Noncompetitive Pricing and Exchange Rate Pass-Through in Mauritanian Octopus Export Markets

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Abstract: *Octopus exports are an important source of foreign exchange earnings for Mauritania. The export market has historically been dominated by coordinated Japanese buyers, a situation that led Mauritania to create the Société Mauritanienne de Commercialisation de Poisson (SMCP) to negotiate with buyers and manage all octopus exports. Issues concerning competitiveness, price discrimination, and exchange rate pass-through in the Mauritanian octopus export market were empirically examined in this study using a seemingly unrelated regression model corrected for contemporaneous and serial correlation. Results indicate some degree of price discrimination across destination markets, market share enhancement through local currency price stabilization, and increases in marginal costs of production following nationalization of the Mauritanian trawler fleet. Thus, while creation of the SMCP did not result in the development of complete countervailing market power, Mauritania has managed to enhance the position of its octopus exports in the lucrative Japanese market.*

Keywords and Phrases: *International trade, Exchange rates, Imperfect competition, Octopus fisheries.*

Cephalopod exports to Japan and Europe are an important source of foreign exchange earnings for Mauritania and a critical component of the nation's economy. Mauritanian cephalopod exports, including octopus, cuttlefish and squid, totaled 34,140 metric tons in 1989, or approximately $112 million U.S. (Dia). Japanese demand for Mauritanian octopus has steadily increased over the last decade to the extent that Mauritania claims more than a 30 percent share of the Japanese octopus market. Taken together, cephalopods generated 50 percent of the total Mauritanian fishery income and 25 percent of all government income. Because octopus accounts for nearly 85 percent of all cephalopod landings and more than 21 percent of government income, the control of octopus harvesting and marketing is an important policy issue in Mauritania.

In an attempt to improve the reliability of information used for supporting policy development and marketing strategies, this paper investigates the market structure and pricing characteristics of the Mauritanian octopus export market. In particular, we

examine the influence of exchange rates on the octopus price adjustment process, identify alternative market structures consistent with pricing performance by testing whether Mauritania price discriminates across destination markets, and investigate the time variation properties of marginal cost and export prices. By applying concepts from the empirical industrial organization literature to the cephalopod export pricing problem, we distinguish changes in marginal cost from changes in price markup, thereby identifying whether exporters act as if they are in a perfectly or imperfectly competitive environment. In a competitive market with constant marginal cost, exchange rate changes should be fully reflected in import prices. If the exporter has market power, he can adjust markups in destination markets as exchange rates fluctuate. As a result, imperfect exchange rate pass-through provides evidence of noncompetitive pricing. Identifying the nature of the octopus market, as revealed through exporter behavior, will provide an economic framework from which to evaluate the success of past policy decisions and guide future attempts to manage the Mauritanian octopus resource.

Industry and Market Characteristics

Japanese trawlers have operated off northwest Africa since at least 1959. In 1965 they discovered the Cap Blanc octopus fishing grounds off northern Mauritania (Hatanaka). The richness of this previously unexploited demersal fishery and the relatively high market value of octopus in their home country led the Japanese to rapidly expand fishing efforts. Mauritania initiated attempts to control access to the octopus fishery in 1970 by requiring Japanese trawlers to pay access fees to operate in Mauritania's inshore territorial waters. In subsequent years, Mauritania attempted to expand and enforce control over the octopus fishery and its exploitation, a process that accelerated with the 1978 declaration of a 200-mile economic exclusive zone and the implementation of Mauritania's first comprehensive plan for fisheries development.

While initial efforts at controlling the octopus fishery were aimed at biological resource management, problems in marketing octopus and other fishery products rapidly gained importance. In 1984, following extensive debate concerning the competitiveness of the octopus export market (Grebovál), Mauritania created the Société Mauritanienne de Commercialisation de Poisson (SMCP), or the Mauritanian Enterprise for Fish Commercialization. This organization, which was designed to counteract the perceived market power of Japanese importers, served as the only buyer of Mauritanian octopus landings and the only seller of Mauritanian octopus in the international market. The influence of the SMCP was enhanced in 1987 with the nationalization of the cephalopod fishery, in effect restricting the octopus fishing grounds to Mauritanian-owned trawlers. By acting as the sole buyer and marketer of

octopus products, the SMCP hoped to significantly influence the market by reducing catch landings in foreign harbors, increasing the collection of foreign currency from cephalopod sales, and creating enhanced market opportunities for Mauritanian octopus products by at least developing countervailing market power (Gilly and Maucorps).

Although Mauritania has attempted to actively manage its cephalopod fishery and the marketing of its products, little formal information exists for making these kinds of economic decisions. The biological management of the octopus resource has been supported by numerous investigations into the population dynamics of the species, and it is understood that octopus migrate to offshore fishing grounds from shallower coastal waters, dispersing gradually and over a limited area. As a result, octopus can be considered a non-migratory, demersal fishery (Hatanaka). Economic management, however, has been based on a few studies of limited scope, and the actions of the SMCP tend to be based primarily on conjecture about the structure of the international market.

While there has been concern about the limited information base upon which to develop a national fishery policy, perhaps most problematic is the relevance of previous economic studies. Bertignac, Cunningham and Zouiri developed a model of the Moroccan cephalopod fishery, but with the assumption that Morocco was a price-taker in the international market and that the quantity landed in Morocco had no influence on the export price. Given the presence and activity of the SMCP, the Moroccan perfect competition model would appear to have limited usefulness in Mauritanian decision making. However, both the Moroccan study and a price-taking model developed by Catanzano have been used to support management and marketing decisions by the SMCP and the Mauritanian government. This raises the possibility that recent policies and marketing strategies may have undesirable long-term effects if the octopus export market is not perfectly competitive. In addition to the presence of the SMCP and coordinated Japanese buyers, inelastic demand and noncompetitive pricing may arise due to strong quality preferences in Japan and Mauritania's role as a major exporter. Indications of a basic misunderstanding of the Mauritanian export market was the unforecasted 1987 decrease in Japanese demand for octopus, a situation that led to lower-than-expected export prices and serious damage to the Mauritanian economy (Mitzuishi). Thus, a study that examines the nature of the Mauritanian octopus export market and its pricing characteristics would be useful to policymakers as they try to develop and manage marketing strategies for the cephalopod fishery.

Model Selection and Estimation

In a perfectly competitive market at equilibrium, an export firm will choose an output level that equates marginal cost with export price, thereby forming a clear

relationship between price and quantity supplied. Under these conditions, the supply curve represents the marginal cost of production for the export industry as a whole. By implication, exchange rate changes in a perfectly competitive export market will be completely passed through to prices in the importing country in order to maintain the law of one price. The more competitive the market, the closer the pass-through should come to unity. As a result, any devaluation in the exporter's currency should increase an importing country's demand for the exporter's product.

While appealing in theory, studies examining the extent of exchange rate pass-through have failed to strongly support the perfect market hypothesis for a wide range of industrial, agricultural and fishery products (Dunn; Isard; Pompelli and Pick; DeVoretz and Salvanes; Athukorala and Menon). One explanation for this result is that strong loyalty for particular types of products can cause demand within certain market segments to be inelastic. Within this context, Mauritania as a dominant exporter may view the octopus market not as a single competitive market, but as a number of market niches with unique demand elasticities. If a monopolistic export market exists, then there is no specific supply curve because output decisions depend not only on marginal cost, but also on an importer's demand curve that is not directly linked to quantity supplied. Thus, a one-to-one relationship between price and quantity exported does not necessarily hold, and shifts in demand can lead to changes in price with no changes in output and/or changes in output with no changes in price. Under these conditions, the markup of the monopolist is equal to the negative inverse of the elasticity of demand, a value that can be small with a very elastic demand function and relatively large with an inelastic demand function. Because exporters hold pricing power in monopolistic markets, they may find it profitable to not fully pass through exchange rate changes. As a result, one approach for testing the competitiveness of the export market would be to focus on the magnitude of divergence from perfect exchange rate pass-through.

Theoretical Model. Using the conceptual framework outlined above, a price discrimination model can be developed that explicitly recognizes incomplete exchange rate pass-through as consistent with two very different types of market structure. One structure would be competitive trade, wherein exchange rate changes are highly correlated with large changes in import demand, perhaps due to industry-wide changes in marginal cost. The second structure is the imperfectly competitive market, wherein exporters are capable of price discrimination across destination markets by manipulating markup over marginal cost, or "pricing to market" (Krugman). Assuming that export price behavior must reflect the influence of changing marginal cost and that a single country of interest is selling its products to any number of other countries, each with a unique demand curve, then export demand can be defined as (Knetter):

$$q_{it} = f_i(s_{it}, p_{it})(v_{it}) \qquad i = 1,...,n \text{ and } t \qquad (1)$$

where: q_{it} is the quantity demanded by destination market I in period t, is the exchange rate (destination market currency per unit of the exporter's currency), p_{it} is the price in terms of the exporter's currency, v_{it} is a random variable that may shift the demand curve, n is the total number of markets, and T is the time horizon. Given this demand relationship, the exporter's cost function is defined by

$$C_t = C\left(\sum_{i=1}^{n} q_{it}\right) \delta_t \tag{2}$$

where C_t is the total cost in domestic currency units at time t and δ_t is a random variable that may shift the cost curve $C(\cdot)$. Using equations (1) and (2), the exporter's profit function in period t can be expressed as

$$\pi_t = \sum_{1}^{n} p_{it} q_{it} - C\left(\sum_{1}^{n} q_{it}\right) \delta_t \tag{3}$$

Substituting the export demand functions into the profit function and maximizing with respect to the price charged in each period yields a set of first order conditions of the form:

$$p_{it} = c_t \left(\epsilon_{it} / (\epsilon_{it} - 1)\right) \quad i = 1,\ldots,n \quad \textit{and} \quad t = 1, \tag{4}$$

where:

$$c_t = \frac{\partial C}{\partial q_{it}} \delta_t \tag{5}$$

with c_t being the marginal cost of production in period t and ϵ_{it} the elasticity of demand for imports in country I with respect to the local currency price. These conditions describe the prices, in the exporter's currency, that are marked up over marginal cost, with the markup determined by the elasticity of demand in various destination markets. Equation (4), which indicates that a price discriminating monopolist will equate marginal cost to marginal revenue in each market, can be used to distinguish among three market structure alternatives; the competitive market model and two versions of the price discrimination model (Knetter). In the perfectly competitive case, demand elasticities will be infinite and independent of destination. As a result, there will be no markup over the marginal cost of production. Instead, the exporter chooses a level of output at which marginal cost is equal to the world price. However, if demand elasticities are finite and constant across destination markets, then exporters are practicing uniform price discrimination. Uniform price discrimination

involves having the price charged to each destination market be a fixed markup over the marginal cost of production, with the marginal cost being common across destinations, but possibly varying over time. If the demand elasticities are found to vary by destination market, then export prices are being determined, at least partially, by country-specific exchange rates and exporters are practicing a targeted form of price discrimination.

Empirical Model. There are a number of ways to empirically adapt the theoretical framework to the Mauritanian octopus market, with the exact form dependent on the objectives of the study and the structure of the data set (Menon). Structural models that include substitute prices have been advocated by some researchers (Aw; Athukorala and Menon), but the data requirements often cannot be met when examining developing countries. As an alternative, reduced-form models can provide substantial insight into market pricing behavior when data is relatively limiting (Knetter; Yumkella, Unnevehr and Garcia; Dwyer, Kent and Pease).

Given that more than one export market will be of interest at any point in time, and that these markets need to be observed over time, then the required data will have both cross-sectional and time-series characteristics. Problems involving cross-sectional data generally require examining a set of economic functions whose disturbances at any point in time may reflect common unmeasurable factors (contemporaneous correlation). In addition, the use of time-series data always raises the possibility of serial correlation in the disturbances. Thus, simultaneous use of cross-sectional and time-series data requires a specification and estimation procedure that explicitly accounts for both contemporaneous and serial correlation. One way to accommodate all of these modeling concerns is through the use of a seemingly unrelated regression (SUR) approach (Judge et al.):

$$P_i = X_i \mathrm{B}_i + e_i \qquad i=1,...,M \tag{6}$$

where P_i is a $(Tx1)$ vector of logged average octopus price in destination market I, X_i is a (TxK) matrix of observations on the K explanatory variables in destination market I (including exchange rate and country, seasonal, and yearly dummy variables), B_i is a $(Kx1)$ vector of coefficients (including λ_i for the country effect, β_i exchange rate effects, α_{ij} , j=1,...,3 seasonal effects, and θ_{in} , n=1,...,5 yearly effects), e_i is a $(Tx1)$ vector of disturbances, T is the number of time-series observations, and M is the number of destination markets. Use of the SUR model requires that the error structure of the data be carefully examined in order to identify the appropriate data transformations and estimator.

Once estimated, interpretation of equation (6) is straightforward. Because imperfect markets are characterized by finite demand elasticities, price charged to each destination should be a fixed markup over marginal cost unless demand elasticities

vary across destinations. Marginal cost is assumed common across all destination markets, but may vary over time. Thus, the time variables in equation (6) will measure the effects of changes in marginal cost and the country effects will measure the impact of changing markup. There should be no residual correlation between export price and destination specific exchange rates unless Mauritania is practicing some form of price discrimination. In other words, an imperfect market with constant demand elasticities should have an insignificant exchange rate effect and a significant country effect ($\beta_i = 0$, $\lambda_i \neq 0$), indicating that the monopolistic exporter can segment markets by destination. If the exchange rate effect is also significant ($\beta_i \neq 0$), then demand elasticities and the optimal markup over marginal cost for a monopolistic exporter will vary with exchange rate changes. In a competitive market at equilibrium, price should be equal across all destinations, or both exchange rate and country effects should be insignificant ($\beta_i = 0$, $\lambda_i = 0$). If there is no residual variation between country effect and exchange rates, then e_i will also equal zero. This approach was used by Knetter to examine the competitiveness of trade in manufactured products and by Yumkella, Unnevehr and Garcia to investigate trade in rice.

Data and Estimation. Data used in estimating equation (6) covered the years 1985-1990 and was obtained from the National Oceanographic Center of Mauritania (CNROP). Monthly real octopus export prices by size class were calculated as an average of the ten-day price that is negotiated between the SMCP and export buyers. There are nine size classes for octopus sold to the Japanese market, with the vast majority of exports (>90 percent) falling in the first four size classes. Because these four Japanese size classes also accounted for most of the export value of octopus and corresponded to the highest quality size class exported to Europe, they were aggregated for the purposes of this estimation. Exchange rate information was obtained from various issues of *International Financial Statistics* (International Monetary Fund).

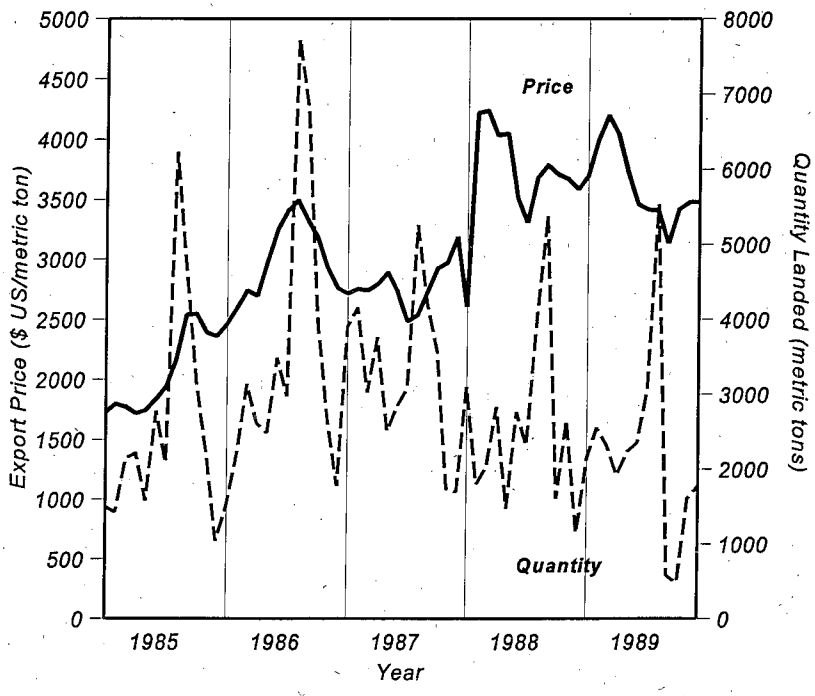
Although it was known that octopus exports to Europe were primarily destined for retail markets in Spain, Italy and/or Greece, the data did not include the specific quantities exported to each market. This lack of information prevented both the calculation of a weighted exchange rate to be used in a composite Japan versus Europe model. In addition, the data only included a single European destination price, not separate prices for each destination market. This latter data constraint prevented the estimation of a completely disaggregate SUR model explicitly containing all the European countries. Given these data limitations, three separate pooled, cross-sectional time-series models were estimated for Mauritanian octopus exports: Japan versus Greece, Japan versus Italy, and Japan versus Spain. Thus, M=2 in equation (6) for three separate models. Each of these models was estimated using the same price series for the included European country. Individuals involved in the Mauritanian

octopus fishery indicated that most of the exports destined for other European countries were initially shipped to Spain and that the Spanish export market would be expected to have a significant influence on Mauritanian marketing strategy. Thus, divergence from the Japan-versus-Spain model deserve close scrutiny and interpretation.

The potential effects of time on the model were included through both yearly and seasonal dummy variables. Seasonal effects were divided into quarterly periods. The first seasonal dummy, covering January to March, corresponded to a traditional harvest period during which octopus landings tend to be rising. The second period, April to June, corresponded to the octopus reproduction season and generally reduced harvest. July through September is a season of high volume landings and a period during which Japanese importers buy large quantities of octopus in preparation for the annual Japanese holiday season (Mitzuishi). This holiday season, or the fourth yearly period, also corresponds with a second wave of octopus reproduction and substantially reduced harvest (Figure 1).

Given the theoretical structure of equation (4), the natural logarithms of export prices and exchange rates were used in estimating the empirical models. Given the two-function specification suggested by equation (6) and the paired market comparisons (M=2), the data were examined for serial correlation by testing the joint hypothesis of no first degree autoregressive disturbances in each market using the Durbin-Watson statistic. The null hypothesis was rejected ($\alpha \leq 0.001$), indicating the need to account for autoregressive disturbances in the estimation procedure. The deseasonalized price series were tested for unit roots using the augmented Dickey-Fuller statistic (Hamilton, p. 516-530). The test rejected the null hypothesis of a unit root ($\alpha \leq 0.10$), indicating that the price series can be modeled as a stationary process. In addition, application of the Breusch-Pagan LM statistic for testing the null hypothesis of a diagonal covariance matrix led to rejection ($\alpha \leq 0.001$). Taken together, these tests indicated the need to transform the data to account for a first degree vector autoregressive error structure before obtaining the seemingly unrelated, generalized least squares (SUR-EGLS) estimator. Residuals from the model corrected for a first degree autoregressive structure were well behaved and did not indicate the need to include higher-order autocorrelation processes. Heteroskedasticity, a frequent occurrence in combined cross-sectional, time-series models, was not a significant problem in the data set. Goodness of fit for the estimated SUR systems was calculated using McElroy's multi-equation analog of Buse's R^2 (Judge et al. 1985, p. 477-478), while cross-equation tests of exchange rate, seasonal and yearly effects were conducted using the appropriate general F-statistic (Judge et al., p. 475). Details of the statistical tests, data transforms and the EGLS estimator can be found in Judge et al. Statistical calculations were conducted using Gauss 2.0.

Figure 1.
Yearly and Seasonal Relationships Between Export Price and Landed Quantity for Mauritanian Octopus



Empirical Results and Discussion

The corrected SUR estimates for the Japan-Greece, Japan-Italy, and Japan-Spain export price models are presented in Tables 1-3. In the Japan-Greece model, overall significance as measured by McElroy's multi-equation analog of Buse's R^2 was quite high and reinforced by a large number of statistically significant independent variable coefficients (Table 1). The estimated exchange rate coefficient was significant and negative in the Japan model, suggesting that export prices to Japan vary with exchange rates and that negotiated export prices tend to compensate for the relative price changes in the local currency that are induced by exchange rate fluctuations. This price discrimination process has been termed "local currency price stabilization" and

Table 1.
Estimated Seemingly Unrelated Regression Model for Price[a] Determination in Mauritania's Japan and Greece Octopus Export Markets (Corrected for Auto-correlation of Degree One and Lagged Cross Equation Error Correlations)

	Japan		Greece	
Variable	Estimated Coefficient	T-Ratio	Estimated Coefficient	T-Ratio
Constant	16.937	7.663	16.937	7.663
Exchange Rate	-1.781	-4.237	2.231	5.002
Country Effect	----	----	-21.505	-6.135
Season 1	0.631	14.256	0.754	14.690
Season 2	0.682	15.465	0.763	15.658
Season 3	0.071	1.694	0.082	1.903
Year 1985	-0.137	-1.367	0.528	2.574
Year 1986	-0.098	-1.846	0.471	3.228
Year 1987	-0.201	-3.461	0.313	2.656
Year 1988	-0.121	-1.579	0.449	5.059
Year 1989	-0.106	-1.563	0.251	3.657
Total Number of Observations = 144				
Goodness of Fit (Buse R^2): = 0.964				

[a]Real prices denominated in Mauritanian currency (ouguiyas) were used in the estimation.

it reflects optimizing behavior on the part of exporters trying to maximize profits in currency units of the destination market (Knetter). However, the estimated exchange rate coefficient for Greece was significant and positive, suggesting that the SMCP negotiates European export prices in a way that reinforces the effect of exchange rate fluctuations on the local currency price. The significance of this result is reinforced by the fact that a test for a common exchange rate coefficient between the two countries is decisively rejected (Table 4). However, this behavior can only be optimal for Mauritania if the SMCP perceives, conditional on the estimated marginal costs, that demand schedules in Greece are more convex than a constant elasticity demand schedule. It is obvious from the negative country effect that Mauritania conducts a differential markup strategy between the two countries, with the markup to Greece

Table 2.
Estimated Seemingly Unrelated Regression Model for Price[a] Determination in Mauritania's Japan and Italy Octopus Export Markets (Corrected for Autocorrelation of Degree One and Lagged Cross Equation Error Correlations)

	Japan		Italy	
Variable	Estimated Coefficient	T-Ratio	Estimated Coefficient	T-Ratio
Constant	19.521	8.746	19.521	8.746
Exchange Rate	-2.277	-5.362	-2.321	-3.061
Country Effect	----	----	5.144	0.853
Season 1	0.653	14.414	0.645	13.945
Season 2	0.715	15.696	0.692	14.152
Season 3	0.094	2.204	0.019	0.431
Year 1985	0.003	0.034	-0.114	-0.833
Year 1986	-0.099	-1.744	0.002	0.026
Year 1987	-0.223	-3.676	-0.081	-1.101
Year 1988	-0.156	-1.991	0.292	3.435
Year 1989	-0.135	-1.928	0.269	3.277
Total Number of Observations = 144				
Goodness of Fit (Buse R^2): = 0.929				

[a] Real prices denominated in Mauritanian currency (ouguiyas) were used in the estimation.

being significantly lower than that charged to Japan. This suggests that Greece may be viewed as a residual market for octopus, and as such may not be subject to a well-defined SMCP price negotiating strategy. An additional complicating factor in the interpretation of the positive exchange rate effect is the absence of substitutes in the reduced-form model, a limitation that prevents examination of how pricing behavior for other cephalopod species affects octopus export prices.

Given the significant exchange-rate and country effects, and thus rejection of the constant elasticity hypothesis, time effects in the Japan-Greece model cannot be interpreted as exactly measuring changes in the marginal costs of production. Nonetheless, the estimated model implies that changes in the prices charged to Japan and Greece are not merely the result of fluctuating markups, but also reflective of

Table 3.
Estimated Seemingly Unrelated Regression Model for Price[a] Determination in Mauritania's Japan and Spain Octopus Export Markets (Corrected for Auto-correlation of Degree One and Lagged Cross Equation Error Correlations)

	Japan		Spain	
Variable	Estimated Coefficient	T-Ratio	Estimated Coefficient	T-Ratio
Constant	19.794	8.826	19.794	8.826
Exchange Rate	-2.326	-5.453	-0.761	-0.934
Country Effect	----	----	-8.532	-1.789
Season 1	0.646	14.539	0.621	12.249
Season 2	0.702	15.854	0.668	13.155
Season 3	0.082	1.941	0.001	0.031
Year 1985	-0.011	-0.109	-0.287	-1.566
Year 1986	-0.096	-1.821	-0.041	-0.268
Year 1987	-0.234	-4.051	-0.048	-0.359
Year 1988	-0.186	-2.404	0.258	2.139
Year 1989	-0.152	-2.237	0.201	2.149
Total Number of Observations = 144				
Goodness of Fit (Buse R^2): = 0.962				

[a]Real prices denominated in Mauritanian currency (ouguiyas) were used in the estimation.

changes in the underlying marginal cost structure. As expected, seasonality coefficients were positive and highly significant in determining export price for both Japan and Greece, in part reflecting the seasonally variable demand and the underlying population dynamics of harvestable octopus. The fact that these seasonal variables are measuring more than just biology-induced changing marginal costs is evidenced by rejection of the constant cross-country seasonal effect hypothesis (Table 4). This result is reinforced by significantly different yearly effects between Japan and Greece, both in terms of magnitude and sign (Tables 3, 4). In addition, the negative yearly effects in the Japan estimation along with non-model evidence that Mauritania continues to increase its share of the Japanese octopus market suggest that the SMCP price negotiations are at least partially driven by market enhancement objectives. The

Table 4.
Tests for Common Exchange Rate, Seasonal, and Yearly Effects Between Japan and Alternate Markets for Mauritania's Octopus Exports

Null Hypothesis	Test Statistic	Calculated Statistic for Japan/Greece Comparison	Calculated Statistic for Japan/Italy Comparison	Calculated Statistic for Japan/Spain Comparison
Common Exchange Rate	3.841 F(1,142,0.05)	37.348	0.003	2.689
Common Seasonal Effects	2.601 F(3,138,0.05)	6.982	3.404	3.192
Common Yearly Effects	2.212 F(5,134,0.05)	32.227	29.653	29.038

significantly positive relationship between year and price for Greece may be more reflective of the true underlying changes in marginal cost, especially if the SMCP considers Greece to be a residual market.

Similar to the Japan-Greece model, the overall significance of the Japan-Italy model was relatively high as measured by McElroy's multi-equation analog of Buse's R^2 (Table 2). However, other aspects of the Japan-Italy model were quite different. The exchange rate coefficient was significant and negative in both the Japan and Italy equations, suggesting that the SMCP practices price discrimination in the form of local currency price stabilization with respect to Italy as well as Japan. In fact, the hypothesis of a common exchange rate effect could not be rejected for the Japan-Italy model (Table 4). The coefficient for country effect in the Japan-Italy model was insignificant, suggesting that Mauritanian markup behavior does not discriminate between the two markets and that both Japan and Italy are considered to be primary export destinations. These results are consistent with simple international price discrimination models that conceptualize pricing behavior as being driven by profit maximization objectives, thus generating significant incentives to price stabilize in the local currency. Strong seasonal effects were also present in the Japan-Italy model, particularly with respect to the first two quarters. However, yearly time effects were more variable in the Japan-Italy model, and were only significant in the latter part of the time series for Italy. Nonetheless, the hypothesis of common seasonal and yearly effects was rejected (Table 4), again indicating that the time variables are measuring something in addition to changing marginal cost. The significantly negative yearly effects for the Japan equation, coupled with the positive time effects in the last couple

of years for the Italy equation, reinforce the hypothesis that SMCP pricing behavior has focused on securing Japanese market share.

In contrast to the Japan-Greece and Japan-Italy models, exchange rates were not a significant influence on pricing for either country in the Japan-Spain model (Table 3). While the exchange rate coefficient was negative and significant for Japan, and approximately of the same magnitude as in the Japan-Italy model, it was insignificant for Spain. Combined with a lack of significance at the $\alpha \leq 0.05$ level for the country effect, the results indicate a competitive market outcome with constant elasticity of demand in the case of Spain. Under these conditions, the yearly time effects for Spain should come the closest to measuring the actual changes in marginal cost over time, and they indicate increasing marginal costs since 1987. The yearly effects for Japan and the seasonal effects for both Japan and Spain are similar to those estimated in the other two models, again suggesting the important influences of seasonal demand, fluctuating octopus populations, and the SMCP's apparent goal of increasing Mauritania's share of the Japanese market. As in the Japan-Greece and Japan-Italy models, the hypotheses of common seasonal and yearly effects between Japan and Spain were rejected (Table 4).

Although the results were quite variable with respect to the European destination markets, taken together, the three estimated models portray an octopus export market to Japan that cannot be characterized as competitive. At least superficially, this result indicates that Mauritania has not achieved its goal of at least developing countervailing market power through the SMCP. However, there is strong evidence to suggest that the SMCP has successfully negotiated export prices to Japan that serve to maximize profits in the local currency. There are a number of reasons why this form of price stabilization might continue to exist over time, including standard imperfect competition, costs of adjustment, concern for market share, and the relative dominance of different currencies in international financial markets (Dunn; Knetter). While the fixed costs associated with establishing the marketing and distribution networks to each country may be partially responsible for the apparent price discrimination between Japan and the European countries, it fails to explain the differences in the form, or even the presence, of price discrimination among Greece, Italy and Spain. Another suggested reason for apparent price discrimination is the potential for invoicing asymmetries and short-run price stickiness in international trade (Magee). However, the augmented Dickey-Fuller tests did not support nonstationary behavior, and therefore error-correction dynamics, in the price series. Perhaps the most logical reason for continued price discrimination in the octopus export market to Japan concerns the nature of Mauritania's competition in the Japanese market.

Viewed from the framework of a Cournot oligopoly trade model with linear demands, the number of firms in any given market should be inversely related to the magnitude of exchange rate influences on local currency prices (Dornbusch). Under these conditions, the practice of local currency price stabilization by Mauritania in the

Japanese market may be an effort to prevent the entry of alternate suppliers of octopus products. Given the extensive history and size of the Japanese cephalopod fishing industry, the SMCP may feel compelled to try and protect Mauritania's market share in its most lucrative market. One way of doing so would be to maintain a steady or slowly declining pricing schedule in the destination market. This goal of protecting and increasing market share, and its implications for price stabilization, indicates both the lack of a competitive destination market and the limited amount of price-enhancing market power enjoyed by the SMCP during the study period. However, as Mauritanian octopus products increase their penetration into the Japanese market, market power may increase and allow the SMCP to move toward a constant markup pricing strategy with respect to Japan. The variable results with respect to Greece, Italy and Spain, and the fact that less than 20 percent of Mauritanian octopus products are shipped to these countries, may reflect their lack of importance as an octopus export market relative to Japan. Thus, the results suggest that Mauritania has not developed a well-defined European marketing strategy. In addition, the competitive market outcome suggested by the estimated Japan-Spain model, as opposed to the other European models, may in part reflect the greater size and number of firms in the Spanish octopus market, including those from other West African nations.

Conclusion

This study examined the Mauritanian octopus export market for competitiveness and price discrimination using a seemingly unrelated regression model corrected for contemporaneous and serial correlation. The export market for Mauritanian octopus displayed evidence of both uniform and targeted price discrimination. This result is consistent with the contractual pricing arrangements between Mauritania's SMCP and Japanese importers. However, Mauritania's use of price discriminating power to pursue price stabilizing policies was unexpected, although this result provides an explanation for the increase in Japanese market share that Mauritanian octopus products have enjoyed in recent years. Thus, the SMCP appears to be at least partially fulfilling its mandate to enhance the market position of Mauritanian octopus products. One caveat to this conclusion concerns the lack of substitute prices in the reduced-form, estimated model. A structural model could be specified to include potential substitute products, but the appropriate data was not available for all the countries examined in this study. In addition, the literature on exchange rate pass-through suggests that the reduced-form model utilized in this study can provide substantial and reliable insight into export market behavior (Knetter; Yumkella, Unnevehr and Garcia; Dwyer, Kent and Pease).

Another significant aspect of the Mauritanian octopus export market is that it appears to be characterized by recent increases in the marginal cost of production. This

situation might be linked to inefficiencies that are developing in the recently nationalized trawler fleet, although in reality only the legal boat ownerships tended to change. Thus, the apparent changes in the structure of marginal cost may be more indicative of changing capital stock conditions and/or changes within the octopus biological stock. It is likely that both an aging fleet and problems in clearly defining sustainable harvest levels are to blame. In addition, while the nationals-only access policy has given the Mauritanian government greater control over the fishery, the resulting increase in costs may have negative long-run effects on the demand for octopus in both Europe and Japan. Mauritania is not likely to be able to continue a defacto price stabilization policy indefinitely in the face of a tightening cost-price squeeze. This underlying structure implies that SMCP promotion policies and market strategies will be the most effective at insuring the long-run survival of the octopus products industry if they are oriented toward identifying overlooked market windows in existing markets or developing access to new markets.

Notes

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