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Effects of China's Antidumping Tariffs on U.S–China Bilateral Poultry Trade

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Abstract

In recent years, the United States has taken the lion's share of the Chinese broiler meat import market, ranging from 53.0% to 84.9%. Under the threat of rising poultry imports from the United States Chinese producers asked for an investigation into chicken prices, accusing American poultry firms of dumping. The investigation led to antidumping duties on U.S. chicken imports as of February 13, 2010, ranging from 43.1% to 105.4%. This study is designed to evaluate U.S.-China poultry bilateral trade relations under the new tariff using an excess-supply-excess-demand model. The structural model is estimated using GMM with HAC (heteroskedasticity-autocorrelation) robust standard errors to obtain structural coefficients. The analysis focuses on chicken wings, legs, and feet. Monthly data for 2005 to 2009 are used in the analysis and reflect recent events.

Key Words: poultry, excess demand, excess supply, antidumping tariff.

Introduction

China began imposing antidumping duties ranging from 43.1% to 105.4% on U.S. chicken imports in February 2010, accusing American poultry firms of exporting at unfairly low prices (Ministry of Commerce 2010). According to an announcement published by the Ministry of Commerce of the People's Republic of China on February 5, 2010, importers of U.S. broiler products are required to pay tariffs related to dumping profit margins. China began an investigation of U.S. chicken imports in September 2009, two weeks after the Obama administration announced tariffs of up to 35% on tire imports from China (Burgdorfer 2009). This apparent counter measure is an indication of a new round of trade conflicts, possibly leading to a deepening trade rift.

China has been one of the largest poultry export markets for the United States. From 2005 to 2008 China's broiler meat imports increased from 370,873 metric tons to 787,358 metric tons with the U.S. accounting for almost 73% of the Chinese broiler import market in 2008. In 2009, the demand for imports from the United States continued to rise. In the first six months, total Chinese imports of U.S. broiler meat (including transshipments through Hong Kong) reached 391,723 metric tons, up almost 10% from the previous year (USDA, FAS, China, *Poultry and Products Annual Report*, 2006-2009).

Most of the U.S. chicken products exported to China are dark meat because, historically, Chinese consumers have exhibited a strong preference for dark meat over breast meat (USDA, FAS, China, *Poultry and Products Semi-Annual Report*, 2009). Domestic Chinese producers have not been able to satisfy the demand for these chicken parts. From 1997 to 2009, frozen chicken parts from the United States to the China/Hong Kong market increased at a steady pace

(USITC). In 2009, U.S. exports of \$352 million in chicken feet, \$103 million in wings and wing tips, and almost \$60 million in chicken legs accounted for most of the 85% U.S. market share of broiler meat imports that year (USITC). U.S. to China export quantities and average monthly prices for wings, feet, and legs from 2005 to 2009 are shown in figure 1.

The increased volume of imports at relatively low prices resulted in appeals from Chinese poultry producers for government intervention in the market. In the first six month of 2009, the average domestic chicken price fell to 8,834.04 RMB/tons, 20.65% lower than for the same period in 2008 (USDA, FAS, China, *Poultry and Products Semi-Annual Report*, 2008) .

This study seeks to estimate the impacts of the new Chinese tariffs on poultry exports from the U.S. to mainland China and Hong Kong. For our analysis we combine the China and Hong Kong markets because Hong Kong is a major transshipment port for poultry imports into China. Hong Kong re-exports of broiler meat into China accounted for nearly 25% of total China broiler imports in 2008 (USDA, FAS, China, *Poultry and Products Semi-Annual Report*, 2008).

We estimate tariff impacts through the estimation of excess supply and demand models for the U.S. and China for chicken wings, legs, and feet, which comprise most U.S. chicken exports to China. Estimated parameters from these models are used to calculate excess supply and demand elasticities, and these are used to calculate the proportion of the tariff absorbed by U.S. exporters and Chinese consumers. If excess demand is more inelastic than excess supply, a greater portion of the tariff will be reflected in higher consumer prices in China. When excess supply is more inelastic than excess demand, the incidence of the tariff on exporters is greater and the tariff will be reflected more by a reduction in the price received by the exporter (Koo

and Kennedy 2005).

Methodology

General Form of Excess Supply and Excess Demand Functions

In a two-country model excess supply indicates the quantity that will be exported at different prices and is equal to the quantity domestically produced in the exporting country minus the quantity domestically consumed, at prices above the autarky equilibrium (Reed, pp. 28-36). Similarly, excess demand is domestic consumption minus domestic production at prices below autarky equilibrium in the importing country. This model can be extended to multiple countries by adding rest-of-world (ROW) import demand to domestic demand for exporting countries and ROW export supply to domestic supply for importing countries.

Modeling US excess supply of chicken parts to China is heavily influenced by the facts that all parts are jointly produced with the production of broilers and that, despite China's prominent position as an importer of U.S. chicken, exports of these parts to China are a small portion of total U.S. chicken production (about 3%) due to the high levels of domestic chicken consumption and exports to other countries.

Due to these characteristics we model US excess supply of each chicken part to China as an allocation decision by U.S poultry producers. Thus, exports of chicken parts to China are assumed to be a function of the total production of broilers in the US and the prices of each part in the China/Hong Kong market, the U.S. domestic market, and the ROW market.

$$(1) Q_{us_ch,t}^i = f(Q_{us,t}^{broilers}, P_{us_ch,t}^i, P_{us,t}^i, P_{us_row,t}^i)$$

where

$Q_{us_ch,t}^i$ = quantity of U.S. frozen chicken part i exported to China/Hong Kong in period t ,

$Q_{us,t}^{\text{broilers}}$ = quantity of U.S. broilers slaughtered in period t,

$P_{us, \text{ch}, t}^i$ = value per unit of U.S. frozen chicken part i exports to CH/HK in period t,

$P_{us, t}^i$ = U.S. domestic wholesale price of chicken part i in period t,

$P_{us, \text{row}, t}^i$ = value per unit of U.S. frozen chicken part i exports to ROW in period t.

We expect US exports of each part to China to be positively related to US broiler production and the part export price for the Chinese market and negatively related to the part price in the US market and the part export market for the ROW.

The Chinese excess demand specification for each chicken part from the US was influenced by the relatively small amount of these imports relative to Chinese domestic consumption (about 3%). We specified the quantity demanded of each part imported from the US as a function of the price of each part imported from the US, prices of related products in China, the Chinese income level and the exchange rate. We included the Chinese domestic prices of live chicken and pork as two related consumer goods, and used GDP as an income proxy. We included the exchange rate between China and the US as a separate variable rather than converting the price in USD to the price in Yuan due to uncertainty about the pass through of changes in the exchange rates into the Chinese consumer price for US chicken. We also included the average price of all chicken exported by Brazil, the US's main competitor in this market, as an indicator of competition in this market. We chose to use a general export price for Brazilian exports of all chicken to all countries because we reasoned that it would reflect the impact of changes in Brazilian production and export policies on the Chinese demand for US chicken, but still be mostly exogenous to the excess demand for each US chicken part because Brazilian exports of these parts to China are very small relative to total production and

consumption of Brazilian chicken.

The general form of the excess demand model is:

$$(2) \quad Q_{us_ch,t}^i = f(P_{us_ch,t}^i, P_{ch,t}^{Live\ Chk}, P_{ch,t}^{Pork}, P_{Brazil,t}^{ChkExp}, GDP_{HK,t}, Exch_{Yuan/USD}),$$

where

$Q_{us_ch,t}^i$ = quantity of U.S. frozen chicken part i imported by CH/HK in period t,

$P_{us_ch,t}^i$ = price of U.S. frozen chicken part i imported by CH/HK in period t,

$P_{ch,t}^{Live\ Chk}$ = price of live chicken produced in the CH/HK domestic market in t,

$P_{ch,t}^{Pork}$ = price of pork in the CH/HK domestic market in period t,

$GDP_{HK,t}$ = GDP in CH/HK in period t, and

$Exch_{Yuan/USD,t}$ = the exchange rate expressed as Yuan per US dollar in period t.

We expect the excess demand for each US chicken part to be positively related to prices of substitutes for US chicken and GDP in China/Hong Kong and negatively related to the import price of each part from the US and the exchange rate

Econometric Considerations

We used monthly data from January 2005 through December 2009 for the analysis.

Augmented Dickey-Fuller tests for stationarity indicated that export quantities for wings and legs were stationary at the 5% significance level with zero lags and no trend for this period. The export quantity for feet was not stationary for the whole period, but after examining graphs of the data we decided to test the feet export quantity for the latter half of the period, from April, 2007 through December, 2009 and found that the series was stationary at the 5% level of significance with 1 lag and no trend. Because of this we used this truncated data series for the excess supply and demand for feet.

Due to concerns about the speed at which adjustments can be made and the possibility that timing of monthly observations may differ across variables, we used three-month moving averages (current and two lagged values) for all variables in the models. Other than the own-price variables for exports, there do not appear to be serious endogeneity problems for the remaining right-hand-side variables. The quantities of US to China exports of wings, legs, and feet appear to be too small relative to the market to have much impact on the US, China, and Brazilian prices included in the model. To address the endogeneity problem with the own-price of exports we used instruments for export own-prices in a GMM model with HAC (heteroskedasticity-autocorrelation) robust standard errors (Hayashi 2000; Baum 2006).

We also altered the estimation of equations 1 and 2 by adding a dummy variable, *Ban*, to the Excess Supply equation to coincide with the time period January 2005 to July 2008 when there was a partial ban on imports of US chicken from some states due to Avian Influenza. China imposed a ban on U.S. poultry from early September 2003 on seven U.S states and lifted the ban on July 1, 2008 for six of these states (USDA, FAS, China, *Poultry and Products Annual Report*, 2003 and 2008). We also added a seasonality dummy to some excess demand equations for the months April to October based on the observation of seasonality of Chinese demand for chicken feet (USDA, FAS, China, *Challenges to Increasing U.S. Sales of Chicken Paws to China*, 2006). Four specifications were estimated for each ES and ED model. Two specifications used nominal prices, one with the seasonal dummy in the demand equation and one without the seasonal dummy. The other two specifications for each equation used real prices and incomes with excess supply equation prices deflated by a US consumer price index and China prices and income deflated by a China/Hong Kong consumer price index. We estimated the real-price

equations with and without the seasonal dummy variable.

Data Sources

US-China/Hong Kong and US-ROW export quantities and prices (value per kg.) are from the USITC database. U.S. monthly wholesale price data for Northeast legs and wings were used as proxies for domestic prices for those parts, and they were obtained from the USDA, Monthly AMS Price Summary¹. No US domestic price for chicken feet was available so none was included in the feet excess supply equation.

Data for chickens slaughtered in the United States come from the Poultry Yearbook database (Poultry Yearbook).

Hong Kong live chicken prices, the pork price, and GDP data are from the Census and Statistics Department, the Government of the Hong Kong Special Administrative Region. The Hong Kong Composite Consumer Price Index for live poultry is used as a proxy for the CH/HK domestic chicken price (Census and Statistics Department, the Government of the Hong Kong Special Administrative Region). The composite Brazilian chicken export price for all destinations is from the U.N. Comtrade database. Exchange rates were from the Federal Reserve Bank of St. Louis website. Before mid-2005, the Yuan was pegged to the dollar at around 8.3 Yuans/\$ (Jeffrey, 2006). From 2005 to 2008, China allowed controlled appreciation and the rate reach 6.83 Yuan/\$. Beginning in July 2008, China reintroduced its currency peg at this rate during the financial crisis to protect its export economy.

Results and Implications

Results

¹ Monthly AMS Price Summary was obtained from David J. Harvey, djharvey@ers.usda.gov, U.S. Department of Agriculture, Economic Research Service.

The estimation results for wings, legs, and feet are shown in Tables 2 to 4, respectively.

The excess supply equations for wings were quite robust across specifications and the estimated coefficients were all of the expected signs and significant. The excess demand results for wings were less robust across specifications and fewer coefficients were of the expected sign and statistically significant. Inclusion of the seasonal dummy in the excess demand equation for wings increased the number of significant coefficients with the expected sign including the own-price of exports. In the specification using nominal prices with the seasonal dummy, GDP, the pork price, and the price of Brazilian chicken were all positive and significant as expected. In the real-price specification with seasonal dummy these income and substitute prices were insignificant but the exchange rate was significant and of the expected sign.

Results for the excess supply of chicken legs were similar across specification in that all coefficients except US broiler production were of the expected sign and significant. The coefficients for broiler production were statistically insignificant across all specifications. There were more differences across ES specifications for the magnitudes of coefficients for legs than there were for wings, especially for the own-price of US leg exports and the domestic price of legs in the US where the nominal price without seasonal dummy coefficients were about double the corresponding coefficients for the real price with a seasonal dummy.

Results for the legs excess demand equation were quite similar across the four specifications with significant and expected signs for the own-price of exports, GDP, the Brazilian chicken price and the exchange rate. The coefficients of the price of live chickens and the price of pork were the unexpected sign and significant across all four specifications of the

excess demand equation for legs.

The feet models were estimated for the truncated data period due to stationarity problems with the export quantity. Excess supply estimates for much poorer for feet than for wings and legs. This may be partially due to the lack of a US consumer market for chicken feet. This results in feet being a true residual market for US producers where exports of feet are mainly driven by demand in other countries, especially China. The own-price coefficient for feet exports is either insignificant or significant and the “wrong” sign for a supply equation. In terms of significant coefficients with the expected sign, the real-price specifications perform better than the nominal price equations for excess supply estimation.

The excess demand with seasonal dummy results for feet are actually somewhat better than the excess demand equations for wings and legs. Own-price, GDP, Brazil price, the exchange rate, and the seasonal dummy coefficients are all significant and of the expected sign in these two specifications.

Elasticity estimates for variables with significant coefficients of the expected sign are reported in Table 5. The excess supply of legs for the China market appears to be very elastic with respect to own-price across all specifications – ranging from an estimate of 4.5 for real prices with a seasonal dummy to 9.3 for nominal prices with no seasonality of demand. The corresponding supply elasticity for wings was consistently estimated to be around 0.6 across all four specifications. The own-price demand for wings appears to be relatively inelastic, while the own-price demand elasticity estimates for legs ranges from -0.94 to -2.15. Generally both excess supply and demand elasticities are smaller for wings than for legs.

The excess supply of feet exports to China appears to be highly sensitive to the number of

US broilers produced. The demand for US chicken feet appears to be relatively responsive to the price of imports from the US and GDP in China.

Tariff Incidence Analysis

According to the announcement published by Chinese Customs on April 2010, 35 of the major U.S. chicken export companies will be affected by the antidumping tariff at different levels (General Administration of Customs 2010). Tyson Foods with 43.1% of the total frozen chicken exports to China will face a 43.1% tariff while Pilgrim's Pride will be levied a preliminary duty of 80.5%. Most of the companies cooperating in the antidumping investigation face a median 64.5% tariff while those refusing to cooperate face a higher percentage, perhaps as much as 105.4% according to the Chinese Ministry of Commerce (Ministry of Commerce 2010).

The median tariff rate of 64.5% is used in the analysis as it is applicable to nearly 90% of the companies. The tax incidence on producers and consumers is determined using the developed formula based on Koo and Kennedy (2005):

$$S = e_x / (e_x + e_m)$$

Where e_m is the price elasticity of import demand and e_x is the price elasticity of export supply, and S is the incidence of the tax borne by consumers in the importing country. Price elasticities of excess supply and excess demand can be used directly from Table 3 to Table 4 for this exercise.

The tariff incidence results are summarized in table 6. Tariff incidences are not reported where the coefficients of price variables are not significant at the 10 percent level. The price elasticities for both excess supply and excess demand for wings are inelastic, but demand is

more inelastic than supply and Chinese consumers are therefore expected to bear more of the tariff in increased prices than US exporters bear in decreased prices. Chinese consumers are projected to absorb between 54 and 67 percent of the tariffs on wings.

Own-price excess supply and demand are both elastic for legs, but excess supply is much more elastic. The large difference in these elasticities results in a greater portion of the tariff being borne by Chinese consumers than was estimated for wings. Our estimates indicate that between 77 and 83 percent of the tariff on legs will be absorbed by Chinese consumers.

Conclusions

We developed an excess-supply/excess-demand model to examine the tariff effects on U.S. frozen broiler imports to China/Hong Kong. The generalized method of moments (GMM) was used to estimate the system for each chicken part – wings, legs, and feet.

Most of the estimation results are compatible with general supply and demand theory. Findings show that producers are not very responsive to own-price with respect to wings yet very responsive for legs.

Additional estimations of these equations are planned. The poor performance of the substitute good prices in the ED equations suggest that the Hong Kong prices used for live chickens and pork may not represent the price of alternatives for Chinese consumers well. We will attempt to find more representative prices. The finding of superior excess supply results for wings and legs and better excess demand results for feet suggest that the absence of a viable US market for feet has a strong influence on that market and we intend to study that characteristic more completely in future analysis.

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Figure 1. Prices and Quantities of Chicken Part Exports to China/Hong Kong, 2005-2009

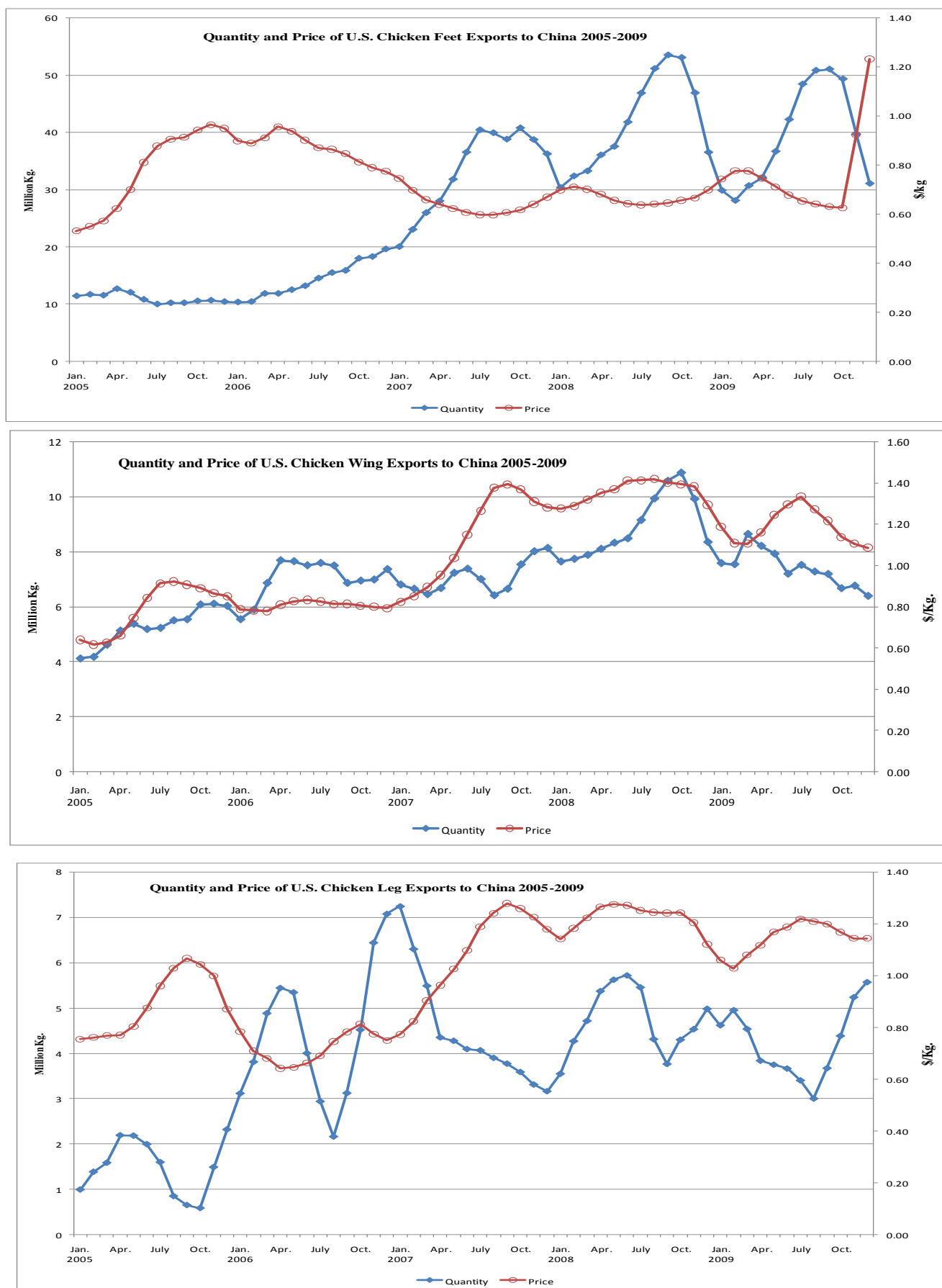


Table 1. Definition of Variables for the Empirical Model

Variable	Description
$Q^{wings}_{US-CH/HK,t}$	Quantity of U.S. frozen chicken wing exports to CH/HK (million kg)
$Q^{legs}_{US-CH/HK,t}$	Quantity of U.S. frozen chicken leg exports to CH/HK (million kg)
$Q^{feet}_{US-CH/HK,t}$	Quantity of U.S. frozen chicken feet exports to CH/HK (million kg)
$P^{wings}_{US-CH/HK,t}$	Price of U.S. frozen chicken wing exports to CH/HK (U.S. dollars/kg)
$P^{legs}_{US-CH/HK,t}$	Price of U.S. frozen chicken leg exports to CH/HK (U.S. dollars/kg)
$P^{feet}_{US-CH/HK,t}$	Price of U.S. frozen chicken feet exports to CH/HK (U.S. dollars/kg)
$Q^{Broilers}_{US}$	Total number of U.S. chickens slaughtered (million head)
$P^{wings}_{US,t}$	U.S. domestic chicken wing price (cents/lb)
$P^{legs}_{US,t}$	U.S. domestic chicken leg price (cents/lb)
$P^{wings}_{US-ROW,t}$	Price of U.S. frozen chicken wing exports to ROW (U.S. dollars/kg)
$P^{legs}_{US-ROW,t}$	Price of U.S. frozen chicken leg exports to ROW (U.S. dollars/kg)
$P^{feet}_{US-ROW,t}$	Price of U.S. frozen chicken feet exports to ROW (U.S. dollars/kg)
P^{ChkExp}_{Brazil}	Price of Brazilian frozen fowl cut exports to the world (U.S. dollars/kg)
$P^{Live\ Chk}_{HK}$	CPI for Hong Kong live chicken (alternative food)
GDP_{HK}	Hong Kong GDP (billions in chained (2007) dollars)
P^{Pork}_{HK}	Domestic Price of Pork in Hong Kong (U.S. dollars/kg)
$Exch_{Yuan/USD}$	Monthly exchange rate from 2004 to 2009 (Yuan per dollars)
Ban	Dummy variable, equal to 1 for January 2005 to July 2008, 0 otherwise
Ds	Seasonal dummy, equal to 1 for April-October, 0 otherwise

Table 2. Estimation Results for U.S. Chicken Wings Exports to CH/HK

Variable	Nominal Price without Seasonal Dummy	Nominal Price with Seasonal Dummy	Real Price without Seasonal Dummy	Real Price with Seasonal Dummy
Excess Supply^a				
Constant	5.2950** (1.0365)	5.0614** (0.9977)	5.7191** (0.9272)	5.3908** (0.9001)
$P^{wings}_{US-CH/HK}$	4.5365** (0.1772)	4.4335** (0.1186)	4.3145** (0.1774)	4.2050** (0.1350)
$Q^{Broilers}_{US}$	0.0059** (0.0017)	0.0063** (0.0017)	0.0060** (0.0015)	0.0065** (0.0014)
P^{wings}_{US}	-0.0155** (0.0019)	-0.0155** (0.0017)	-0.0177** (0.0023)	-0.0174** (0.0022)
P^{wings}_{US-ROW}	-3.2706** (0.1336)	-3.2358** (0.0783)	-3.3572** (0.1428)	-3.3385** (0.0974)
Ban	-0.03925** (0.1348)	-0.0416** (0.1268)	-0.3889** (0.1233)	-0.4058** (0.1194)
Excess Demand^b				
Constant	26.4822** (7.7857)	1.0751 (10.7236)	51.6335** (4.7230)	46.7881** (9.9028)
$P^{wings}_{US-CH/HK}$	0.1588 (0.4809)	-3.7557** (0.9864)	-0.0333 (0.5682)	-2.1607* (1.2274)
$P^{Live\ Chk}_{HK}$	-0.0142** (0.0064)	-0.0106 (0.0101)	-0.0994** (0.0087)	-0.0939** (0.0172)
GDP_{HK}	0.0067** (0.0031)	0.0171** (0.0043)	0.0014 (0.0024)	0.0065 (0.1924)
P^{ChkExp}_{Brazil}	0.2500 (0.5765)	2.3953** (0.7650)	-0.6559 (0.4931)	0.1924 (0.8857)
P^{Pork}_{HK}	0.0307 (0.3700)	0.0877* (0.0507)	-0.0052 (0.0272)	0.0166 (0.0363)
$Exch_{Yuan/USD}$	-2.4812** (0.8090)	-0.4955 (1.0765)	-4.3296** (0.4025)	-4.0778** (0.7493)
Ds	NA	1.0997** (0.2163)	NA	0.4941** (9.9028)

Note: **Significant at the 5.0% level, *significant at the 10.0% level.

^a The instrumented variable is $P^{wings}_{US-CH/HK,t}$ and the instruments are $P^{Live\ Chk}_{HK}$, GDP_{HK} , P^{ChkExp}_{Brazil} , P^{Pork}_{HK} , $Exch_{Yuan/USD}$, Ds.

^b The instrumented variable is $Q^{wings}_{US-CH/HK,t}$ and the instruments are $Q^{Broilers}_{US}$, $P^{wings}_{US,t}$, $P^{wings}_{US-ROW,t}$, Ban.

Numbers in parentheses are HAC standard errors of the estimated parameters.

Table 3. Estimation Results for U.S. Chicken legs Exports to CH/HK

Variable	Nominal Price without Seasonal Dummy	Nominal Price with Seasonal Dummy	Real Price without Seasonal Dummy	Real Price with Seasonal Dummy
Excess Supply^a				
Constant	-0.9358 (9.6583)	3.6879 (6.9768)	4.2580 (5.7799)	7.2976 (4.6389)
$P^{legs}_{US-CH/HK}$	35.4147** (4.3517)	29.0495** (2.9066)	24.4478** (1.8240)	18.2134** (1.4487)
$Q^{Broilers}_{US}$	0.0098 (0.1268)	0.0030 (0.0089)	0.0042 (0.0074)	0.0001 (0.0057)
P^{legs}_{US}	-0.4333** (0.0627)	-0.3546** (0.0452)	-0.2888** (0.0232)	-0.2071** (0.0164)
P^{legs}_{US-ROW}	-14.5193** (1.7922)	-12.0177** (1.1510)	-12.5165** (1.2364)	-10.7012** (1.2588)
Ban	-1.0780** (0.5141)	-0.8135** (0.3860)	-0.7641** (0.3030)	-0.5965** (0.2340)
Excess Demand^b				
Constant	27.9760** (4.6258)	33.6932** (10.6315)	48.7542** (3.8217)	71.2625** (5.6211)
$P^{legs}_{US-CH/HK}$	-8.1810** (1.1885)	-7.4424** (1.4680)	-7.5466** (0.7475)	-4.0414** (1.0895)
$P^{Live\ Chk}_{HK}$	-0.0291** (0.0069)	-0.0376** (0.0165)	-0.0828** (0.0060)	-0.1256** (0.0119)
GDP_{HK}	0.0285** (0.0061)	0.0263** (0.0061)	0.0188** (0.0046)	0.0094** (0.0036)
P^{ChkExp}_{Brazil}	4.6007** (1.2777)	4.1169** (1.6202)	4.3965** (1.3442)	1.7640* (1.0391)
P^{Pork}_{HK}	-0.0950** (0.0431)	-0.0988** (0.0385)	-0.1640** (0.0370)	-0.1877** (0.0217)
$Exch_{Yuan/USD}$	-3.3709** (0.5435)	-3.8311** (0.9141)	-4.6015** (0.3434)	-6.1938** (0.4171)
Ds	NA	-0.2602 (0.2705)	NA	-1.0912** (0.2550)

Note: **Significant at the 5.0% level, *significant at the 10.0% level.

^a The instrumented variable is $P^{legs}_{US-CH/HK}$ and the instruments are $P^{Live\ Chk}_{HK}$, GDP_{HK} , P^{ChkExp}_{Brazil} , P^{Pork}_{HK} , $Exch_{Yuan/USD}$, Ds.

^b The instrumented variable is $Q^{legs}_{US-CH/HK,t}$ and the instruments are $Q^{Broilers}_{US}$, P^{legs}_{US} , P^{legs}_{US-ROW} , Ban.

Numbers in parentheses are HAC standard errors of the estimated parameters.

Table 4. Estimation Results for U.S. Chicken feet Exports to CH/HK

Variable	Nominal Price without Seasonal Dummy	Nominal Price with Seasonal Dummy	Real Price without Seasonal Dummy	Real Price with Seasonal Dummy
Excess Supply^a				
Constant	-208.7467** (28.9975)	-189.0697** (21.7168)	-215.1303** (32.4100)	-184.7701** (22.2741)
$P^{\text{feet}}_{\text{US-CH/HK}}$	0.6022 (4.2005)	-8.6421** (2.7695)	3.8985 (5.8100)	-10.1000** (3.3952)
$Q^{\text{Broilers}}_{\text{US}}$	0.3488** (0.0361)	0.3249** (0.0271)	0.3583** (0.0401)	0.3221** (0.0274)
$P^{\text{feet}}_{\text{US-ROW}}$	-0.1098 (1.4969)	5.1502** (1.7921)	-3.6419** (1.7454)	-3.0949** (1.8426)
Ban	-15.8548** (0.5857)	-15.8697** (0.3986)	-15.9292** (0.7020)	-15.8162** (0.4282)
Excess Demand^b				
Constant	445.4959** (53.5214)	80.3298** (28.3298)	373.3353** (47.8199)	83.8886** (27.3818)
$P^{\text{feet}}_{\text{US-CH/HK}}$	-65.7131** (12.3579)	-32.3632** (5.6261)	-95.7327** (16.479)	-42.2083** (8.9734)
$P^{\text{Live Chk}}_{\text{HK}}$	-0.4004** (0.1292)	0.0520 (0.0381)	-0.3610** (0.1589)	0.0571 (0.0449)
GDP_{HK}	0.1926** (0.0195)	0.1371** (0.0105)	0.2197** (0.0236)	0.1429** (0.0130)
$P^{\text{ChkExp}}_{\text{Brazil}}$	-12.4114 (9.2258)	8.1632* (4.6705)	-9.6687 (11.4782)	9.5827* (5.6004)
$P^{\text{Pork}}_{\text{HK}}$	-0.7742** (0.1060)	-0.3055** (0.1024)	-1.1499** (0.1164)	-0.4161** (0.1126)
$\text{Exch}_{\text{Yuan/USD}}$	-44.7985** (4.7963)	-12.1804** (2.4322)	-35.7551** (3.9454)	-12.1557** (2.1692)
Ds	NA	11.8825** (0.7950)	NA	11.4582** (0.8748)

Note: **Significant at the 5.0% level, *significant at the 10.0% level.

^a The instrumented variable is $P^{\text{feet}}_{\text{US-CH/HK},t}$ and the instruments are $P^{\text{Live Chk}}_{\text{HK}}$, GDP_{HK} , $P^{\text{ChkExp}}_{\text{Brazil}}$, $P^{\text{Pork}}_{\text{HK}}$, $\text{Exch}_{\text{Yuan/USD}}$, Ds.

^b The instrumented variable is $Q^{\text{feet}}_{\text{US-CH/HK}}$ and the instruments are $Q^{\text{Broilers}}_{\text{US}}$, $P^{\text{feet}}_{\text{US}}$, $P^{\text{feet}}_{\text{US-ROW}}$, Ban.

Numbers in parentheses are HAC standard errors of the estimated parameters.

Table 5. Estimated Excess Supply and Demand Elasticities

Elasticity	Nominal Price without Seasonal Dummy	Nominal Price with Seasonal Dummy	Real Price without Seasonal Dummy	Real Price with Seasonal Dummy
WingsExcess Supply: Q_{US-CH/HK}				
Q ^{Broilers} _{US}	0.6067	0.6478	0.6170	0.6683
P ^{wings} _{-CH/HK}	0.6721	0.6569	0.6007	0.5854
P ^{wings} _{US}	-0.2401	-0.2401	-0.2587	-0.2543
P ^{wings} _{S-ROW}	-0.7415	-0.7336	-0.7220	-0.7179
Wings Excess Demand: Q_{US-CH/HK}				
P ^{wings} _{-CH/HK}	NS ^a	-0.5564	NS ^a	-0.2846
GDP _{HK}	0.3637	0.9282	NS ^a	NS ^a
P ^{ChkExp} _{Brazil}	NS ^a	0.4979	NS ^a	NS ^a
P ^{Pork} _{HK}	NS ^a	0.5966	NS ^a	NS ^a
Legs Excess Supply: Q_{US-CH/HK}				
Q ^{Broilers} _{US}	NS ^a	NS ^a	NS ^a	NS ^a
P ^{legs} _{US-CH/HK}	9.2925	7.6224	6.0405	4.5001
P ^{legs} _{US}	-5.9560	-4.8742	-3.7329	-2.6769
P ^{legs} _{US-ROW}	-3.7861	-3.1338	-3.0843	-2.6370
Legs Excess Demand: Q_{US-CH/HK}				
P ^{legs} _{S-CH/HK}	-2.1466	-1.9528	-1.7668	-0.9462
GDP _{HK}	2.8610	2.6402	1.8873	0.9436
P ^{ChkExp} _{Brazil}	1.7688	1.5828	1.5096	0.6057
Feet Excess Supply: Q_{US-CH/HK}				
Q ^{Broilers} _{US}	9.1844	8.5550	9.4345	8.4813
P ^{feet} _{US-ROW}	NS ^a		-0.0978	-0.0831
Feet Excess Demand: Q_{US-CH/HK}				
P ^{feet} _{US-CH/HK}	-1.7554	-0.8645	-2.3046	-1.0161
GDP _{HK}	2.6771	1.9056	3.0537	1.9862
P ^{ChkExp} _{Brazil}	NS ^a	0.4346	NS ^a	0.4556

^a Not significant.

Table 6. Tariff Incidence – Proportion of Tariff Reflected in Consumer price

Specifications	Wings	Legs
Nominal Price without Seasonal Dummy	NA ^a	0.8123
Nominal Price with Seasonal Dummy	0.5414	0.7961
Real Price without Seasonal Dummy	NA ^a	0.7737
Real Price with Seasonal Dummy	0.6729	0.8263

^a Tariff incidence with zero price elasticities will not be reported