

# Avian Influenza and the Poultry Trade

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## Abstract

Because of high mortality rates, high rates of contagion, and the possibility of cross-species infection to mammals including humans, high pathogenic avian influenza is a major concern both to consumers and producers of poultry. The implications of the avian influenza for international poultry markets are large and include the loss of consumer confidence, loss of competitiveness, loss of market shares, supply shortages, and disruptions of trade flows. This paper illustrates the effect that high

pathogenic avian influenza has had on the trade flows of poultry products. The findings suggest that outbreaks of avian influenza have greatly restructured the international flow of poultry products. Consequent to high pathogenic avian influenza, Brazil has emerged as the world's largest supplier of frozen raw chicken products, while poultry industries in Southeast Asia have largely refocused their export markets by converting production from unprepared to prepared poultry meat.

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## Avian Influenza and the Poultry Trade<sup>°</sup>

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Keywords: Avian Influenza, HPAI, International trade, Poultry.

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## 1. Introduction

The sudden death of 25,000 chickens at a farm near Seoul in December 2003 was the first sign of a major epidemic of the highly pathogenic avian influenza (HPAI) virus (type H5N1) that would disrupt the worldwide poultry industry in the years to come. By early 2004, outbreaks of the same virus were confirmed in Cambodia, China, Hong Kong (China), Japan, Thailand, and Vietnam. By mid 2004, outbreaks were detected throughout Southeast Asia. By 2005 the virus had spread outside of Southeast Asia, and by 2006 it was confirmed in numerous European, African and Middle Eastern countries. Since 2003, hundreds of millions of birds, wild and domestic, have been killed directly by the disease or by culling.<sup>1</sup> Because of high mortality rates, high rates of contagion, and the possibility of cross-species infection to mammals including humans, HPAI is a major concern both to consumers and producers of poultry. At the local level, avian influenza is generally controlled through strict biosecurity practices, frequent veterinary controls, vaccinations, and the culling of infected birds. Across countries, governments try to control the spread of avian influenza by imposing import bans on poultry products originating from HPAI affected areas. Whatever measures are adopted, the implications of avian influenza for the international poultry markets are large. Consequences of the epidemic include the loss of consumer confidence, loss of competitiveness, loss of market

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<sup>1</sup> Prior to the present situation, outbreaks of highly pathogenic avian influenza in poultry were considered rare. Excluding the present one, only 24 outbreaks of highly pathogenic avian influenza have been recorded worldwide since 1959. Most of these outbreaks have been geographically restricted and short lived (WHO 2006).

shares, supply shortages, and disruptions in trade flows.<sup>2</sup> The objective of this paper is to explore the effect that HPAI epidemics have had on the trade flows in poultry products. The findings suggest that HPAI outbreaks have had only a limited effect on overall trade volumes but have greatly restructured the international flows of poultry products. Consequent to HPAI, Brazil has emerged as the world's largest supplier of raw chicken products, while poultry industries in Southeast Asia have largely refocused their export markets by converting production from unprepared to prepared poultry meat.

## 2. Avian Influenza

Avian influenza is a potentially devastating disease which is caused by a type of virus that is hosted by birds. Avian influenza viruses are generally categorized as low pathogenic (LPAI) or high pathogenic (HPAI). In addition, there are many different groups of avian influenza, called subtypes. Among the subtypes, H5N1 is the particular virulent strain that has been responsible for most of the recent avian influenza cases.<sup>3</sup> Table 1 summarizes avian influenza outbreaks between 2003 and 2006 by country and geographic region.

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<sup>2</sup> Burns et al. (2006) forecast the cost of pandemic spread of bird to bird flu, in the range of 0.1 of GDP for high income countries and 0.4 percent of GDP for middle and low income countries. See also Blayney (2005) for a discussion on the effects of various animal diseases on trade.

<sup>3</sup> Although across-species contagion is rather uncommon, certain strains of avian influenza have infected several species of mammals, including humans. WHO has confirmed more than 250 human cases of HPAI with a mortality rate of about 60 percent.

Table 1 - Avian influenza outbreaks, 2003-2006

<b>ASIA (High pathogenic)</b>			<b>EUROPE (High pathogenic)</b>		
Country	1st outbreak	Latest outbreak	Country	1st outbreak	Latest outbreak
Afghanistan	02-Mar-06	04-Apr-06	Albania	16-Feb-06	09-Mar-06
Cambodia	12-Jan-04	01-Aug-06	Austria	10-Feb-06	22-Mar-06
China	20-Jan-04	04-Aug-06	Azerbaijan	2-Feb-06	18-Mar-06
Hong Kong (China)	19-Jan-04	25-Feb-06	Bosnia-Herzeg.	16-Feb-06	16-Feb-06
India	27-Feb-06	18-Apr-06	Bulgaria	31-Jan-06	09-Feb-06
Indonesia	02-Feb-04	10-Jul-06	Croatia	21-Oct-05	24-Mar-06
Japan	28-Dec-03	05-Mar-04	Czech Rep.	27-Mar-06	19-May-06
Kazakhstan	22-Jul-05	10-Mar-06	Denmark	12-Mar-06	22-May-06
Korea, Rep.	10-Dec-03	22-Mar-04	France	17-Feb-06	26-Apr-06
Laos	15-Jan-04	14-Jul-06	Georgia	23-Feb-06	23-Feb-06
Malaysia	19-Aug-04	21-Mar-06	Germany	8-Feb-06	02-Aug-06
Mongolia	10-Aug-05	Jun-06	Greece	30-Jan-06	27-Mar-06
Myanmar	08-Mar-06	25-Apr-06	Hungary	4-Feb-06	12-Jul-06
Pakistan	23-Feb-06	20-Apr-06	Italy	1-Feb-06	19-Feb-06
Thailand	23-Jan-04	24-Jul-06	Poland	2-Mar-06	07-May-06
Viet Nam	09-Jan-04	15-Aug-06	Romania	7-Oct-05	06-Jun-06
<b>MIDDLE EAST (High pathogenic)</b>			Russia	15-Jul-05	31-Jul-06
Iran	02-Feb-06	02-Feb-06	Serbia-Monten.	28-Feb-06	09-Mar-06
Iraq	18-Jan-06	01-Feb-06	Slovakia	17-Feb-06	18-Feb-06
Israel	16-Mar-06	30-Mar-06	Slovenia	9-Feb-06	25-Mar-06
Jordan	23-Mar-06	23-Mar-06	Spain	7-Jul-06	07-Jul-06
Palestine Aut.	21-Mar-06	02-Apr-06	Sweden	28-Feb-06	26-Apr-06
<b>AFRICA (High pathogenic)</b>			Switzerland	26-Feb-06	11-Mar-06
Burkina Faso	01-Mar-06	18-May-06	Turkey	5-Oct-05	31-Mar-06
Cameroon	21-Feb-06	28-Mar-06	United Kingdom	30-Mar-06	30-Mar-06
Côte d'Ivoire	31-Mar-06	10-Jun-06	Ukraine	2-Dec-05	11-Jun-06
Djibouti	06-Apr-06	06-Apr-06	<b>AMERICAS (Low pathogenic)</b>		
Egypt	17-Feb-06	05-Jul-06	USA	11-Feb-04	03-Sep-04
Niger	06-Feb-06	25-Apr-06	Canada	19-Feb-04	29-Apr-04
Nigeria	16-Jan-06	Aug-06	Mexico	20-Mar-04	15-Jul-05
Sudan	25-Mar-06	Apr-06			

Source: Avian Influenza technical task force, FAO bulletins.

The first HPAI (type H5N1) outbreak was recorded in Korea in December 2003. By 2004 the same virus had spread to at least 10 Asian countries, including Cambodia, China, Hong Kong (China), Japan, Indonesia, Laos, Malaysia, Thailand and Vietnam. By 2005 and 2006 the virus had further spread into Asia, Europe, the Middle East and Africa.<sup>4</sup> Absence of migratory flyways from infected areas, strict border controls and severe biosecurity practices have largely kept the H5N1 virus outside of the Americas. However, in 2004 and 2005, different strains of avian influenza were also diagnosed in

<sup>4</sup> The pattern of H5N1 infections in Africa remains elusive as surveillance is especially weak there.

the USA, Canada and Mexico.<sup>5</sup> As of 2006, South America is the only region that has been free from high pathogenic avian influenza outbreaks.

The avian influenza virus is predominantly transmitted by direct bird to bird contact or through viral contaminated equipment. Epidemiologic evidence also suggests that migratory birds have a role in spreading the virus.<sup>6</sup> Avian influenza infections are generally prevented by strict biosecurity practices. However, biosecurity practices are used mainly on large scale farms while small flocks and live bird markets, particularly common in South East Asia, lack the controls and practices necessary to prevent infections. Because of this, small flocks are believed to be the main reservoir of the virus and live markets are thought to be the principal source of contagions and outbreaks.<sup>7</sup> Highly pathogenic avian influenza has high mortality rates and is generally controlled through the extensive culling of infected birds. Alternative strategies also use vaccination as a supplementary control measure during outbreaks.

The avian influenza virus is particularly resistant and can survive for considerable lengths of time outside the host. Its resiliency is important from a trade perspective as the virus can survive for rather long periods in refrigerated products. Hatching eggs are particularly hazardous, as newborn chicks can infect new flocks. Raw meat is also a potential source of infection as it can contaminate equipment and transmit the disease

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<sup>5</sup> Few LPAI outbreaks and two HPAI cases were reported in Texas and Canada in 2004.

<sup>6</sup> Migratory birds are believed to be mostly carriers and not reservoir for the virus as most of wild bird infections are thought to occur from spillover from infected poultry. See Olsen et al. (2006).

<sup>7</sup> FAO (2005).

when used for feeding. On the other hand, the trade, marketing and consumption of cooked and prepared poultry meats is generally considered safe, as the virus is destroyed at temperatures reached during conventional cooking.

### 3. Trade Impact of Avian Influenza

Avian influenza has affected a market worth more than 10 billion US\$ per annum in overall trade. Largely because of substitution from grains to protein rich diets in the developing world, poultry consumption is rapidly increasing. The overall trade of products originating from poultry has been steadily increasing in the last 10 years and has reached a total of more than 10 billion US\$ as of 2006. International trade of poultry products is similar in values to that of bovine meat and second only to swine. Although poultry is to some extent produced and consumed in all countries, poultry trade is dominated by a few countries both on the import and export side. Major importers include the European Union, Japan, Mexico, Hong Kong (China), Russia and Saudi Arabia. Major exporters are Brazil, USA, China and Thailand.

The economic impact of avian influenza depends on its effects on consumer confidence, and on the disruption of supply. From a trade perspective, changes in consumer demand would translate into changes in the overall volume of imports, while the disruption of supplies would affect bilateral flows by reallocating market shares to the advantage of HPAI free countries. In practice, as contagion has involved only a very small part of poultry farming, the disruption of supplies is largely determined by the



imposition of trade bans rather than the culling of infected birds. On the demand side, avian influenza outbreaks seem not to have significantly affected demand.<sup>8</sup>

Trade policy responses to avian influenza have generally focused on the imposition of trade bans. As soon as an outbreak is confirmed, countries prohibit imports of potentially infected goods originating in HPAI affected countries. Although the products covered and the duration of these bans vary considerably, most countries generally conform to guidelines proposed by the World Organization for Animal Health. In summary, these guidelines advise: a) not to take regulatory action on countries where HPAI is found only in migratory or wild birds; b) to lift bans once the area of origin has been free from HPAI for 12 months;<sup>9</sup> and c) not to apply bans to products that have been rendered non-infectious (processed to at least 70 degrees Celsius). Although most trade bans affect imports from whole countries, an increasing number of countries recognize “regionalities”, thus applying import bans only from the affected zones or “commercial compartments”.<sup>10</sup> The existence of regionalities greatly reduces the impact of avian flu on trade flows, as poultry exporters generally operate several poultry farms in a country,

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<sup>8</sup> With the exception of few countries, the avian influenza scare did not have a lasting effect on consumer confidence. On a yearly basis, per capita consumption of poultry meat has decreased only in the East Asian countries worst hit by avian flu. In most other countries consumption of poultry meat has increased even during 2004 and 2005.

<sup>9</sup> Although the bans are generally lifted in a shorter period if the affected country can demonstrate that it has applied strict biosecurity practices and drastic steps to contain the contagion.

<sup>10</sup> In general, regionalities are only applied to larger countries where the virus is not considered endemic.

and production for export can be quickly re-localized to HPAI free “commercial compartments”.

The impact of avian influenza on trade flows is also constrained by the existing structure of trade policy. Poultry trade is hardly a free market, as it is subjected to substantial tariffs often provided on a preferential basis, and non-tariff measures such as veterinary certification, licensing, product characteristic requirements and quotas. These policy instruments are quite effective in shaping bilateral trade flows as they effectively limit imports or favor determined countries. Major importers such as the European Union and Russia apply a complex system of quotas regulating the poultry markets. Other importers, such as Mexico, offer significant advantages to some trading partners (in particular the USA), by providing them with a high preferential margin in the tariff. In these cases, the effect of avian influenza on trade is found to be mitigated by pre-existing trade policies.

The impact of avian influenza on poultry trade depends also on trade composition. Poultry trade consists in two main categories: unprepared and prepared poultry. The international trade of poultry largely regards unprepared poultry meat, mostly frozen (about 7 billion US\$ in 2006); however international trade in prepared meat is rapidly increasing. Prepared poultry meat trade reached almost 3 billion US\$ in 2006. Chicken eggs and live poultry trade is of much lower value (about half billion US\$ each).<sup>11</sup> Avian

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<sup>11</sup> These figures do not include intra-EU trade. Intra-EU trade in poultry is valued at about 5 billion US\$ of unprepared meat and 2 billion US\$ in prepared meat.

influenza has had a significant but diverse impact on these products. Generally speaking, avian influenza appears to have had little impact on overall volumes of trade, but it has greatly restructured the international trade flows of poultry products, especially regarding Asian markets. What follows below is an analysis of the effects of avian influenza on the different poultry products.<sup>12</sup>

### 3.1 International Trade of Unprepared Poultry Parts

Supported by development in the cold chain, meat processing, packaging and transportation, international trade in unprepared poultry has constantly increased during the last 10 years. Unprepared poultry trade increased from a value of about 4 billion US\$ in 1995 to about 7 billion US\$ in 2006. In values, trade flows of unprepared poultry have increased even during the avian influenza epidemic; however, when measured in weight, volumes have temporarily decreased in 2004 and 2005, by 2006 volumes were already higher than these observed pre-2004.<sup>13</sup>

The avian influenza outbreaks have had a larger impact on the market shares of exporters than overall volumes. Because international trade in unprepared poultry is

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<sup>12</sup> This analysis utilizes yearly data from the United Nations COMTRADE database. Trade data follows the HS 88 classification: 0207 (unprepared poultry), 1602 (prepared poultry), 0407 (eggs) and 0105 (live poultry).

<sup>13</sup> This is related to the increase of prices in 2004 and early 2005 on supply constraints. Prices generally declined in 2006. See Moore T. and N. Morgan (2006) for a discussion on the effect of HPAI on volumes and prices.

dominated by few countries on both export and import flows, trade flows are quite subjective to shocks on either the supply or demand side. More specifically, six import markets (Japan, Russia, European Union, Hong Kong (China), Mexico and the states in the Arabian Peninsula) account for more than 60 percent of all imports. Five exporters (Brazil, European Union, USA, China and Thailand) account for about 90 percent of total exports.

Table 2 reports the evolution of imports in the major import markets from 1995 to 2006. With the exception of Japan and Hong Kong (China), most countries have seen a rapid increase of imports of unprepared poultry during the last 10 years. Imports have grown most substantially in Russia, Mexico, in the states in the Arabian Peninsula<sup>14</sup>, and in the early year in the European Union. Increases in imports are largely due to a greater consumption of poultry meat in developing countries, where increases in living standards drive upward the demands for meats.<sup>15</sup> In general, the trade data shows very little evidence of the effect of avian influenza on overall imports. Slight decreases in imports are observed only for 2004 and only for countries, such as Japan and Hong Kong (China), which relied heavily on imports from countries affected by HPAI. By 2006, with the exception of Japan, imports of unprepared poultry products exceeded the levels of 2004. At the aggregate level, total trade in unprepared poultry meats was stable between 2003 and 2004 and increased thereafter. This suggests that, on the demand side, the impact of avian flu has been modest and temporary.

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<sup>14</sup> Bahrain, Kuwait, Oman, Qatar, Saudi Arabia. United Arab Emirates and Yemen.

<sup>15</sup> Consumption demand of poultry meat grew in most countries even in 2004 and 2005 (FAO 2005).

Table 2: Imports of unprepared poultry (million US\$, current)

Year	Japan	Russia	European Union	Arabian Peninsula	Hong Kong (China)	Mexico	Others	Total Trade	Total Trade (million Tons)
1995	1,320	490	363	393	747	174	752	4,238	2,530
1996	1,301	509	477	379	833	213	1,131	4,844	3,770
1997	1,030	815	450	382	885	245	1,262	5,069	4,080
1998	963	563	418	408	806	226	1,291	4,675	4,550
1999	1,000	154	408	661	908	198	1,624	4,953	4,840
2000	899	366	502	674	835	257	1,652	5,185	5,480
2001	881	756	894	750	761	298	1,721	6,060	5,950
2002	959	816	722	675	650	246	1,729	5,795	6,180
2003	815	698	892	746	639	327	2,002	6,118	6,330
2004	749	663	860	805	520	386	2,163	6,146	5,660
2005	924	848	931	866	579	533	2,455	7,136	6,140
2006	743	922	863	864	660	599	2,764	7,413	6,496

Source: COMTRADE database.

Note: Excludes intra-EU trade. Arabian Peninsula include: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen.

The impact of avian flu on international trade flows is more evident by examining the evolution of the exports of major exporters. Table 3 shows the rapid shifting in overall exports of unprepared poultry from HPAI affected countries to HPAI free countries after 2003. Thailand has been the most affected by these shifts. Thai exports of unprepared meat decreased from more than 600 million US\$ in 2003 to almost zero in 2005. With a loss of about 300 million US\$, China was also badly affected, especially in its export to Japan. Overall Chinese exports did not decrease as dramatically as those of Thailand because Chinese suppliers were able to maintain a presence only in the Hong Kong (China) market by relying on regionalities.

As the overall demand in major importing countries was not substantially affected by HPAI, the loss of Southeast Asian suppliers was replaced by increases in domestic production and shifts in imports to HPAI free countries. Among these, Brazil has been

the main beneficiary. Brazilian suppliers were able to both replace the banned suppliers in Southeast Asian countries and meet the increase in world demand. Brazilian success in the unprepared poultry industry has been driven by its large supply capacity, its status as an HPAI free country and the highly competitive price of Brazilian poultry relative to other large HPAI free suppliers. Brazilian exports of unprepared poultry rose by almost 1.5 billion between 2003 and 2006. Increases in exports, on a smaller scale, are reflected in the data from other HPAI free countries.

Table 3: Exports of unprepared poultry (million US\$)

Year	Brazil	USA	European Union	China	Thailand	Others HPAI affected	Others HPAI free	Total Trade
1995	672	1,278	982	623	411	48	224	4,238
1996	814	1,835	926	638	345	46	241	4,844
1997	847	1,991	983	567	341	41	299	5,069
1998	733	1,787	997	495	396	32	236	4,675
1999	914	1,773	878	534	431	32	390	4,953
2000	897	2,006	851	599	425	23	384	5,185
2001	1,387	2,206	856	593	572	29	417	6,060
2002	1,457	2,048	918	406	585	49	333	5,795
2003	1,741	2,005	897	416	631	45	384	6,118
2004	2,642	1,616	943	141	46	19	739	6,146
2005	3,252	1,800	990	162	15	32	885	7,136
2006	3,119	1,965	1,086	171	21	34	1,016	7,413

Source: COMTRADE database.

Note: Excludes intra-EU trade. Other HPAI affected countries include: Cambodia, Hong Kong (China), Japan, Indonesia, Laos, Malaysia, South Korea, and Vietnam.

The extent of the effect of avian flu on trade flows is more evident when analyzing gains and losses of market shares at the bilateral level. International trade in unprepared poultry is quite segmented, and each import market is often dominated by one or few suppliers.

Table 4 shows the allocation of market shares among major exporters before and after the HPAI outbreaks of early 2004.<sup>16</sup>

Table 4 – Bilateral trade in unprepared poultry (Market share pre- and post-HPAI)

Importers		Brazil	China	European Union	Thailand	USA	Others
European Union	pre	61%	1%		21%	7%	9%
	<i>post</i>	<b>75%</b>	<b>0%</b>		<b>1%</b>	<b>4%</b>	<b>19%</b>
Hong Kong (China)	pre	19%	11%	9%	2%	56%	3%
	<i>post</i>	<b>36%</b>	<b>25%</b>	<b>16%</b>	<b>0%</b>	<b>21%</b>	<b>3%</b>
Japan	pre	24%	26%	3%	38%	6%	3%
	<i>post</i>	<b>80%</b>	<b>1%</b>	<b>9%</b>	<b>2%</b>	<b>4%</b>	<b>4%</b>
Mexico	pre	0%	0%	0%	0%	94%	6%
	<i>post</i>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>91%</b>	<b>9%</b>
Russia	pre	17%	3%	16%	0%	61%	3%
	<i>post</i>	<b>22%</b>	<b>0%</b>	<b>22%</b>	<b>0%</b>	<b>54%</b>	<b>3%</b>
Persian Gulf States	pre	59%	8%	25%	0%	3%	4%
	<i>post</i>	<b>71%</b>	<b>1%</b>	<b>25%</b>	<b>0%</b>	<b>2%</b>	<b>1%</b>
Others	pre	10%	3%	23%	4%	31%	29%
	<i>post</i>	<b>22%</b>	<b>1%</b>	<b>30%</b>	<b>0%</b>	<b>33%</b>	<b>15%</b>

Source: COMTRADE Database

Note: Excludes intra-EU trade. Three year averages are reported for 2001-2003 and 2004-2006 in bold italic.

Bilateral market shares indicate that Brazilian exporters, although increasing their presence in most markets, have done so particularly in countries which relied the most on Southeast Asian suppliers. In particular, Brazil's market shares in Japan increased by about 56 percentage points, replacing most Chinese (-25%) and Thai (-36%) suppliers. The Brazilian market share also increased in the Hong Kong (China) market (+4%) and in the European Union (+14%). To a lesser extent Brazil also increased its market shares

<sup>16</sup> Market share is calculated as a three year average (2001-2003 and 2004-2006)

in countries that were less heavily dependent on imports from Thailand and China, such as Russia and the states in the Arabian Peninsula. Among other gainers, European Union exports have followed, on a smaller scale a similar pattern of these of Brazil, with gains in most markets and especially in these of Southeast Asia.

The countries whose raw poultry exports appear to have suffered the most as a consequence of avian flu have been Thailand, China and to a lesser extent the USA. While imports originating from Thailand have been practically halted in all markets from 2004 onward, Chinese suppliers lost most markets, but were able to retain (and actually increase) market share in Hong Kong (China) where proximity, political ties, price advantage and regionalities in the import bans, kept export flowing. The onset of an unrelated type of avian influenza in the USA in 2004 and the consequent import bans greatly penalized USA suppliers in some markets, notably Hong Kong (China). Despite the fact that the import ban was lifted after few months, the US poultry industry was not able to recover its previous leading position, a position now occupied by Brazil.<sup>17</sup> USA suppliers were able to maintain their market shares in countries with which they had regionalities agreements such as Mexico<sup>18</sup> or pre-determined quotas, such as Russia.

The effect of avian influenza on the international markets of unprepared poultry has been felt not only on trade flows but also on prices, although only marginally so. In

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<sup>17</sup> This suggest that even short lived import bans can have permanent effects on trade flows.

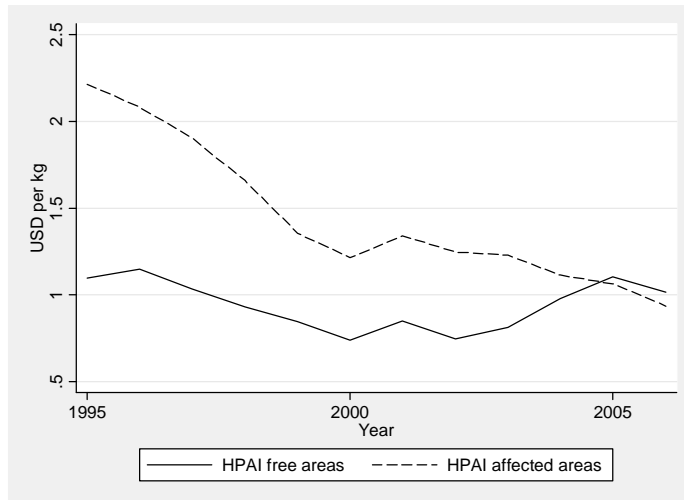
<sup>18</sup> Moreover, Mexico applies a hefty MFN tariff which de-facto protects US exporters from the competition of other suppliers such as Brazil. More recently, Mexico negotiated a preferential trade agreement with Chile which is slightly eroding the dominant position of US poultry meat suppliers.



theory, the shift in demand from HPAI affected to HPAI free countries would be to depress export prices of products originating from HPAI affected areas, while increasing prices from HPAI free areas. In practice, prices from HPAI affected areas have only marginally declined as avian influenza outbreaks have largely rendered unprocessed poultry products originating from these areas un-marketable because of import bans. Figure 1 reports the trend in current prices of poultry originating from exporters in HPAI affected areas (East Asia) and major exporters in the rest of the world. These prices are calculated as unit values of exports and are averages comprising of many varieties (legs, wings, breasts, etc) all which have different prices, thus these prices should be compared with some caution. For example, the gap between HPAI affected and non HPAI affected countries in the late 1990s is largely due to the higher value of cuts exported by Thailand (breast) versus Brazil and USA (legs and wings). In general, the data suggests similar trends in the prices of unprepared poultry originating from all major exporters until the onset of avian influenza. Prices of unprepared poultry meat have been declining in the late 1990s to stabilize in the early 2000. Once avian influenza outbreaks initiated, difficulty in find export markets for countries in East Asia led to a decrease in the prices of unprepared poultry originating from these countries. On the contrary, the shrink in supply due to avian influenza outbreaks of 2004 and 2005 has produced an upward pressure on prices of unprepared poultry for all other major exporters. However, this increase has been short lived, increase in supply for Brazil and other major exporters led to a decrease in the prices of unprepared poultry in 2006. The trend in prices reinforces the hypothesis that the effect of avian influenza was quite limited on the demand side and was largely confined to the supply side. The shrink in supply of 2004 and 2005 was

matched only by a much smaller reduction in demand, with the consequence of a overall increase in the international price of poultry during the worst period of avian influenza outbreaks.

Figure 1 – Prices of Unprepared Poultry (Current USD per kg.)



A related concern to the international trade of unprepared poultry meat is the possibility that HPAI infected countries have diverted part of their export to third countries with no or less restrictive import bans. The data generally does not support this hypothesis. Exports from Thailand to Africa, for example, have been following a similar pattern of those to other countries, with most exports halting by early 2004.<sup>19</sup>

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<sup>19</sup> However, it is still possible that some “dumping” of poultry product has occurred illegally through misclassification at customs. This hypothesis can not be verified by the analysis of the official data and would require further investigations.

### 3.2 International Trade: the Market for Processed Poultry Meat

Second to raw meat, prepared poultry is increasingly taking a larger share in the international trade of poultry products. A large part of the trade in prepared poultry meat takes the form of convenience food such as fried, steamed, or roasted chicken meat. The product is usually packaged “ready-to-eat”, and shipped frozen. Consumers’ demand for this type of prepared food is rapidly increasing especially in developed countries.

Following consumption, total trade in processed poultry meat has rapidly increased both in values and volumes soaring from half a billion US\$ in 1995 to almost 3 billion US\$ in 2006. Major destination markets are the developed countries, especially Japan and the European Union. Because the avian influenza virus does not survive cooking, processed poultry meat has not generally been subject to trade bans, even if it originated from HPAI affected areas.

The international trade for prepared poultry meat is highly concentrated. The bulk of trade is directed to developed countries and just two import markets (Japan and European Union) account for more than 70 percent of total imports. Four exporters (Thailand, China, Brazil, and USA) account for more than 85 percent of total trade.

Table 5 - Imports of prepared poultry meat (million US\$)

Year	Japan	European Union	Canada	USA	Others	Total Trade	Total Trade (million. Tons)
1995	233	40	63	3	191	531	318
1996	280	87	62	5	231	665	365
1997	302	111	78	7	252	748	409
1998	326	140	82	10	218	776	439
1999	408	166	75	18	191	857	495
2000	517	215	92	27	225	1,075	633
2001	615	264	103	40	268	1,291	773
2002	702	285	101	43	276	1,407	801
2003	733	363	110	51	302	1,558	855
2004	790	410	116	63	463	1,841	1,128
2005	1,101	684	134	67	512	2,499	1,391
2006	1,211	785	154	75	580	2,806	1,530

Source: COMTRADE Database  
 Note: Excludes intra-EU trade.

Table 5 reports the evolution of the import of prepared poultry meat for the four major importers. With more than 1.2 billion US\$ worth of imports in 2006, Japan is the largest importer of prepared chicken. The large increase in imports between 2004 and 2005 (300 million US\$) is possibly due both to increases in demand and to shortages of suppliers of fresh chicken, for which prepared poultry is a substitute. A substantial part of chicken consumed in Japan is now being prepared abroad and imported already cooked. The European Union's imports of prepared poultry have also increased substantially, especially in the last few years. Imports have almost doubled from about 400 in 2004 to about 800 million US\$ in 2006. Increases in imports, but to a much smaller extent have also been recorded for Canada and USA, and for all other countries in general.

The increase in demand for prepared poultry has been met largely by three major exporters: Thailand, China and Brazil. In particular, countries such as Thailand and China, which were major exporters of unprepared meat before avian influenza outbreaks,

have heavily invested to convert their crippled export industry from unprepared to prepared meat. The consequence of this is reflected in the large increase in their exports between 2003 and 2005. Table 6 reports overall trade and exports originating from the four major suppliers of prepared poultry meat.

Table 6 - Exports of prepared poultry meat (million US\$)

Year	Thailand	China	Brazil	USA	Others	Total Trade
1995	164	43	7	219	99	531
1996	190	150	12	221	91	665
1997	229	150	10	261	99	748
1998	284	156	17	230	88	776
1999	326	214	22	190	105	857
2000	365	333	28	200	149	1075
2001	407	421	48	242	174	1291
2002	452	512	65	208	170	1407
2003	566	492	97	197	207	1558
2004	798	490	110	186	258	1841
2005	1164	639	256	198	242	2499
2006	1185	709	419	222	271	2806

Source: COMTRADE Database  
 Note: Excludes intra-EU trade.

As of 2006, the export market for prepared poultry meat is dominated by the two countries where the poultry industry was worse hit. Thailand's total exports in 2006 were worth almost 1.2 billion US\$, while China accounted for about 700 million US\$. Brazil's exports have also grown but at a smaller pace.

As in the case of unprepared poultry products, the market for prepared poultry is highly segmented with each importer relying on a limited number of suppliers. Table 7 illustrates the market shares in each import market as a three year average before and after the onset of avian influenza.

Table 7 – Bilateral trade in prepared poultry meat (Market share pre- and post-HPAI)

Importers		Brazil	China	Thailand	USA	Others
European Union	pre	19%	0%	63%	0%	17%
	<i>post</i>	<b>28%</b>	<b>0%</b>	<b>56%</b>	<b>0%</b>	<b>16%</b>
Japan	pre	0%	64%	33%	2%	1%
	<i>post</i>	<b>1%</b>	<b>56%</b>	<b>42%</b>	<b>0%</b>	<b>1%</b>
Canada	pre	0%	0%	2%	98%	0%
	<i>post</i>	<b>0%</b>	<b>0%</b>	<b>3%</b>	<b>96%</b>	<b>0%</b>
USA	pre	0%	1%	0%	0%	99%
	<i>post</i>	<b>0%</b>	<b>22%</b>	<b>0%</b>	<b>0%</b>	<b>78%</b>
Others	pre	4%	9%	12%	23%	53%
	<i>post</i>	<b>6%</b>	<b>8%</b>	<b>8%</b>	<b>14%</b>	<b>64%</b>

Source: COMTRADE Database

Note: Excludes intra-EU trade. Three year averages are reported for 2001-2003 and 2004-2006 in bold italic.

Bilateral market shares indicate the key role that Thailand plays in exporting both to the Japanese and European Union markets. Thailand's position in these markets has not been affected by HPAI outbreaks. Thailand's slight loss of market share in the European Union is compensated by large gains the Japanese market. Similar to Thailand, China's position in the Japanese market has not substantially changed. Brazil has not been able so far to penetrate the Japanese market for processed poultry and its exports are almost exclusively relegated to the European Union.<sup>20</sup> In any case, as the trade of prepared poultry has boomed in the last few years, modest losses in market shares still correspond to large gains in trade flows. In this regard Thailand and China have fared

<sup>20</sup> China has also increased its presence in the US markets to reach about 20 percent in 2006. However, US imports of unprepared poultry are relatively small. China's exports to the USA totaled only 30 million USD in 2006.

particularly well. Thailand's exports of prepared poultry both to the Japanese and EU markets have each grown by about 250 million US\$ between 2003 and 2006. Chinese growth in the Japanese market has been about 200 US\$. This data suggests that the Thai and Chinese poultry industries have been highly successful in reconverting their exports from unprepared to prepared poultry. In this perspective, the onset of avian influenza may have accelerated a transition to the production and export of a higher value added products.

### 3.3 International Trade: the Market for Chicken Eggs and Live Poultry

The international trades of chicken eggs and live poultry are relatively smaller. Total trade in chicken eggs has increased from about 350 million in 1995 to almost 700 million US\$ in 2006.<sup>21</sup> Total trade in live poultry has been relatively constant at about half a billion US\$ between 1995 and 2006. Trades in both live poultry and chicken eggs mainly occur only between neighboring countries. Major trade flows are from Malaysia to Singapore, China to Hong Kong (China), and the USA to Canada.

In general, both eggs and live chicken are among the first products covered by the import bans once HPAI outbreaks are notified. However, from a trade perspective the data show that the impact of HPAI on chicken eggs has been small both in terms of

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<sup>21</sup> The industrial production of chicken eggs is largely separate from that of chicken meat. Eggs are produced by "layer" chickens while chicken meat is produced by "broiler" chickens. Thus, countries that export poultry meat do not necessarily produce or export chicken eggs.

volumes and market shares.<sup>22</sup> Regarding live poultry, the impact of HPAI has been more severe, with a reduction of overall imports for Singapore (in 2004) and for Hong Kong (China) (both for 2004 and 2005). As in the case of chicken eggs, the data does not show any switch in suppliers or any change in market shares. The likely explanation is that the requisite of freshness and higher transportation costs make long distance shipping uneconomical for these products. Market shares are dictated mostly by geographic proximity and suppliers cannot be easily replaced.

#### 4. Conclusions

From a trade perspective, the effects of avian influenza translate into changes in the overall volume of imports (driven by changes in demand), and changes in bilateral trade flows (driven by the disruption in some suppliers). Poultry products can be categorized into unprepared, or raw, and prepared or cooked products. Avian influenza epidemic has affected the trade of these products in different ways.

The trade in poultry products, both prepared and unprepared, is dominated by few countries on both export and import flows and trade flows are quite subjective to shocks on either the supply or demand side. While avian influenza outbreaks seem to have had little effect on demand as consumption and overall trade of poultry products have kept increasing even during the HPAI epidemic, avian influenza has greatly restructured the

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<sup>22</sup> In general, eggs are perceived to be safer than meat, and consumer demand seems to have been largely unaffected by HPAI.



suppliers of international markets, especially in East Asia. In the years before the HPAI epidemic the principal driver of Asia's poultry market was Japanese demand for unprepared poultry from China and Thailand. As HPAI outbreaks spread through Asia, Japanese importers shifted their suppliers to the advantage HPAI free countries. Imports of unprepared poultry from China and Thailand virtually halted, while imports from Brazil soared. Brazil was able to take most advantages from import bans because its large supply capacity and competitive products relative to other HPAI free countries. This pattern is not limited to the Japanese market, but also in other markets where Thailand or China had a substantial presence. For example, Thailand's market share in the European Union was swiftly lost to the advantage of Brazilian suppliers.

While Brazil is found to have obtained the largest gains in market shares, whether Thai and Chinese poultry industries have suffered as a consequence of avian influenza is debatable. Avian influenza had also the effect to redirect consumers' demand and import from unprepared meat (subjected to import bans) to prepared meat (perceived safer and not subjected to import bans). In this regard, the major beneficiaries of the increase in world demand have been these countries where suppliers were hit the most from import bans on unprepared meat, in particular China and Thailand. To circumvent import bans on unprepared meat, Chinese and especially Thai poultry exporting firms have quickly refocused their exports to prepared poultry meats. Prepared meat, because it is subject to high temperature is free of the HPAI virus, and is therefore not subjected to import bans. As the demand for prepared meat is growing considerably faster than that of unprepared products, particularly in high income countries, Thai and Chinese suppliers have gained

an early advantage in a highly profitable market. In this regard, HPAI outbreaks may have accelerated a transition to the production and export of higher value added products.

This paper does not address a number of related issues on the effects of HPAI on international trade. In this regard, further research could be aimed to distinguish the temporary trade effects driven by import bans from permanent ones driven by shifts in production or consumer preferences. Furthermore, trade shocks, such as those consequent to HPAI, have an impact on welfare, income distribution and ultimately on poverty. Finally, future research should better investigate the role of trade policies, especially sanitary standards, in limiting the effect of exogenous shocks as these of avian influenza.

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