Selected Paper Proposal for the
AAEA 2001 ANNUAL MEETINGS
Chicago, August 5-8

Authors:	**Institution:**
Dr. Sayed Saghaian	University of Kentucky Department of Agricultural Economics 317 Ag. Engineering Building Lexington, KY 40546-0276 Phone: 859-257-8842 x 241 Fax: 859-257-7290 E-mail: shsagh2@pop.uky.edu
Dr. Michael Reed	University of Kentucky Department of Agricultural Economics 308 Ag. Engineering Building Lexington, KY 40546-0276 Phone: 859-257-7259 Fax: 859-257-7290 E-mail: mrreed@pop.uky.edu

Contact Person: Dr. Michael Reed

Paper Title: Exchange Rate Changes and Pricing-to-Market Behavior of U.S. Meat Exporters

Subject Code: International Trade

Abstract: This study examines the pricing-to-market behavior of U.S. meat exporters across destination markets and investigates the sensitivity of U.S. export prices in response to exogenous exchange rate changes. The objective is to see whether price discrimination is present or meat export markets have become more integrated during the 1990s.

Note: This research has not been previously presented.

EXCHANGE RATE CHANGES AND THE PRICING-TO-MARKET BEHAVIOR OF U.S. MEAT EXPORTERS

Introduction

Economists have applied many different theoretical models of imperfect competition to explain price formation in international markets, yet the empirical work is sparse. (For example, see Dixit, Helpman and Krugman, and Dornbusch in international trade and McCalla, Sarris and Freebairn, Kolstad and Burris, and Paarlberg and Abbott in agricultural trade.) Empirical testing of imperfectly competitive models is challenging and difficult due to the lack of appropriate data sets and the fact that the theoretical models usually do not lend themselves easily to empirical testing. The most basic approach, which assumes the least structure among competitors, is Knetter's (1989) empirical testing method of the pricing-to-market (PTM) hypothesis of Krugman. Krugman originally argued that exporters might price discriminate among foreign markets in response to exchange rate changes, which he termed PTM.

PTM is a model of imperfect competition that involves price discrimination by market destination and the model can be used to investigate market organization and the structure of export markets. Export firms operating in imperfectly competitive and segmented markets, in order to maximize profit, may sort markets by destination and price discriminate across those markets by adjusting their markups of price over marginal cost in response to bilateral exchange rate changes. With currency depreciation (appreciation) of an importing country, exporters may adjust export prices and decrease (increase) markups, thereby stabilizing import prices in that market. Market liberalization and integration due to bilateral, regional, or international trade agreements may reduce PTM over time.

The PTM model has been little used in analysis of international agricultural trade. Only a few studies are related to PTM in U.S. food exports although the U.S. is a major exporter of many agricultural products with a significant market share. Knetter (1989) offered a simplified empirical method to test PTM and used a number of products, including several agricultural commodities--onions, bourbon, orange juice, and breakfast cereals-- while analyzing the pricing-to-market behavior of U.S. and German exporters. Pick and Park applied Knetter's empirical testing method to U.S. cotton, wheat, corn, soybeans, and soybean meal exporters. Both of these studies found little PTM by U.S. exporters except for the wheat market. Patterson, Reca, and Abbott conducted the only study that applied the PTM model to U.S. beef and chicken export markets, as far as we know. They used two categories of beef and four categories of chicken for the period 1989-91 and found some evidence supporting the PTM hypothesis. However, their study was limited in scale and scope; the data period is short and the data set is outdated.

In this paper, we examine the pricing-to-market behavior of U.S. meat exporters across destination markets and investigate the sensitivity of U.S. export prices in response to exogenous nominal exchange rate changes, which may indicate price discrimination and imperfect competition in the international trade of meats. Export unit values vary by destination and might be sensitive to destination specific exchange rate fluctuations. The objective is to see whether price discrimination and PTM is present in the U.S. meat export markets, and, if so, whether this price discrimination has become less pronounced and meat export markets have become more integrated over time.

This analysis of PTM in beef, pork, and chicken is much more than an update of other studies. We have added more specialized categories of beef, pork, and chicken to the analysis, so the data are more refined. We also investigate whether increased international market liberalization and economic integration (through unilateral change in Korea, Japan, and other countries; the North American Free Trade Agreement, NAFTA; and implementation of the latest GATT agreement) have changed the competitive structure for these markets. Finally, we have modified the PTM model to include price lags and a more refined measure of marginal costs.

The Model

Knetter (1989) develops the usual price discrimination-markup relationship from a set of first-order conditions for the profit maximization problem of an exporter selling to *N* foreign destinations facing residual export demands:

$$p_{it} = c_t \left(\frac{\varepsilon_{it}}{\varepsilon_{it} - 1} \right) \quad i = 1, \ldots, N \text{ and } t = 1, \ldots, T. \tag{1}$$

Where p_{it} is the export price to destination i, c_t is the marginal cost of production in period *t*, and ε_{it} is the elasticity of the residual demand in destination market i facing the exporter in terms of the importer's local currency price. He further proposes a fixed-effect regression model applied to a pooled, time series-cross sectional data to test for exporter's behavior:

$$\ln(p_{it}) = \theta_t + \lambda_i + \beta_i \ln(e_{it}) + u_{it}. \tag{2}$$

Where θ_t is a time effect dummy variable (to measure marginal cost, which changes over time), λ_i is a country effect, e is the nominal exchange rate in units of import-country currency, and u_{it} is a regression disturbance. The response of export prices to exchange rate changes depends on the convexity of the demand schedules facing exporters. Demand schedules that are less convex than a constant-elasticity schedule will lead to decreasing markups to stabilize import prices as an importing country's currency depreciates, while those with convex demand schedules will lead to increasing markups.

In this research a modified version of Knetter's (1989) pooled, cross section-time series model is used to investigate the competitive structure of U.S. meat export markets:

$$\ln(p_{it}) = \lambda_i + \alpha_i \ln(p_{it-1}) + \beta_i \ln(e_{it}) + \gamma_t \ln(wp_t) + u_{it} \,. \qquad (3)$$

p is export unit value in dollars, λ_i s are destination country effects, wp is marginal cost in the exporting country, u is the regression disturbance, i indexes destination, and t time period. The model has been modified to allow for lagged adjustments in export prices, similar to Kasa's model, and domestic wholesale prices are included to measure marginal costs instead of the time-related dummy variables. Wholesale meat prices should capture marginal costs more accurately than the time-related dummy variables; further their inclusion will allow us to investigate price transmission from the U.S. market. Kasa found that the transitory component in exchange rates (the degree that exchange rates differ from their long-run equilibrium) makes a difference for the length of adjustment.

There are three different scenarios that can be expected with this model (Goldberg and Knetter, Knetter 1993). If the international export markets for meats are competitive and integrated, all export prices will equal a common underlying marginal cost with zero markup and there will be no residual variation in export prices that are correlated with country effects or exchange rates. Therefore, the country effects, λ_i s, and the coefficients of bilateral exchange rates, β_i s, will be zero for all destinations. The λ_i s and β_i s will still equal zero if markets are imperfectly competitive but integrated. Integration will lead to equalization of prices in export markets and prices will equal marginal cost plus the common markups, and the country effects will again equal zero because the markups are common and not identifiable.

If markets are imperfectly competitive and segmented, which may involve price discrimination across destination markets, the results will depend on the nature of the demand elasticity facing exporters. If exporters are facing a constant elasticity of demand, then export price will be equal to marginal cost (which is common across destinations but will vary with time) plus a fixed, destination specific markup over marginal cost. Country effects will capture the differences in destination specific markups leading to statistically significant λ_i s, but β_i s will be zero because residual variation in export prices will not be correlated to the country specific exchange rates. Note that the λ_i s will also pick up product heterogeneity by country.

If exporters face changing demand elasticity as exchange rates change, export prices will depend on local currency prices, which will lead to statistically significant β_i s as well. This will be an indication of market segmentation and price discrimination. Exporters operating in imperfectly competitive and segmented markets will price discriminate by varying optimal markups across destinations and these markups will change as bilateral exchange rates change. The sign for the exchange rate coefficients in the model will depend on the convexity of the demand schedule faced by exporters. If demand becomes inelastic as the local currency depreciates, a positive sign will be expected because the optimal markup charged by the exporter will rise, and if demand becomes elastic as local currency depreciates, then the markup will fall and a negative sign will be expected. Comparing the results among the three meat categories will lend insight into the competitive structure of export meat markets.

The incorporation of marginal costs (wholesale prices) into the analysis adds the possibility that export markets are integrated, but still distinct from the domestic market. If all λ_i s and β_i s are zero, but γ is close to zero, this would indicate that prices among international markets are highly related, but still treated quite differently than U.S. markets. Such a finding infers market power because international prices would not reflect marginal costs.

Data

The data used in this study are based on the U.S. monthly value and quantity of meat exports to selected destination countries for a number of harmonized system (HS) 10-digit meat categories of beef, pork, and chicken. The data source is the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture (USDA). The beef categories and their respective commodity codes include non-processed boneless fresh or chilled (0201306000), non-processed bone-in fresh or chilled (0201206000), non-processed boneless frozen (0202306000), processed boneless frozen (0202303550), and non-processed bone-in frozen beef (0202206000) for the period 1990:01-1998:12. The pork categories and their respective commodity codes include non-processed frozen (0203294000) for the period 1994:01-1999:02, processed frozen (0203292000) for the period 1990:01-1999:02, non-processed bone-in frozen (0203229000) for the period 19990:01-1998:12, non-processed fresh or chilled (0203194000) for the period 1990:01-1999:02, and processed fresh or chilled pork (0203192000) for the period 1990:01-1997:12. The chicken categories and their respective commodity codes are frozen poultry cuts (0207140000) for the period 1996:01-1996:12 and frozen poultry cuts, other (0207140090) for the period1997:01-2000:03. The quantity and value data were used to generate the price (unit value) variable. Unfortunately due to the lack of data, we could not choose the same time period for all the categories, though that would have been preferred. The data set also includes bilateral nominal exchange rates and wholesale prices of beef, pork, and broilers. Bilateral exchange rates are from *International Financial Statistics* published by the International Monetary Fund (IMF); and the wholesale livestock prices are from USDA, Economic Research Service (ERS)

Estimation and Results

U.S. meat exports have been on the rise during the past decade in terms of value, volume, and as a percentage of total domestic production. The U.S. now has about 20% of the world export market share of meat products (FAO). This growth is largely due to higher foreign incomes and population, stable-to-declining foreign production, and continued world trade liberalization (USDA-ERS). With such a large market share, pricing-to-market behavior of U.S. exporters is an important factor in analyzing exporters' pricing decisions in international markets.

U.S. Beef Exports

The major export markets for U.S. fresh and frozen beef are Canada, Japan, and Mexico. The U.S. also exports some beef to Korea and Taiwan. Overall, the U.S. exports about six to eight percent of its total beef production and has about 17 percent of the world export market share (USDA, *FATUS*). Japan is the largest export market and Mexico is the fastest growing market. Canada, Japan, and Mexico together account for more than 90 percent of U.S. fresh and frozen beef exports. Japan imports more fresh and frozen beef on the average than the other top three countries combined. Even Japan's economic crisis of the past few years and a weaker yen has not appeared to affect Japan's import volume as consumers shift to lower price cuts of beef (USDA-ERS*)*. Mexico has increased imports of U.S. beef more than ten-fold since 1995 and is expected to remain an exceptionally strong market for U.S. beef.

Table 1 presents the results of the model for the beef categories[1]. The fitted model explained 54 to 93 percent of the variation in the export prices, depending on the beef category, and the Durbin-Watson *d* statistics indicated there was no first-order autocorrelation.

The adjustment processes, α_i s, were for the most part highly statistically significant. The lagged price played a large explanatory role for different destinations, indicating that it takes more than one period (a month in this case) for prices to adjust to changed economic conditions. The coefficients ranged from 33 to 83 percent for the different beef categories, but most were above 0.50. The incorporation of a Kasa-type adjustment process helped to explain export-pricing behavior of beef exports.

Almost one-half (8 out of 18) of the exchange rate coefficients were significantly different from zero. Three beef categories were statistically significant for Canada, indicating that export price to this higher income market depended on the local currency price. The significant coefficients were all negative and ranged from 28 to 57 percent. This is an indication of price discrimination and incomplete exchange rate pass-through for the Canadian beef market. The high degree of PTM for Canada in some beef cuts may be due to the proximity of the Canadian market and that there is less competition facing U.S. exporters. Many U.S. meat packers own facilities in Canada and there are few Canadian owned packers.

All three coefficients for Korean beef were significantly different from zero, but they were fairly low, between 20 to 26 percent, which suggests that the Korean import price reflected the change in the exchange rate more completely than the Canadian import price. The Korean beef market was highly controlled by the government during the observation period. Evidently U.S. exporters do not pass through all their exchange rate changes because of that structure. They likely wanted to maintain their market share so they would be ready when the Korean beef market liberalized in 2001.

The exchange rate coefficient for Japan and Mexico were statistically insignificant for four of the beef categories, meaning PTM had not occurred. Liberalization of beef markets in Japan and Mexico may have diminished price discrimination in these locations and as a result there is less pricing-to-market as exchange rates change. The exchange rate coefficients have mostly negative signs for different destinations, which means U.S. exporters tend to stabilize local currency prices because demand schedules are elastic and the optimal markups of U.S. exporters change as the exchange rate changes. Overall, there is evidence of market segmentation in the Canadian and Korean beef markets.

The empirical results show the country effects, λ_i s, were statistically significant for Canada and Japan for three beef categories and for Mexico for two beef categories. No λ_i s were significantly different from zero for Korea. This indicates U.S exporters apply destination-specific markups over marginal cost to Canada and Japan, the two high-income markets. This would also indicate more price discrimination by beef exporters to those destinations. Statistically significant country effects may also be an indication of quality differences stemming from underlying differences in tastes or incomes. It is generally thought that products become more differentiated over time, so it is likely that some of the price differences among markets might be due to product differentiation. All of the λ_i s that are significantly different from zero are negative and most are for frozen beef. This result would be consistent with U.S. exporters giving discounts to these countries to preserve or increase market share.

The coefficient for the U.S. domestic wholesale price is statistically significant for four of the beef categories and has the expected positive sign, ranging from 21 to 78 percent, which indicates wholesale beef prices are a good measure of marginal costs[2]. The significance and magnitude of the wholesale price coefficients show that beef export prices incorporate some of the price swings present in domestic U.S. prices, but not all of the wholesale price variation is passed through. Wholesale beef prices had a pronounced downward trend during the study period, so gross margins for beef exports were increasing based on these results. This leads us to believe that beef export markets, in general, are somewhat segmented from U.S. beef markets.

U.S. Pork Exports

The major export markets for U.S. pork are Canada, Japan, Korea, and Mexico. Mexico is again the major growth market for U.S. pork, while Japan is by far the largest export market. The value and volume of U.S. exports of fresh and frozen pork to Mexico has more than doubled since early 1995. Currently, Mexico accounts for about 20 percent of U.S. pork exports (USDA-ERS). U.S. exports of pork to Korea and Russia have experienced the most volatility due to those countries' economic crises and currency fluctuations in recent years. Taiwan's absence in world pork markets has helped increase overall U.S. exports. Currently, the U.S. exports about five to seven percent of its total domestic pork production and accounts for about 20 percent of world exports.

Table 2 presents the regression results of the model for the pork categories. For the specified model for the pork categories, the goodness of fit, as measured by R-squared, ranges from 41 to 93 percent and the Durbin-Watson *d* statistics indicates serial correlation was not a problem.

The results for α_i s again suggest a strong relationship between export prices and their lagged values for the five pork categories. Pork exporters are adjusting more slowly to price changes in Canada and Japan than in Mexico or Korea, which is identical to the findings for the beef market. The estimated coefficients for Canada range from 41 to 71 percent, 45 to 74 percent for Japan, 16 to 51 percent for Mexico, and 5 to 43 percent for Korea. Exporters may be willing to absorb small changes in their margins before prices are changed in order to preserve market share or volume.

The exchange rate coefficients, β_i s, were significantly different than zero for only three destinations in the five pork categories (out of 13 coefficients), indicating little PTM by pork exporters. Two of the significant exchange rate coefficients had a negative sign, which implies that if the importing country's currency depreciated, its import price in dollar terms would fall.

All the β_i s were less than one in absolute value, ranging from 23 to 91 percent, showing incomplete exchange rate pass-through. Canada's exchange rate coefficient of –0.91 shows nearly complete sterilization, which may indicate U.S exporters want to keep their prices (in Canadian dollars) stable. Overall, the empirical results reveal that there is much less PTM in pork than in beef export markets.

The results for the country effects, λ_i s, also indicate that there is not much price discrimination or product heterogeneity in pork export markets. For the five pork categories, only two country effects are statistically different from zero, one for Korea and another for Mexico. Korea had a positive sign for its country-effect coefficient and Mexico had a negative sign suggesting that Korea imports higher-priced pork for that category, and both coefficients were greater than one in absolute value. Overall, the results indicate that export prices vary less by country in pork than beef export markets.

The parameter estimates for the U.S. domestic wholesale price variable were found to be statistically significant for only one of the five pork categories, which shows variations in U.S. wholesale pork prices do not explain variations in unit export prices. The significant coefficient was 53 percent with the expected positive sign, which indicates export prices for that category are responding moderately to wholesale price changes. Wholesale pork prices were quite volatile during this period. Yet, during the last two years of the data, which coincided with the pronounced increase in U.S. pork exports, there was a sharp downward trend in prices. These results, therefore, indicate that U.S. pork exporters were generally enjoying much higher margins on their exports since 1997.

U.S. Chicken Exports

The major export markets for U.S. chicken meat are Canada, China and Hong Kong, Japan, Mexico, Russia, and Singapore. Currently the U.S. is exporting between 18 and 20 percent of its total chicken meat production. Traditionally, Hong Kong has been the major export market, transshipping some of the poultry meat to Mainland China. Hong Kong/China and Japan are the primary Asian markets for U.S. chicken exports and accounted for 23 percent of all exports in 1997 (USDA-ERS). At the beginning of 1998, U.S. chicken exports to Hong Kong/China fell significantly as consumers avoided all poultry products due to an avian influenza scare. In recent years, Russia has become the largest export market for U.S. poultry meat, while some of the newly independent countries, such as Ukraine and Latvia, have also increased their imports, though much of this product is sold at concession rates. The Asian and Russian economic crises lowered U.S. exports, however, exports have rebounded since then to levels above the previous years. Mexico has again continuously increased imports from about 10,000 metric tons at the beginning of 1995 to almost 25,000 metric tons at the end of 1999 (USDA, *FATUS*).

Table 3 presents the regression results of the model for U.S. chicken meat exports. The model fits the data well and 70 and 94 percent of the variation in export prices for the two categories are explained by the specification. The Durbin-Watson *d* statistics were 1.73 and 1.98 for the two categories which exceed the upper limit critical value in the bounds test, indicating serial correlation did not present a problem. Remember that these estimates cover a much shorter data period than for beef or pork.

The empirical results showed most of the estimated lagged-chicken export prices were not statistically different from zero indicating prices passed through quickly. Three coefficients were significantly different from zero (one each for Canada, Russia, and Singapore). All the β_i coefficients were also statistically insignificant (except for the Russian coefficient) indicating PTM did not exist. PTM and price discrimination was only observed for Russia where U.S. chicken meat is often sold at concessional rates. These suggest that markets are integrated across export destinations. Export prices are determined on a longer-run basis, less subject to short-run market fluctuations. This is not surprising, since poultry production and marketing has always been more vertically integrated than beef and pork.

The empirical results indicate that chicken meat export markets are competitive and integrated among destinations. The results show that the country effects for Canada, Russia, and Singapore were significantly different from zero, which indicates some product differentiation. The empirical results of the wholesale price variable are quite different between the two equations, even though both categories have similar export volumes. For one chicken category there is no apparent relationship between wholesale prices and export price. Yet for the other category there is a significant and positive relationship between wholesale price and U.S. export prices. Wholesale chicken prices were quite variable during the observation periods, but there was no clear trend. For one product category exporters chose to keep export prices rather stable, while in the other they choose to pass wholesale prices forward.

Structural Change

Market liberalization and integration due to bilateral, regional, or international trade agreements may reduce PTM over time. To check to see whether there is more market integration and less price discrimination over time in U.S. meat export markets, we first made a visual inspection of the data set for unit export prices to different destinations. It shows a convergence of unit export prices since 1995 for some, but not all of the meat categories. We decided to consider the end of 1994 as the year to be tested for structural change. Obviously any other time can be tested as well, but the NAFTA agreement came to effect at the beginning of 1995 and with this choice for a break point, the data set (which covers the 1990s) is broken in the middle.

After breaking up the data set to two different time periods, 1990:01-1994:12 and 1995:01-1998:12, we tested for structural change for each beef and pork category. The overall results are mixed. While the results for the second beef category (non-processed, fresh and chilled beef with bone) show some PTM for Canada even after NAFTA, the results for the third (boneless frozen beef) and fifth (frozen beef with bone) indicate less PTM in Canada and Mexico since NAFTA. The results revealed no change for the first beef category (boneless, non-processed, fresh and frozen beef). Also the results for the pork categories suggest there is less PTM over time in respect to the first pork category, but there is no change with respect to the other categories[3].

Summary and Conclusions

Overall, the U.S. accounts for between 17 to 23 percent of the world meat exports depending on the year. The question is whether U.S. exporters apply this market power in international markets and price discriminate with respect to the destination markets. The PTM model and analysis of movements in export unit values tests whether changes in export prices are due to price discrimination and are related to changes in the importers' currencies relative to the U.S. dollar.

The empirical results for five different categories of fresh and frozen beef indicate that U.S. exporters exercise more market power for that product than pork or chicken. Exporters are also slow to adjust their export prices when economic conditions change. They seem to transmit only part of the fluctuations in U.S. domestic prices into their export markets. In some of the markets where liberalization has taken place (Japan and Mexico) there is less price discrimination. However, there is still some evidence of pricing-to-market taking place in Canada and Korea. This pricing behavior may come about because U.S. exporters want to maintain their market share in these beef markets. But an important consideration is the finding that gross margins for exporters have improved throughout the period, so they may have market power that they exercise in all markets.

The observations for the pork export markets are different from the beef categories. There is much less evidence of pricing-to-market, but the relationship between wholesale prices and export prices is also very weak. Gross margins for pork exports have increased dramatically in recent years as the U.S. began to export large quantities of pork. This would mean that U.S. pork exporters are able to price discriminate between domestic sales and exports, but they do not discriminate among export destinations. The empirical results for chicken meat also indicate that U.S. exporters do not price discriminate among export destinations and markets adjust rapidly to changes, though export prices are slow to transmit as wholesale price changes in one case.

It is clear from this study that international meat markets, except beef, are price-integrated in the sense that price differences among countries are minimal. However, it is also clear that exporters are able to increase their margins as U.S. wholesale prices fall. The price instability in the U.S. market is not always passed forward to the international market, but when it is, it is passed forward to all international markets. The fact that export prices are more stable than domestic U.S. prices, though, might mean U.S. meat exporters want to smooth price changes over a longer time period. Reducing export prices, when wholesale prices are low, and then increasing export prices after wholesale prices rebound might be detrimental to long-run market shares. This will be easier to investigate using future periods when wholesale meat prices rebound.

Footnotes

[1] We choose to look at pricing strategies for countries that are major destinations for U.S. exports. These vary by meat type and cut. For beef we choose Canada, Japan, and Mexico in some cases, while in other cases we add Korea

[2] The only beef category where the wholesale price was not significantly different from zero was also the category with the lowest export levels (about 10% of the highest volume category). This might mean that the volumes are small enough that packers have less concern about wholesale prices.

[3] Since the results are not consistent among meat categories they are not presented here. However, these results are available from the authors by request.

Table 1. Regression Results for U.S. Beef Exports

	BF, WO/B, NPROSD, F/C[1]			BF, W/B, NPROSD, F/C[2]		
Destination	α	β	λ	α	β	λ
Canada	0.81***	-0.13	-0.78**	0.53***	-0.57**	1.12
	(8.30)	(-0.82)	(-2.06)	(3.10)	(-2.31)	(1.43)
Japan	0.70***	-0.23***	0.53	0.81***	-0.03	0.64
	(13.50)	(-3.88)	(1.3)	(19.6)	(-0.26)	(0.82)
Mexico	0.65***	-0.02	-0.66	0.13	-0.01	1.20
	(9.40)	(-0.92)	(-1.57)	(1.16)	(-0.35)	(1.50)
WP	0.21**			-0.05		
	(2.78)			(-0.37)		
R^2		0.93			0.75	
DW		2.09			2.13	

	BF, WO/B, CRS, FRZ[3]			BF, WO/B, PROSD, FRZ[4]		
	α	β	λ	α	β	λ
Canada	0.63***	-0.28*	-1.10**	0.33***	-0.10	-3.10***
	(9.17)	(-1.75)	(-2.19)	(3.18)	(-0.33)	(-3.27)
Japan	0.83***	0.01	-1.45**	0.77***	-0.10	-3.20***
	(15.30)	(0.14)	(-2.81)	(10)	(-0.81)	(-3.43)
Mexico	0.55***	-0.02	-1.10**	0.53***	-0.01	-3.40***
	(5.96)	(-0.62)	(-2.13)	(6.03)	(-0.30)	(-3.62)
Korea	0.45***	-0.20***	0.40	0.01	-0.26*	-1.10
	(6.36)	(-3.31)	(0.54)	(0.92)	(-2.63)	(-0.82)

Table 1. Continued

WP	0.31***		
	(3.32)		
R^2		0.74	
DW		2.20	

BF, W/B, CRS, FRZ[5]			
	α	β	λ
Canada	0.09	-0.40*	-0.30
	(0.87)	(-1.63)	(-0.36)
Japan	0.62***	0.01	-1.42*
	(6.88)	(0.08)	(-1.64)
Mexico	0.03	0.17***	-0.99
	(0.33)	(3.71)	(-1.13)
Korea	0.56***	-0.22*	0.22
	(6.80)	(-2.10)	(0.17)
WP	0.36*		
	(2.20)		
R^2		0.57	
DW		2.18	

Note: Values in parentheses are t-values. One asterisk denotes significance at the 10% level, two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level.
[1] boneless non-processed, fresh and chilled beef
[2] non-processed, fresh and chilled beef with bone
[3] frozen boneless carcasses of beef
[4] boneless processed frozen beef
[5] frozen carcasses of beef with bone

Table 2. Regression Results for U.S. Pork Exports

Destination	SWN, MT, NE, PROSD, FRZ[1]			SWN, MT, PROSD, F/C[2]		
	α	β	λ	α	β	λ
Canada	0.41***	-0.36	0.56	0.57***	-0.91***	0.28
	(4.66)	(-1.41)	(0.96)	(8.95)	(-4.03)	(0.53)
Japan	0.45***	-0.08	0.96	0.74***	0.04	-0.07
	(3.47)	(-0.57)	(1.16)	(3.92)	(0.38)	(-0.12)
Mexico	0.16**	-0.02	0.70	----	----	----
	(1.93)	(-0.54)	(1.24)	----	----	----
WP	0.06			0.07		
	(0.48)			(0.68)		
R^2		0.46			0.93	
DW		2.05			1.99	

	SWN, MT, NPROSD, FRZ[3]			HM/SH, W/B, XPROSD, FRZ[4]		
	α	β	λ	α	β	λ
Canada	0.71***	-0.52	0.04	----	----	----
	(4.16)	(-0.57)	(0.05)	----	----	----
Japan	0.68***	-0.33	1.53	0.72***	0.06	-0.47
	(4.60)	(-1.26)	(1.12)	(6.15)	(0.35)	(-0.51)
Mexico	0.39***	0.23**	-0.38	0.43***	0.01	-0.05
	(2.76)	(2.21)	(-0.54)	(6.10)	(0.08)	(-0.07)

Table 2. Continued

Korea	-0.05	-0.43**	3.31***	----	----	----
	(-0.69)	(-2.90)	(2.53)	----	----	----
WP	0.08			0.11		
	(0.55)			(0.71)		
R^2		0.41			0.48	
DW		2.08			2.09	

	SWN, MT, F/C[5]		
	α	β	λ
Japan	0.56***	-0.16	-0.98
	(3.23)	(1.16)	(-1.22)
Mexico	0.51***	-0.06	-2.10***
	(8.72)	(-1.53)	(-3.17)
WP	0.53***		
	(3.70)		
R^2		0.90	
DW		2.18	

Note: Values in parentheses are t-values. One asterisk denotes significance at the 10% level, two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level.

[1] meat of swine, processed, frozen

[2] meat of swine, processed, fresh or chilled

[3] meat of swine, non-processed, frozen

[4] hams, shoulders and cuts thereof, of swine, bone in, non-processed, frozen

[5] meat of swine, non-processed, fresh or chilled

Table 3. Regression Results for U.S. Chicken Exports

	CHKN, CTS/OFF, FRZ[1]			CHKN, OTHER, FRZ[2]		
Destination	α	β	λ	α	β	λ
Canada	0.53**	1.18	-0.48	-0.26	1.30	-2.65***
	(1.91)	(0.41)	(-0.43)	(-0.87)	(1.06)	(-2.69)
China	0.13	-11.20	23	0.03	-16.98	32.55
	(0.55)	(-0.8)	(0.77)	(0.21)	(-0.30)	(0.27)
Hong Kong	0.10	45.10	-92.90	0.75**	-0.04	-3.03
	(0.25)	(0.74)	(-0.74)	(1.84)	(-0.002)	(-0.05)
Japan	-0.12	-0.05	0.09	0.06	-0.21	-1.97
	(-0.12)	(-0.04)	(0.02)	(0.15)	(-0.45)	(-0.85)
Mexico	0.18	0.99	-2.50	0.36	-0.60	-1.96
	(0.40)	(0.86)	(-1.08)	(0.97)	(-1.14)	(-1.47)
Russia	0.25	0.93**	-1.93***	-0.02	-0.50*	-2.67***
	(1.08)	(1.90)	(-2.44)	(-0.22)	(-1.61)	(-2.49)
Singapore	0.19	-5.46	1.71	0.36***	-0.16	-2.85***
	(0.37)	(-0.71)	(0.62)	(2.51)	(-0.24)	(-2.84)
WP	0.09			0.74***		
	(0.67)			(3.17)		
R^2		0.94			0.70	
DW		1.73			1.98	

Note: Values in parentheses are t-values. One asterisk denotes significance at the 10% level, two asterisks denote significance at the 5% level, and three asterisks denote significance at the 1% level.

[1] meat and edible offal, of chicken, cuts and offal, frozen

[2] meat and edible offal, of chicken, cuts and offal, frozen, other

References

Dixit, A. "International Trade Policy for Oligopolistic Industries." *Econ. J.* 94(1984):1-16.

Dornbusch, R. "Exchange Rates and Prices." *Amer. Econ. Rev*. 77(1987):93-106.

Helpman, E. and P. Krugman. *Market Structure and Foreign Trade.* Cambridge: MIT Press, 1985.

International Monetary Fund (IMF). *International Financial Statistics*. Washington DC: calendar year report, 2000.

Kasa, K. "Adjustment Costs and Pricing-to-Market: Theory and Evidence." *J. Int. Econ*. 32(February 1992):1-30.

Knetter, M.M. "Price Discrimination by U.S. and German Exporters." *Amer. Econ. Rev*. 79(March 1989):198-210.

Knetter, M.M. "International Comparisons of Pricing-to-Market Behavior." *Amer. Econ. Rev*. 83(June 1993):473-486.

Goldberg, P.K. and M.M. Knetter. "Goods Prices and Exchange Rates: What Have We Learned?" *J. Econ. Lit*. 35(September 1997):1243-1272.

Kolstad, C. D. and A. E. Burris. "Imperfectly Competitive Equilibria in International Commodity Markets." *Amer. J. Econ.* 68(1986):25-36.

Krugman, P. "Pricing to Market When Exchange Rate Changes." in S.W. Arndt and J.D. Richardson (eds.) *Real-Financial Linkages among Open Economies*. Cambridge: MIT Press, 1987.

McCalla, A. F. "A Duopoly Model of World Wheat Pricing." *J. Farm Econ.* 48(1966):711-27.

Paarlberg and P. C. Abbott. "Oligopolistic Behavior by Public Agencies in International Trade: The World Wheat Market." *Amer. J. Agr. Econ.* 68(1986):528-42.

Pick, D.H. and T.A. Park. "The Competitive Structure of U.S. Agricultural Exports." *Amer. J. Agr. Econ*. 73(February 1991):133-141.

Patterson, P.M., Reca, A., and Abbott, P.C. "Price Discrimination by U.S. High-Value Food Product Exporters." in *Industrial Organization and Trade in the Food Industries.* Sheldon I.M. and Abbott, P.C. edts. Westview Press,1996.

Sarris, A. H. and J. Freebairn. "Endogenous Price Policies and International Wheat Prices." *Amer. J. Agr. Econ.*65(1983):214-24.

U.S. Dept. of Agriculture. *Livestock, Dairy and Poultry Situation and Outlook*. Washington, DC: Economic Research Service, August 1998.

U.S. Dept. of Agriculture. *Foreign Agricultural Service of the United States, (FAS).* Washington, DC: Economic Research Service, Web Cite.

U.S. Dept. of Agriculture. *Foreign Agricultural Trade of the United States, (FATUS).* Washington, DC: Economic Research Service, various monthly issues.