The Role of Promotion Programs for U.S. Poultry Exports

Abdus Shahid and Conrado M. Gempesaw, II

This study examines the effectiveness of price versus nonprice promotion programs for U.S. poultry exports. A comparative static simulation framework is specified for this purpose. The elasticities needed for the simulation model are estimated using seemingly unrelated regression and time-varying parameter regression techniques. Results from this study indicate that a price subsidy is more effective than nonprice market promotion programs in raising export demand for U.S. poultry.

Key Words: export subsidy, market promotion programs, simulation, U.S. poultry

The U.S. poultry industry generates approximately $2 billion in exports per year. As a result of rising export demands, the industry experienced a 63% growth in employment in the 1990s [U.S. Department of Agriculture/Foreign Agricultural Service (USDA/FAS), 1998b]. Poultry exports are expected to reach 2.74 million metric tons in 2001, up from 0.59 million metric tons in 1990, and by 2005 are projected to expand to 3.6 million tons, an increase of more than 53% from current export levels (USDA/FAS, 1998a, 2000). Exports are expected to account for 16.54% of total U.S. poultry production, in contrast to 3% in 1985 (USDA/FAS, 1997b, 2000).

Despite these optimistic projections, poultry exports are coming under pressure from other nations and the Uruguay Round Agreement. The Agreement aims at dismantling trade barriers and distortions among the trading nations and seeks to reduce both volume and value of export subsidies. The signatory nations are required to bring down price subsidies. Nonprice market promotion programs, however, are unaffected by the Agreement (Ackerman, Smith, and Suarez, 1995).

The United States supports its poultry exports in three forms: an indirect price subsidy program known as the Export Enhancement Program (EEP), and two nonprice promotion programs—the Foreign Market Development (FMD) program, and the Market Access Program (MAP), formerly known as the Targeted Export Assistance (TEA) program.

Through the EEP since 1986, the United States has been supporting its poultry exports to the Middle East (Bahrain, Egypt, Iraq, Jordan, Kuwait, Oman, Saudi Arabia, and the United Arab Emirate), East Asia (Hong Kong, Korea, and Singapore), and West Africa. Yet, as a policy tool, the EEP has not been used in a consistent manner. For instance, in 1986, only 25,948 metric tons of U.S. poultry exports were supported by the EEP; in 1987, the EEP supported a record 95,375 metric tons of poultry exports; and in 1989, the EEP support of poultry exports reached a low of 3,618 metric tons (USDA/FAS, 1998c).

The United States spent about $60 million on nonprice promotion programs between 1986 and 1997 to promote exports of poultry, representing approximately 3% of total U.S. expenditures on nonprice promotion programs during this period. These programs have been considered successful in establishing the U.S. as the leading supplier of poultry in Russia and China/Hong Kong, two of the world's largest poultry import markets. Partly as a result of these programs, the 2001 U.S. share in world poultry trade is projected to be 42%, compared to 15% in 1986 (USDA/FAS, 1998b, 2000).

A key issue confronting U.S. policy makers is how best to devise new strategies for maintaining and expanding the U.S. share of world poultry trade in the face of competition from its major trade rivals

---

Abdus Shahid is institutional research analyst, Institutional Research and Planning, and Conrado M. Gempesaw, II, is Vice Provost for Academic Programs and Planning, both at the University of Delaware. This study was partially supported by the National Institute for Commodity Promotion Research and Evaluation. The authors thank the anonymous reviewers for their insightful comments and Harry Kaiser for his support. This article is published as Paper No. 1711 in the journal series of the Delaware Agricultural Experiment Station.

Agricultural and Resource Economics Review 31/1 (April 2002): 59–70

who are also attempting to devise alternative trade strategies for meeting challenges posed by the Uruguay Round Agreement.

One way to promote agricultural exports in foreign markets is by pursuing nonprice promotion programs. Several studies (e.g., Williams, 1985; Rosson, Hammig, and Jones, 1986) have shown that returns per dollar invested in promotional activities are quite high compared to the returns from a price subsidy program such as the EEP (Seitzinger and Paarlberg, 1990). Solomon and Kinnucan (1993), in an analysis of the effects of nonprice export promotion on cotton, found promotional programs have a carryover period lasting beyond one year.

The objective of this study is to examine the effectiveness of price versus nonprice promotion programs for U.S. poultry exports to two groups of importers. Group 1 consists of China, Hong Kong, Japan, and Mexico, where U.S. poultry exports are supported only by nonprice promotion programs. Group 2 is comprised of Egypt, Saudi Arabia, and Singapore, where U.S. poultry exports are supported by both the EEP and nonprice promotion programs.

A simulation model based on a comparative static framework is developed to examine the effectiveness of price versus nonprice promotion programs for U.S. poultry exports. The elasticities needed for the simulation are estimated using relevant time-series data for each country.

The remainder of the article proceeds as follows. In the section below, we describe the methodology and data used for this study, along with the simulation procedure. Next, the main results are identified and discussed. In the final section, conclusions are drawn based on these findings.

Methodology, Data, and Procedure

We employ a modified version of the simulation framework developed by Kinnucan, Duffy, and Ackerman (1995) to determine the effectiveness of price versus nonprice incentives for U.S. cotton exports. The model used here is modified such that domestic demand for poultry meat is a function not only of domestic price, but also of income and price of a substitute (pork or beef).[1] Similarly, export demand is not only a function of price in the export market and expenditures on price and nonprice promotion programs, but also of income of consumers in that market and exchange rate. Quantity supplied is taken as a function of product price and input prices. The model is then used to simulate the effects of a certain increase in price subsidy versus an equivalent dollar value increase in promotion on equilibrium price, domestic demand, and export of U.S. poultry. The simulation model is specified below.

Simulation Model

$$(1)\quad Q_d = f(P_d, P_{ss}, Y_{us}),$$

$$(2)\quad Q_x = g[(P_d - S), Y_f, A],$$

$$(3)\quad Q_s = h(P_d, P_{in}),$$

$$(4)\quad Q = Q_s = Q_d + Q_x,$$

where Q_d = domestic demand, P_d = domestic poultry price, P_{ss} = price of the substitute (pork or beef), Y_{us} = income in the United States, Q_x = export demand, S = the per unit export subsidy, Y_f = income in the foreign country, Q_s = quantity supplied, A = expenditure for nonprice promotion in the foreign market, and P_{in} = the price of input. Totally differentiating (1)–(4) gives:

$$(5)\quad d\ln(Q_d) = N_d d\ln(P_d) + N_{ss} d\ln(P_{ss}) + N_{Yus} d\ln(Y_{us}),$$

$$(6)\quad d\ln(Q_x) = N_x(d\ln(P_d) - m) + N_{Yf} d\ln(Y_f) + N_a d\ln(A),$$

$$(7)\quad d\ln(Q_s) = E_s d\ln(P_d) + E_{in} d\ln(P_{in}),$$

$$(8)\quad d\ln(Q_s) = k_d d\ln(Q_d) + k_x d\ln(Q_x),$$

where N_d = domestic demand elasticity, N_{ss} = demand elasticity of substitution, N_{Yus} = U.S. income elasticity of demand, N_x = export demand elasticity, N_{Yf} = foreign income elasticity of demand, N_a = export advertising elasticity, E_s = domestic supply elasticity, and E_{in} = supply elasticity of input; k_d = domestic share of total supply, k_x = export share, and m = dS/P_d, or change in subsidy as a proportion of initial market price.

The reduced-form equation for the percentage change in domestic price is obtained by substituting equations (5)–(7) into equation (8), which yields:

$$(9)\quad d\ln(P_d) = \Big(k_x(N_{Yf} d\ln(Y_f) + N_a d\ln(A) - N_x m) + k_d(N_{ss} d\ln(P_{ss}) + N_{Yus} d\ln(Y_{us})) - E_{in} d\ln(P_{in})\Big)/(E_s + E_{in} - k_x N_x).$$

[1] Pork is designated as the substitute for Group 1 countries; beef is the substitute for Group 2 countries, as Saudi Arabia and Egypt do not import any pork for religious reasons and Singapore's import of U.S. beef is much higher than its import of U.S. pork.

Back-substitution of equation (9) into equations (5) and (6) gives the change in domestic consumption [$d\ln(Q_d)$] and change in exports [$d\ln(Q_x)$]:

$$(10)\quad d\ln(Q_d) = N_d d\ln(P_d) + N_{ss} d\ln(P_{ss}) + N_{Yus} d\ln(Y_{us})$$

and

$$(11)\quad d\ln(Q_x) = N_x(d\ln(P_d) - m) + N_{Yf} d\ln(Y_f) + N_a d\ln(A).$$

Export Demand Elasticities

The specified simulation model requires estimates of domestic demand elasticity (N_d), demand elasticity of substitution (N_{ss}), U.S. income elasticity of demand (N_{Yus}), export demand elasticity (N_x), foreign income elasticity demand (N_{Yf}), export advertising elasticity (N_a), domestic supply elasticity (E_s), and supply elasticity of input (E_{in}) with respect to U.S. poultry. Econometric models were specified to estimate the demand for U.S. poultry exports and poultry demand and supply functions to obtain these elasticities.

Demand for U.S. poultry exports to the Group 1 countries (China, Hong Kong, Japan, and Mexico) is specified by equation (12):

$$(12)\quad Qx_{ct} = f(Px^*_{ct}, Ps^*_{ct}, Y^*_{ct}, EX^*_{ct}, Ep^*_{ct}, EEP^*, T_t),$$

where the subscript *ct* denotes the specific country. Asterisks indicate deflated variables, deflated by an index of consumer prices of the specific country (base year 1990), while EEP was deflated by the U.S. index of consumer prices (base year 1990). The dependent variable in equation (12) is *Qx*, which represents the annual U.S. exports of poultry to a specific country, expressed in metric tons. The explanatory variables in (12) are defined as follows: the nominal U.S. export price of poultry faced by the importing country in U.S. dollars (*Px*), and the export price of U.S. pork faced by the importing country in U.S. dollars (*Ps*); the gross domestic product (*Y*) of the importing country in the domestic currency of the importer; and the exchange rate index (base year 1990) for U.S. exports to the importing country (*EX*). The country-specific expenditures by the United States on nonprice promotion of poultry are denoted by (*Ep*). Total expenditures under EEP which were not used to subsidize U.S. poultry exports to any country in Group 1 are denoted by *EEP*. The time trend variable (*T*) in (12) is included in the models to capture other time-specific effects that may influence export demand for U.S. poultry.

The equation for estimating the demand for U.S. poultry exports to the Group 2 countries (Egypt, Saudi Arabia, and Singapore) is designated by:

$$(13)\quad Qx_{ct} = f(Px^*_{ct}, Ps^*_{ct}, Y^*_{ct}, EX^*_{ct}, Ep^*_{ct}, EEP^*_{ct}, T_t),$$

where EEP^*_{ct} represents the deflated EEP expenditure to support U.S. poultry exports to a specific country in Group 2. The explanatory variable *Ps* in equation (13) denotes price of U.S. beef exports, which is taken as the price of substitute for U.S. poultry to these countries.

Based on economic theory, the own-price effect on quantity demanded is expected to be negative. A negative relationship is also expected between exchange rate and quantity demanded of U.S. exports of poultry. The export prices of pork and beef included in equations (12) and (13), respectively representing substitute products, are assumed to be positively related to the quantity of U.S. poultry exports. A positive relationship is also likely between income of the importing country and quantity demanded of U.S. exports of poultry.

Because market promotion programs are expected to enhance exports of U.S. poultry, a positive relationship is anticipated between *Ep* and U.S. poultry exports. EEP support of poultry exports to certain countries can possibly distort free trade, and consequently divert U.S. poultry exports away from the countries where exports are not supported by the EEP. Thus, EEP can have a negative relationship with the quantity of poultry exports to Group 1 countries [equation (12)], while country-specific EEP in equation (13) can be expected to have a positive relationship with quantity exported to a specific country in Group 2.

Demand and Supply Elasticities

The equation for estimating domestic demand elasticity, demand elasticity of substitution, and domestic income elasticity for poultry is specified as:

$$(14)\quad Q_d = f(Pr^*_{us}, Psp^*_{us}, Psb^*_{us}, Y^*_{us}, T_t).$$

The dependent variable in (14) is represented by Q_d, which is the annual domestic demand for poultry in the United States. The explanatory variables are retail price of poultry in the U.S. (*Pr*), price of pork and beef as prices of substitutes (*Psp* and *Psb*, respectively), and per capita income in the U.S. (Y_{us}). All variables were deflated by an index of U.S. consumer prices, as denoted by the asterisks.

The equation to determine domestic supply elasticity of poultry and supply elasticity of inputs used in poultry production is written as:

$$(15)\quad Q_s = f(Pw_{us}^*, PITW_{us}^*, T),$$

where the dependent variable is the total production of poultry (Q_s), and the explanatory variables are wholesale price of chicken in the U.S. (*Pw*), and an index of cost of production items, interest, taxes, and wage rates (*PITW*). Asterisks indicate these variables were deflated by an index of U.S. consumer prices.

Following Armah and Epperson (1997), a semi-log specification was used to transform equations (12)–(15) as follows:

$$(16)\quad Q_x = \alpha_1 \log(Px_{ct}^*) + \alpha_2 \log(Ps_{ct}^*) + \alpha_3 \log(Y_{ct}^*) + \alpha_4 \log(EX_{ct}^*) + \alpha_5 \log(Ep_{ct}^*) + \alpha_6 \log(EEP^*) + \alpha_7 \log(T_t) + e_{ct},$$

$$(17)\quad Q_x = \alpha_1 \log(Px_{ct}^*) + \alpha_2 \log(Ps_{ct}^*) + \alpha_3 \log(Y_{ct}^*) + \alpha_4 \log(EX_{ct}^*) + \alpha_5 \log(Ep_{ct}^*) + \alpha_6 \log(EEP_{ct}^*) + \alpha_7 \log(T_t) + e_{ct},$$

$$(18)\quad Q_d = \beta_1 \log(Pr_{us}^*) + \beta_2 \log(Psp_{us}^*) + \beta_3 \log(Psb_{us}^*) + \beta_4 \log(Y_{us}^*) + \beta_5 \log(T_t) + e_{us},$$

and

$$(19)\quad Q_s = \gamma_1 \log(Pw_{us}^*) + \gamma_2 \log(PITW_{us}^*) + \gamma_3 \log(T_t) + e_{us}.$$

Econometric Estimation and Statistical Tests

Equations (16) and (17) were estimated by ordinary least squares (OLS) and time-varying parameter regression (TVPR) methods. In addition, Zellner's iterative seemingly unrelated regression (ITSUR) model was employed to estimate the individual country equations using equations (16) and (17) in respective system-of-equations frameworks for Group 1 and Group 2 countries.[2]

Ordinary least squares would be an appropriate regression method if the relationships between U.S. poultry exports and its own-price, price of substitute, exchange rate, and expenditure on promotion programs were linear for a specific importer. OLS equations also would assume the import decision for U.S. poultry by one country is unrelated in any way to the import decision of any other country. Furthermore, the OLS method ignores any structural change in the parameters over time. Conversely, the iterative seemingly unrelated regression procedure would be appropriate if the import decisions of the countries were not unrelated. ITSUR would take into account any contemporaneous correlation in the errors across the equations resulting from possible simultaneity of import decisions.

Time-varying parameter regression assumes away any arbitrary functional form and is able to provide last-period parameter coefficients, making forecasting more meaningful if parameters indeed shift over time (Rouhiainen, 1978; Zhang, Fletcher, and Ethridge, 1994). Thus, TVPR would be an appropriate regression method to use in estimating the relevant elasticities if structural changes in taste, income, exchange rate regimes, and export policy instruments are suspected.

Gao and Shonkwiler (1993) found evidence of significant taste changes in beef and poultry demands. Kinnucan et al. (1997) also addressed the issue of consumers' preference away from red meat to poultry in the context of the effects of generic advertising and health information. They concluded poultry benefitted from the dissemination of health information at the expense of beef. Many countries of the world also moved from relatively strict exchange control regimes to more liberal ones starting in the early 1980s.

Nested tests were conducted to determine the appropriateness of OLS versus ITSUR, and OLS versus TVPR estimating procedures. The null hypothesis for the first nested test (OLS versus ITSUR using the log-likelihood ratio test) was that the correlation between the error terms of the single equations used for OLS estimates is zero, while the alternative hypothesis was that the correlation between the error terms of the single equations was not zero, as assumed in the case of ITSUR.

The second nested test (OLS versus TVPR using an *F*-test) was conducted with the null hypothesis of a single parameter estimate for all periods (obtained from OLS) versus the alternative hypothesis of different parameter estimates for each period (obtained from TVPR). Nonnested tests (Davidson-MacKinnon *J*-test) were performed to determine the appropriateness between ITSUR and TVPR methods. Results of these tests are described in the next section.

Detailed explanations of nested and nonnested tests are provided in Gujarati (1995) and Greene (1997). Equations (18) and (19) were estimated

[2] Canada was included in the system of equations for the ITSUR model for Group 1, as it is one of the largest importers of U.S. poultry; as such, its imports are expected to influence world trade of U.S. poultry. Export of U.S. poultry to Canada, however, was never supported by either export subsidy or market promotion programs. Therefore, the export elasticity of U.S. poultry for Canada was not estimated here.

using OLS and TVPR. F-tests were also conducted to determine the appropriate functional forms for these equations. The Eviews econometric software program (Quantitative Micro Software, 1998) was used to estimate the regression models.

Data Description

Annual data on both value and volume of U.S. poultry exports, export prices of pork, along with data on MAP, FMD, TEA, and EEP expenditures for 1980–1998, were obtained from USDA/FAS (1998c, d, e). Data on gross domestic product (GDP), population, and consumer price and exchange rate indexes were taken from various issues of the International Monetary Fund's *International Financial Statistics* publication. Retail and wholesale prices of poultry and price of pork in the U.S., and an index of production item, interest, taxes, and wage rates needed to estimate the domestic demand and supply elasticities were derived from various issues of *Agricultural Outlook* (USDA/Economic Research Service).

Simulation Procedure

All elasticities required for the simulation model were calculated from the relevant parameter estimates using the elasticity at the mean approach and the mean elasticity approach.[3] In all cases, mean elasticities were found to be higher than elasticities at the mean.

In the long run, the supply elasticity (E_s) can be expected to have higher values because of greater flexibility in production. Since the long-run elasticity was not directly estimated in this study, the mean elasticity estimate was taken as a proxy for the long-run supply elasticity value in simulating the effectiveness of export subsidy and export market promotions in the long run. The elasticity at the mean estimate was taken as the short-run supply elasticity value. Both the long-run and short-run scenarios were simulated in combination with the lower and higher export (N_x) and advertising (N_a) elasticities, with the lower values provided by the elasticities at the mean and the higher values provided by the mean elasticities.

Table 1 presents the export, income, and advertising elasticity estimates used to generate the simulation results for China, Hong Kong, Japan, Egypt, and Saudi Arabia. For Mexico and Singapore, it was not possible to obtain theoretically consistent parameter estimates needed to calculate the required elasticities. Consequently, no simulation was done for these two countries.

The model was simulated as follows. First, the effect of a \$0.05/lb. subsidy on domestic price of poultry (\$1.05/lb. in 1998) was simulated by setting m (= dS/P_d = \$0.05/\$1.05) in equation (9) equal to 0.0476, and setting dln(A) equal to zero. The percentage share of U.S. consumption of total U.S. poultry production was taken as the domestic share of total supply (k_d), and the percentage share of export of U.S. poultry specific to a country was taken as the export share (k_x) for that country.

The effects of the subsidy on domestic demand and export were obtained by back-substitution of the change in domestic price in equations (10) and (11). The effect of an increase in advertising by the same amount was obtained by setting m in equation (9) to zero, and setting dln(A) equal to dA/A, where A is the current expenditure on promotional activities (based on 1998 FMDP and MAP statistics) and $dA = dS(Q_x + dQ_x)$. This procedure provides an estimate of the percentage change in the domestic price when an equivalent amount was spent on advertising rather than on export subsidy. The associated percentage changes in equilibrium exports and domestic quantities were obtained by back-substitution of the change in domestic price in equations (10) and (11).

Discussion of Results

Based on a 5% significance level, nested tests (F-test) between OLS and TVPR showed the TVPR method is the appropriate approach to use in estimating the demand for U.S. poultry exports in these countries. This finding may indicate the presence of structural changes in the relationship between export demand for U.S. poultry and own-price, price of the substitute, income, and exchange rate over the period.

Nested tests (log-likelihood ratio test) between OLS and ITSUR for both groups of countries rejected OLS in favor of ITSUR, suggesting exports of U.S. poultry to these countries might be correlated. However, nonnested tests (Davidson-MacKinnon J-test) between ITSUR and TVPR methods used in estimating U.S. poultry export demand for all countries considered, yielded mixed

[3] Elasticities at the mean were estimated as e_i ' $(\hat{\beta}_i/\bar{Y})$, and mean elasticities were estimated as e_i ' mean$(\hat{\beta}_i/Y_t)$. For China, Russia, and Egypt, mean elasticities were not estimated. High fluctuations in imports of U.S. poultry by these countries produce unrealistic estimates of mean elasticities. For these countries, simulation results were obtained only with elasticities at the mean.

Table 1. Poultry Elasticity Estimates

Importing Country	Elasticity Description	Elasticity at Mean	Parameter Estimate	Std. Error of Parameter	Mean Elasticity	Std. Error of Mean Elasticity
China	Export	!0.126	!3,211.78	1.878	NA	NA
	Income [a]	!0.888	!1,372,472	82.198	NA	NA
	Advertising	2.056	52,168.70	1.322	NA	NA
Hong Kong	Export	!2.347	!418,100*	4.618	!7.237	1.4109
	Income	4.208	749,518*	4.578	12.974	2.5295
	Advertising	0.118	20,966.9*	1.759	0.363	0.0708
Japan	Export	!0.700	!65,968.1*	6.522	!0.813	0.0828
	Income	1.672	157,501*	3.319	1.942	0.1977
	Advertising	0.688	64,849.9*	2.403	0.799	0.0814
Egypt	Export	!0.402	!5,714.36*	2,011.085	NA	NA
	Income	1.061	15,095.00*	6,162.390	NA	NA
	Advertising	0.095	1,350.18*	577.303	NA	NA
Saudi Arabia	Export	!0.431	!3,374.56*	4.505	!0.682	0.1608
	Income	2.058	16,137.06*	1.354	3.262	0.5268
	Advertising	0.167	1,311.53*	2.659	0.265	0.0428
U.S. Demand	Own-Price	!0.374	!19.54169*	6.314	!0.423	0.086
	Substitute Price: Pork	0.142	7.426496*	6.463	0.161	0.033
	Substitute Price: Beef	1.258	65.68039	8.704	1.423	0.288
	Income	1.263	65.97817*	10.550	1.430	0.289
U.S. Supply	Own-Price	1.797	15,722.27*	5.624	1.881	0.027
	Supply Input	!1.193	!79.81917*	1.124	!1.214	0.059

Notes: * denotes significance at the 5% level; NA denotes not applicable.

[a] Contrary to prior expectations, U.S. poultry exports were found to be negatively related to GDP in China, suggesting that U.S. poultry is considered an inferior good there. According to a USDA report, families in China prefer traditional Chinese breeds for home cooking. The same report mentions that the demand for such breeds has driven up their prices to $2 per kilogram (USDA/FAS, 1997a).

results. For China and Saudi Arabia, the *J*-test decidedly rejected ITSUR in favor of TVPR, while for other countries both specifications were found to be acceptable. In the latter case where both models were found acceptable by the *J*-test, Kmenta (quoted in Gujarati, 1995, p. 491) cautions that the data do not provide sufficient information to select one model over the other. The *J*-test is also dependent on the asymptotic normal distribution of the disturbance terms, making its results suspect when the sample size is small (Gujarati, 1995).

TVPR provided theoretically consistent parameter estimates (significant estimates with the expected signs) for the required elasticities for all countries except Egypt. Thus, the relevant elasticities for both Group 1 and Group 2 countries (except Egypt) were calculated from TVPR parameter estimates. TVPR parameter estimates for Egypt did not have the expected signs. For this reason, the elasticities for Egypt were based on the ITSUR parameter estimates, as these estimates had the expected signs.

The elasticities used to generate the simulation results are reported in the lower portion of table 1, along with the parameter estimates, statistical significance of these estimates, and standard errors of the elasticities. TVPR estimates of U.S. domestic demand and supply functions for poultry have the expected signs for all coefficient estimates. However, in the demand function, the coefficient estimate of one of the substitutes (pork) was found to be statistically insignificant. All other parameter estimates were statistically significant. The standard errors of elasticities at the mean used for the simulation model indicated the estimates are quite reliable. Similar results were found for the standard errors of the mean elasticities.

Comparison with Other Studies

A search of the literature revealed no comparable study on export demand elasticities for U.S. poultry to Japan, China, Hong Kong, Saudi Arabia, or Egypt. However, some studies have estimated meat demand elasticities (including chicken) in the Far East, along with one analysis of Japanese meat import demand that includes chicken.

Table 2 provides a comparison of the export demand elasticities for U.S. poultry from this study

Table 2. Comparison of Poultry Export and Demand Elasticities Across Studies

Current Study (1998 data) [export elasticities]	Capps, Tsai, Kirby, and Williams, 1994 [price elasticities]	Yang and Koo, 1994 [import demand elasticities]	Hayes, Wahl, and Williams, 1990 [price elasticities]
Japan: !0.813 (mean elasticity); !0.70 (elasticity at the mean) **China:** !0.126 (elasticity at the mean) **Hong Kong:** !7.237 (mean elasticity); !2.347 (elasticity at the mean) **Saudi Arabia:** !0.682 (mean elasticity); !0.431 (elasticity at the mean) **Egypt:** !0.402 (elasticity at the mean)	Compensated Price Elasticities: **Japan:** !0.1210 **South Korea:** !0.3677 **Taiwan:** !0.1481 Uncompensated Price Elasticities: **Japan:** !0.4480 **South Korea:** !0.4698 **Taiwan:** !0.2779	**Japan:** Marshallian elasticity of Japanese meat import demand based on ▪ Restricted AIDS model = !2.13 ▪ RSDAIDS model = !2.457	**Japan/chicken:** ▪ Hicksian elasticity for Japanese household model = !0.56 ▪ Hicksian elasticity for Japan per capita model = !0.42 ▪ Marshallian elasticity for Japan per capita model = !0.59

to elasticities reported in earlier studies. For example, Capps et al. (1994) found compensated price elasticity for chicken in Japan to be !0.121. Hayes, Wahl, and Williams (1990) reported a Marshallian elasticity for chicken in Japan of !0.59, while Wahl, Hayes, and Johnson (1992) estimated a Marshallian elasticity for chicken in Japan of !0.91. Yang and Koo (1994) found a Marshallian elasticity of Japanese import demand for chicken of !2.457. Our study estimated the mean export demand elasticity for U.S. poultry to Japan to be !0.813 (!0.70 is the elasticity at the mean). The high export demand elasticities for Hong Kong found here may be due to the fact that this port serves as a transshipment center to China, which has become a large U.S. poultry export market.

Table 3 compares estimates of U.S. poultry demand and supply elasticities, input supply elasticity, income elasticity of demand (U.S.), and demand elasticity of substitution (beef and pork) from the present study to estimates reported in other studies. Demand elasticity for poultry in the United States was estimated to be !0.0522 (uncompensated) and !0.0630 (compensated) by Huang (1994), !0.169 by Kinnucan et al. (1997), and !0.51 by Hayes, Wahl, and Williams (1990). Park et al. (1996) estimated demand elasticity for poultry in the United States to be !0.2177 for poverty status households and !0.3456 for nonpoverty status households. This study's estimate of !0.423 appears to be reasonable.

Gempesaw and Dunn (1987) estimated supply elasticity for poultry at 2.84, while this study obtained a poultry supply mean elasticity of 1.881 (1.797 is the elasticity at the mean). Gempesaw and Dunn also report a supply elasticity of feed grain of !1.86. This study estimated the mean input elasticity at !1.214 (!1.193 is the elasticity at the mean). Hayes, Wahl, and Williams (1990) found the demand elasticity of beef and pork to be 0.34 and 0.24, respectively, when beef and pork are considered as substitutes for poultry. Comparative figures from the current study are 1.423 and 0.161, respectively (1.258 and 0.142 are the elasticities at the mean). Capps and Havlicek (1987) estimated the expenditure elasticity for poultry at 1.10, which is comparable to the 1.43 (mean income elasticity) and 1.263 (income elasticity at the mean) reported in this study.

Table 4 presents the estimated advertising elasticities for U.S. poultry exports for different countries considered in this study, along with estimates of advertising elasticities for different types of meats in the domestic (U.S.) market and export markets from other studies. There are no published estimates of advertising elasticities for U.S. poultry in export markets, and very few published estimates of advertising elasticities for other meat products.

As shown in table 4, depending on the particular estimation technique, advertising elasticities reported can vary widely. For example, Piggott et al. (1996) found demand response to advertising for beef in Australia to be 0.000084 using a single-equation estimation method, and 0.0310 based on a double-log estimation method. Piggott, Piggott, and Wright (1995) documented an elasticity of 0.05. The advertising elasticities estimated in this study were 2.056 for China, 0.118 for Hong Kong, 0.688 for Japan, 0.095 for Egypt, and 0.167 for Saudi Arabia.

Table 3. Comparison of Demand and Supply Elasticities Across Studies

Description	Current Study (1998 data)	Gempesaw and Dunn (1987)	Huang (1994)	Kinnucan, Xiao, Hsia, and Jackson (1997)	Hayes, Wahl, and Williams (1990)	Park, Holcomb, Raper, and Capps (1996)	Capps and Havlicek (1987)
Domestic demand elasticity	!0.423 (mean elasticity); !0.374 (elasticity at the mean)		!0.0522 (uncompensated); !0.0630 (compensated)	!0.169	!0.51	!0.2177 (poverty status household); !0.3456 (nonpoverty status household)	!1.25
Domestic supply elasticity	1.881 (mean elasticity); 1.797 (elasticity at the mean)	2.84					
Supply elasticity of input	!1.214 (mean elasticity); !1.193 (elasticity at the mean)	!1.86					
Income elasticity of demand for poultry	1.430 (mean elasticity); 1.263 (elasticity at the mean)						1.10 (expenditure elasticity)
Demand elasticity of substitution (beef)	0.161 (mean elasticity); 0.142 (elasticity at the mean)				0.34		
Demand elasticity of substitution (pork)	1.423 (mean elasticity); 1.258 (elasticity at the mean)				0.24		

Table 4. Comparison of Meat Advertising Elasticities Across Studies

Current Study (1998 data)	Piggott, Piggott, and Wright (1995)	Piggott, Chalfant, Alston, and Griffith (1996)
Elasticity of poultry demand with respect to U.S. advertising in: **Japan:** 0.799 (mean elasticity); 0.688 (elasticity at the mean) **China:** 2.056 (elasticity at the mean) **Hong Kong:** 0.363 (mean elasticity); 0.118 (elasticity at the mean) **Saudi Arabia:** 0.265 (mean elasticity); 0.167 (elasticity at the mean) **Egypt:** 0.095 (elasticity at the mean)	**Australia:** Elasticity of: ▪ Domestic beef demand with respect to domestic beef advertising: 0.05 ▪ Export beef demand with respect to export beef advertising: 0.05 ▪ Domestic lamb demand with respect to domestic lamb advertising: 0.02 ▪ Export lamb demand with respect to export lamb advertising: 0.02	**Australia:** Advertising elasticity of: ▪ Beef: 0.000084 (AMLC, single-equation estimate) ▪ Beef: 0.000108 (APC, single-equation estimate) ▪ Pork: 0.000008 (APC, single-equation estimate) ▪ Beef: 0.0310 (AMLC, double-log estimate) ▪ Lamb: 0.0078 (AMLC, double-log estimate) ▪ Beef: 0.0220 (APC, double-log estimate) ▪ Pork: 0.0085 (APC, double-log estimate)

Several reasons can account for the disparities in various elasticities reported. One explanation is the different estimating techniques employed, as exemplified by use of the TVPR approach in this study and fixed coefficient techniques adopted in other analyses. The TVPR approach applied here allows for the last-period parameter coefficients to be included in calculating the elasticities. Second, differences in data used and time period covered can also account for the elasticity disparities.

For the sake of brevity, only the simulation results from the two scenarios for Japan and Saudi Arabia are discussed below. Tables 5 and 6, respectively, provide results of the simulations for these two countries. The first and fourth numeric columns of tables 5 and 6 present the effects of an export subsidy on domestic price, domestic consumption, and quantity exported. The second and fifth columns detail the effects of advertising when the advertising elasticity is higher, and the third and sixth columns show the effects of advertising when the advertising elasticity is lower. The top panel in each table reports effects of a price subsidy and advertising when the export elasticity is higher, and the bottom panel displays corresponding results when the export elasticity is lower.

The results for Japan and Saudi Arabia clearly show an export subsidy will be the most effective strategy in increasing U.S. poultry exports to these countries. In contrast, nonprice market promotion programs have virtually no effect in this regard. An export subsidy also causes the domestic price of poultry to rise significantly, resulting in lower domestic consumption demands.

The simulation exercise for China, Hong Kong, and Egypt also produced similar results. This finding is consistent with the theory of export subsidy. Imposition of an export subsidy drives a wedge between domestic and international prices of the good for which an export subsidy is given, causing the domestic price to rise above the international price of the good. Price in the domestic market, however, rises by less than the full amount of the subsidy because imposition of an export subsidy also depresses the price of the good in the importing country. A higher domestic price of the good causes domestic consumption to fall. A price subsidy, however, encourages domestic producers to export more even though the real price of their goods may not be lower than that of their competitors. In contrast, market promotion programs do not drive any wedge between domestic and international prices of the commodity promoted in export markets. These programs, if effective, may raise demand for the product in export markets, diverting these goods from domestic markets to export markets without affecting domestic price directly.

As seen from tables 5 and 6, domestic price rises in both Japan and Saudi Arabia as a result of a 4.80% subsidy on per unit of exports, but by less than the subsidy increase. In the case of market promotion programs, the rise in domestic price is found to be very insignificant for both countries. An export subsidy is found to be more effective in raising exports when the export elasticity is higher. Based on the estimated elasticities and simulation results, long-run and short-run scenarios do not differ in any practical sense. The effects of a 5% export subsidy appear to be the same in both cases for these countries. Finally, since Japan and Saudi Arabia face the same U.S. supply elasticities, the results are simply driven by the differences in export and advertising elasticities.

Summary and Conclusions

The objective of this study was to examine the effectiveness of price and nonprice market promotion programs for U.S. poultry products in several importing countries. A comparative static simulation model was developed to meet this objective. The elasticities needed for the simulation model were calculated by estimating country-specific econometric models using relevant data for each country instead of arbitrarily assuming elasticity values. Nested and nonnested tests were conducted to determine the appropriate estimation method. The estimated elasticities were found to be reliable estimates based on the usual significance tests of the relevant parameters (t-test) and the standard errors of the elasticities. A review of the existing literature was also conducted to compare the estimated elasticities.

The simulation results for both groups of countries based on the two sample scenarios (Japan and Saudi Arabia) suggest an export subsidy is basically the most effective policy instrument in expanding exports of U.S. poultry. The results also show that effects of an export subsidy will be the same in both long- and short-run scenarios. However, caution should be taken in interpreting these results. This study measures performance of promotion programs solely on expenditures on poultry export promotions.

Table 5. Simulation Results of Poultry Exports to Japan (% changes)

	SHORT-RUN IMPACTS			LONG-RUN IMPACTS		
		Export Advertising Elasticity			Export Advertising Elasticity	
Description [a]	Price Subsidy	N_a = 0.799	N_a = 0.688	Price Subsidy	N_a = 0.799	N_a = 0.688
N_x = !0.813:						
P_d	0.0473233	2.248E-05	1.936E-05	0.0417218	1.982E-05	1.707E-05
Q_d	!0.0198758	!9.441E-06	!8.129E-06	!0.0175232	!8.324E-06	!7.167E-06
Q_x	3.8639262	0.0018353	0.0015804	3.8684801	0.0018376	0.0015823
N_x = !0.700:						
P_d	0.0408017	2.239E-05	1.928E-05	0.0359663	1.974E-05	1.700E-05
Q_d	!0.0171367	!9.405E-06	!8.099E-06	!0.0151059	!8.291E-06	!7.139E-06
Q_x	3.3314388	0.0018284	0.0015744	3.3348236	0.0018303	0.0015761

[a] Terms are defined as follows: N_x = export demand elasticity, P_d = % change in domestic price, Q_d = % change in domestic consumption, and Q_x = % change in quantity exported.

Table 6. Simulation Results of Poultry Exports to Saudi Arabia (% changes)

	SHORT-RUN IMPACTS			LONG-RUN IMPACTS		
		Export Advertising Elasticity			Export Advertising Elasticity	
Description [a]	Price Subsidy	N_a = 0.265	N_a = 0.167	Price Subsidy	N_a = 0.265	N_a = 0.167
N_x = !0.682:						
P_d	0.0020742	2.748E-09	1.731E-09	0.0018267	2.420E-09	1.525E-09
Q_d	!0.0008712	!1.154E-09	!7.272E-10	!0.0007672	!1.016E-09	!6.404E-10
Q_x	3.2721854	4.334E-06	2.731E-06	3.2723542	4.335E-06	2.732E-06
N_x = !0.431:						
P_d	0.0013111	2.716E-09	1.712E-09	0.0011545	2.392E-09	1.507E-09
Q_d	!0.0005506	!1.141E-09	!7.189E-10	!0.0004849	!1.005E-09	!6.330E-10
Q_x	2.0682349	4.285E-06	2.700E-06	2.0683024	4.285E-06	2.700E-06

[a] Refer to footnote to table 5 above.

In their study on the effect of generic advertising and health information on U.S. meat demand, Kinnucan et al. (1997) found advertising's influence on demand may not depend solely on advertising expenditures, but also on the number and quality of messages consumers receive as influenced by advertising copy, target audience, and media mix. Solomon and Kinnucan (1993), examining the effects of government-subsidized export promotion on the demand for U.S. cotton in six Pacific Rim countries, cite evidence that a minimum level of funding may be necessary to achieve a market response.

Future studies on the effectiveness of price and nonprice promotion programs for U.S. poultry exports might also take into account that vertical integration is prevalent in the U.S. poultry industry. Examination of additional factors which may affect poultry prices and exports would be helpful in extending the results reported here.

This study offers several contributions to the literature dealing with the effectiveness of price versus nonprice market promotion programs for exports:

- No previous study has employed the methodological framework proposed here to evaluate the effectiveness of price versus nonprice incentives for U.S. poultry exports. Results from this study can provide much needed information in formulating strategies to promote U.S. poultry exports.

- The simulation model developed here represents an improvement over earlier simulation models used to examine the effects of price versus nonprice promotion. Specifically, in our model, quantity exported is a function not only of export prices (as in other models), but is also influenced by price of substitute products, input prices, and income in both the exporting and importing countries. As such, this model is fully defined and takes into consideration explanatory factors that are expected to affect export demand.

- Rather than arbitrarily employing a particular estimating method, this study attempts different regression techniques in an effort to capture the appropriate functional form and conducts statistical tests to determine the correct form. Use of the time-varying parameter regression approach also allows this study to incorporate the last-period coefficients in calculating the elasticities, making predictions more meaningful.

- Finally, this study estimates relevant elasticities needed in the simulation model. These elasticities can be used by researchers as benchmarks in future studies of poultry exports, supply, and demand.

References

Ackerman, K. Z., M. E . Smith, and N. R. Suarez. (1995). "Agricultural Export Programs, Background for 1995 Farm Legislation." Agricultural Economics Report No. 716, USDA/ Economic Research Service, Washington, DC.

Armah, B. K., and J. E. Epperson. (1997). "Export Demand for U.S. Orange Juice: Impacts of U.S. Export Promotion Programs." *Agribusiness: An International Journal* 13, 1–10.

Capps, O., and J. Havlicek. (1987). "Analysis of Household Demand for Meat, Poultry, and Seafood Using the S_1-Branch System." In R. Raunikar and C.-L. Huang (eds.), *Food Demand Analysis: Problems, Issues, and Empirical Evidence* (pp. 128–142). Ames, IA: Iowa State University Press.

Capps, O., R. Tsai, R. Kirby, and G. W. Williams. (1994). "A Comparison of Demands for Meat Products in the Pacific Rim Region." *Journal of Agricultural and Resource Economics* 19, 210–224.

Gao, X. M., and J. S. Shonkwiler. (1993). "Characterizing Taste Change in a Model of U.S. Meat Demand: Correcting for Spurious Regression and Measurement Errors." *Review of Agricultural Economics* 15, 313–324.

Gempesaw, C. M., and J. W. Dunn. (1987, December). "Production Structure of U.S. and Northeast Agriculture: A Profit Function Analysis." Bulletin No. 866, College of Agricultural Sciences, Penn State University.

Greene, W. H. (1997). *Econometric Analysis*, 3rd ed. Upper Saddle River, NJ: Prentice-Hall.

Gujarati, D. N. (1995). *Basic Econometrics*, 3rd ed. New York: McGraw-Hill, Inc.

Hayes, D. J., T. I. Wahl, and G. W. Williams. (1990). "Testing Restrictions on a Model of Japanese Meat Demand." *American Journal of Agricultural Economics* 72, 556–566.

Huang, K. S. (1994). "A Further Look at Flexibilities and Elasticities." *American Journal of Agricultural Economics* 76, 313–317.

International Monetary Fund. (1980–98). *International Financial Statistics.* Washington, DC. Various issues.

Kinnucan, W. H., P. A. Duffy, and K. Z. Ackerman. (1995). "Effects of Price versus Nonprice Promotion: The Case of Cotton." *Review of Agricultural Economics* 17, 91–100.

Kinnucan, W. H., H. Xiao, C.-J. Hsia, and J. D. Jackson. (1997). "Effects of Health Information and Generic Advertising on U.S. Meat Demand." *American Journal of Agricultural Economics* 79, 13–23.

Kmenta, J. (1971). *Elements of Econometrics.* New York: Macmillan Publishing Co.

Park, J. L., R. B. Holcomb, K. C. Raper, and O. Capps, Jr. (1996). "A Demand System Analysis of Food Commodities by U.S. Households Segmented by Income." *American Journal of Agricultural Economics* 78, 290–300.

Piggott, N. E., J. A. Chalfant, J. M. Alston, and G. R. Griffith. (1996). "Demand Response to Advertising in the Australian Meat Industry." *American Journal of Agricultural Economics* 78, 268–279.

Piggott, R. P., N. E. Piggott, and V. E. Wright. (1995). "Approximating Farm-Level Returns to Incremental Advertising Expenditures: Methods and Application to the Australian Meat Industry." *American Journal of Agricultural Economics* 77, 497–511.

Quantitative Micro Software. (1998). Eviews Econometric Software Program. Irvine, CA.

Rosson, C. P., M. D. Hammig, and J. W. Jones. (1986). "Foreign Market Promotion Programs: An Analysis of Promotion Response for Apples, Poultry, and Tobacco." *Agribusiness: An International Journal* 2, 33–42.

Rouhiainen, J. (1978). "The Problem of Changing Parameters in Demand Analysis and Forecasting." *European Review of Agricultural Economics* 5, 349–359.

Seitzinger, A. H., and P. L. Paarlberg. (1990, February). "A Simulation Model of the U.S. Export Enhancement Program for Wheat." *American Journal of Agricultural Economics* 72, 95–103.

Solomon, H., and H. W. Kinnucan. (1993). "Effects of Nonprice Export Promotion: Some Evidence for Cotton." *Australian Journal of Agricultural Economics* 37, 1–15.

U.S. Department of Agriculture, Economic Research Service. (1980–98). *Agricultural Outlook.* USDA/ERS, Washington, DC. Various issues.

U.S. Department of Agriculture, Foreign Agricultural Service. (1997a, September). "Export Enhancement Program." USDA/ FAS, Washington, DC. Online. Available at: http://www.fas.usda.gov/info/factsheets/eep.html.

———. (1997b, October). "Livestock and Poultry, World Markets and Trade." USDA/FAS, Washington, DC. Online. Available at: http://www.fas.usda.gov:80/dlp/circular/1997/97-0LP/poult_cmpt.html.

———. (1998a). "Diversity Is Key to Continued Success of U.S. Poultry Exports." USDA/FAS, Washington, DC. Online. Available at: http://www.fas.usda.gov:80/info/agexporter/1997/poultry.html.

———. (1998b). "Export Promotion Increases Employment in U.S. Poultry Industry." USDA/FAS, Washington, DC. Online. Available at: http://www.fas.usda.gov:80/dip/success.html.

———. (1998c). Unpublished Data: Export Enhancement Program. USDA/FAS, Washington, DC.

———. (1998d). Unpublished Data: Market Access Program Budget and Expenditures. USDA/FAS, Washington, DC.

———. (1998e). Unpublished Data: Targeted Export Access Program. USDA/FAS, Washington, DC.

———. (2000, October). "Livestock and Poultry: World Markets and Trade." Circular Series DL&P 2-00, USDA/FAS, Washington, DC.

Wahl, T. I., D. J. Hayes, and S. R. Johnson. (1992, July). "Impacts of Liberalizing the Japanese Pork Market." *Journal of Agricultural and Resource Economics* 17(1), 121–137.

Williams, G. W. (1985). "Returns to U.S. Soybean Export Market Development." *Agribusiness: An International Journal* 1, 243–263.

Yang, S.-R., and W. W. Koo. (1994). "Japanese Meat Import Demand Estimation with the Source Differentiated AIDS Model." *Journal of Agricultural and Resource Economics* 19(2), 396–408.

Zhang, P., S. M. Fletcher, and D. E. Ethridge. (1994, July). "Interfiber Competition in Textile Mills Over Time." *Journal of Agricultural and Applied Economics* 26(1), 173–182.