.24	4.86	100
1994	14.96	5.53	47.96	26.48	5.07	100
1995	20.33	5.30	46.50	20.36	7.51	100
1996	20.55	5.98	37.91	18.21	17.35	100

SOURCE: LIPC Livestock Monthly Statistics
Note: Shares based on Japanese fiscal year (April-March), with 1996 data from April 1995 to February 1997 only.

case of pork, a gate price is used as a minimum import price for each import shipment entering Japan, allowing for a composite valuing of combined low- and high-priced cuts. It is a negotiated minimum import price, and the standard import price is computed as the sum of gate price and an *ad valorem* duty. Thus, with world price levels lower than the gate price, Japanese domestic production and consumption are substantially buffered from fluctuations in world price.

Moreover, under a Safe Guard (SG) measure termed the "snap-back" provision, when the total imports in each cumulative quarter within a fiscal year exceeds 119 percent (the "trigger" level) of the corresponding period average of the previous three years, the gate price is automatically raised 24 percent to discourage rapid imports. The gate price is held at that level until the beginning of the next fiscal year. Additionally, Special Safe Guard (SSG) measures provide for similar but smaller increases in the standard import price through the *ad valorem* duty without affecting the gate price. The gate price was raised to ¥709.67/kg. on July 1, 1997. In view of the likely shortfall in supply resulting from the market, alternative

measures including reversal of the extension are to be considered.

This two-step price mechanism in one of the primary import markets for pork has had a jarring effect on world trade, especially in frozen pork (USDA, Livestock & Poultry, 1996). Typically, the first quarter of the Japanese fiscal year sees an annually high level of imports included to beat the onset of the trigger; but this, in fact, hastens the trigger. The flood of pork imports is followed by an extended lull in trade due to the high barrier. Import suppliers stockpile pork, preparing to compete for market share as soon as the gate price falls but before the snap-back provision is triggered once again. This cycle effectively reduces the active trading period, collapsing it into a few months within the year and thereby increasing storage costs at both ends of the marketing chain.

As the predominant exporter to Japan, and possibly due to direct investment interests of Japanese establishments in Taiwan in both feed and livestock industries, Taiwan has had a significant role in accelerating this within-year volatility in trade. Hence, the withdrawal of Taiwan from the Japanese pork market is also expected to smoothen the within-year trade by making the triggering process an exception rather than the rule, as it probably was meant to be. With Taiwan, the largest supplier to Japan, out of the market the likelihood and thus the threat of the disruptive trigger is substantially reduced. Reductions in the frequency and duration of the higher gate price imply a lower average annual import price, which would contribute to increased consumption and increases in both the volume and share of Japanese imported pork.

The expected consequences of the Taiwanese pork export ban can thus be described as follows. The abrupt supply reduction in the world market will exert upward pressure on world pork prices. Because Japan is, to a large extent, insulated from world price movements, import demand in Japan is not expected to decline significantly. Thus, the trade share lost by Taiwan is transferred to other major suppliers, and their export supply response affects other importers as well. In addition, the reduced competition in exports to Japan eases the threat of turning on the snap-back provision, thus smoothing the quarterly trade pattern. This effectively lowers annual average Japanese import price by reducing both the frequency and duration of the higher gate price. The lower import price in Japan will promote consumption, dampen production, and thereby add to import demand. The present analysis, however, focuses only on the redistribution of the share of exports lost by Taiwan and the consequent and simultaneous changes in prices and quantities of pork and feed consumed, produced, and traded worldwide.

Scenario Assumptions

Perhaps the most critical assumptions for this analysis are the duration of the export ban and the likelihood of Taiwan's reentry into the Japanese pork market. At this point it is uncertain how long the export ban will last; nevertheless, according to the International Animal Health Code (Part 2, Sec. 2.1, Article 2.1.1.2), a country is required to send a declaration to OIE stating that there has been no outbreak of FMD within the previous two years and must demonstrate the absence of viral activity to be listed as FMD-free with vaccination. If listing as an FMD country without vaccination is desired, an additional 12-month waiting period with no vaccination is required. These are the minimum requirements to be certified as FMD-free.

Although Taiwan may begin exporting to other countries that are not FMD-free before it is declared FMD-free, it may not export to Japan. Taiwan's reentry into the Japanese market is further complicated by Japan's anticipated declaration of a swine fever free country in 1999. Moreover, Taiwan must strive to become hog cholera free to enter into other import markets and to regain access to the import market in Japan. Thus in addition to combating FMD, Taiwan has embarked on a three-year Swine Fever Eradication Plan that started July 1996 and is expected to last until June 1999.

The severity of the problem in Taiwan makes any claims for resumption of Taiwanese

exports to Japan within three years appear optimistic. Japan, which currently is the sole importer of any significant quantities of pork from Taiwan, is not likely to look favorably upon imports from Taiwan given the perceived threat to Japan's inventory of 10 million hogs. Moreover, there is the possibility of consumer overreaction to FMD in the wake of last year's BSE and *E-Coli* scares.

Japan will likely remain extremely cautious with respect to pork imports from Taiwan. It is questionable whether Taiwan will be able to find alternative export markets. Of the other major pork consumers in the region, both the Philippines and South Korea will be cautious about exposing their animal inventories to possible large-scale FMD infection. While FMD may be a negligible consideration in Hong Kong, which imports nearly all of its domestic pork requirement, future import policies set by China are likely to hinder rather than favor increased imports from Taiwan. In light of these arguments, the primary scenario analyzed incorporates the assumption that Taiwan will not export any pork in the next ten years. In comparison, the last FAPRI baseline projected Taiwan's net exports would stay stable at nearly 350 tmt, varying very marginally with world price changes. An alternative scenario allowing for limited recovery in Taiwanese exports after three years is also analyzed, providing some measure of the sensitivity of the results to the export assumption. Brief comments on this will follow the main impact analysis based on the zero-export assumption presented in the section on scenario results

Scenario Results

Scenario 1: Taiwan Does Not Reenter the Export Market

Taiwan's pork exports during the first two months of this year, before the ban came into effect, are estimated at 30 tmt. An additional 13 tmt slaughtered before February 20, 1997, is reportedly available for shipping to Japan, but to avoid infection of domestic herds and losing further consumer confidence in Japan, this meat will most likely be destroyed. As shown in Table 4, it is assumed that Taiwan does not export any more than the 30 tmt of pork already shipped in 1997. Also, the export levels in the rest of the projection period remain at zero. Thus, at the baseline prices, there will be an import demand surplus of 337 tmt (Taiwan's baseline exports of 367 tmt less 30 tmt already exported in 1997). The import demand surplus for the rest of the period at baseline prices will equal Taiwan's projected baseline export levels, since Taiwan's exports are constrained to zero in the current scenario.

Taiwan's exit from the pork export market creates a supply vacuum in world pork trade, exerting upward pressure on world pork prices as the world export supply falls short of demand. Exporters and importers respond to the new prices. Japan, however, is largely insulated from world price changes by the gate-price mechanism; thus, the import demand of this single largest pork importer remains largely unaffected. The bulk of the resulting supply shortage is filled by U.S. exports. Figure 1 displays the scenario and baseline paths for pork exports. Relative to the baseline, the United States exports an additional 210 tmt of pork in 1997, accounting for nearly 57 percent of Taiwan's baseline exports for that year.

U.S. pork exports are projected to continue to grow relative to the baseline until 2001. In the long run, the United States will gain just over 300 tmt of additional pork export sales annually, representing an average annual increase of 26 percent. Higher pork export levels, however, do not equate one-to-one into higher pork production. In 1997 and 1998, respectively, only 5 percent and 28 percent of

Table 4. Pork trade redistribution with no re-entry of Taiwanese exports

	Year									
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
U.S. Barrows and Gilts Price				(dollars per mt)						
Scenario	1,249	1,071	944	1,001	1,085	1,029	962	1,046	1,125	1,041
Change from Baseline	62	49	17	-1	4	13	18	19	19	18
Change as percent	5.2%	4.8%	1.8%	-0.1%	0.4%	1.3%	1.9%	1.8%	1.7%	1.8%
				(tmt)						
Loss in Exports by Taiwan	337	360	348	347	354	355	349	349	357	357
World Imports										
Scenario	1,791	1,910	2,031	2,126	2,218	2,345	2,459	2,471	2,480	2,571
Change from Baseline	-70	-57	-35	-16	-12	-15	-22	-25	-27	-31
Change as percent	-3.9%	-3.0%	-1.7%	-0.8%	-0.5%	-0.7%	-0.9%	-1.0%	-1.1%	-1.2%
Import reductions from										
Japan	6	7	4	1	2	3	4	3	3	3
Mexico	19	16	16	14	9	5	6	8	10	10
Others	45	34	15	0	1	8	13	14	15	18
Total	70	57	35	16	12	15	22	25	27	31
Added Export Opportunities	267	303	313	331	343	340	327	325	329	326
As percent of export reduction in Taiwan	79%	84%	90%	95%	97%	96%	94%	93%	92%	91%
United States	210	252	293	325	335	324	310	304	308	306
European Union (15)	7	8	4	0	1	2	4	3	3	3
Canada	37	30	14	5	6	9	11	12	13	13
U.S. Share	78%	83%	93%	98%	98%	95%	95%	94%	93%	94%

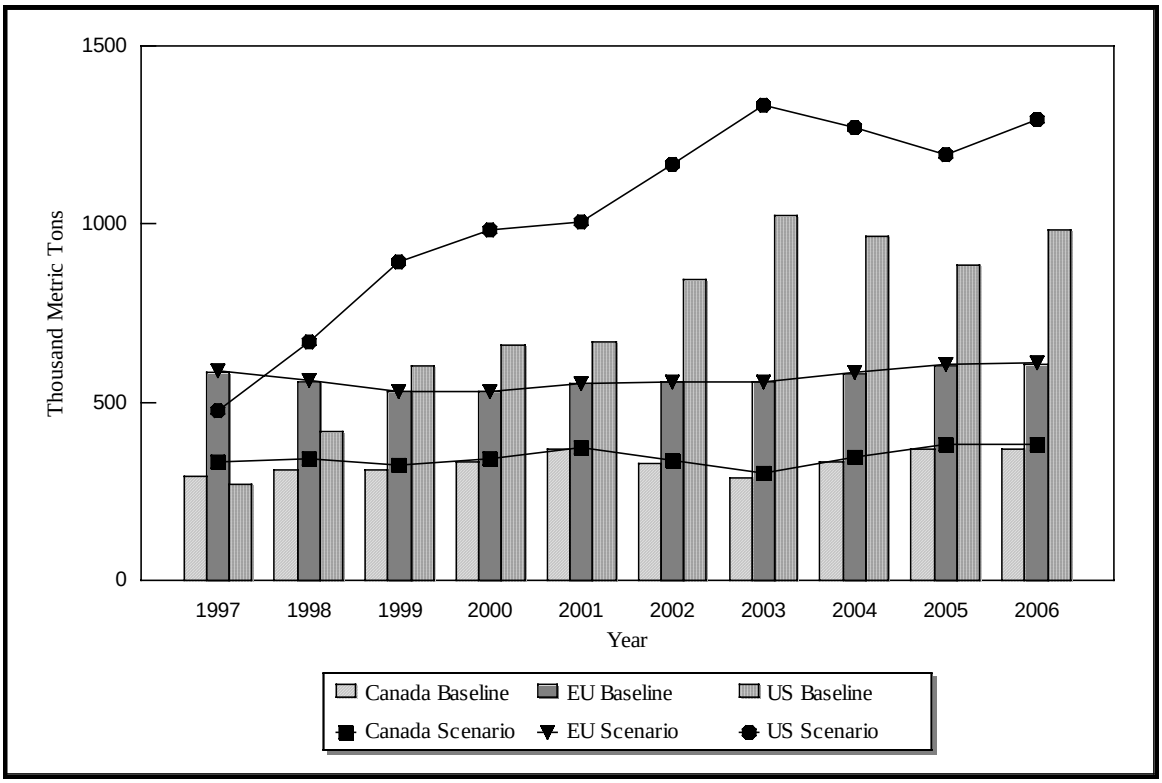

Figure 1. Baseline and scenario export levels

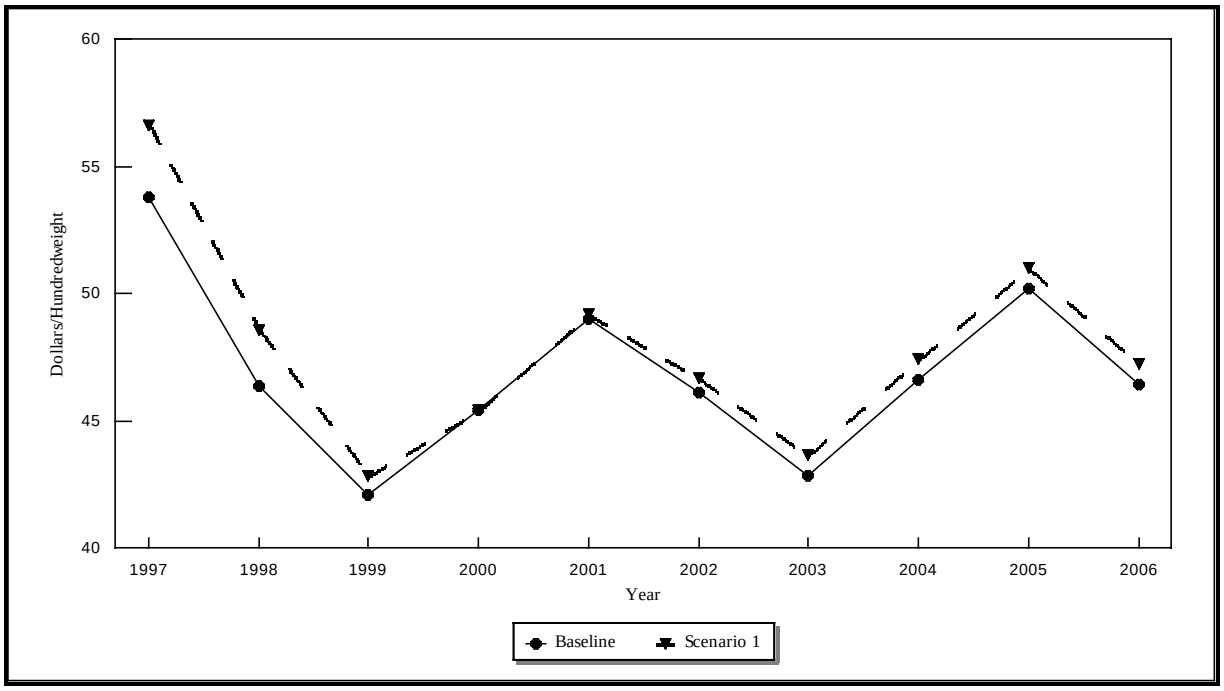

Figure 2. U.S. barrow and gilt prices

the additional pork exports are supplied by production increases; the remainder come from a decline in U.S. consumption. In the longer term additional U.S. pork bound for world markets is the result of greater pork production.

Increasing U.S. pork exports by an average of 36 percent of the baseline in the next five years will raise hog prices roughly 5 percent in 1997 and 1998; however, once additional hog inventories are built, pressure on prices drops significantly. Figure 2 shows the path of U.S. hog prices over the projection period. U.S. barrow and gilt prices average 1.7 percent higher than the FAPRI baseline price projections in 1999 and beyond. Higher hog prices are passed on to U.S. consumers, causing domestic pork consumption to drop an average of 1.8 percent (see Table A.2 in the Appendix). Slightly higher pork prices also send small ripples through other U.S. meat markets, increasing domestic demand for beef and poultry, but long-run price and quantity changes are generally less than 0.3 percent.

The abrupt cessation in Taiwan's pork exports to Japan is naturally expected to affect the Japanese market most directly and significantly. However, the price insulation mechanism in Japan transfers nearly the entire impact to more price responsive traders, both exporters and importers. The gate-price mechanism is effective only when external price is below the gate price. Even at the lower gate price of ¥560/kg, the price far exceeds the comparable U.S. price. On the other hand, it is evident that despite the higher barrier at ¥695/kg during the snap-back, there are continued imports, albeit at a much subdued level, and most likely in specific, higher–quality cuts. Therefore, it is likely that a small segment of the import market exists that is not insulated by the gate price, being at a level higher than the gate price, especially when the snap-back is off. This price–sensitive segment of import demand responds to the 5 percent increase in world pork price by reducing consumption a mere 0.2 percent. Domestic production, meanwhile, is insulated by the gate-price mechanism and remains virtually unchanged. The result is a 6 tmt reduction in Japanese pork imports in 1997, amounting to a 0.6 percent decline from the 904 tmt projected in the baseline.

The effects on substitute meat products are also minimal. As pork per capita consumption decreases from 17.14 to 17.10 kg, consumption of domestic beef (Wagyu and dairy beef) increases marginally. However, consumption of imported beef falls from 7.50 to 7.45 kg as a result of the 2 percent world price increase, resulting in a negligible decline in total beef consumption. Even these minor deviations from the baseline decline rapidly as world prices tend toward the baseline prices in the long run.

Other pork exporting countries also will see an increase in the demand for their products, particularly over the next three years while the United States is building extra production capacity. Figure 3 displays export levels for United States, Canada, and the European Union. Canada is one of the few countries able to export pork to Japan, and it will experience the second largest growth in exports. Unlike the United States, however, Canadian export potential is limited by meat-packing capacity in the short run. Nevertheless, Canada is projected to gain an additional 37 tmt in 1997, amounting to a 12.5 percent increase over the baseline level. Canada's pork shipments grow 9.7 and 4.5 percent in 1997 and 1998, respectively, but Canadian pork exports will be up only an average of 3 percent relative to the baseline for the remaining years as world prices stabilize. The EU, and Denmark in particular, is also a significant force in the Japanese pork market and should see some increase (roughly 1.3 percent in 1997 and 1998) in their pork shipments to Japan. Danish pork production costs are higher than in the United States; consequently, their exports are not price competitive. Further, the recent incidence of swine fever could affect the expansion of the EU's exports.

Just as the higher U.S. prices dampen domestic consumption of pork, importing countries also experience a decline in the quantity of imported pork products. Mexico, South Korea, the former Soviet Union (FSU), and other smaller countries in the rest of the

world (ROW)[5] significantly decrease their imports of pork relative to the baseline projections. Of the net importers, Mexico is the most responsive to U.S. prices, both in production and in consumption. In response to the 5 percent price increase in 1997, Mexican pork consumption falls by 21 tmt (a 2.2 percent decline). The higher prices also promote hog inventory buildup in Mexico, leading to a marginal loss of 2 tmt in production in 1997 but increasing productive capacity for the future. The net result is a 19 tmt reduction in imports from the 73 tmt projected in the baseline for 1997. The other major import reduction by any single country is the 18.4 tmt reduction in the FSU. This 3 percent reduction in imports results from a mere 0.5 percent decline in consumption. The ROW reduces imports by 20, 13, and 10 percent respectively, in the first three years of the projection period. In 1997 this amounts to a 21 tmt decline in pork imports.

The short-run impact on net importing countries is large because total world pork production cannot be rapidly increased without creating lasting impacts on future productive capacity. Once inventories in the United States and other exporting countries are allowed to adjust to the changes introduced by Taiwan's departure from world pork trade, pork prices and import demand levels move closer to the baseline projections. After 1999, Mexico and ROW imports decline an average of 3.7 and 7.2 percent, respectively.

The import reductions mentioned here together with smaller reductions from other net importers, amount to a 70 tmt reduction in world imports, as world prices rise by 5 percent. Thus of the original 337 tmt of pork removed from the market following Taiwan's imposition of a pork export ban in 1997, 70 tmt is lost due to the price increase, leaving the remaining exporters only 267 tmt of additional export opportunities. Among these exporters, the United States is projected to capture 78 percent of the additional export demand faced by these countries in 1997. A breakdown of Taiwan's baseline exports is shown in Figure 3.

Greater pork production in the United States and declining pork production in Taiwan will have a small net impact on U.S. corn and soybean markets. Domestic corn consumption increases an average of 762 tmt relative to baseline projections, less than a 0.5 percent change. At the same time, corn exports decline an average of 965 tmt, causing the U.S. Gulf of Mexico price to fall roughly $.67 per mt below the baseline price. In 1997 the corn price at Gulf ports is $1.65 below the baseline projection of $122.61/mt Similar changes occur in the U.S. soybean market. Soybean crush is up an average of 134.6 tmt annually relative to the baseline, but soybean exports are down 198 tmt. The U.S. soybean price at the Gulf is projected to average $1.66 per mt below the baseline, with declines closer to $2.00/mt in 1997 and 1998. The impact on grain prices is the greatest in the first two years of the projection period because foreign import demand for feed drops off more rapidly than U.S. hog production is able to increase.

Scenario 2: Taiwan Reenters the Export Market In 2000

The results from Scenario 1 are conditioned upon the assumption that Taiwan's pork export industry is unable to recover from the damage caused by the outbreak of FMD. While a plausible assumption, given the difficulties the country faces in reentering the export market, it is possible Taiwan could resume exporting some pork in as little as three years. To measure the impact of such a recovery on meat trade and prices, a second simulation was performed under the assumption that Taiwan would gradually reenter the pork export market in the year 2000.

[5] FAPRI Staff Report #2-97, FAPRI 1997 *World Agricultural Outlook*, provides a list of the countries included in the ROW.

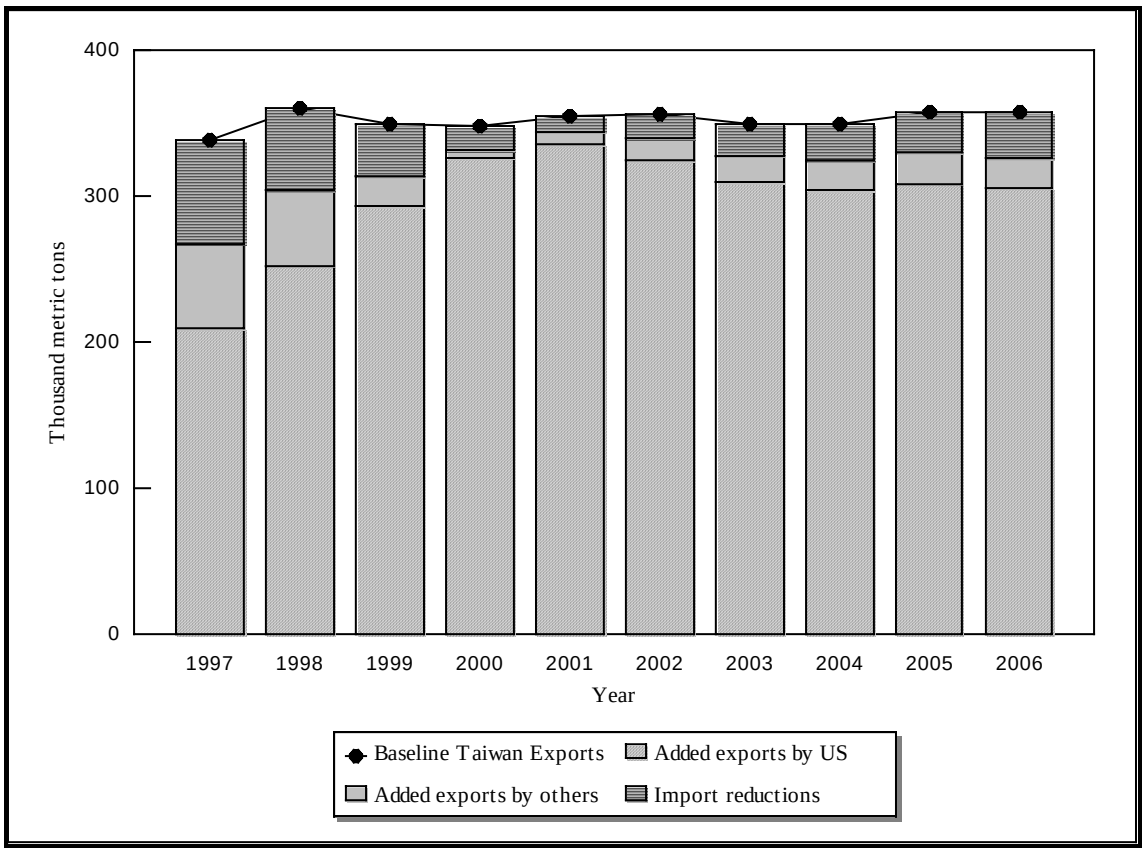

Figure 3. The impact of Taiwan's ban on pork exports

In this scenario, Taiwan begins exporting at roughly 8 percent of its baseline level in 2000, expanding to just under 53 percent by 2004. In 2000, Taiwan ships 28 tmt of pork, displacing 17 tmt from the United States, 3 tmt from Canada, and 1 tmt each from China, Eastern Europe, and the European Union. The remaining 5 tmt represent increases in imports relative to scenario 1 due to slightly lower U.S. hog prices. A similar shifting of trade patterns occurs in the following years as Taiwan reclaims a portion of its market share lost as a result of the FMD outbreak. By the end of the scenario, the United States exports 136 tmt of pork more than in the baseline but 173 tmt less than the level in Scenario 1. The majority of Taiwan's exports in 2006, 92.5 percent, represent lost market share on the part of the United States relative to Scenario 1.

Other exporting countries also react to Taiwan's reentry and its impact on U.S. hog prices. Canadian pork exports fall below the baseline levels in 2001, 2002, and 2003 because the U.S. price falls in response to increased world pork supply. Likewise, EU exports fall less than 1 percent below their baseline levels in 2000, 2001, and 2002. Both countries' exports recover as U.S. hog prices rise, but neither reaches the levels achieved in Scenario 1. Net importing countries show stronger demand for pork imports relative to Scenario 1. Some countries post positive import changes relative to the baseline in years when U.S. pork prices dip below baseline levels. For example, in 2002 when the U.S. barrow and gilt price is below the baseline price, the FSU imports 15 tmt, Mexico imports 3 tmt, and Japan imports 1 tmt more than in the baseline. Total imports in these countries are, respectively, 13, 8, and 4 tmt above the quantities in Scenario 1. Of the importing countries significantly impacted in

Scenario 1, ROW shows the weakest import demand recovery in Scenario 2.

The weakening of U.S. pork export demand impacts domestic production, consumption, and prices. A higher hog price relative to the baseline in the latter years of the 1990s prompts swine producers to build inventories and production capacity in the expectation of continued strong export demand. When Taiwan reenters the export market in 2000, producers slaughter greater numbers of hogs from the breeding herd, but the previous years of hog inventory buildup do not allow production to decline as rapidly as export demand. The result is that hog prices fall below the baseline levels in 2000, 2001, and 2002, while productive capacity adjusts to the new export climate. Once production has stabilized, output is only 0.7 percent above the baseline level. The lower hog price works up the chain to consumers, prompting domestic consumption to rise an average of 62 tmt above levels in Scenario 1. Domestic pork consumption still remains just under 1 percent lower than the baseline quantity.

Summary

Taiwan has been a major player in world pork trade for more than a decade, and it holds a particularly significant place in the important Japanese import market. The recent outbreak of FMD in Taiwan, causing them to ban pork exports, is certain to a have a substantial impact on world pork trade. This paper seeks to increase our understanding of the magnitude and direction of the changes that will occur in meat and feed grain prices and trade volumes by simulating world agricultural trade using FAPRI's world agricultural trade model. Two scenarios were run employing different assumptions regarding Taiwan's ability to reenter the pork export market.

Under the assumption that Taiwan does not resume exporting pork in the next 10 years, the simulation indicates that the United States will capture roughly 80 percent of the export opportunities projected for 1997 and 1998. Canada, China, and the European Union are also able to increase their exports over the baseline levels. Greater demand for U.S. pork exports drives up the U.S. barrow and gilt price by 5 percent in 1997 and 1998 and by a lesser amount for the majority of the projection period. A higher hog price dampens the quantity demanded in both domestic and import pork markets, taking some pressure off world markets to completely replace Taiwan's exports. In 1997, pork imports by the FSU, Mexico, South Korea, Japan, and the rest of the world decline significantly, lowering total pork trade by 70 tmt. As productive capacity in exporting countries increases, world prices come closer to the baseline levels, and the reduction in world pork trade relative to the baseline narrows to 31 tmt.

If we assume Taiwan is able to begin exporting gradually beginning in 2000, the long-run gain in U.S. market share is significantly lower than under the previous assumption. Other exporters also lose some of the market share gained in the later 1990s, as Taiwan recaptures 53 percent of its baseline exports. The U.S. barrow and gilt price falls below the baseline level for the first three years of the next century, as export demand weakens and the U.S. hog sector eliminates additional productive capacity built up in response to Taiwan's exit from the export market in 1997. Once hog inventories have adjusted, the U.S. hog price climbs above the baseline level, ending the period a little over 1 percent higher than previous projections. Generally lower world pork prices after 2000 relative to Scenario 1 leadsto greater world pork imports, even exceeding baseline levels in 2001, 2002, and 2003.

In conclusion, a cautionary note on the interpretations of these additional volumes and shares is in order. The nature of net trade models with no specific reference to source-destination relationships can obscure both interpretation of these share changes and any inferences drawn from them. For example, the 210 tmt additional exports from the United States to meet the 267 tmt of export opportunities in Scenario 1 does not suggest that the United States will capture 78 percent of the Japanese market opened up by Taiwan's export ban. First, Japanese imports declined by only 6 tmt, and thus the additional opportunities in

Japan are 331 tmt: 64 tmt export opportunities were closed in the rest of the world in response to higher world prices. Second, the added 210 tmt from the United States may not all go to the Japanese market. For instance, given the Japanese preference for some Danish pork products, it is possible more frozen Danish products may be diverted from other export markets to Japan. Thus, the 7 mmt added net exports for the European Union may understate the actual additional exports to Japan from Denmark. The United States may export to countries other than Japan to partially offset the supply reductions in those countries. Similarly, the expanding South Korean export sector may supply a much larger volume to Japan than 3 tmt of premium pork by diverting product from its domestic market and satisfying domestic demand through less expensive imports from the United States.

With these cautions in mind, the conclusion of this study is that the pork industry in the United States, more than in any other pork exporting nation, has much to gain from the recent turn of events in Taiwan. Moreover, the removal of Taiwanese pork from the Japanese market will not substantially impact pork consumption levels in Japan; however, significant adjustments will occur in the market shares of nations exporting pork to Japan. Modest increases in the world pork price will cause other pork importing countries to reduce their import quantities, facilitating world market clearing until greater pork production is generated.

APPENDIX A.

Impacts and Results for Scenario 1 and Senario 2

Table A.1. Scenario 1 world pork trade impacts

	Year									
	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
					(tmt)					
Net Exports										
Canada	331	341	322	340	375	338	300	345	384	383
China	256	229	206	206	207	195	184	187	190	177
Eastern Europe	106	105	76	65	78	87	82	87	105	113
European Union	590	564	532	531	555	558	559	584	608	609
Taiwan	30	0	0	0	0	0	0	0	0	0
United States	478	672	894	984	1,003	1,167	1,334	1,268	1,194	1,288
Total Net Exports	1,791	1,910	2,031	2,126	2,218	2,345	2,459	2,471	2,480	2,571
Net Imports										
Former Soviet Union	523	556	564	544	516	549	595	578	560	565
Hong Kong	173	186	197	200	201	208	216	218	219	228
Japan	898	920	952	1,012	1,104	1,148	1,164	1,182	1,199	1,221
Mexico	73	104	137	175	200	231	247	243	252	279
Other Western Europe	12	14	16	18	20	22	24	26	28	30
South Korea	25	47	67	72	77	91	109	115	120	146
Rest of World	86	82	98	106	100	96	104	109	102	101
Total Net Imports	1,791	1,910	2,031	2,126	2,218	2,345	2,459	2,471	2,480	2,571
					(dollars per mt)					
U.S. Barrow and Gilt Price	1,249	1,071	944	1,001	1,085	1,029	962	1,046	1,125	1,041
Change from Baseline										
					(tmt)					
Net Exports										
Canada	37	30	14	5	6	9	11	12	13	13
China	8	6	-2	0	4	7	4	5	5	3
Eastern Europe	6	8	5	-0	-3	-2	-1	0	0	0
European Union	7	8	4	0	1	2	4	3	3	3
Taiwan	-337	-360	-348	-347	-354	-355	-349	-349	-357	-357
United States	210	252	293	325	335	324	310	304	308	306
Total Net Exports	-70	-57	-35	-16	-12	-15	-22	-25	-27	-31
Net Imports										
Former Soviet Union	-19	-15	-1	8	7	3	0	-0	-1	-1
Hong Kong	-3	-2	-1	0	-0	-1	-1	-1	-1	-1
Japan	-6	-7	-4	-1	-2	-3	-4	-3	-3	-3
Mexico	-19	-16	-16	-14	-9	-5	-6	-8	-10	-10
Other Western Europe	0	0	0	0	0	0	0	0	0	0
South Korea	-3	-4	-2	-1	-1	-3	-4	-4	-4	-8
Rest of World	-21	-13	-11	-8	-7	-7	-8	-8	-9	-9
Total Net Imports	-70	-57	-35	-16	-12	-15	-22	-25	-27	-31

Table A.2. Scenario 1 U.S. pork sector results

	Year									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Inventories				(million head)						
Market Hogs	49.8	50.7	50.7	51.0	52.3	52.7	53.0	54.6	56.1	56.7
Percent Change from Baseline	0.4%	1.4%	2.3%	2.5%	2.2%	1.9%	1.8%	1.7%	1.6%	1.6%
Breeding Herd	6.94	7.13	7.17	7.07	7.01	7.12	7.11	6.94	6.95	6.93
Percent Change from Baseline	0.9%	2.1%	2.6%	2.3%	2.0%	1.8%	1.7%	1.7%	1.7%	1.7%
Supply and Demand				(tmt)						
Production	7,937	8,462	8,962	9,057	9,076	9,372	9,655	9,531	9,486	9,785
Percent Change from Baseline	0.1%	0.8%	1.7%	2.3%	2.2%	1.9%	1.7%	1.7%	1.7%	1.7%
Domestic Use	7,449	7,773	8,064	8,091	8,079	8,192	8,317	8,278	8,291	8,482
Percent Change from Baseline	-2.5%	-2.3%	-1.7%	-1.5%	-1.6%	-1.7%	-1.7%	-1.7%	-1.8%	-1.7%
Exports	753	933	1144	1222	1241	1406	1573	1506	1432	1527
Percent Change from Baseline	38.6%	37.0%	34.4%	36.2%	36.9%	30.0%	24.5%	25.3%	27.3%	25.1%
Prices				(dollars per cwt)						
Barrows and Gilts	56.63	48.56	42.80	45.39	49.21	46.69	43.64	47.44	51.03	47.22
Percent Change from Baseline	5.3%	4.8%	1.8%	-0.1%	0.4%	1.3%	1.9%	1.8%	1.7%	1.8%
				(dollars per lb)						
Pork Retail	2.34	2.31	2.27	2.37	2.49	2.49	2.47	2.58	2.66	2.65
Percent Change from Baseline	5.0%	4.9%	3.7%	3.1%	3.3%	3.7%	3.9%	3.7%	3.7%	3.8%
Net Returns				(dollars per cwt)						
Farrow - Finish	16.50	10.89	5.50	7.22	9.95	6.78	3.48	6.28	8.78	4.73
Percent Change from Baseline	20.5%	25.2%	17.6%	1.5%	3.1%	11.4%	33.1%	17.2%	11.9%	24.9%

Table A.3 Scenario 1 results for U.S. corn and soybean use, trade, and prices

	Year									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Corn					(mmt)					
Domestic Feed Use	132.6	133.9	135.1	137.9	139.9	140.6	142.0	143.6	144.8	147.7
Percent Change from Baseline	0.6%	0.3%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%
Exports	46.8	52.1	59.6	63.4	65.0	67.9	70.3	72.2	75.1	76.1
Percent Change from Baseline	-2.9%	-1.6%	-1.3%	-1.4%	-1.4%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Soybeans										
Domestic Crush	38.1	38.4	39.3	40.0	40.8	41.5	42.1	42.7	43.4	44.0
Percent Change from Baseline	0.3%	0.1%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%
Exports	24.1	24.0	23.8	23.9	24.0	24.2	24.4	24.6	24.9	25.4
Percent Change from Baseline	-0.9%	-0.2%	-0.6%	-0.7%	-0.9%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%
Prices					(dollars per mt)					
Corn Gulf Price	120.96	106.77	106.26	108.74	109.96	114.37	116.96	119.17	123.42	126.19
Percent Change from Baseline	-1.3%	-0.6%	-0.4%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.6%	-0.4%
Soybean Gulf Price	268.33	244.70	230.42	229.07	233.58	235.66	239.54	243.18	247.97	256.04
Percent Change from Baseline	-0.7%	-0.8%	-0.5%	-0.7%	-0.7%	-0.7%	-0.6%	-0.7%	-0.7%	-0.6%

Table A.4. Scenario 2 pork trade redistribution

	Year						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
US Barrows and Gilts Price			(dollars per mt)				
Scenario	994	1,064	1,004	943	1,016	1,092	1,011
Change from Baseline	-7	-17	-12	2	11	14	12
Change as percent	-0.7%	-1.5%	-1.2%	0.2%	1.0%	1.2%	1.2%
			(tmt)				
Loss in Exports by Taiwan	319	249	186	168	167	170	170
World Imports							
Scenario	2,132	2,239	2,375	2,486	2,489	2,492	2,582
Change from Baseline	-10	9	14	4	-7	-15	-20
Change as percent	-0.5%	0.4%	0.6%	0.2%	-0.3%	-0.6%	-0.8%
Import reductions from:							
Japan	1	-1	-1	1	2	2	2
Mexico	12	3	-3	-3	-1	3	5
Others	-3	-11	-10	-1	6	10	13
Total	10	-9	-14	-4	7	15	20
Added Export Opportunities	309	258	200	172	160	155	150
Taiwan	97%	104%	108%	102%	96%	91%	88%
United States	309	271	212	176	153	142	139
European Union (15)	-1	-2	-1	1	2	2	2
Canada	2	-7	-7	-0	5	8	8
U.S. Share	100%	105%	106%	102%	95%	92%	92%

Table A.5. Scenario 2 world pork trade impacts

	Year						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Net Exports				(tmt)			
Canada	337	362	322	289	338	378	378
China	205	205	193	182	186	189	177
Eastern Europe	64	75	82	77	84	103	111
European Union	530	552	554	556	583	607	608
Taiwan	28	105	169	181	182	187	187
United States	969	939	1,056	1,200	1,117	1,028	1,121
Total Net Exports	2,132	2,239	2,375	2,484	2,489	2,492	2,582
Net Imports				(dollars per mt)			
Former Soviet Union	546	525	561	603	583	563	568
Hong Kong	200	202	209	217	218	219	228
Japan	1,013	1,106	1,152	1,167	1,183	1,200	1,222
Mexico	176	206	239	256	252	259	284
Other Western Europe	18	20	22	24	26	28	30
South Korea	73	78	93	112	116	121	147
Rest of World	106	101	98	106	111	103	102
Total Net Imports	2,132	2,239	2,375	2,484	2,489	2,492	2,582
				(tmt)			
U.S. Barrow and Gilt Price	994	1,064	1,004	946	1,038	1,120	1,035
Change from Baseline							
Net Exports				(tmt)			
Canada	2	-7	-7	-0	5	8	8
China	-0	2	4	2	4	5	3
Eastern Europe	-1	-6	-8	-6	-4	-2	-1
European Union	-1	-2	-1	1	2	2	2
Taiwan	-319	-249	-186	-168	-167	-170	-170
United States	309	271	212	176	153	142	139
Total Net Exports	-10	9	14	4	-7	-15	-20
Net Imports				(1,000 mt)			
Former Soviet Union	11	16	15	8	4	2	2
Hong Kong	0	1	1	-0	-0	-1	-1
Japan	-1	1	1	-1	-2	-2	-2
Mexico	-12	-3	3	3	1	-3	-5
Other Western Europe	0	0	0	0	0	0	0
South Korea	-1	0	-0	-1	-3	-3	-7
Rest of World	-8	-6	-5	-6	-7	-8	-8
Total Net Imports	-10	9	14	4	-7	-15	-20

Table A.6. Scenario 2 U.S. pork sector results

	Year						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Inventories				(Million Head)			
Market Hogs	51.0	52.2	52.4	52.6	54.0	55.5	56.1
Percent change from Baseline	2.5%	2.0%	1.4%	1.0%	0.7%	0.6%	0.6%
Breeding Herd	7.06	6.99	7.07	7.04	6.86	6.87	6.86
Percent change from Baseline	2.2%	1.6%	1.1%	0.7%	0.7%	0.7%	0.7%
Supply and Demand				(tmt)			
Production	9058	9069	9345	9596	9447	9390	9687
Percent change from Baseline	2.3%	2.2%	1.6%	1.1%	0.8%	0.7%	0.7%
Domestic Use	8107	8135	8276	8393	8346	8360	8551
Percent change from Baseline	-1.3%	-0.9%	-0.7%	-0.8%	-0.9%	-0.9%	-0.9%
Exports	1207	1178	1294	1438	1355	1266	1359
Percent change from Baseline	34.5%	29.9%	19.6%	13.9%	12.7%	12.7%	11.4%
Prices				(dollars per cwt)			
Barrows and Gilts	45.10	48.28	45.54	42.92	47.08	50.78	46.94
Percent change from Baseline	-0.7%	-1.5%	-1.2%	0.2%	1.0%	1.2%	1.2%
				(dollars per lb)			
Pork Retail	2.36	2.45	2.44	2.42	2.54	2.61	2.60
Percent change from Baseline	2.6%	1.7%	1.4%	1.8%	1.9%	1.9%	1.8%
Net Returns				(dollars per cwt)			
Farrow - Finish	7.00	9.19	5.84	2.95	6.08	8.69	4.63
Percent change from Baseline	-1.5%	-4.9%	-4.1%	12.8%	13.4%	10.8%	22.2%

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