The Sources of Oligopsony Power in the Haitian Coffee Market

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Abstract

This paper extends Appelbaum's model to test for potential sources of oligopsony power and determinants of the number of exporters in the Haitian coffee market. The analysis and results provide insights into consequences of government policy alternatives.

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Because the issue of market power–the ability to influence price or quantity flow in the marketplace–is quite important in agriculture, one is interested in investigating whether or not market power is *actually* being exercised and to what extent. In addition, one is interested in identifying the sources of market power to provide useful information to the policy-making process.

Perhaps, the most plausible conceptual and empirical approach to measuring and testing the degree of market power is provided by Appelbaum. Assuming identical marginal costs and conjectural variation elasticities across firms, Appelbaum developed an econometric model that converts the price/marginal cost gap to a measurable and testable oligopoly index. The approach has been applied to the U.S. beef-packing industry (Azzam et al., Schroeter) and marketing orders (Taylor and Kilmer). Other approaches have been applied to tomatoes (Just and Chern; Melnick and Shalit), and cigarettes (Sumner). Although the focus of previous work has been on "measuring and testing," an empirical analysis of the sources of market power is lacking.

This paper attempts to identify some of the sources of oligopsony power in the Haitian coffee market. The methodology follows the work of Appelbaum, Schroeter, and Azzam et al. Features of the empirical model include supply response of a perennial crop, accounting for the export and domestic markets, institutional changes, and endogenizing the number of exporters in the market.

Conceptual Framework

The Haitian coffee market provides an interesting case study for measuring the degree and determining the sources of market power. Aside from the Haitian government, which sets export taxes and prescribes licensing requirements to intermediaries, there are five major participants in the Haitian coffee marketing chain: producers, primary intermediaries (speculators), exporters, domestic wholesalers, and consumers.[1] In 1984, there were approximately 250,000 producers, 800 speculators (primary intermediaries), 18 exporters, and several thousand domestic wholesalers operating in the market (Seguino).

The average Haitian coffee producer is a small multiproduct farmer who can best be characterized as a peasant. Intermediaries who buy coffee from the farmers are called "speculateurs" (herein called speculators). Speculators provide coffee growers with credit needed for harvesting and even for personal needs, and the loans are repayable in coffee or money. The effective interest rates on these loans has been reported to be as high as 100 percent per year (Seguino). Speculators handle coffee for both the domestic and export markets.

Coffee for the domestic market is handled by domestic wholesalers who buy coffee from speculators and sell it to local merchants. Many wholesalers and merchants not only deal in coffee but also distribute other agricultural commodities. Also, wholesalers are very mobile and are not bound to any particular speculator for their capital or coffee supply needs. Although the speculators also buy coffee from the peasants for the export market, they essentially act as agents of the exporters. (Capital Consult). In 1960, coffee exporters formed an association that, in 1977, established an internal quota system to coordinate their purchases for export.

For the purpose of this paper, market participants are aggregated into three groups: exporters, coffee growers, and domestic wholesalers. Coffee growers are price takers, and their market supply is given by $Q^s = f(P, Z^s)$, where Q^s is quantity of coffee supplied, P is coffee price received, and Z^s is a vector of relevant variables other than the price of coffee. Domestic consumers and wholesalers are also price takers, and their derived market demand is given by $Q^d = g(P, Z^d)$ where Q^d is the quantity of coffee consumed domestically, and Z^d is a vector of other relevant variables that affect demand. Letting the domestic wholesalers be competitive, the coffee supply available for exports is given by $Q^s - Q^d = Q$. Let q_i denote the amount of coffee bought by the i^{th} exporter and let the total amount bought by all exporters be given by $Q = \sum q_i (i = 1, \cdots, N)$. The exporters' profit-maximization problem is given by

$$\max \pi_i = P_w(1 - t^a)q_i - C^i(q_i) - Pq_i \tag{1}$$

where P_w is the f.o.b. world price of coffee received by exporters t^a is the tax rate on coffee exports imposed by the Haitian government, and C^i is the intermediary's processing and handling cost. The first-order condition for profit maximization is

$$\frac{\partial \pi_i}{\partial q_i} = P_w(1 - t^a) - \frac{\partial C^i}{\partial q_i} - P - \frac{\partial P}{\partial q_i} q_i = 0. \tag{2}$$

Applying the chain rule and multiplying and dividing by Q, leads to the perceived impact of coffee expenditures through change in prices, given by

$$\frac{\partial P}{\partial q_i} q_i = \frac{\partial P}{\partial Q} \frac{\partial Q}{\partial q_i} q_i \frac{Q}{Q} = \theta_i \frac{\partial P}{\partial Q} Q, \tag{3}$$

where $\theta_i = (\partial Q / \partial q_i)(q_i / Q)$ is the conjectural variation elasticity, an exporter's perception of the change in purchases by all exporters in response

to a 1 percent change in purchases. Analogous to Appelbaum's conjectural elasticity, θ_i ranges from 0 for perfect competitive behavior to 1 for perfect collusion or monopsonistic behavior. Rewriting equation (2),

$$P_w(1-t^a) - \frac{\partial C^i}{\partial q_i} - P(1+\frac{\theta_i}{\eta}) = 0, \tag{4}$$

where η is the price elasticity of market supply available for exports. To maximize profits, an exporter equates net value of marginal product (first two terms) to *perceived* marginal input cost (last term). To measure oligopsony power, consider the analogue of the Lerner index for the i^{th} intermediary and use equation (4) to obtain

$$L_i = \frac{VMP_i - P}{P} = \frac{\theta_i}{\eta}, \tag{5}$$

where VMP_i is the after-tax value of marginal product of q_i previously defined. L_i ranges from 0 for perfect competition to $1/\eta$ for a monopsonist.[2] This measure is the buying power analogue of Appelbaum's measure of oligopoly power. An aggregate Lerner index, computed from the individual intermediaries' Lerner indexes is given by

$$L = \sum_i \frac{\theta_i}{\eta} s_i, \tag{6}$$

where $s_i = q_i/Q$ is the intermediary's share of the coffee market. At equilibrium let the marginal marketing cost and conjectural variation elasticity be the same across intermediaries ($\partial C^i/\partial q_i = mc_i = mc_j = mc$ and $\theta_i = \theta_j = \theta$ for all i *and* j).[3] An aggregate price-setting behavior of intermediaries, based individually on equation (4) can be described as

$$P^* = \frac{P_w(1-t^a) - mc}{(1+\frac{\theta}{\eta})}. \tag{7}$$

Equation (7) depicts pricing behavior when an export quota imposed by the International Coffee Agreement is not effective. If this quota is effective,

the constrained solution occurs at a price at which the ICA quota (Q^{ica}) equals supply available for exports, at a price below P* in equation (7).

Econometric Procedures

A procedure outlined by Lopez and Dorsainvil, based on the domestic farm-level supply and demand parameters, were used to compute the price elasticity of supply available for exports.

To operationalize equation (7), all variables and parameters can be obtained, except for θ, the conjectural elasticity. Previous studies have modeled conjectural elasticity as a function of input prices (Appelbaum; Schroeter; Taylor and Kilmer) or a function of a partial concentration ratio (Azzam, Lopez). Based on the situation pertinent to the Haitian coffee market, the conjectural elasticity is presumed to be determined by

$$\theta_t = \lambda_0 + \lambda_1 N_t + \lambda_2 Y_t + \lambda_3 \sigma_t^y + \lambda_4 BOARD_t + \lambda_5 QUOTA_t, \qquad (8)$$

where N_t is the number of exporters, a measure for market structure and potentiality of collusion. Y_t and σ_t^y are producer's income level and variability from farm activities, including coffee, to account for market power attributable to financing by intermediaries. Lundahl notes that the informal rural credit interest rate is linked to peasant's income risk. $BOARD_t$, a dummy variable, accounts for the establishment of the Haitian Exporters Board Association in 1960, a potential mechanism for collusion among the exporters. $QUOTA_t$, another dummy variable, accounts for the establishment of the Quota Administration Association by exporters in 1977, which coordinates *internal* export quotas among exporters different from the *external* quotas imposed by ICA. The expected signs of the parameters are $\lambda_1, \lambda_2, < 0$ and $\lambda_3, \lambda_4, \lambda_5 > 0$.

A serious estimation problem may arise from the endogeneity of the number of exporters in equation (12). Cutthroat competition, persistent losses, and bankruptcies among exporters before the 1960s fostered the creation of the Board Association.

Adapting the work of Clarke and Davies, it is presumed that the number of exporters is a function of the degree of collusion, the price elasticity of export supply, and the variation in costs across firms. In addition, export taxes are included because heavy export taxes may have been responsible for pushing fringe exporters out of the market. When the variation in costs across exporting is assumed to be constant (i.e., captured by an intercept term), a linear version of the determinants of the number of exporters is given by

$$N_t = \gamma_0 + \gamma_1\theta_t + \gamma_2\hat{\eta}_t + \gamma_3 t_t^a + \gamma_4 N_{t-1}, \tag{9}$$

where θ_t is the proxy for the degree of collusion, $\hat{\eta}_t$ is the price elasticity of export supply (equation 11), t_t^a is the tax rate on coffee exports, and N_{t-1} accounts for partial adjustment in entry and exit. Substituting equation (12) into (13) and solving for N_t yields the following expression:

$$\begin{aligned} N_t &= (1-\gamma_1\lambda_1)^{-1}\{\gamma_0 + \gamma_1(\lambda_0 + \lambda_2\gamma_t + \lambda_3\sigma_t^y + \lambda_4 BOARD_t + \\ &\quad \lambda_5 QUOTA_t) + \gamma_2\hat{\eta}_t + \gamma_3 t_t^a + \gamma_4 N_{t-1}\}. \end{aligned} \tag{10}$$

Substituting equation (12), and using the price elasticity of supply obtained via equation (11), we obtained an econometric version of equation (7) which denotes market equilibrium in the absence of binding ICA export quotas:

$$P_t^* = \frac{P_w(1-t_t^a) - mc_t}{(1 + (\lambda_0 + \lambda_1 N_t + \lambda_2 Y_t + \lambda_3\sigma_t^y + \lambda_4 BOARD_t + \lambda_5 QUOTA_t)/\hat{\eta}_t)}, \tag{11}$$

where λ_j represents the parameters to be estimated in this equation.

Data and Estimation

The model was applied to aggregate time-series data for the Haitian coffee market for the years 1954 to 1984. Major data sources included Seguino for coffee production and prices, export volume and number of firms, and marketing costs. USAID reports provided information on hurricanes. Other data came from Capital Consult on further farm data and reports by the International Coffee Organization on international trade arrangements.

A farmers' income Laseypres index was constructed based on price data and a Haitian coffee farm model. Since this index is partially based on farm-level coffee price–the dependent variable in this equation–an instrumental (GIVE) variable was used in place of the income index. Standard deviation of the GIVE income estimate based on three lagged periods was computed to denote farm income uncertainty. Class variables were utilized for the $BOARD_t$ and $QUOTA_t$. Because the ICA quotas were found to be binding only in four years of the sample, they were excluded from the final estimation sample.

Equations (10) and (11) constitute a recursive system given that N_t is the dependent variable in the first one and a regressor in the second. In addition, the equations contain nonlinear parametric restrictions. Given this, the parameters in both equations were estimated with the Full Information Maximum Likelihood technique.

Empirical Results

Table 1 contains the parameter estimates for the equations of the number of exporters and pricing behavior (equations (10) and (11)). While the conjectural elasticity–a proxy for degree of collusion–can be expected to

have a negative sign to reflect entry deterrence by incumbent firms, a positive sign in the results here may reflect exit deterrence by incumbent firms via collusion. The negative effect of export supply elasticity on the number of exporters was confirmed. Since coffee production in Haiti has been stagnant for the most part while domestic consumption has grown significantly, the price elasticity of export supply has increased while the quantity of coffee available at a given price has decreased. The decline in the volume of exports is thus followed by a decline in the number of exporters necessary to sustain the export market. The export tax rate was also confirmed as an important force driving exporters out of business. Finally, the coefficient associated with the lagged number of exporters indicates a relatively high degree of friction or partial adjustment in export entry/exit decisions.

The number of exporters was found to have a negative and significant effect (at the 5 percent level) on the conjectural variation elasticity and, thus, a positive effect on price. This result confirms the conventional structure-conduct-performance paradigm of industrial organization in that strategic pricing behavior is more likely to occur the more concentrated the industry is. The results also support Lundahl's argument that risk rather than income level may result in market power in informal credit markets. The level of farmers' income was found to have a negative but insignificantly different from zero effect (at the 10 percent level) on conjectural elasticity. This insignificant result is consistent with the fact that the share of coffee in farm income has been declining due to expansion in the production of grains (Seguino) which has weakened the market power position of coffee intermediaries. Farm income variability (standard deviation of income) had a positive and significant effect (at the 5 percent level) on conjectural elasticity, and, thus, a negative effect on farm-level coffee price. The direction

of the effect indicates that producers' preference for security is a significant source of oligopsony power.

The impact of the creation of the Export Board Association ($BOARD_t$) failed to show a significant impact on conjectural elasticity. It should be noted that the creation of the Board occurred during a time when exporters were exiting the market. The increase-in-concentration effect may have already been captured by the N_t variable. Also, the creation of the board coincided with stiff increases in export taxes (1960-63 had the highest tax rates in the sample), which also affected concentration. The creation of the internal-quota administration mechanism within the Board Association ($QUOTA_t$), however, shows a positive and significant effect (at the 5 percent level) on conjectural elasticity and, thus, a negative effect on farm-level coffee price. Unlike the board, this institutional change was not followed by an increase in export taxes. The quota mechanism also allows more *explicit* collusion among exporters than the board itself because exporters agree on the magnitude of an internal quota assigned to each exporter.

Concluding Remarks

In general, the empirical results supported the model specified and the various hypotheses drawn from the literature on sources of oligopsony power and determinants of the number of firms. The more significant sources of oligopsony power in the Haitian coffee market were found to be the number of exporters (concentration), farm income variability (a partial proxy for credit needs), and the creation of a quota-adminstration system among exporters.

The results also point out some interesting conclusions on the determinants of the number of exporters. Collusion among exporters was found to

be a significant mechanism for keeping themselves in business in face of a declining export supply market. Thus, while a lower number of exporters increase pricing collusion in the market (via conjectural elasticities), the effect of collusion on the number of the exporters is positive. The main reasons for exporters going out of business are the high export taxes imposed by the Haitian government and the fact that farm-level export supply has become more price-elastic as domestic consumption has grown faster than the relatively stagnant total farm supply.

The analysis helps clarify several important consequences of government policy alternatives in the Haitian coffee market. Conventional economic theory suggests that higher export taxes shifts down the exporters' derived demand for coffee resulting in lower farm-gate prices under nonzero farm-level price elasticity of supply. An additional hidden cost is that higher taxes put fringe exporters out of business, increase concentration in the market, and thus result in greater collusion among remaining exporters and even lower farm-gate prices. The lack of access to competitive financing in rural areas not only results in supranormal finance charges by intermediaries, but also in lower farm prices via oligopsony power generated by these financial arrangements. The exporters' board and internal quota administration are important purchase coordination mechanisms that were apparently created with the purpose of deterring the exiting of exporters.

The research presented in this paper has, of course, several shortcomings. The main one being that since measures of marginal costs are available for the Haitian coffee case, the model can be simplified substantially. For example, the conjectural elasticity (θ) may be directly completed rather than assuming it is implicit in the data. This could get reared off the non-linearities in the model and would simplify it without any major loss and

perhaps even gain in the validity of results. Also, since the main interest of the paper is on the sources of oligopsony power, the determinants of the export supply elasticity ($\hat{\eta}$) should be incorporated directly into the model, since they also modify oligopsony power. Work is in progress toward a more seasonable and comprehensive analysis of the sources of oligopsony power.

Table 1. Full Information Maximum Likelihood Parameter Estimates of the Number of Exporters and Pricing Equations

Equation	Variable	Notation	Coefficient Estimate	Standard Error
Number of Exporters	Intercept	1	20.735*	11.42
	Conjectural Elasticity	θ_t	69.704**	25.257
	Export Supply Elasticity	$\hat{\eta}_t$	-29.240**	15.192
	Export Tax Rate	t_t^a	-27.606*	16.661
	Lagged Number of Exporters	N_{t-1}	.533**	.275
Pricing	Intercept	1	.203**	.053
	Number of Exporters	N_t	-.008**	.003
	Farmers' Income	Y_t	-.016*	.013
	Farmers' Income Variability	σ_t^y	.263**	.133
	Board Association	$BOARD_t$	.016	.014
	Quota Administration	$QUOTA_t$	.052**	.020

Note: The corresponding equations are (10) and (11). Because the ICA quotas were found to be effective only in 4 years, these observations were excluded from estimation. One and two asterisks indicate significance at the 10 and 5 percent levels.

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