SHORT- & LONG-RUN EFFECTS OF SEAFOOD IMPORTS ON DOMESTIC PRICE

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INTRODUCTION

Producers are quite concerned about adverse movements in prices caused by economic shocks. In the U.S. seafood market, fish producers are concerned about imports because domestic prices may be adversely affected by the influx of imports. Such suspected inverse effects of imports are based on the substitutability of imports for domestic products. For examples, domestic catfish producers are naturally concerned about imported catfish because domestic producers assume that imported catfish serves as a substitute for domestically produced catfish. Also, domestic catfish producers have concerns about the imports of other related fishery products (e.g., like shrimp) because these products also have the possibility of serving as catfish substitutes, displacing domestic catfish consumption. However, own imports could be complementary in their relationship to domestic catfish, while cross imports could be viewed as substitutes for domestic catfish. The reason for this assumption may be that for products that are relatively small in volume and are sold in local or regional markets is not supplied by domestic producers for the entire domestic market but could, with exposure of cheaper imports of like goods, cause the domestic product to be nationally distributed through the aid of distributors at the national level. In this case, own imports do not compete with the domestic product of like nature but are rather complementary to the domestic product, while cross imports could be viewed as being substitutes.

OBJECTIVE

This study seeks to identify short-run and long-run effects that fish imports have on domestic price. This challenge will be resolved by using two different methodologies, namely, *Dynamic Structural Analysis* and *Impluse Response Analysis*.

PREVIOUS RESEARCH

Fish price formation has been investigated by agricultural economists (Barten and Bettendorf, 1989; Eales, Durham, and Wessells, 1997; Asche, Bremnes, and Wessells, 1999; Beach and Holt, 2001; Holt and Bishop, 2002; and Gary-Wong and McLaren, 2005). Fish have unique features as a commodity group. For example, seasonality in fish demand and/or supply causes price variations or cycles in a specific time interval. Bose, Bodman, and Campbell (2006) indicated a strong likelihood that fish price series may contain significant seasonal components. Also, perishability leads to one to the study of inverse demand systems in which price variation is explained by quantity variation as opposed to traditional economic models where quantity variation is explained by price variation. Barten and Bettendorf (1989) provided a justification of the use of an inverse demand system for describing price variation in terms of quantity variation because fish supply is very inelastic in the short run. And homogeneity has raised questions about which fish species belong to a common market or the long-run price relationship between fish species. Cointegration tests are usually adopted for this objective. There are many studies related to fish price formation. However, most of them have separately considered these properties (Barten and Bettendorf, 1989; Lee and Kennedy, 2008 and 2009) or only as being partially integral (Asche, Salvanes, and Steen, 1997; and Bose, Bodman, and Campbell 2006). Recognizing these features of fish, this study tried to identify the short- and long-run responsiveness of domestic seafood market to imports.

DATA

This study uses domestic catfish and imported catfish, trout, tuna, shrimp, tilapia, and salmon data. We originally obtain monthly price and quantity data of these products from different sources for the period spanning from January 1989 to December 2007. Price and quantity data for domestic catfish come from the National Agricultural Statistics Service (NASS). Price and quantity data for domestic catfish is for round weight processed catfish. Quantity and value data for imported fish were obtained from the National Marine Fisheries Service (NMFS). Using these monthly data, we then combine data to obtain quarterly data. The unit prices of imported fish are obtained by dividing the total value by the volume of imports. The obtained quantity and price data represent an actual quantity amount, like pounds, and an actual price, like dollars per pound. Whenever needed, we normalized these data following the method as suggested by Lee and Kennedy (2009).

MODEL FRAMEWORK

1. Dynamic Structural Analysis

Quantity's short-run price effect is usually measured by a quantity elasticity (or price flexibility). Barten and Betterndorf (1989) developed a series of dynamic inverse demand models for fish which are usually used to analyze the short-run effect that quantity has on price. In particular, a Differential Inverse Rotterdam Demand System (DIRDS) more clearly reflects the original properties of sample data than any other variants of inverse demand systems because of less restrictions in the model. For example, although the estimated coefficients of the quantity elasticity by other variants is complemented by the mixing of parameters in order to obtain unbiased own quantity elasticity, the estimated coefficients of quantity elasticity of DIRDS cannot be complemented by these parameters, implying that if the sample data that were used in the DIRDS were not consistent with microeconomic theory, the estimated quantity elasticity would be inconsistent with economic theory as well. For example, the sample data violate the negativity condition of own quantity on price, then one would obtain a non-negative own quantity elasticity. Furthermore, cross quantity elasticities exactly reflect the sample data used in DIRDS. Therefore, this study uses DIRDS to reflect the exact effects of own and cross quantity reflected by the sample data during the period of this study, which will be helpful to understand the historical relationships among seven fish used in this study. The DIRDS is expressed as :

$$(1) \qquad w_i \Delta \ln \pi_i = h_i \Delta \ln Q + \sum\nolimits_j h_{ij} \Delta \ln q_j, \quad i,j = 1,2,3,\ldots,7,$$

where w_i is fish i's expenditure share, $\Delta \ln Q = \sum_j w_j \Delta \ln q_j$ is the Divisa volume index, h_{ij} is quantity elasticity coefficient, and h_i is the scale elasticity coefficient.

This study follows the procedure of normalization for price and quantity data as suggested by Lee and Kennedy (2009). For the seven types of fish used in this study, the DIRDS is estimated. For econometric estimation, this study follows estimation procedure suggested by Berndt and Savin (1975) as a means of fixing singularity in the covariance matrix of the model. The short-run quantity elasticity between fish i and j will be identified as substitutes if $f_{ij} = h_{ij} / w_i + w_j < 0$ and complements if $f_{ij} = h_{ij} / w_i + w_j < 0$.

2. Impulse-Response Analysis

Impulse response analysis is utilized to describe the impacts of shocks on prices and their propagation mechanism over time. An impulse response function can be written in a Vector Moving Average (VMA) form as follows:

$$(2) \qquad P_t = \mu + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t-i},$$

where, P_t is a 7×1 vector of price variables, μ is a 7×1 vector of means (constants), is a 7×7 coefficient matrix and ε_{t-i} is the innovation sequence. The matrix has the following interpretation:

$$(3) \qquad \left(\frac{\Delta P_{t+n}}{\Delta \varepsilon_t^T} \right) = \phi_i(n),$$

where, '*n*' and '*T*' represent time horizon and transpose operators, respectively. For example, the jk^{th} (i.e., j^{th} row, k^{th} column) element of matrix identifies the consequences of a one unit increase in the innovation of the j^{th} price variable at time '*t*' for the value of the k^{th} endogenous price variable at time '*t+n*', keeping all other innovations constant (Hamilton, 1994).

Using a VMA-in-level model, impulse-response functions were generated for four-period horizons with three lags and with rank ordering based on market value. Following the interpretation of expression (3), other things being equal, two fish are said to be substitutes on the demand side when an increase in the prices of one fish '*j*' causes the demand for another fish '*i*' to increase, which, given supply, leads to an increase in the price of fish '*i*' (a positive price relationship), and vice versa. When two fish are complements to each other, a decrease in the price of one fish '*j*' results in an increase in the demand for another fish '*i*' which leads to an increase in the price of fish '*i*' (a negative price relationship), and vice versa. In this regard, significant positive and negative responses over time can be seen to respectively indicate the substitutability and complementarity relationships between fish types.

RESULTS

1. Short-Run Relationship among Fish Prices

Table 1 shows empirical short run quantity elasticities among the seven fish types. All fish show substitutability in both own and cross effects. For example, the first row of Table 1 shows negative quantity elatisticities domestic catfish (Catfish (D)), and imported catfish, trout, tuna, shrimp, tilapia, and salmon have on domestic catfish price. These results are different from the results of the impulse-response analysis, implying that there is a difference between the short- and long-run effect of imports on domestic price.

Table 1. Short-Run Quantity Elasticity

	Catfish (D)	Catfish	Trout	Tuna	Shrimp	Tilapia	Salmon
CADP	-0.597	-0.009	-0.007	-0.266	-0.918	-0.033	-0.183
CAIP	-0.639	-0.042	-0.001	-0.229	-0.602	-0.093	-0.161
SAIP	-0.847	-0.002	-0.163	-0.261	-0.604	-0.023	-0.092
SHIP	-0.22	-0.003	-0.002	-0.133	-0.520	-0.019	-0.114
TIIP	-0.395	-0.004	-0.002	-0.27	-1.122	-0.043	-0.204
TRIP	-0.227	-0.012	-0.001	-0.178	-0.803	-0.054	-0.007
TUIP	-0.327	-0.004	-0.001	-0.249	-0.850	-0.009	-0.409

2. Long-Run Relationship among Fish Prices

In Table 2, the symbols '*S*' and '*C*' are used to represent substitutes or complements based on the significant positive or negative responses, respectively, of price to shocks over the four-period time horizon. '*S*' and '*C*' indicate that the price responses were uniformly positive or negative, whereas the symbols '*S**' and '*C**' denote cases in which the responses over the four-period time horizon were mixed (both positive and negative), with the sum of the statistically significant responses being positive and negative, respectively. The number in parentheses is the number of significant response(s) during the four-period horizon. For example, *S**(3) simply means that there are three significant responses during the four-period horizon with the aggregate being positive, whereas *C*(2) means that there were two significant responses and both were negative. Of the 43 results reported in Table 2, the majority (27) represent uniform responses, with the remainder exhibiting mixed responses denoted by an asterisk, '*', as indicated above.

It can be seen from Table 2 that the response to own-price shocks is positive and significant for all cases as expected. In the absence of significant income effects symmetry is also to be expected, in the sense that if fish *j* is found to be a substitute/complement to fish *i*, then fish *i* is found to be a substitute/complement to fish *j*. There are 21 possible pair wise relationships in the seven-species demand system, but, as can be seen from Table 2, there are only 10 cases in which the impulse-response is significant in both directions. Of these cases, seven are substitutionary and four are complementary in relationship. In particular, the condition of symmetry is satisfied for domestic and imported catfish. Table 2 shows that imported catfish is a complement of domestic catfish and domestic catfish (and vice versa). However, trout, tuna, shrimp, tilapia, and salmon did not satisfy the symmetry condition. For example, imported shrimp is a substitute for domestic catfish but domestic catfish is a complement of imported shrimp.

Table 2. Results of Impulse Response for Four-Period Time Horizon

	CADP	CAIP	SAIP	SHIP	TIIP	TRIP	TUIP
CADP	S*(4)	C*(2)	S*(4)	C*(2)	C*(2)	C*(3)	
CAIP		C*(3)	C*(3)	C*(2)	C*(3)	S*(2)	C*(1)
SAIP	S*(3)	S*(3)	C*(4)	C*(4)	C	S	C*(3)
SHIP	C*(2)	S*(2)	S*(4)	C*(4)	S*(2)	C*(3)	C
TIIP	S*(4)	C*(3)	C	C	C*(4)	S*(4)	S
TRIP	S*(2)	C*(3)	S*(3)	C*(4)	S*(3)	C*(3)	
TUIP	S	S	C*(2)	C	C*(2)	C*(2)	C*(3)

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