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THE IMPACT OF ANIMAL DISEASE OUTBREAKS ON LIVESTOCK MARKETS

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(Note by the Secretariat)

This report is part of the 2006 Agricultural Outlook activity. It discusses the recent situation with respect to Avian Influenza, Foot and Mouth Disease and Bovine Spongiform Encephalopathy and provides an assessment of the market impacts of animal disease outbreaks under different scenarios. The report is based on collaborative modelling and analytical work between the OECD and FAO Secretariats in the context of the Agricultural Outlook activity. It applies the AGLINK-COSIMO model in the generation of scenarios that are used to analyse the domestic and world market changes in production, consumption, trade and prices as well as some of the factors that can influence market outcomes in the context of animal disease outbreaks.

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THE IMPACT OF ANIMAL DISEASE OUTBREAKS ON LIVESTOCK MARKETS

I. Introduction

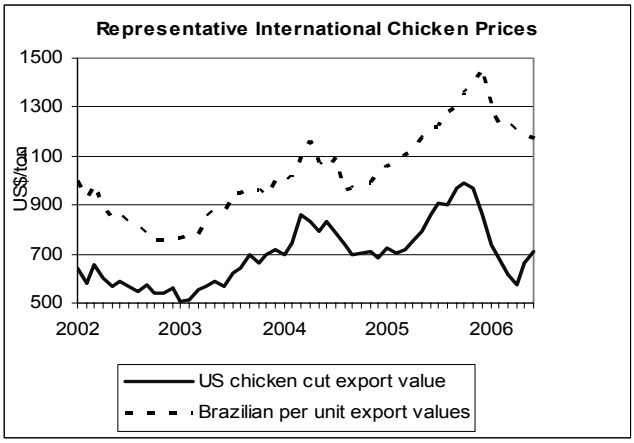
1. While it is recognised that animal disease may have a significant local impact, the growing interdependence of livestock markets is creating awareness of the broader costs on livestock industries around the globe. Certainly, escalating outbreaks of animal diseases have increased market instabilities, most recently with a recurrence of foot-and-mouth disease (FMD) in South America, the identification of bovine spongiform encephalopathy (BSE) in various major exporting countries and, most specifically, the ever widening and troublesome spread of Avian Influenza (AI) around the world. These outbreaks have tested the resilience of global livestock markets which have recently exhibited the slowest growth in trade over the past decade. Notifications of trade bans for meat have increased and where disease outbreaks raise consumers' concerns about meat safety, they lead them to shift consumption to other animal proteins. Governments express rising concern about the costs and socio-economic impacts of animal disease prevention and control. At the same time, the zoonotic nature of H5N1 is precisely such costs, prompted by the possibility of a disease pandemic affecting the human population.

2. This document provides a market review of the status of the major animal diseases currently affecting markets. It then assesses the results of three broad animal disease scenarios involving AI, FMD and BSE outbreaks. This scenario analysis is part of the 2006 Agricultural Outlook activity and provides a fist step to implementing a larger programme of work planned for 2007 and 2008 on the trade impacts of animal diseases and alternative control practices. The examination of alternative model simulations in this report helps identify and assess critical aspects of the impacts of animal diseases on markets by providing general benchmark estimates on the market and trade costs of these diseases under different scenarios.

II. Animal disease outbreaks: an update

3. Latest developments in meat markets are set against a backdrop of animal disease-induced market instability in recent years. Such instability is characterized by consumption shocks, variability of export supplies and price volatility. The onset of avian influenza in Asia (AI outbreaks in late 2003 and early 2004) coincided with the discovery of BSE in North America, a region which supplies nearly one-quarter of global meat exports. Exacerbating market instability were the FMD outbreaks in Brazil and Argentina in late 2005. Limitations on exportable supplies initially supported meat prices, with poultry prices rising by more then 30% over the 2004 and 2005 period. This trend reversed itself in late 2005 in response to the adverse consumption impacts of the spread of AI to major poultry markets in Europe, Africa and the Middle East**.**

Figure 1. Representative international chicken prices



Avian Influenza

4. New AI detections in the major consumption areas of 12 poultry importing nations in Western Europe, the Near East, and Africa in late 2005 and early 2006 led to large consumption shocks which translated into shifting trade flows and declining prices with subsequent supply responses in both infected and non-infected countries. While more than 220 million birds are estimated to have been culled since the onset of the disease, this accounts for less than one per cent of the 52 billion birds slaughtered annually. Most of the market and trade impact of AI are closely linked to consumption shocks and the imposition of trade restrictions, which have sent broader ripple effects around the globe. Simultaneously, the culling and high mortality of birds, coupled with the unproductive "downtime" forced on affected poultry farms has had an impact on the incomes of poultry producers.

5. In the European region, AI outbreaks were confirmed in 25 countries, with trade bans put in place for those 9 countries where AI was identified in domestic poultry operations. Approximately 69 countries have put import bans on poultry products from the various affected Member countries within the EU25. Eleven of those did not adopt a regional approach and imposed bans on products from all EU countries. In addition to bans related to H5N1, trade restrictions were also put in place on product from the Netherlands which in August identified a low pathogenic bird flu strain on one farm. With EU poultry consumption a short term decline, ranging from 70% in Italy to 40% in France and 0 to 10% in other Member states, EU aggregate chicken prices declined by 15% in late 2005.

Foot-And-Mouth Disease in South America

6. In October 2005, FMD outbreaks in the cattle sector were reported in the two Brazilian States of Mato Grosso do Sul and Parana. These two States previously accounted for 50% of Brazil's beef exports. Bans were imposed by over 50 countries, but the overall export impact was mitigated as the European Union and Russia, recipients of nearly half of Brazil's beef exports, applied the regionalization principle to their trade bans and targeted only the two affected States. The Brazilian Government is expected to request from the OIE the reinstatement of sanitary status as an area free of FMD with vaccination soon after the conclusion by the end of September 2006 of the six-month period required after the last animals were culled on the properties affected. (For OIE rules on freedom from animal diseases, see Annex 1). The regionalization of export bans allowed the beef sector to maintain export volumes at almost the previous years' level, because slaughterhouses substituted beef from the affected States with that produced in states completely free of FMD such as Goias, Mato Grosso and Minas Gerais. This process of substitution was facilitated by Brazil's diversified export markets with product moving to over 150 countries.

Figure 2. Representative international beef prices

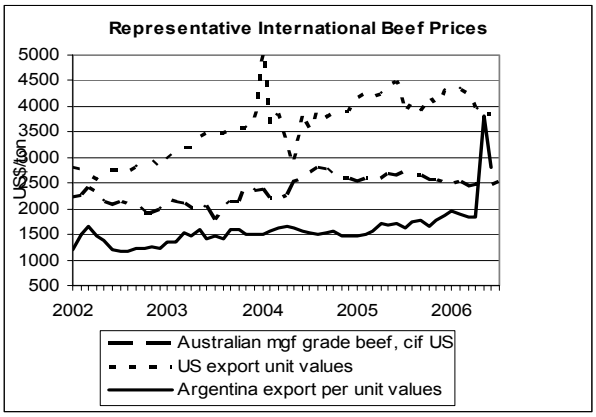
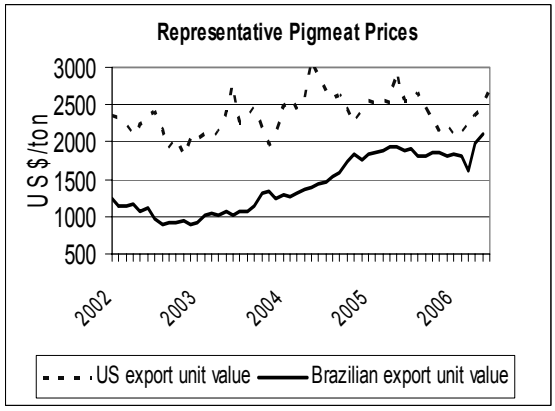


Figure 3. Representative pigmeat prices



7. The pork sector in Brazil has been more disadvantaged by the FMD outbreak than the beef sector, where the outbreak actually originated. The share of pigmeat exports to production, at 21%, is similar to that of beef, but the pork sector is heavily dependent on trade with Russia, the destination of 65% of Brazil's total pork exports. This, combined with a decision by the Russian Government to extend the ban to Santa Catarina (the only State in Brazil which has the status of being completely free of FMD without vaccination) and Rio Grande do Sul, has led to serious damage to the industry with prices declining on the Brazilian domestic market by 30%, pushing them well below the costs of production. Approximately 60 countries have imposed import restrictions on pork from Brazil. While exports were reported down more than 25% in the first half of the year, a resumption of trade to Russia from Rio Grande do Sol in mid-year implied some export recovery. There have been attempts this year to diversify markets to FMD areas, in particular Singapore, Hong Kong and other smaller markets in Africa and Asia.

8. In Argentina, FMD was detected in the province of Corrientes in early February 2006. Since the outbreak, Argentina has lost its status of being FMD-free with vaccination, a suspension which could last 6-8 months as the country responded to the outbreak through a stamping out action, during which around 5 000 animals (mainly cattle) were culled and destroyed. The trade impact has been minimal because, with the exception of Chile, most major markets only banned imports from Corriente, a province which accounts for only 2% of Argentine beef exports.

Bovine Spongiform Encephalopathy in North America

9. In 2003, BSE infected cows were discovered in North America, a region which supplies nearly one-quarter of global beef exports (valued at USD 4 billion). Since then, net exports of beef from the region have been significantly reduced by about 1 million tonnes from a level of about 1.6 million tonnes in 2002. It was only some 30 months after BSE was found in Canada (May 2003) and the United States (December 2003) that major high value Asian beef markets have started to re-open the access to Canadian and US beef cuts. The economic impact of the prolonged ban on North American beef products extended beyond the immediate effects on the two affected markets (see below) as reduced exportable supplies prompted a nearly 20% increase in Pacific market beef prices (supported also by rising chicken prices in the context of AI).

10. The BSE-related market losses in Canada and the United States have differed depending on the two countries' export dependency and net trade position. For example, the Canadian cattle industry exported 12% of its live animals and nearly 50% of total beef production prior to the identification of a BSE-infected animal in May 2003. After more than two years, at a total estimated cost of over USD 4

billion, exports of meat are gradually recovering, but live animal exports are still languishing. Cattle prices dropped by some 50%, and in 2003 alone, the value of Canadian beef and cattle exports declined by over USD 1 billion (USD 400 million for beef, USD 700 million for live cattle). This situation contrasts with that in the United States. Although one of the world's largest beef exporters, the country is a net beef and live cattle importer and its exports account for only 10% of production. While the value of US beef exports, following the detection of two BSE-cows dropped by USD 2.6 billion in 2004, domestic prices remained relatively high as imports adjusted.

III. Animal disease scenarios: some model results[1]

11. This section provides some preliminary estimates of producer market impacts due to disease outbreaks, in particular those that result from production, consumption, trade and price impacts. The document reviews estimates of outbreaks of AI in Europe, FMD in Brazil, and BSE in North America. Hypothetical AI outbreaks are also examined for Brazil and the United States as comparisons to the European situation. The discussion focuses on: 1) the role that market characteristics play in determining individual country market impacts; 2) the impact that regionalization policies have on disease costs; 3) the nature of consumer responses in influencing market impacts; 4) the differential market impacts of various animal diseases.

12. The heterogeneous nature of meat products and markets complicates modelling of the sector and this needs to be taken into consideration in understanding the results. For example, world beef and pigmeat markets are considered to be divided into at least three market segments. These markets, the Pacific Market (PM), the Atlantic Market (AM), and the FMD endemic market (FMDM) have been established over time, largely on the basis of the FMD status of the various countries, but also by trading patterns and trade agreements.[2] In general, the Pacific Market for beef includes North and Central America, Oceania, Japan, South Korea, Thailand and a portion of the Chinese and Indonesian markets; it is similar for pigmeat but this includes also the Philippines and high quality cuts from the EU. The Atlantic Market for beef includes South America, Malaysia, Viet Nam, various countries in North Africa and the Middle East, Eastern Europe and the remaining portion of the Chinese and Indonesian markets; for pigmeat, lower quality cuts from EU are also included. The FMDM is the residual market. The PM is the premium market with the highest prices, followed by the AM, with the FMDM having the lowest prices.

13. Exporters sell into specific markets largely based on their own disease status, supported by bilateral protocols. The poultry market, one of the fastest growing sectors, is characterised by diverse consumer preferences, with higher income markets preferring white over dark meat. While an estimated 54% of world chicken production consists of white meat, dark meat predominates in international markets, as it accounts for about 65% of the volume of world poultry meat trade. Comparing the two largest exporters, the United States is the major supplier of dark poultry cuts while Brazil provides whole birds as well as dark and white meat cuts. The heavy concentration of poultry export suppliers, with Brazil, the United States and the EU supplying nearly 80% of global trade, implies that any outbreak or consumption shock in those countries could generate large global market shocks.

14. Meat import markets are generally less concentrated, but, in the context of an animal disease outbreak, most countries place trade bans immediately to protect their own markets. Consumers, increasingly linked to the global media, are now more aware of food safety issues, thus heightening the

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1 The model results presented here focus on major exporters that have the largest impact on international markets.

2 In 2004-05, the Pacific Markets accounted for some 46% of world beef exports and 68% of world pork exports. Atlantic markets accounted for 51% of world beef exports and 29% of world pork exports. The remaining FMD markets account for the remainder and are small.

impact of a food crisis. These responses have direct implications for market prices and trade patterns. Within these market contexts, trade policies also condition trade flows and, hence, international market impacts. These policies range from specific disease bans or meat safety standards, to high tariffs and tariff rate quotas that limit trade. In some cases, export subsidies also apply. The AGLINK-COSIMO model that has been employed for this study takes these various policy measures into consideration.

Avian influenza scenarios

15. The following scenarios on the market and trade impacts of AI were analysed:

- A global AI consumption shift of 10% away from poultry to other meats.[3]
- Two scenarios of an AI outbreak in the EU. The first evaluates the loss in exports for 6 months[4], in the absence of a consumption shock, the second one combines the trade impact with a 10% consumption shock as defined in footnote 4.
- An AI outbreak in Brazil with a loss in exports for 6 months and no consumption shock.
- An AI outbreak in the United States with a loss in exports for 6 months and no consumption shock.

16. Results are presented for the year in which the outbreak occurs and examined relative to the baseline projections for 2006 as presented in the latest OECD-FAO Agricultural Outlook (see Tables 1-4). This analysis does not assess the longer term impacts to avoid having to make assumptions about the duration of the disease outbreak and the related trade measures. Such assumptions will be elaborated and examined in the context of work on trade impacts of animal diseases and alternative control practices under the 2007-2008 PWB.

Global consumption shock due to AI.

17. The impact on global markets and trade of shifting consumer preferences in all countries against poultry meat is demonstrated in Scenario 1 which simulates the effect of a global 10% shift away from poultry towards other meats in 2006 (see Table 1). In the first year, trade in poultry products falls by 13% and traded prices by almost 7%. World production and consumption of poultry meat decline by nearly 6%. Given the lag in supply response of other meats, prices increase considerably, with beef and pigmeat prices up from 10 to 20% in the Atlantic and Pacific markets. Feed prices fall as poultry production contracts and other meat production remains largely unchanged in the first year.

[3] The "shift" is interpreted to mean a shift in the demand schedule such that for the same prices and incomes, consumers consume 10% less poultry meat

[4] Annual average equivalent of a complete ban on exports for 6 months

Table 1. Scenario 1 - Worldwide 10% Preference Shift Away From Poultry Consumption
First year per cent impacts

	World	Developed	Least Developed	Other developing
Poultry:				
Production	-5.8	-4.7	-5.5	-6.7
Consumption	-5.8	-5.5	-6.2	-6.0
Imports		-16.2	-8.0	-12.3
Exports	-13.3	-7.7	na	-18.9
International Prices:				
Poultry	-6.7			
Atlantic Pigmeat	14.9			
Pacific Pigmeat	18.8			
Atlantic Beef	15.8			
Pacific Beef	10.7			
Maize	-3.2			
Oilmeal	-3.3			

Notes: In this scenario the consumption preference shift away from poultry is re-allocated to other meats on a proportion basis using world consumption shares of 2004-05. An na value for LDCs results from the fact that exports from these countries are miminal.

AI outbreak in the EU.

18. In Scenario 2a, a simulated reduction in EU poultry exports, channelled into the domestic market in the short term, reduces EU chicken prices by almost 4%. In response to a 7% decline in production, a shortage of white poultry meat develops in the EU, resulting in increased imports and a rise in international poultry prices increase by almost 2%. Substitution effects lead to small changes in the prices of beef and pigmeat in the EU and other markets. Scenario 2b is identical to 2a, except that a 10% EU consumption shock (*i.e.* a shift left in the demand schedule), which is allocated proportionally to other meats, has been assumed. In this scenario, chicken prices decline by over 6%, poultry output by almost 12% and consumption by almost 7%. The consumption shift affects the domestic pigmeat sector and, given the biological lag that limits the supply response for the first year, prices rise by almost 12%. Pigmeat prices in the United States – part of the Pacific market, which is the highest value destination for EU pigmeat - rise a bit over 1%, as EU supplies to that market are reduced. In the beef sector, increased beef consumption attracts imports from the Atlantic market, causing beef prices in that market - represented by Brazil - to rise 3.5%. The price and trade impacts of a significant shift in European meat consumption patterns stimulate higher Brazil and US poultry exports. Finally, while under the first scenario EU producer market revenues resulting from the price and output changes fall by about 11% (or about EUR 1.2 billion); they fall almost 18% (or about EUR 2.1 billion) under a consumption preference shift away from poultry meat.

Table 2. Market and Trade Impacts of AI outbreaks in the European Union

Scenario 2a: AI outbreaks in the EU: No consumption preference shift First year per cent impacts							
	World	**EU**	**Brazil**	**United States**	**Developed**	**Least Developed**	**Other developing**
				% change			
Poultry:							
Production	-0.2	-7.0	2.1	0.4	-2.0	1.0	1.3
Consumption	-0.2	0.8	-1.3	0.0	0.3	-0.8	-0.6
Imports		37.1	0.0	0.0	9.3	-3.9	-8.6
Exports	-0.6	-50	10.2	2.5	-12.2	na	10.9
Price:							
Poultry	1.6	-3.8	2.1	0.3			
Pigmeat	0.0	-1.2	0.4	0.0			
Beef	0.0	-0.6	0.0	0.1			

Notes: Applied to 2006 base projection. Assumes trade bans last 6 months. Results for annual data.

For the EU, the world reference prices used are the Pacific pigmeat prices and Atlantic beef prices.

Scenario 2b: AI outbreaks in the EU: 10% preference shift away from poultry First year per cent impacts							
	World	**EU**	**Brazil**	**United States**	**Developed**	**Least Developed**	**Other developing**
				% change			
Poultry							
Production	-1.0	-11.9	1.5	0.6	-3.4	0.9	1.0
Consumption	-1.0	-6.6	-0.3	0.2	-1.7	-0.9	-0.4
Imports		-0.4	0.0	0.0	3.0	-4.5	-8.5
Exports	-3.2	-50	5.8	3.0	-12.3	na	5.8
Price:							
Poultry	1.2	-6.2	1.5	0.5			
Pigmeat	1.5	11.8	-0.1	1.5			
Beef	3.6	4.7	3.6	0.6			

Notes: Applied to 2006 base projection. Assumes trade bans last 6 months. Results for annual data.

For the EU, the world reference prices used are the Pacific pigmeat prices and Atlantic beef prices.

Hypothetical AI outbreaks in Brazil and the United States

19. Scenarios 3 and 4 evaluate hypothetical AI breakouts in Brazil and the United States (see Tables 3 and 4). Not surprisingly, given their large share of world trade, these scenarios hold broader implications for international poultry markets than that carried out for the EU, which only accounts for 10% of global trade. These two examples show how market shocks differ for countries depending on their relative linkages to international markets. A 50% export shock in Brazil, which exports about 30% of its production, leads to a 10% reduction in domestic poultry prices. Meanwhile, given the lower export dependence of the industry in the United States, where exports (almost exclusively lower priced dark meat) account for only 15% of domestic output, the same proportionate loss of export markets is estimated to reduce production and prices by only about 7%. These scenarios demonstrate that greater involvement in international markets exposes a country to proportionally greater risks in terms of lower prices and reduced sales in case export markets close in response to a disease outbreak. In these two scenarios, market revenue losses, as exports are banned for the duration of six months, are 20% in Brazil compared to about 14% in

the United States. Effects on international markets obviously depend on relative market shares, the importance of trade to the overall industry, and the destination of trade flows.

Table 3.Scenario 3 - Hypothetical AI Outbreak in Brazil: No consumption preference shift
First year per cent impacts

	World	EU	Brazil	United States	Developed	Least Developed	Other developing
				% change			
Poultry							
Production	-0.1	1.8	-9.8	0.2	0.6	1.4	-0.6
Consumption	-0.1	-0.6	5.7	-0.1	-0.2	-0.9	0.0
Imports		-25.0	0.0	0.0	-2.5	-3.3	-9.7
Exports	-6.3	8	-50	1.5	3.9	na	-16.7
Price:							
Poultry	3.4	2.7	-9.7	0.4			
Atlantic Pigmeat	-3.0	0.8	-3.0	0.0			
Atlantic Beef	-1.7	0.4	-1.7	0.1			

Notes: Applied to 2006 base projection. Assumes trade bans last 6 months. Results for annual data.

Table 4. Scenario 4 - Hypothetical AI Outbreak in United States: No consumption preference shift
First year per cent impacts

	World	EU	Brazil	United States	Developed	Least Developed	Other developing
				% change			
Poultry							
Production	0.0	3.5	3.2	-6.6	-2.2	2.2	1.7
Consumption	0.1	-0.4	-1.7	1.3	0.4	-2.3	-0.1
Imports		-20.2	0.0	0.0	-3.3	-11.6	-5.6
Exports	-6.2	23	15.0	-50	-25.3	na	12.8
Price:							
Poultry	2.3	1.8	3.0	-6.8			
Pacific Pigmeat	0.7	0.5	0.7	-1.4			
Pacific Beef	0.9	0.3	0.9	-2.1			

Notes: Applied to 2006 base projection. Assumes a trade ban lasting 6 months. Results for annual data.

FMD Scenarios: the Impact of Regionalisation

20. The market and trade impact of an outbreak of foot-and-mouth disease in Brazil is assessed for the two year period, 2006-2007. Scenarios 5a illustrates the impact that may be anticipated under an OIE recognized regionalization approach, under which importing countries ban beef only from the disease-stricken regions. This is compared with results from a scenario that does not recognize regionalization, thus resulting in a total ban of imports from the country rather than from the affected region only (Table 5). In the case of Brazil, the world's largest beef exporter, the assumed difference in export levels due to regionalization, as evidenced in 2006, is significant; for beef, under a regionalised market, exports of beef and pork fall by about 9 and 60% respectively, compared to a 100% reduction for exports of both products when regionalization is not assumed.

21. Under the regionalisation[5] scenario (see results in Table 5), the decline in beef exports in 2006 of about 10% is accompanied by a drop in market prices of 15% in the first year. Domestic production falls less than one per cent in the first year and the total market revenue loss is estimated at 16-17% of market receipts. Lower production in the second year causes domestic prices to rebound to previously projected levels, with market revenue losses of only 2.5%. Beef prices in the Atlantic markets, as measured by the Argentinean export price, rise by nearly 7%, reflecting the lower export supplies to that market in the first year, but by only 2% in the second year. Further gradual erosion of the market impacts can be expected subsequently as market access is regained when bans are lifted. For the pigmeat sector, a reduction of exports of almost 60% pushes down domestic prices by over 25% in the first year. Producers respond to the lower prices of the previous year through an output cut of 9.5% in year two. Given the significant market share of Brazil in the Atlantic pigmeat market, prices rise by over 60% in the first year, before moderating to only about 3% increase in the second year.

22. Under an assumption of non-regionalization, the impact of an outbreak of foot-and-mouth disease in Brazil is estimated to be very severe. A total ban of exports in 2006 pushes down domestic prices of both beef and pigmeat by more than 50%, as all exports are disposed of in the domestic market. Market revenues for beef fall by almost 55% in the first year, and by 20% in the second year, compared to the baseline projection. For pigmeat, the results are more severe with market revenue losses estimated at 56% and 47% in the first and second year, respectively. Prices in both the Atlantic beef and pigmeat meat markets respond drastically to significantly lower supplies and prices increase by about 80% in each of these markets. The closing of price differentials between markets segments cause major changes in international trading patterns, with participants of the premium Pacific markets also shipping to the Atlantic markets as the prices in the later market rise. This scenario highlights the very important role played by regionalization policies, not only in stabilizing the domestic market of a major trading country, but also in limiting price volatility in international markets. Clearly, the benefits arising from the application by partner countries of the regionalization principle are greater, the larger the export dependency and international market share of the disease-affected country is.

[5] Exports not allowed from the two disease-affected Brazilian States of Mato Grosso do Sul and Parana. These two States previously accounted for 50% of Brazil's beef exports.

Table 5. FMD Outbreak: Trade Impacts of Regionalisation - the Case of Brazil

	Scenario 5a: Regionalization				Scenario 5b: No regionalization			
	World		Brazil		World		Brazil	
	2006	2007	2006	2007	2006	2007	2006	2007
Impact on the Beef Sector								
Production	0.0	-0.2	-0.8	-2.7	0.2	-0.4	-4.0	-13.4
Consumption	0.0	-0.2	1.8	-0.7	0.2	-0.4	24.9	12.6
Imports			0.0	0.0			0.0	0.0
Exports	-1.3	-0.9	-9.6	-9.0	-8.7	-6.6	-100	-100
Impact on the Pigmeat Sector								
Production	0.0	0.2	0.0	-9.5	0.0	0.3	0.0	-20.2
Consumption	0.0	0.1	14.3	2.2	0.0	0.2	23.9	-1.6
Imports			0.0	0.0			0.0	0.0
Exports	0.4	-2.8	-59.7	-59.6	-0.1	0.7	-100	-100
Prices								
Pigmeat	62.8	2.6	-26.4	-3.8	83.0	61.1	-50.1	-8.6
Poultry	-0.5	0.1	-0.6	0.1	-1.8	-0.5	-2.3	-0.7
Beef	6.5	2.1	-15.6	0.3	76.1	50.0	-56.0	-27.5
Feed	0.0	0.8	0.0	0.3	-0.1	1.4	0.0	0.5

Scenario 5a: Regional Bans on Three States: 200 000 tonne reduction in beef exports, 60% reduction in pigmeat exports

Scenario 5b: Total Ban on Brazilian Beef: 100 % reduction in exports of beef and pigmeat

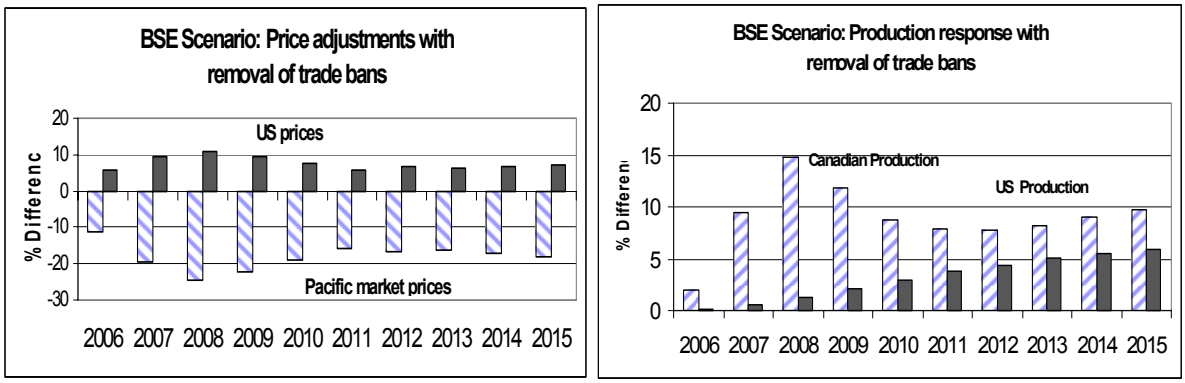
BSE in North America: adapting back into international markets

23. The effects of BSE in Canada and United States have been assessed in several studies. The key impact of this disease has been to reduce exportable supplies from these countries to the Pacific Market by about one million tonnes of beef annually. Severe domestic price depression created by excess domestic supply, particularly in Canada, but also in the United States, has led to a contraction of the industry. As trade bans have been lifted, first between these two countries where intra-trade is significant, then by importers in Pacific Markets, the North American beef sectors are gradually returning to a pre-BSE situation. Of clear concern is the long term impact of prolonged trade bans, the ability of the sectors to recover and to regain their international market shares, as well as the broader incentives related to long term investment in the industry.

24. To evaluate the implications of re-establishing market shares, the baseline projections, which assumed a lifting of trade bans, are contrasted with a simulation which extends trade bans into the indefinite future. The difference between these scenarios provides an impact assessment of BSE in North America on international beef markets and a measure of the length of time that markets take to adjust to the lifting of the trade bans.

25. Figure 4 illustrates the response of both the United States and Canadian industry over the projection period to 2015 after trade bans are removed, compared to a situation where trade bans are retained. This scenario shows the responsiveness of North American beef output to the higher domestic prices associated with the relaxation of the ban. The adjustment time appears to be long with production continuing to adjust over the ten year period. By 2015, beef output is only 6% higher than if trade bans were to have remained in place in the US and almost 10% higher in Canada. The industry recovery allows it to supply to the Pacific Market the volumes that had been previously precluded by the trade bans. This raises North American domestic prices by 5 to 10% over the period, while Pacific market prices decrease by 15 to 20%, compared to a situation where trade bans continue.

Figure 4. BSE scenario: Effects of removal of trade bans



Notes: The charts show the percentage difference from a base where trade bans on North American beef continue and a scenario where these bans are lifted.

IV. Conclusions

26. This document has reviewed the status of the three major animal diseases, namely AI, FMD, and BSE, which have been major causes of instability in meat markets and trade in recent years. Through the use of the AGLINK-COSIMO model, the document presents the results of three broad animal disease scenarios and draws some lessons on several factors that critically influence market losses and international market impacts that result from animal diseases.

27. The discussion in this report shows that international market responses to animal disease outbreaks depend critically on the type of disease, the nature of consumer responses, the size of the market affected and trade linkages. Obviously, the impact of animal disease outbreaks, in the form of market losses, is highest for countries where the outbreak occurs and is in proportion to the country's export dependence. The prevalence of disease-related market segmentation, such as those existing for beef and pigmeat, create higher international impacts for those market segments where the disease outbreak occurs.

28. It also appears from the analysis that consumer reactions play an important role in determining the size of market losses associated with animal diseases. In fact, exporters from countries that are not disease infected may be significantly and adversely affected by animal disease related demand shocks in importing countries. Government policies which seek to sustain consumer confidence could mitigate market losses, thus minimizing markets impacts, both within affected countries and globally.

29. Regionalization appears to be an effective instrument to limit market losses in countries that are experiencing an animal disease outbreak and to stabilize international markets. This has proved to be the case for Brazil and Argentina, where the potential market impacts of FMD outbreaks could have been extremely severe in the absence of importer recognition of disease free regions within these two countries.

30. A return to market equilibrium following a significant disease outbreak varies by disease and meat product. Poultry markets rebound very quickly, given the rapid supply responses of the industry, in contrast to beef markets which may take a decade to return to equilibrium.

ANNEX 1

Extract from the International Animal Health Code – 2006

CHAPTER 2.2.10.

FOOT AND MOUTH DISEASE

Article 2.2.10.7.

Recovery of free status

1. When an FMD *outbreak* or FMDV infection occurs in an FMD free country or zone where vaccination is not practised, one of the following waiting periods is required to regain the status of FMD free country or zone where vaccination is not practised:
    a. 3 months after the last *case* where a *stamping-out policy* and serological surveillance are applied in accordance with Appendix 3.8.7.; or
    b. 3 months after the slaughter of all vaccinated animals where a *stamping-out policy*, emergency vaccination and serological surveillance are applied in accordance with Appendix 3.8.7.; or
    c. 6 months after the last *case* or the last vaccination (according to the event that occurs the latest), where a *stamping-out policy*, emergency vaccination not followed by the slaughtering of all vaccinated animals, and serological surveillance are applied in accordance with Appendix 3.8.7., provided that a serological survey based on the detection of antibodies to nonstructural proteins of FMDV demonstrates the absence of infection in the remaining vaccinated population.

    Where a *stamping-out policy* is not practised, the above waiting periods do not apply, and Article 2.2.10.2. or 2.2.10.4. applies.

2. When an FMD *outbreak* or FMDV infection occurs in an FMD free country or zone where vaccination is practised, one of the following waiting periods is required to regain the status of FMD free country or zone where vaccination is practised:
    a. 6 months after the last *case* where a *stamping-out policy*, emergency vaccination and serological surveillance in accordance with Appendix 3.8.7. are applied, provided that the serological surveillance based on the detection of antibodies to nonstructural proteins of FMDV demonstrates the absence of virus circulation; or
    b. 18 months after the last *case* where a *stamping-out policy* is not applied, but emergency vaccination and serological surveillance in accordance with Appendix 3.8.7. are applied, provided that the serological surveillance based on the detection of antibodies to nonstructural proteins of FMDV demonstrates the absence of virus circulation.

CHAPTER 2.3.13.

BOVINE SPONGIFORM ENCEPHALOPATHY

Article 2.3.13.1.

The recommendations in this Chapter are intended to manage the human and animal health risks associated with the presence of the bovine spongiform encephalopathy (BSE) agent in cattle (*Bos taurus* and *B. indicus*) only.

1. When authorising import or transit of the following *commodities* and any products made from these *commodities* and containing no other tissues from cattle, *Veterinary Administrations* should not require any BSE related conditions, regardless of the BSE risk status of the cattle population of the *exporting country*, *zone* or *compartment*:
    a. *milk* and *milk products*;
    b. semen and *in vivo* derived cattle embryos collected and handled in accordance with the recommendations of the International Embryo Transfer Society;
    c. hides and skins;
    d. gelatine and collagen prepared exclusively from hides and skins;
    e. protein-free tallow (maximum level of insoluble impurities of 0.15% in weight) and derivatives made from this tallow;
    f. dicalcium phosphate (with no trace of protein or fat);
    g. deboned skeletal muscle meat (excluding mechanically separated meat) from cattle 30 months of age or less, which were not subjected to a stunning process prior to slaughter, with a device injecting compressed air or gas into the cranial cavity or to a pithing process, and which passed ante-mortem and post-mortem inspections and which has been prepared in a manner to avoid contamination with tissues listed in Article 2.3.13.13.;
    h. blood and blood by-products, from cattle which were not subjected to a stunning process, prior to slaughter, with a device injecting compressed air or gas into the cranial cavity, or to a pithing process.
2. When authorising import or transit of other *commodities* listed in this Chapter, *Veterinary Administrations* should require the conditions prescribed in this Chapter relevant to the BSE risk status of the cattle population of the *exporting country*, *zone* or *compartment*.

Standards for diagnostic tests are described in the *Terrestrial Manual*.

Article 2.3.13.2.

The BSE risk status of the cattle population of a country, *zone* or *compartment* should be determined on the basis of the following criteria:

1. the outcome of a *risk assessment*, based on Section 1.3., identifying all potential factors for BSE occurrence and their historic perspective. Countries should review the risk assessment annually to determine whether the situation has changed.
    a. Release assessment

        Release assessment consists of assessing, through consideration of the following, the likelihood that the BSE agent has either been introduced into the country, *zone* or *compartment* via *commodities* potentially contaminated with it, or is already present in the country, *zone* or *compartment*:

        i. the presence or absence of the BSE agent in the indigenous ruminant population of the country, *zone* or *compartment* and, if present, evidence regarding its prevalence;
        ii. production of *meat-and-bone meal* or *greaves* from the indigenous ruminant population;
        iii. imported *meat-and-bone meal* or *greaves*;
        iv. imported cattle, sheep and goats;
        v. imported animal feed and feed ingredients;
        vi. imported products of ruminant origin for human consumption, which may have contained tissues listed in Article 2.3.13.13. and may have been fed to cattle;
        vii. imported products of ruminant origin intended for *in vivo* use in cattle.

        The results of any epidemiological investigation into the disposition of the *commodities* identified above should be taken into account in carrying out the assessment.

b. Exposure assessment

If the release assessment identifies a *risk* factor, an exposure assessment should be conducted, consisting of assessing the likelihood of cattle being exposed to the BSE agent, through a consideration of the following:

i. recycling and amplification of the BSE agent through consumption by cattle of *meat-and-bone meal* or *greaves* of ruminant origin, or other feed or feed ingredients contaminated with these;
ii. the use of ruminant carcasses (including from fallen stock), by-products and slaughterhouse waste, the parameters of the rendering processes and the methods of animal feed manufacture;
iii. the feeding or not of ruminants with *meat-and-bone meal* and *greaves* derived from ruminants, including measures to prevent cross-contamination of animal feed;
iv. the level of surveillance for BSE conducted on the cattle population up to that time and the results of that surveillance;

2. on-going awareness programme for veterinarians, farmers, and workers involved in transportation, marketing and slaughter of cattle to encourage reporting of all *cases* showing clinical signs consistent with BSE in target sub-populations as defined in Appendix 3.8.4.;
3. the compulsory notification and investigation of all cattle showing clinical signs consistent with BSE;
4. the examination in an *approved laboratory* of brain or other tissues collected within the framework of the aforementioned surveillance and monitoring system.

When the *risk assessment* demonstrates negligible risk, the country should conduct Type B surveillance in accordance with Appendix 3.8.4.

When the *risk assessment* fails to demonstrate negligible risk, the country should conduct Type A surveillance in accordance with Appendix 3.8.4.

Article 2.3.13.3.

Negligible BSE risk

Commodities from the cattle population of a country, *zone* or *compartment* pose a negligible risk of transmitting the BSE agent if the following conditions are met:

1. a *risk assessment*, as described in point 1 of Article 2.3.13.2., has been conducted in order to identify the historical and existing risk factors, and the country has demonstrated that appropriate specific measures have been taken for the relevant period of time defined below to manage each identified risk;
2. the country has demonstrated that Type B surveillance in accordance with Appendix 3.8.4. is in place and the relevant points target, in accordance with Table 1, has been met;
3. EITHER:
    a. there has been no *case* of BSE or, if there has been a *case*, every *case* of BSE has been demonstrated to have been imported and has been completely destroyed, and
        i. the criteria in points 2 to 4 of Article 2.3.13.2. have been complied with for at least 7 years; and
        ii. it has been demonstrated through an appropriate level of control and audit that for at least 8 years neither *meat-and-bone meal* nor *greaves* derived from ruminants has been fed to ruminants;

OR

    b. if there has been an indigenous *case*, every indigenous *case* was born more than 11 years ago; and
        i. the criteria in points 2 to 4 of Article 2.3.13.2. have been complied with for at least 7 years; and

ii. it has been demonstrated through an appropriate level of control and audit that for at least 8 years neither *meat-and-bone meal* nor *greaves* derived from ruminants has been fed to ruminants; and
iii. all BSE *cases*, as well as:
- all cattle which, during their first year of life, were reared with the BSE *cases* during their first year of life, and which investigation showed consumed the same potentially contaminated feed during that period, or
- if the results of the investigation are inconclusive, all cattle born in the same herd as, and within 12 months of the birth of, the BSE *cases*,

if alive in the country, *zone* or *compartment*, are permanently identified, and their movements controlled, and, when slaughtered or at death, are completely destroyed.

Article 2.3.13.4.

Controlled BSE risk

Commodities from the cattle population of a country, *zone* or *compartment* pose a controlled risk of transmitting the BSE agent if the following conditions are met:

1. a *risk assessment*, as described in point 1 of Article 2.3.13.2., has been conducted in order to identify the historical and existing risk factors, and the country has demonstrated that appropriate measures are being taken to manage all identified risks, but these measures have not been taken for the relevant period of time;
2. the country has demonstrated that Type A surveillance in accordance with Appendix 3.8.4. has been carried out and the relevant points target, in accordance with Table 1, has been met; Type B surveillance may replace Type A surveillance once the relevant points target is met;
3. EITHER:
   a. there has been no *case* of BSE or, if there has been a *case*, every *case* of BSE has been demonstrated to have been imported and has been completely destroyed, the criteria in points 2 to 4 of Article 2.3.13.2. are complied with, and it can be demonstrated through an appropriate level of control and audit that neither *meat-and-bone meal* nor *greaves* derived from ruminants has been fed to ruminants, but at least one of the following two conditions applies:
      i. the criteria in points 2 to 4 of Article 2.3.13.2. have not been complied with for 7 years;
      ii. it cannot be demonstrated that controls over the feeding of *meat-and-bone meal* or *greaves* derived from ruminants to ruminants have been in place for 8 years;

   OR

   b. there has been an indigenous *case* of BSE, the criteria in points 2 to 4 of Article 2.3.13.2. are complied with, and it can be demonstrated through an appropriate level of control and audit that neither *meat-and-bone meal* nor *greaves* derived from ruminants has been fed to ruminants, but at least one of the following two conditions applies:
      i. the criteria in points 2 to 4 of Article 2.3.13.2. have not been complied with for 7 years;
      ii. it cannot be demonstrated that controls over the feeding of *meat-and-bone meal* and *greaves* derived from ruminants to ruminants have been in place for 8 years;

   AND

      iii. all BSE *cases*, as well as:
      - all cattle which, during their first year of life, were reared with the BSE *cases* during their first year of life, and which investigation showed consumed the same potentially contaminated feed during that period, or
      - if the results of the investigation are inconclusive, all cattle born in the same herd as, and within 12 months of the birth of, the BSE *cases*,

if alive in the country, *zone* or *compartment*, are permanently identified, and their movements controlled, and, when slaughtered or at death, are completely destroyed.

Article 2.3.13.5.

Undetermined BSE risk

The cattle population of a country, *zone* or *compartment* poses an undetermined BSE risk if it cannot be demonstrated that it meets the requirements of another category.

CHAPTER 2.7.12.

AVIAN INFLUENZA

Article 2.7.12.3.

NAI free country, zone or compartment

A country, *zone* or *compartment* may be considered free from NAI when it has been shown that neither HPNAI nor LPNAI infection has been present in the country, *zone* or *compartment* for the past 12 months, based on surveillance in accordance with Appendix 3.8.9. The surveillance may need to be adapted to parts of the country or existing *zones* or *compartments* depending on historical or geographical factors, industry structure, population data, or proximity to recent outbreaks.

If infection has occurred in a previously free country, zone or compartment, NAI free status can be regained:

1. In the case of HPNAI infections, 3 months after a *stamping-out policy* (including *disinfection* of all affected *establishments*) is applied, providing that surveillance in accordance with Appendix 3.8.9. has been carried out during that three-month period.
2. In the case of LPNAI infections, poultry may be kept for slaughter for human consumption subject to conditions specified in Article 2.7.12.19. or 2.7.12.20 or a *stamping-out policy* may be applied; in either case, 3 months after the *disinfection* of all affected *establishments*, providing that surveillance in accordance with Appendix 3.8.9. has been carried out during that three-month period.

Article 2.7.12.4.

HPNAI free country, zone or compartment

A country, *zone* or *compartment* may be considered free from HPNAI when it has been shown that HPNAI infection has not been present in the country, *zone* or *compartment* for the past 12 months, although its LPNAI status may be unknown, or when, based on surveillance in accordance with Appendix 3.8.9., it does not meet the criteria for freedom from NAI but any NAI virus detected has not been identified as HPNAI virus. The surveillance may need to be adapted to parts of the country or existing *zones* or *compartments* depending on historical or geographical factors, industry structure, population data, or proximity to recent *outbreaks*.

If infection has occurred in a previously free country, *zone* or *compartment*, HPNAI free status can be regained 3 months after a *stamping-out policy* (including *disinfection* of all affected *establishments*) is applied, providing that surveillance in accordance with Appendix 3.8.9. has been carried out during that three-month period.

Article 3.8.7.6.

Countries or zones re-applying for freedom from FMD where vaccination is either practised or not practised, following an outbreak

In addition to the general conditions described in Chapter 2.2.10., a country re-applying for country or *zone* freedom from FMD where vaccination is practised or not practised should show evidence of an active surveillance programme for FMD as well as absence of FMDV infection/circulation. This will require serological surveillance incorporating, in the case of a country or a *zone* practising vaccination, tests able to detect antibodies to NSPs as described in the *Terrestrial Manual*.

Four strategies are recognised by the OIE in a programme to eradicate FMDV infection following an *outbreak*:

1. slaughter of all clinically affected and in-contact susceptible animals;
2. slaughter of all clinically affected and in-contact susceptible animals and vaccination of at-risk animals, with subsequent slaughter of vaccinated animals;
3. slaughter of all clinically affected and in-contact susceptible animals and vaccination of at-risk animals, without subsequent slaughter of vaccinated animals;
4. vaccination used without slaughter of affected animals or subsequent slaughter of vaccinated animals.

The time periods before which an application can be made for re-instatement of freedom from FMD depends on which of these alternatives is followed. The time periods are prescribed in Article 2.2.10.7.

In all circumstances, a Member Country re-applying for country or *zone* freedom from FMD with vaccination or without vaccination should report the results of an active surveillance programme implemented according to general conditions and methods in this Appendix.