Measuring the Degree of Monopsony Power in the EU Fish Importing Industry: Implications for Ugandan Fresh and Chilled Fish Fillet Exports

Andrew Muhammad
Department of Economics and Finance
Southern University
PO Box 9723
Baton Rouge, LA 70813

Phone: (225) 771-5640
Fax: (225) 771-5262
E-mail: *andrew_muhammad@subr.edu*

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Abstract

Although France, Belgium and the Netherlands import a significant percentage of chilled fish fillet from Uganda, results suggest no significant degree of monopsony power is exercised by these countries. If Ugandan firms export to a few countries the competitive price should still prevail if there are many importing firms.

1. Introduction

The export of fish from Uganda has been an important source of revenue for the country. For the period 1998 through 2003, Uganda's fish exports grew in value from $14.7 million to $87.5 million. This growth had made fish exports the second largest source of export revenue (Uganda Export Promotion Board, 2005). Growth in fish exports has be so rapid that fish exports could likely overtake coffee as the country's leading source of foreign exchange (Africa Online, 2004).

Although fish exports have grown quite significantly in the last decade, Uganda is dependent on the European Union (EU) for a significant percentage of export disappearance. In 1996, EU countries imported 85 percent of Uganda's exports of fresh and chilled fish products and 24 percent of all frozen fish products. Currently, the EU imports about 70 percent of all fish exports with Belgium and the Netherlands being the primary destinations (Dijkstra, 2001; Uganda Investment Authority, 2000).

For many African countries, geographic concentration of export trade can have dire economic and political consequences. Firstly, exports are more vulnerable to fluctuations in imports and the economic conditions of principle markets. Secondly, exports are particularly vulnerable to protectionist policies in these markets. Lastly, countries are vulnerable to political pressures and forced concessions on non-trade issues (Moss and Ravenhill, 1989). McGowan

(1976) found evidence that African countries that export primarily to a single external market tend to manifest poorer economic performance overall than countries that have more diversified markets for their exports. Consequences of the EU dominating Ugandan fish trade occurred when the EU imposed successive import bans on Ugandan fish from February 1997 through June 1998 and March 1999 through August 2000. Although these bans were primarily imposed due to food safety concerns, protecting domestic industries was also a factor. As a result, much of the capital in the fish exporting industry went unused causing both prices and industry output to decline, resulting in substantial economic decline in both the exporting and domestic industry (Marriott, Dillon and Hannah, 2004).

In 2004, EU-15 member countries accounted for 9 of the top 15 importing countries of Ugandan fresh/chilled fish fillet. Total fresh/chilled fillet exports for that year were slightly over 19 million kilograms valued at $70.4 million. Of these totals, EU countries accounted for 92 percent of the total quantity and 89 percent of the total value. Belgium, France and the Netherlands alone accounted for over 70 percent of both quantity and value (Table 1).

[Insert Table 1 here]

The primary purpose of this paper is to measure the degree of monopsony power exercised by EU firms when importing fresh and chilled fish fillet from Uganda. Given that Belgium, France and the Netherlands account for most of the fish exported these are the countries considered in this study. The methodology used builds on the econometric method for determining oligopoly power introduced by Appelbaum (1982). This was extended to include buyer market power (oligopsony or monopsony power) by Schroeter (1988) and further developed by Murray (1995) and, Muth and Wohlgenant (1999). These studies focused on

domestic industries where the primary objective was determining market power in material input markets and intermediate products.

Given that the bulk of international trade consist of intermediate products in that processing is often required before reaching the final consumer, the above methods for determining monopsony power is applied to the fish importing industry in EU countries. Although fresh and chilled fish fillet arrive in final form there is enough domestic value added such as handling, insurance, transportation, storing and repackaging that these imports can be viewed as inputs or intermediate products. Burgess (1974), Kohli (1978) and Sanyal and Jones (1982) give a thorough discussion of traded goods as intermediate goods even is cases od little or no product transformation.

2. Methodology

Let the industry be comprised of N importing firms (indexed by j=1, 2,..., N) with each firm importing a country-specific commodity Q in its final form and then reselling Q domestically. Using labor, capital, and other resources these firms incur the cost of importing such as freight, insurance, transportation and storage. Given the behavior of these firms the quantity imported and output resold are identical and can be represented by the same variable. Note that this is similar to the fixed proportions technology assumption in Schroeter (1988). The inputs used to carry out the firm's activities (labor, capital, etc.) are employed in variable proportions and add value to the imported product through the services carried out by the firm. For a fixed level of output each firm will minimize the cost of employing these "value added" inputs when importing. If these inputs are purchased in competitive resource markets, a system of value-

added factor demand equations for the j^{th} firm can be derived using Shephard's lemma. The system of value-added factor demand equations are expressed generally is

$$\mathbf{x}^j = \partial C^j(Q^j, \mathbf{w}) / \partial \mathbf{w} . \quad (1)$$

$C^j(Q^j, \mathbf{w})$ is the j^{th} firm's value-added input cost function, Q^j is the firm's output (quantity imported) and $\mathbf{w}$ is the vector of value-added factor prices.

If firms are not price takers in import markets then each firm expects that total imports for the country and imports prices are affected to some degree by the amount of Q imported by the firm. Let the total amount of Q exported to the importing country and export price be represented by the following export supply function

$$Q = Q(P_x, \mathbf{Z}) \quad (2)$$

where P_x is the export price and $\mathbf{Z}$ is a vector of exogenous export supply determinants.

The problem for the j^{th} firm is to choose Q^j such that profit is maximized. Given that the total imported by the firm and the firm's output are identical, and given variable proportions technology for value-added inputs, the profit maximization problem (PMP) for the firm is

$$\underset{Q^j}{Max}\ \pi^j = P_d Q^j - P_x Q^j - C^j(Q^j, \mathbf{w}) \quad (3)$$

where P_d is importer's selling price (domestic prices). The first order necessary condition is

$$P_d - P_x - \frac{\partial P_x}{\partial Q^j} Q^j - \frac{\partial C^j(Q^j, \mathbf{w})}{\partial Q^j} = 0 \quad (4)$$

If the PMP is subject to equation (2) then $\partial P_x / \partial Q^j = (\partial Q / \partial Q^j)(\partial P_x / \partial Q)$. Letting $\theta^j = (\partial Q / \partial Q^j)(Q^j / Q)$ (the firm' conjectural elasticity) and $\varepsilon = (\partial Q / \partial P_x)(P_x / Q)$ (the export supply elasticity), the first order necessary condition is

$$P_d - P_x\left[1+\frac{\theta^j}{\varepsilon}\right]-\frac{\partial C^j(Q^j,\mathbf{w})}{\partial Q^j}=0 \qquad (5)$$

θ^j is the percentage change in the total amount of a good imported into a country given a percentage change in the amount imported by a firm in that country. If a country's total imports is unaffected by a change in what is imported by a firm then $\theta^j = 0$. For absolute monopsony power $Q^j \equiv Q$ and $\theta^j = 1$. Therefore for varying degrees of monopsony power $1 > \theta^j > 0$ and the appropriate test a test for competitive behavior is $\theta^j = 0$.

Solving for θ^j/ε results in an index measure of the monopsony price distortion

$$M^j = \frac{P_d - P_x - \dfrac{\partial C^j(Q^j,\mathbf{w})}{\partial Q^j}}{P_x} = \frac{\theta^j}{\varepsilon}. \qquad (6)$$

In the absence of market power the importing firms selling price should equal the price paid to the exporter and the marginal cost of value-added inputs. Note that this is the case only when $\theta^j/\varepsilon = 0$.

2.1 Industry aggregation

Given the difficulty in obtaining firm-level data, empirical analysis requires aggregation to the industry level. In order for equations (1), (3)-(5) to be considered on an aggregate industry level assumptions must be made about the cost function for value added inputs $C^j(Q^j,\mathbf{w})$. According to Appelbaum (1981) a Gorman form cost function for a representative firm satisfies the conditions required for industry aggregation. If the cost function is of the following form

$$C^j(Q^j,\mathbf{w}) = Q^j C(\mathbf{w}) + G^j(\mathbf{w}), \qquad j = 1, 2, \ldots, N \qquad (7)$$

Then firms have linear and parallel expansions paths, so that the marginal costs of value- added inputs are constant and equal across firms. Given this assumption, the industry demand for value added inputs is

$$\mathbf{x} = Q[\partial C(\mathbf{w})/\partial \mathbf{w}] + \sum_{j=1}^{N} \partial G^j(\mathbf{w})/\partial \mathbf{w} \tag{8}$$

Since $\partial C^j(Q^j, \mathbf{w})/\partial Q^j = C(\mathbf{w})$ for all firms, the industry level counterpart to equation (5) is

$$P_d = P_x\left[1 + \frac{\theta}{\varepsilon}\right] + C(\mathbf{w}).^1 \tag{9}$$

Equation (2), the export-supply equation, equation (8), the system of value-added factor demand equations and equation (9) provide a model that can be used to estimate monopsony price distortions.

3. Econometric specification and data

Having outlined the theoretical framework an application to the EU fish importing industries is provided. As mentioned, the purpose of this study is to determine the degree of monopsony power exercised by EU countries when importing fresh and chilled fish fillet from Uganda. Given that EU countries represent a significant percentage of Ugandan fish it is expected that Ugandan exports prices are greatly influence by EU imports.

To estimate the model, functional forms must be chosen for equations (2), (8) and (9) and a parameterization for the conjectural elasticity must be developed. Assuming only two value-

[1] Appelbaum (1981), and Muth and Wohlgenant (1999) provide a detailed explanation on the relationship between θ^j and θ, and the interpretation of θ given the assumed behavior of firms. It can be shown that $\theta = 1/N \sum_j \theta^j$ and if a Cournot import market is assumed then θ is a measure of the Herfindahl index.

added inputs labor and capital, the industry value-added input cost function in generalized Leontief form is

$$C(Q,\mathbf{w}) = \sum_{j=1}^{N} C^j(Q^j,\mathbf{w}) = Q\sum_i \sum_k b_{ik}(w_i w_k)^{\frac{1}{2}} + \sum_i b_i w_i \qquad (10)$$

Where the *b*'s are parameters to be estimated and $b_{ik} = b_{ki}$ for all *i* and *k*. Note that equation (10) is of Gorman form where $C(\mathbf{w}) = \sum_i \sum_k b_{ik}(w_i w_k)^{\frac{1}{2}}$ and $\sum_{j=1}^{N} G^j(\mathbf{w}) = \sum_i b_i w_i$. Using Shepard's lemma the capital and labor demand equations are

$$x_K = (b_{KK} + b_{LK}(w_L / w_K)^{\frac{1}{2}})Q + b_K \qquad (11)$$

$$x_L = (b_{LL} + b_{LK}(w_K / w_L)^{\frac{1}{2}})Q + b_L \,. \qquad (12)$$

The functional form for the first order condition equation (9) is

$$P_d = P_x\left[1 + \frac{\theta}{\varepsilon}\right] + (b_{LL}w_L + 2b_{LK}(w_L w_K)^{\frac{1}{2}} + b_{KK}w_K)\,. \qquad (13)$$

For the export supply equation (equation (2)) assume the following functional form

$$\ln Q = b_0 + \varepsilon \ln P_x + \sum_i b_i \ln Z_i \qquad (14)$$

Following Appelbaum (1981) and Schroeter (1988) the conjectural elasticity θ is approximated linearly as a function of the exogenous variables and a trend term to account for excluded variable, define under the following linear specification

$$\theta_t = \theta_0 + \theta_1 w_K + \theta_2 w_L + \theta_3 t \,. \qquad (15)$$

3.1 Data and estimation

Panel data is used to estimate the model. The time period is 1994-2004 and the countries are Belgium, France and the Netherlands. The Commodity Trade Statistics section of the United

Nations provided Chilled fish fillet imports values and quantities. Per unit import values for the EU countries ($ per kilogram) were proxies for Uganda export prices (the price at which the EU countries pay Uganda for fish) and per unit export values were proxies for EU countries selling prices (the price at which the EU importing firms charge when reselling fish domestically or re-exporting). Real interest rates were provided by the World Bank Development Indicators and represented the price of capital. For each EU country a national wage index was used for the price of labor and was obtained from the Bureau of Labor Statistics.

Due to limited data the labor and capital demand equations could not be estimated and only equations (13)-(15) are estimated. Substituting equation (15) into equation (13) and solving for the difference in the domestic selling price and the price paid for imports, the first order condition with an error component is expressed as follows:

$$\begin{aligned}(Pd-Px)_{it} = {} & \frac{\theta_0}{\varepsilon}Px_{it} + \frac{\theta_1}{\varepsilon}(Px\bullet r)_{it} + \frac{\theta_2}{\varepsilon}(Px\bullet w)_{it} + \frac{\theta_3}{\varepsilon}(Px\bullet t)_{it} \\ & + \frac{\delta_1}{\varepsilon}(Px\bullet D_{Belgium})_{it} + \frac{\delta_2}{\varepsilon}(Px\bullet D_{France})_{it} \\ & + b_{KK}r_{it} + b_{LK}[2(w_L w_K)^{\frac{1}{2}}]_{it} + b_{LL}w_l + \gamma_B D_{Belgium} + \gamma_F D_{France} + \mu_{it}\end{aligned} \tag{16}$$

The export supply equation with error is

$$\ln Q_{it} = b_0 + \varepsilon \ln Px^*_{it} + b_1 t + b_2 rug_{it} + b_3 D_{Belgium} + b_4 D_{France} + \mu'_{it} \tag{17}$$

where *t* is the trend term, *rug* is the real interest rate for Uganda, $D_{Belgium}$ is a dummy variable that is equal to 1 if exports are to Belgium and 0 otherwise. D_{France} is equal to 1 if exports are to France and 0 otherwise. Equations (16) and (17) are estimated jointly using maximum likelihood and country dummies are added to the first order condition, export supply equation and the conjectural elasticity specification to account for cross-country effects (fixed effects).

4. Empirical results

The results of the estimation of equations (16) and (17) are presented in Tables 2 and 3 respectively. The R^2 for the estimation of the first order condition is 0.82.and all except three of the parameter estimates are significant by at least the 0.10 significance level. According to Schroeter (1988), the cost function is well behaved if b_{KK}, b_{LK}, and b_{LL} are all significantly positive. Concavity is guaranteed if b_{LK} is positive. From the results concavity holds, however the negative estimates for b_{KK} and b_{LL} suggest that the cost function is not well behave. Negative estimates for b_{KK} and b_{LL} may be due to the labor and capital demand equations not being estimated jointly with the equations (16) and (17).

The R^2 for the export supply estimation is 0.69. The export supply elasticity (0.978) is positive as expected, however it is insignificant. The trend tern is significant (0.350) which indicates that given the other independent variables, exports to the EU countries have been increasing overtime. Also as expected the real interest rate in Uganda has a significant negative impact on the exports supply to the EU countries (-0.069).

[Insert Table 2 here]

[Insert Table 3 here]

Table 4 presents the monopsony price distortion for Belgium, France and the Netherlands from 1994 through 2004. The significance of the price distortions indicate the presence of monopsony power, which suggest that the importing country has influence on the prices received by Ugandan exporters. For Belgium and the Netherlands the monopsony distortion is insignificant for all years indicating that Ugandan prices are not significantly marked down below the price that would prevail under a perfectly competitive import market. For the Netherlands most of the monopsony distortions are insignificant as well, however for the years

1996, 1999, 2002, 2003 and 2004 the monopsony distortions are actually negative which goes against theory and rational firm behavior (firm importing at an economic loss). Although a negative price distortion is against theory, this does suggest that for the Netherlands, importing a significant percentage of Ugandan fish has not resulted in monopsony price markdowns.

[Insert Table 4 here]

5. Summary and Conclusions

The purpose of this paper was to measure the degree of monopsony power exercised by EU firms when importing fresh and chilled fish fillet from Uganda. Given that Belgium, France and the Netherlands account for over 70 percent of all chilled fish fillet exported from Uganda it is likely that export prices are marked downed due to possible monopsony power.

Although France, Belgium and the Netherlands import a significant percentage of chilled fish fillet from Uganda, results suggest that no significant degree of monopsony power is exercised by any the EU countries. A possible explanation is that given the number of importing firms in a country monopsony power may not be realized unless some form of collusion is possible (tacit or otherwise). This suggests that if Ugandan firms export to a few countries the competitive price should still prevail so long as there are many importing firms within these countries.

Table 1
Ugandan Fresh and Chilled Fish Fillets Exports: Top 15 Importing Countries for 2004[a]

Importing Country	Value (US dollars)	Quantity (kilograms)	% of Value	% of Quantity
World	$ 70,397,185	19,137,737	100.00	100.00
Belgium[b]	21,193,484	6,092,039	30.11	31.83
France	19,092,814	5,465,269	27.12	28.56
Netherlands	10,421,620	3,009,625	14.80	15.73
United States	4,741,809	822,187	6.74	4.30
Germany	4,730,778	968,312	6.72	5.06
Spain	4,441,554	1,174,437	6.31	6.14
Luxembourg	2,128,409	632,125	3.02	3.30
United Arab Emirates	1,710,604	487,187	2.43	2.55
Italy	806,346	184,031	1.15	0.96
Lebanon	361,340	111,460	0.51	0.58
Canada	265,496	36,101	0.38	0.19
United Kingdom	99,128	29,902	0.14	0.16
Singapore	86,978	17,570	0.12	0.09
Greece	60,848	17,398	0.09	0.09
Nigeria	51,130	15,375	0.07	0.08
Total EU	**$ 62,974,981**	**17,573,138**	**89.46**	**91.82**

[a] Top 15 countries represent 99.7 percent and 99.6 percent of the total value and quantity respectively.
[b] EU(15) countries are italics.
Source: United Nations Commodity Trade Statistical Data Base, 2005.

Table 2
Maximum Likelihood Estimation Results for First Order Condition

Parameter	Estimate	SE
θ_0/ε	0.044	0.294
θ_1/ε	0.293	0.150*
θ_2/ε	-0.025	0.009***
θ_3/ε	0.031	0.010***
δ_1/ε	-1.376	0.482***
δ_2/ε	-0.744	0.505
b_{KK}	-3.295	0.460***
b_{LK}	0.532	0.057***
b_{LL}	-0.011	0.425
γ_B	5.024	0.333***
γ_F	3.165	1.916**

$R^2 = 0.82$

*** Significant level = .01
** Significant level = .05
* Significant level = .10

Table 3
Maximum Likelihood Estimation Results for Export Supply Equation

Parameter	Estimate	SE
b_0	11.724	1.250***
ε	0.978	0.815
b_1	0.350	0.090***
b_2	-0.069	0.037*
b_3	-0.146	0.609
b_4	-4.146	0.609***

$R^2 = 0.69$

*** Significant level = .01
* Significant level = .10

Table 4
Monopsony Price Distortion Estimates for Belgium, France and The Netherlands: 1994-2004

	Belgium		France		Netherlands	
Year	Estimate	SE	Estimate	SE	Estimate	SE
1994	-0.041	(0.462)	-0.188	(0.404)	-0.132	(0.423)
1995	-0.092	(0.494)	-0.078	(0.476)	-0.436	(0.383)
1996	-0.272	(0.387)	-0.402	(0.356)	**-0.668**	**(0.321)**
1997	0.151	(0.430)	-0.017	(0.357)	-0.240	(0.322)
1998	0.258	(0.456)	0.184	(0.396)	-0.104	(0.352)
1999	0.166	(0.397)	0.255	(0.390)	**-0.892**	**(0.346)**
2000	0.884	(0.633)	0.660	(0.495)	-0.191	(0.247)
2001	1.032	(0.693)	0.803	(0.539)	-0.129	(0.256)
2002	0.757	(0.566)	0.625	(0.463)	**-0.563**	**(0.282)**
2003	0.196	(0.393)	0.261	(0.383)	**-1.271**	**(0.515)**
2004	0.435	(0.415)	0.115	(0.361)	**-1.524**	**(0.618)**

Bold Indicate Significance of at least 0.05.

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