An Analysis of the Banana Import market in the U.S.

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1. Introduction

According to the statistics of United States Department of Agriculture (USDA) and United States International Trade Commission (USITC), banana is the number one fresh fruit consumed in the United States. Its share is over 25% of the yearly quantity of fresh fruit consumption per capita, and even exceeded the sum of annual consumption of all citrus fruit since 1989. The volume of banana imports increased steadily until it peaked in 1999, and since then, it has fluctuated between 3,800 to 4,100 thousand tons annually. The value of banana imports has fluctuated; however, the value has increased continuously since 2004. Because of the geographic location of the United States, all the production of bananas is in Hawaii on 1,200 to 1,500 acres of land, and the ratio of this production to domestic consumption of bananas is inconsequential. In other words, the American consumption of bananas mostly depends on imports. Moreover, in terms of the import quantity of fresh fruits, bananas are the largest staple in the United States, which is the biggest import country of bananas in the world with an approximate 3,977.9 thousand tons in 2008 and whose average share in global banana net import during 2003 to 2008 is about 25.69%. The share of banana imports in the European Union (EU) is more than that of the United States and accounts for about 30.94% share in the period, however, it is made up of 27 countries and has about 1.66 times the population of United States.

Global banana exports are highly concentrated in six countries: Ecuador, Costa Rica, Colombia, Philippines, Guatemala, and Panama. Along with wheat, rice, or corn; bananas are a significant staple commodity for these developing countries. Nevertheless, because of the consideration of transportation costs, time, the delicate and perishable properties in banana distribution, and diverging import policies in the consuming countries, the U.S. banana import originates almost entirely from Latin American countries near the equator, with imports from other parts of the world considered negligible. Colombia, Costa Rica, Ecuador, Guatemala, and Honduras are the largest providers of fresh bananas to the United States. These equatorial countries together supply over 95% of total U.S. fresh banana imports, which makes up about 40% of the fresh fruit quantity shipped by them to the United States in 2008. Furthermore, the percentage of banana export value to total export value (banana quantity exporting to U.S. to total export quantity of bananas) in Colombia, Costa Rica, Ecuador, Guatemala, and Honduras are 1.77% (25.07%), 7.57% (46.78%), 9.29% (17.57%), 4.36% (87.75%), 6.39% (83.29%), respectively. These show that the U.S. banana demand market plays a decisive role in the economic development and gaining foreign exchange of these countries.

Thus, the structural and competitiveness changes in the consuming demand of the U.S. fresh banana may have the possibility to cause severe economic shock in Latin American countries which largely depend on the banana trade. Analyzing demand conditions of the import banana market in the U.S. could provide information for policy makers in banana export countries. In addition, bananas from these countries are called “dollar bananas” because they are exported to North America and of the US-based transnational corporations (TNCs). The two largest producer and marketers of bananas of US-based TNCs are Dole Food Co. (formerly Standard Fruit) and Chiquita Brands International (formerly known as the United Fruit Company, then United Brands). Each accounts for just over 25% of all bananas traded in the world. Then the third largest is Fresh Del Monte Produce, controlling about 16% of the banana trade. Fresh Del Monte Produce headquarters is in Miami, USA. In addition to these US-based TNCs, the fourth largest banana export company in the world is Exportadora Bananera Noboa, one of the largest exporters of Ecuador bananas and controlling about 12% of total world trade. The U.S. banana market is free of tariffs or quantitative import restrictions and basically controlled by these four and some relatively small companies, that is, it has an oligopolistic nature. In addition, due to producing and marketing large quantities of bananas, these TNCs can generate economies of scale at all levels of the marketing chain to make profit. Thus, it is interesting to estimate the degree of imperfect competition in the U.S. market of banana imports.

Others have looked at the banana import market. Deodhar and Sheldon (1995) estimated the degree of market imperfection in the German market for banana imports using a structural econometric model and concluded that the market is imperfectly competitive. Hatirli, Jones, and Aktas (2003) measured the market power of the banana import market in Turkey and concluded that the market is not perfectly competitive and the behavior of firms is much closer to price-taking than to collusion. Burrell and Henningsen (2001) investigated the consumer demand for bananas and for other fruits in Germany and found that demand for bananas is significantly responsive to own price, suggesting that policy-induced price increases generate the usual dead-weight losses.

The banana market in U.S. for the past 20 years has become saturated such that the volume and price (share, wholesale, and retail prices) generally remain fixed even during peak periods. Moreover, the U.S. is the largest country of banana imports in the world. Therefore, the primary goal of this analysis is to investigate the U.S. import demand for fresh bananas differentiated by country of origin to evaluate implication for the six main exporting countries. An ancillary goal is to apply a structural economic model of market power to evaluate the degree of imperfect competition in the import market of fresh bananas of the United States. In order to achieve these goals, the new empirical industrial organization (NEIO) model by using two-stage and three-stage least squares (2SLS and 3SLS) and the nonlinear inverse almost ideal demand system

(IAIDS) by using the maximum likelihood estimation (MLE) for U.S. banana market are calculated and estimated. Note that the U.S. banana demand nearly depends on import. In the U.S., Hawaii is only a place where bananas are planted, but its production is very low and could not satisfy the consumption demand of bananas. The paper is organized as follows. The theoretical framework for the IAIDS, and NEIO is presented in the next section of the paper. Following that, the two models used in the analysis are given. Then, the data used in the analysis are presented and discussed along with estimation considerations. Results and relevant discussion is then presented. A summary of the main findings is presented in the last section of the paper.

2. The Model

2.1 Inverse Almost Ideal Demand System

The traditional AIDS model of Deaton and Muellbauer (1980) is one of the most commonly used demand models in the empirical work. However, in case a many perishable goods such as fresh fruits, vegetables, fish and etc. the quantity supplied is often predetermined and the price must adjust in order to clear the market. The predetermined quantity is often reinforced by the fact that many perishable goods are not fit for storage and must be consumed shortly after harvest. For this reason, we make us of the Inverse Almost Ideal Demand System (IAIDS) of Eales and Unnevehr (1994) to estimate the demand for bananas in the U.S. by country of origin using quarterly data. , In the IAIDS model, the consumer preference is derived from the distance function (transformation function), which is dual to the cost function (expenditure function) of the AIDS. As the properties of cost function, the distance function is continuous in utility and quantity, decreasing in utility, and non-decreasing, concave, and homogeneous of degree one in quality (Moschini and Vissa, 1992). It measures the proportional amount by which all quantities consumed need to be inflated in order to reach a particular indifference curve. Let $U(q)$ represent the direct utility function, where q denotes the vector of quantities. Then, the distance function $F(u,q)$ is implicitly defined by $U\left[q / F(u,q) \right] \equiv u$, where u denotes the reference utility level. The distance function has a derivative property similar to the cost function (Deaton, 1979). That is, differentiation of the distance function with respect to the optimal quantity of a particular good yields the compensated demand for that good in the same way that differentiation of the cost function with respect to a particular price yields a compensated demand function. Thus, following Deaton and Muellbauer's derivation of the AIDS model (1980), a logarithmic distance function may be defined:

$$\ln F(u,q) = (1-u)\ln a(q) + u \ln b(q) \qquad (1)$$

Because the distance function possesses the same properties as the cost function, except of substituting quantities for prices, $\ln a(q)$ and $\ln b(q)$ are basically defined analogous to those in the development of the AIDS model.

$$\ln a(q) = \alpha_0 + \sum_k \alpha_k \ln q_k + \frac{1}{2}\sum_k \sum_j r_{kj}^* \ln q_k \ln q_j \qquad (2)$$

$$\ln b(q) = \ln a(q) + \beta_0 \prod_k q_k^{\beta} \qquad (3)$$

Thus, the IAIDS distance function is written

$$\ln F(u,q) = \alpha_0 + \sum_k \alpha_k \ln p_k + \frac{1}{2}\sum_k \sum_j r_{kj}^* \ln q_k \ln q_j + u\beta_0 \prod_k p_k^{\beta_k} \qquad (4)$$

The compensated inverse demand function can be derived directly from equation (4). The quantity derivatives of the distance function are the normalized prices demanded, i.e., by Shepherd's Lemma $\frac{\partial F(u,q)}{\partial q_i} = \frac{p_i}{x}$ where x denotes total expenditure. Multiplying both sides by $\frac{q_i}{F(u,q)}$ yields

$$\frac{\partial \ln F(u,q)}{\partial \ln q_i} = \frac{p_i q_i}{x} = w_i \qquad (5)$$

where w_i is the budget share of good i. Hence, logarithmic differentiation of (4) gives the budget shares as a function of quantities and utility:

$$w_i = \alpha_i + \sum_j r_{ij} \ln q_j + \beta_i u \beta_0 \prod q_k^{\beta_k} \qquad (6)$$

where $r_{ij} = \frac{1}{2}(r_{ij}^* + r_{ji}^*)$.

Inverting the distance function at the optimal quantity yields the direct utility function which may be substituted into equation (6).

$$U(q) = -\ln a(q) / [\ln b(q) - \ln a(q)] \qquad (7)$$

This yields a system of inverse demand functions that Eales and Unnevehr call IAIDS.

$$w_i = \alpha_i + \sum_j r_{ij} \ln q_j + \beta_i \ln Q \qquad (8)$$

where $\ln Q$ is expressed as follows:

$$\ln Q = \alpha_0 + \sum_k \alpha_k \ln q_k + \frac{1}{2}\sum_j \sum_k r_{kj} \ln q_j \ln q_k \qquad (9)$$

. The IAIDS model, as specified in equation (8), is comprised of six share equations: the sources of the U.S. banana imports are distinguished into Colombia, Costa Rica, Ecuador, Guatemala, and Honduras. It is common in the literature to linearly approximate the IAIDS model by using Stone's nonparametric statistical index instead of $\ln Q$. However, Pashardes (1993) showed that errors resulting from that approximation can be seen as an omitted variable. In addition, Barnett and Seck (2006) indicated that the use of the linear approximation by kinds of price indices exacerbates misclassification of goods as complements and leads to estimated elasticities different from those of the nonlinear AIDS model. Thus, in this paper we estimate the nonlinear IAIDS model specified by equation (8). As with the AIDS model, the theoretical restrictions of the fixed and unknown coefficients are imposed as: $\sum_i \alpha_i = 1$, $\sum_i \beta_i = 0$, and $\sum_i \gamma_{ij} = 0$, , (adding up); $\sum_j \gamma_{ij} = 0$ (homogeneity); $\gamma_{ij} = \gamma_{ji}$ (symmetry).

Eales and Unnevehr (1993) also provide the relevant formulas for the uncompensated (Marshallian) own-quantity & cross-quantity frequencies (ε_{ij}) and the expenditure frequencies (η_i) when estimating the IAIDS model as follows,

$$\varepsilon_{ij} = -\delta_{ij} + \{\gamma_{ij} - \beta_i w_j\} / w_i \quad (10)$$

$$\eta_i = -1 + \beta_i / w_i \quad (11)$$

where δ_{ij} is the Kronecker delta, which takes a value of 1 when i=j and zero otherwise.

In our research we are using quarterly quantity data. hus, before the time-series data are used to estimate the parameters of the IAIDS model, it is necessary to check whether the data structure of each of the variables in the model is not-stationary using an autoregressive model. In statistics, the augmented Dickey–Fuller test (Dickey and Fuller, 1981) that is valid in large samples is commonly used. In general, economic time series data is often violated in the stationary assumption, i.e., the data is the existence of a long-term trend. For this situation, it is important for the data to be differenced to render stationary. According to Engle and Granger's (1987) explanation, if a non-stationary time-series data is differenced d times to reach stationary, expressed as I(d) (integrated of order d), there are d unit roots in the series. All variables to be employed in the IAIDS model are integrated of the order 1, I(1), i.e. stationary in the first difference form.

2.2 New Empirical Industrial Organization

With complete cost information, it is appropriate and straightforward to obtain the index of market power or structure, λ, by a measure of the deviation between price and marginal cost, i.e. the ability of a firm/industry to raise price above marginal cost. Here, Lerner's measure (Collins and Preston, 1969) is

$$L \equiv \frac{P - MC}{P} = -\frac{\lambda}{\varepsilon} \quad (12)$$

where ε is the market elasticity of demand and λ lies in the closed set [0, 1].

However, while price information is often readily observable, marginal cost is rarely so easily measured in reality. In general, most of the researchers would use average cost instead of marginal cost in calculating Lerner's measure. Moreover, except for competitive firms in long-run equilibrium, average (variable) cost is not a good approximation to marginal cost and the disadvantage of account cost data for economic analyses are well-known. Hence, to avoid using cost data, Bresnahan and Lau (1982) developed NEIO structural econometric models, which can be estimated to determine whether market power is being exerted at various stages in supply chain. Market demand plays a critical role in determining market power, since it identifies firms'/industries' perceived marginal revenue. The market demand equation in a given industry is given by the implicit function:

$$Q_t = Q(P_t, Z_t) \quad (13)$$

where Q_t is the total quantity demanded, P_t is the market price of output, Z_t is a vector of exogenous variables which could affect market demand, and t is a time subscript. Since Q_t and P_t are simultaneously determined, the inverse market demand function can be written as $P_t = P(Q_t, Z_t)$. Industry revenue is defined as $R_t = P_t * Q_t$ and, thus, perceived marginal revenues $\{MR_t(\lambda)\}$ can be expressed as

$$MR_t(\lambda) = P_t + \lambda Q_t \left[{dP_t}\Big/{dQ_t} \right] \tag{14}$$

The value of λ represents the rotations of the perceived marginal revenue curve away from consumer demand (Bresnahan, 1982). If λ =0, the given industry is perfectly competitive and the producers perceive that they face a horizontal demand cure. As λ >0, producers face a downward-sloping market demand so there is a departure of perceived marginal revenues from market demand and some seller market power exists. If λ =1, full monopoly market power is being exerted and firms are behaving as if a single firm is acting as a monopoly. In equilibrium, $MR_t = MC_t$ and this relationship can be expressed as

$$P_t + \lambda Q_t \left[{dP_t}\Big/{dQ_t} \right] = MC \tag{15}$$

Given the above-mentioned concepts, the following equations can be adopted to estimate the degree of imperfect competition in the U.S. fresh banana import market. For fresh banana imports, the market demand function is specified in linear form:

$$IMPQ_t = \alpha_0 + \alpha_1 PCB_t + \alpha_2 P_{rt} + e_{1t} \tag{16}$$

where $IMPQ_t$ is the total quantity of bananas imported into United States (thousand pounds/year); PCB_t is per-capita consumption of banana (pound/year); P_{rt} is the retail price of bananas (US$/thousand pounds) and e_{1t} is the error term, where $e_{1t} \sim N(\mu, \sigma^2)$. In addition, suppose that a marginal cost takes the following functional form:

$$MC_t = \beta_0 + \beta_1 P_{wt} \tag{17}$$

where P_{wt} is the wholesale price of bananas as an approximation of the cost of bananas to retailers. Substituting the marginal cost function (17) into the profit-maximizing condition (15) and rearranging terms, we get the optimality equation

$$P_{rt} = \beta_0 + \beta_1 IMPQ_t + \beta_2 \ln(Earnings_t) + \beta_3 IMPI_t + \beta_4 (P_{wt})^2 + e_{2t} \tag{18}$$

where $\ln(\cdot)$ is the natural logarithm; $Earnings_t$ is average hourly earnings in trade, transportation and utilities industries (US$); $IMPI_t$ is the import price index of fruit and fruit preparations; P_{wt} is the wholesale price of bananas (US$/thousand pounds), and e_{2t} is the error term. Conspicuously an absent explanatory variable in equation (17) and (18) which is used by Deodhar and Sheldon (1995) is time trend variable due to statistical insignificance in the model. From (18) $\beta_1 = -\lambda \left[{dP_{rt}}/{dIMPQ_t} \right]$ and $e_{2t} \sim N(\mu, \sigma^2)$. By differentiating (16) with respect to $IMPQ_t$, we derive that $\left[{dP_{rt}}/{dIMPQ_t} \right] = {1}/{\alpha_2}$. Thus, Use the estimates of equation (16) and (18), we can obtain an estimate of the market-power parameter $\lambda = -\beta_1 * \alpha_2$.

3. Data

The dependent variables in our six equation IAIDS are the quarterly shares of the U.S. expenditures on bananas from Colombia, Costa Rica, Ecuador, Guatemala, Honduras and the rest of the world.. The expenditure shares were constructed using U.S. expenditures on imported bananas from each of the six countries divided by the total expenditure on bananas from these countries. The quarterly expenditure and quarterly quantity data were obtained from the U.S. International Trade Commission (USITC) website.

To derive the market-power parameter, λ using the NEIO model, equations (16) and (18) were estimated with 2SLS and 3SLS using annual data over the period 1985~2008. These annual data were obtained from different sources. The per-capita consumption and retail prices of bananas were collected from the United States Department of Agriculture (USDA) website, data on average hourly earnings in trade, transportation and utility industries along with the import price index of fruit and fruit preparations were taken from the United States Department of Labor website, and the information about the wholesale price of bananas is obtained from the Banana Statistics (2001, 2003, 2005, 2009) and the World Banana Economy 1985~2002 of Food and Agriculture Organization (FAO). All nominal variables involving prices and earnings were deflated by the consumer price index.

4. Results

Table 1 presents the econometric results from the MLE method of the nonlinear IAIDS model. With respect to the Costa Rican share equation; seven out of eight estimated parameters were statistically significant at 5% level. In the Colombian, Ecuador, and Guatemala share equations, six parameters were statistically significant at 5% level. Next, five parameters were found to be statistically significant in the Honduran share equation at 5% level of significance. Finally, four parameters in the share equation of the rest of the exporting countries (Others) were statistically significant at 5% level.

Table 1. Estimated parameters from the nonlinear IAIDS model for fresh bananas

	Intercept	$q_{Columbia}$	$q_{CostaRica}$	$q_{Ecuador}$	$q_{Guatemala}$	$q_{Hoduras}$	q_{others}	$\ln(Q)$
Columbia	-0.0504 (0.0338)	0.1028* (0.0058)	-.0323* (.0047)	-.02895* (.0043)	-.0162* (.0049)	-.0110* (.0034)	-.0141* (.0054)	.0101 (.0067)
Costa Rica	.1208* (.0403)	-.0323* (.0047)	.1604 * (.0088)	-.0686* (.0053)	-.0437* (.0059)	-.0215* (.0051)	.0059 (.0042)	-.0241* (.0080)
Ecuador	-.0021 (.0346)	-.0289* (.0043)	-.0686* (.0053)	.1796* (.0062)	-.0472* (.0051)	-.0179* (.0039)	-.0167* (.0043)	.0005 (.0069)
Guatemala	-.0373 (.0352)	-.0162* (.0049)	-.0437* (.0059)	-.0472* (.0051)	.1320* (.0080)	-.0122* (.0043)	-.0124* (.0048)	.0073 (.0070)
Honduras	.0106 (.0338)	-.0110* (.0034)	-.0215* (.0051)	-.0179* (.0039)	-.0122* (.0043)	.0673* (.0052)	-.0044 (.0029)	-.0022 (.0067)
Others	.9583* (.0500)	-.0141* (.0054)	.0059 (.0042)	-.0167* (.0043)	-.0124* (.0048)	-.0044 (.0029)	.0418 (.0086)*	.0083 (.0099)

Asymptotic standard errors are shown in parentheses.

* indicates that a coefficient is statistically significant at the 5% significance level.

Table 2 presents the own and cross flexibility estimates as well as the scale (expenditure) frequencies along with the appropriate standards errors. All frequencies estimates were calculated at the sample means. Note that all own-quantity frequencies are negative as theoretically expected. All own-quantity frequencies estimates were less than one in absolute value, indicating that the fresh bananas of six exporting countries are price inflexible. In terms of the own-quantity frequencies at the price-imported level, the U.S. own price for Honduran bananas with respect to the quantity of Honduran bananas appears to be the largest variation in absolute value (0.4242). That is, a one percent increase (decrease) in the quantity of Honduran bananas was found to decrease (increase) the import price of Honduran bananas in the U.S. market by approximately 0.4242%. A similar change occurs in the price of other banana-exporting countries as their own quantities increase (decrease) by one percent.

The cross-quantity frequencies measure the percentage change in the price of a good when the quantity demanded of another good increase by one percent. From Table 2 all cross-quantity frequencies were found to be negative which classifies all import bananas as gross quantity-substitutes except the Costa Rica-Others and Others-Costa Rica frequencies (gross quantity-complements). The Costa Rican bananas were found to exhibit a relatively strong cross-quantity substitution effect with the Colombian bananas (-0.2589), the Ecuador bananas (-0.2840), and Honduran bananas (-0.1786). For the Ecuador bananas it exhibits a relatively strong cross-quantity substitution effect with the Costa Rican bananas (-0.2520), the Guatemalan bananas (-0.3107), and the other bananas (-0.3528). The cross-quantity frequencies for the Honduran bananas reveal that a change in quantity of Honduran bananas would have very low impact on the retail price of bananas exported in other countries. Scale frequencies measure the percentage change in the normalized price of a commodity due to one percent change in the total expenditure. The scale frequencies are ranged from -0.8442 to -1.0967. Based on these estimates, the price of the other bananas is least affected by the quantity of total import bananas.

Table 2. IAIDS banana frequencies

	Colombia	Costa Rica	Ecuador	Guatemala	Honduras	Other	Scale
Colombia	-0.2446* (0.0157)	-0.2589* (0.0051)	-0.2351* (0.0054)	-0.1358* (0.0033)	-0.0921* (0.0021)	-0.1101* (0.0025)	-0.9247* (0.0015)
Costa Rica	-0.1180* (0.0012)	-0.3334* (0.0137)	-0.2520* (0.0049)	-0.1580* (0.0034)	-0.0742* (0.0017)	0.0305* (0.0007)	-1.0967* (0.0021)
Ecuador	-0.1198* (0.0022)	-0.2840* (0.0053)	-0.2589* (0.0134)	-0.1959* (0.0036)	-0.0744* (0.0013)	-0.0692* (0.0012)	-0.9978* (0.00004)
Guatemala	-0.1090 * (0.0126)	-0.2903* (0.0327)	-0.3107* (0.0351)	-0.1747 (0.0949)	-0.0804* (0.0094)	-0.0806* (0.0101)	-0.9534* (0.0053)
Honduras	-0.0916* (0.0022)	-0.1786* (0.0042)	-0.1486* (0.0035)	-0.1018* (0.0021)	-0.4242* (0.0134)	-0.0369* (0.0010)	-1.0191* (0.0004)
Other	-0.2875* (0.0321)	0.0786* (0.0089)	-0.3528* (0.0387)	-0.2610* (0.0362)	-0.1034* (0.0106)	-0.2285* (0.0881)	-0.8442* (0.0176)

Standard errors are approximated using the bootstrap technique over 3000 drawings with replacement.

* indicates that a coefficient is statistically significant at the 5% significance level.

That is, the one percent proportionate increase in all import bananas would reduce the price of the other bananas by about 0.8442% while the price of Costa Rican bananas declines 1.0967%.

2SLS and 3SLS estimation procedures were employed to estimate the system of equation (16) and (18); however, no improvement over the 2SLS results was observed. The results of estimating these equations are shown in Table 3. The whole model is plausible in terms of adjusted r-squared, the standard error of estimates, and statistical significance of individual parameters. The adjusted R square values of demand and optimality equations are 0.92 and 0.88, respectively. Although the Durbin-Watson ratios lie in the inconclusive range for rejecting the hypothesis of the existence of autocorrelation, it is also clear that they are very close to the upper bound where the hypothesis of the existence of autorotation can be rejected. In the below-mentioned regressions, the relevant parameters for calculating market power are $\alpha_2 = -7053.964$ and $\beta_1 = 0.000044$, both being statically significant at the 5 percent level. Therefore, the market power parameter for this industry is λ=-(-7053.964)*(0.000044)=0.31. The results suggest that the fresh banana import market in the U.S. is closer to competition than monopoly. This implies that although the banana market presents an oligopolistic structure, this does not actually mean that TNCs have a great market power to set selling prices for bananas because their products "bananas" are indifferent, i.e., homogenous in the point of view of consumers. If any of these TNCs wanted to raise prices unilaterally, it could be expected for this company to lose its market share and decrease the ability to compete with the other companies selling fresh bananas except, consumers perceive the difference among these bananas, for example organic and usual bananas. All the parameters have the expected signs, and they are statistically significant. The price elasticity for the retail price of bananas is -0.66, implying that a given change in price will result in a less than proportionate change in quantity imported.

Table 3. 2SLS estimation of the model

	Coefficient	P-value	Elasticity
Intercept	4,542,441**	0.000	
	(980,911.3)		
PCB_t	273,126.6**	0.000	
	(29084.96)		
P_{rt}	-7,053.96**	0.000	-0.66
	(661.32)		
Adjusted R square	0.92		
Durbin-watson	0.959<DW=1.218<1.298		
Intercept	-537.4846*	0.041	
	(245.2847)		
$IMPQ_t$	0.000044*	0.029	
	(0.0000186)		
$\ln(Earnings_t)$	252.3885**	0.000	
	(51.6981)		
$IMPI_t$	1.855343**	0.002	
	(0.5055642)		
$(P_{wt})^2$	0.0004011*	0.045	
	(0.0001865)		
Adjusted R square	0.88		
Durbin-watson	0.805<DW=1.433<1.527		

* and ** indicate that a coefficient is statistically significant at the 5% and 1% significance level, respectively.

5. Summary and Conclusion

Banana consumption in the U.S. is highly dependent on imports and these imports come from a concentrated market that is controlled by a few TNCs. First, using a structural econometric model, based on a method originally developed by Bresnahan (1982), the results show that the U.S. fresh banana import market is imperfectly competitive and implies that the TNCs are exercising some market power. Furthermore, the findings of this study show two variables, retail price of bananas and per-capital consumption of bananas, to have a significant impact on import quantity. Next, we employed the nonlinear IAIDS model developed by Eales and Unnevehr (1993) to serve the following purpose. We believe that estimating the relationship between the U.S. fresh banana imports using prices as the dependent is a better specification given that bananas are highly perishable and it is the price (not quantities) that clears the market. From the perspective of the U.S. market this is an important step toward understanding demand conditions and the difference of competitiveness. Own-quantity effects are relatively inflexible (flexible) in the Guatemalan (Honduran) equation so that a one percent increase in the quantity of bananas induces a less than (more than) one percent fall in the own-price. In addition, in term of the cross quantity effects, the results suggest that Costa Rican and Ecuador bananas have stronger quantity-substitution effect on the other rival bananas while Honduran bananas: weaker quantity-substitution effect on the other rival bananas.

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