THE PRESENCE OF MARKET POWER IN THE COFFEE MARKET: THE CASE OF COLOMBIAN MILDS

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Abstract

The coffee industry has been characterized by a few large buyers and lower and more volatile producer prices since the 1990s. This paper investigates the price adjustment along the supply chain between farm-gate and world prices of high quality “Colombian Milds” coffee, and further explores whether market power affects the coffee price relationship. An Error Correction Model and a test for market power are employed to examine the coffee price relationship. Results show that the producer price and the world price are adjusted asymmetrically and the causality is unidirectional. Market power, a possible explanation for the asymmetric price adjustment, significantly affects the price relationship between upstream and downstream prices. These results have policy implications. Better organization of coffee producers can decrease the bargaining power of buyers along the coffee marketing system.

Key words: Market power, price adjustment, Colombian Milds

JEL Classification: C32, Q13, Q02
Introduction

According to the International Coffee Organization (ICO), the cost of production has been rising in many coffee producing countries during the past years. World coffee beans prices have shown large fluctuations (figure 1). Farmers sometimes sold coffee at a price that did not cover costs (Mehta and Chavas, 2008). This situation is termed in the literature as the ‘coffee crisis’ (Daviron and Ponte, 2005). In contrast, consumer prices have increased and have not fluctuated as much as producer coffee beans prices (figure 2). Consumers can choose now from different combinations of coffee offerings such as brewing and grinding methods, flavoring, and packaging. The emergence of organic, fair-trade, and sustainable coffees in specialty markets have given rise to a “coffee boom” in coffee-consuming countries such as the United States, Italy, Germany, and Sweden (Daviron and Ponte, 2005; Durevall, 2007; Rotaris and Danielis, 2011)

Figure 1 and 2 depict the divergent trend of the coffee prices in coffee producing and consuming countries.

The coexistence of a ‘coffee boom’ and a ‘coffee crisis’ is referred to as the “coffee paradox” in the global coffee value chain (Daviron and Ponte, 2005). This is because the coffee beans sold by producers and the coffee consumed by consumers are differentiate products. Coffee beans pass through as many as six different entities in the global coffee market: farmer, local speculator, exporter, roaster, retailer, and consumer (Daviron and Ponte, 2005).

Therefore, market power is a possible explanation for the paradox between the upstream and downstream coffee prices. In reality the coffee market is characterized as an oligopsony, where a few large companies such as Starbucks, Kraft, Proctor& Gamble and Nestlé dominate the coffee industry. The largest share of the total value-added created within the coffee value-chain is in the importing countries (Daviron and Ponte, 2005). Coffee beans costs only constitute a part of the production costs for roasted coffee. Labor costs, packaging costs and processing
costs are also potential important determinants of coffee prices. The income generated in the coffee chain is mostly retained in the consumer countries with a declining level of producer-held stocks since the 1990s (Ponte, 2002).

The objective of this paper is to test the presence of market power in the coffee market within a price analysis framework. A theoretical framework is adopted to test the existence of market power and the empirical analysis is couched in a vector error correction model.

Note that coffee is a heterogeneous commodity with many varieties, and different types of coffee are processed in different ways into different final products. Hence, it is inaccurate to study coffee markets and analyze prices of coffee as a homogeneous commodity, and it is necessary to analyze coffee prices within a specific coffee type. This article focuses especially on Colombian Milds coffee, which is noted for its high quality and mostly produced in Colombia. Colombian Milds is the highest quality “washed” type of Arabica coffee beans. It has a richer taste and stronger aroma than other types (Gonzalez-Perez and Gutierrez-Viana, 2012).

Also note that in order to explore the discrepancy between the upstream and downstream prices of Colombian Milds coffee, the downstream coffee price, which is called world price in the rest of paper, is calculated based on the daily spot prices of different subdivision coffee-types. The upstream price is the price paid to coffee farmers. Results show that the price adjustment is asymmetric and market power does exist in the Colombian Milds coffee market.

The rest of this article is organized as follows: The next section covers the literature review. In the third section, a theoretical framework for a test of market power in the coffee market is presented. In the fourth section, a vector error correction model is combined with the theoretical market power framework for the price analysis. Finally, the results and conclusions of this study are presented.
Literature Review

This study covers two strands of literature. One strand covers the price analysis of different coffee types. Abaelu and Mandersc.Lv (1968) constructed a nine-equation model of the U.S. coffee market to analyze the structural mechanisms underlying the U.S. coffee industry for three coffee types, Colombian Milds, Robusta and Brazilian Naturals. Results showed that demand for each coffee type was reasonably price-elastic, and the three types were mutual substitutes. Vogelvang (1992) investigated the long-run relationship between the indicator prices of major types of coffee defined by the ICO, using Johansen co-integration tests. The results showed that prices of washed Arabica coffee (Colombian Milds) and other Arabica were co-integrated. Also, Robusta and Arabica coffee prices were found to be co-integrated. Milas, et al. (2004) examined the relationships among four types of coffees. They identified two cointegrating relationships affecting the long-run dynamics of the four types of coffee prices. Their results showed that the short-run adjustment was faster when prices were high than when prices were low. All these studies emphasized that it was necessary to focus on a specific coffee type for price analysis. These are the reasons for why this study focuses on a specific coffee type-Colombian Milds.

The other strand of literature focuses on inclusion of market power into the price adjustment analysis. Krivonos (2004) showed that the transmission of price signals from world markets to coffee growers worked quite well after the implementation of coffee sector reforms in the late 1980s and early 1990s. Although these results did not preclude the existence of oligopoly power, they indicated one should search for market power in consumer markets. A test developed by Lloyd, et al. (2009) was employed to investigate how imperfect competition and market power affects the price spread in vertically linked markets. The idea is based on the
equation of price spread between downstream and upstream prices. They tested for the null hypothesis of perfect competition by incorporating exogenous demand and supply shifters into the equation of farm-retail price spread to check for the existence of market power. Their results showed that the null of perfect competition could be rejected in most of the products investigated.

A few applications of the Lloyd, et al. (2009) analysis to agricultural products are available. Falkowski (2010) tested for market power in the Polish milk sector and found that the behavior of prices is consistent with the use of market power by the downstream sector. Liu (2012) suggested that the spread between producer and retail prices was not consistent with perfectly competitive behavior and thus might be caused oligopsony power in the Finnish food retailing. Cavicchioli (2010) found the existence of market power in the Italian fluid milk supply chain over the period 1996-2008. A similar test was also used by Kinnucan and Tadjion (2013) for the U.S. beef and pork sectors. The hypothesis of competitive market clearing was rejected for pork, but not for beef. In this research we combine the coffee price adjustment analysis with the new test for the existence of market power and imperfect competition to study the Colombian Milds coffee market.

**Theoretical Market Power Framework**

Economic theory suggests that profit-maximizing firms in competitive markets adjust their price symmetrically to input cost decreases or increases. Downstream prices include the upstream prices plus any margins at each level (Dahl and Hammond, 1977). In absence of external shocks, an economic equilibrium relationship among the prices exists. External shocks to downstream or upstream prices trigger short-and long-run adjustments towards the long-run equilibrium. In the real world, however, farmers at the beginning of the value chain and consumers at the other end are much less concentrated than the processors and retailers in the
intermediate stages of the marketing chain. This leads to asymmetric bargaining power among the market participants (Falkowski, 2010; Kinnucan and Forker, 1987; Miller and Hayenga, 2001).

The price spread model in a competitive industry is represented as follows:

\[ WP = PP + M \]  \hspace{1cm} (1)

where \( WP \) and \( PP \) are world and producer prices, respectively, and \( M \) represents the marketing costs in equation (1). The price spread model with exogenous shifters is shown as:

\[ WP = \gamma_0 + \gamma_1 PP + \gamma_2 M + \gamma_3 D + \gamma_4 S \]  \hspace{1cm} (2)

where \( D \) and \( S \) are the exogenous demand and supply shifters, respectively. \( \gamma_i \) \((i=0, 1, 2, 3, 4)\) are coefficients in the equation (2). The expected signs for the coefficients are \( \gamma_1 > 0, \gamma_2 > 0, \gamma_3 > 0, \) and \( \gamma_4 < 0 \). Lloyd, et al. (2009) point out that demand shifters increase the retail producer price spread while supply shifters decrease it. Therefore, \( \gamma_3 \) is expected to be positive and \( \gamma_4 \) negative. Expected signs for \( \gamma_1 \) and \( \gamma_2 \) are positive since they contribute positively to the retail price without being influenced by the market power.

Market shocks affect price formation and further impact the price spread. In a perfectly competitive case, the downstream and upstream price spread is dependent on all sorts of marketing costs. The exogenous shifters may affect either producer or world prices separately, but they would not influence the formation of the price spread in a perfectly competitive market. This study applies this framework in the context of a Vector Error Correction Model (VECM), which is presented in the next section.

**Empirical Methodology**

Given the properties of the time series data, the Augmented Dickey-Fuller test (ADF) is used to determine the stationarity of the variables in the model. Then based on a vector
 autoregressive model (VAR), the Johansen cointegration test is applied to investigate whether the series are cointegrated. A \( p \)-th VAR with exogenous variables \( x \) can be written as:

\[
y_t = y_0 + \sum_{i=1}^{p} A_i y_{t-i} + B_0 x_t + \sum_{i=1}^{s} B_i x_{t-i} + \mu_t
\]

where \( y_t \) is a vector of \( K \) variables, each modeled as function of \( p \) lags of those variables, and optionally, a set of exogenous variables \( x_t \). \( A_1 \ldots A_p \) and \( B_1 \ldots B_p \) are the parameters of the variables in the model. We assume that \( E(\mu_t) = 0, \ E(\mu_t\mu_t') = \Sigma \) and \( E(\mu_t\mu_s') = 0 \ \forall t \neq s \).

Estimation of the parameters of the VAR model requires that the variables in \( y_t \) and \( x_t \) are covariance stationary. If not, but their first differences are covariance stationary, we may model the relationship with a VECM, which captures both the long-run relationship and the short-run adjustment relationship between the producer and world prices. VECM is a dynamic model in which the change of the variables in any period is related to the previous gap from long-run equilibrium. Intuitively, if two variables have a long-run relationship, there must be some force that pulls the equilibrium error back towards zero.

Generally, a VECM takes the following form (Enders, 2004):

\[
\Delta Z_t = \Pi Z_{t-1} + \varphi_1 \Delta Z_{t-1} + \varphi_2 \Delta Z_{t-2} + \cdots + \varphi_{k-1} \Delta Z_{t-k+1} + \zeta_t
\]

Where \( Z_t \) is a \((K \times 1)\) vector of variables integrated of order 1. \( \Pi \) is a \((K \times K)\) coefficient matrix describing the long-run relationship between the variables in the system. \( \Pi \) can be further decomposed into \( \Pi = \alpha \beta' \). \( \beta \) is a \((K \times r)\) vector with parameters of the cointegration equation. \( \alpha \) is a \((K \times r)\) vector with adjustment parameters indicating how the variables adjust when the cointegrating equation deviates from its equilibrium. \( \varphi_i \) is a \((K \times K)\) matrix of the short-run parameters measuring the short-run impact of shocks on \( \Delta X_t \). \( \zeta_t \) is a \((K \times 1)\) vector of disturbances with zero mean and covariance matrix \( \Sigma \) and is i.i.d. normal over time.
According to the number of variables used in the analysis, three scenarios are followed. The first scenario contains producer price and world price, with the goal to investigate the long-run price relationship and short-run adjustment. This scenario is a baseline for the other two scenarios, which incorporates the theoretical framework discussed in the previous section. In the second scenario, the marketing costs are added into the VECM framework by using the farm-retail price spread, as was explained in the theoretical framework in the previous section (equation 1). In a perfect competitive market, world prices are only determined by producer prices and marketing costs. The third scenario expands the second scenario further by including demand and supply shifters into the equation of price spread (equation 2). It attempts to test the potential existence of market power in the vertically linked coffee marketing chain.

**Data Description**

This study uses 276 monthly observations for producer and world prices for Colombian Milds as well as marketing costs, and demand and supply shifters for January 1990 to December 2012 time period. The producer price is the farm-gate price reported to the International Coffee Organization by the national coffee authorities and constitutes all grades purchased from the growers (ICO). The world price is calculated by the International Coffee Organization, which provides an overall benchmark for the price of green coffee of all major origins and varieties received for raw coffee beans.

The motivation for using the world price instead of retail price is to capture the price link of the green coffee before it goes to the retail market. The greater the amount of transformation and the greater the additions to the farm product in the final consumer product, the more difficult it becomes to identify and measure the margins for individual farm products (Dahl and Hammond, 1977). For example, white bread may include wheat flour, eggs, sugar, and vegetable
oil. Similarly, coffee sold at retail level is not identical to that sold at farm level anymore, especially for high quality coffee. Therefore, we use green coffee beans which are subject to the smallest degree of processing by the post-farm chain and thus potentially investigate the existence of oligopsony power.

Figure 3 shows that the producer price moves together with the world price, and they decline more frequently than they increase. Both Falkowski (2010) and Lloyd, et al. (2009) used an index of wage costs for the agro-food manufacturing industry as a proxy for the marketing costs. Similarly, the manufacturing industry real wage index is a proxy for the marketing costs of coffee (M) in this study (see details in table 1). To fill the missing data from August to September in 2007, we used the average value of 2007 and then completed the missing data from December 2007 to November 2008 with the mean values of 2007.

The demand shifter is represented by the food retail price index, and the supply shifter is approximated by the price index of all goods and services. The consumer purchase index for U.S. ground coffee is used for the demand shifter because the U.S. is the main market for Colombian Milds, accounting for 54% of Colombian Milds exports in 2013 (ICO).

The real monthly trade weighted exchange rate for coffee is used for the supply shifter because coffee is mostly a traded cash crop between producer and consumer countries. Figures 4 through 6 show the details about the marketing costs and the exogenous demand and supply shifters, respectively. Interestingly, the tendency of marketing costs is increasing over time, which is consistent with the increasing production costs in the coffee market (ICO). Figure 7 shows how exogenous shifters affect either the producer or world prices separately, but not impacting the price spread. The descriptive statistics are reported in table 2.
Empirical Results

The Augmented Dickey-Fuller (ADF) test was applied to check the stationarity of all the variables in the model. Lag length was selected based on the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC). The results in table 3 show that all variables are non-stationary at levels but when first-differenced, all the variables are stationary or I (1). Then the Johansen test was conducted to determine the number of the cointegrating equations. The first cointegration test is conducted for the producer price, world price and marketing costs, presented in the theoretical equation (1). The second cointegration test is based on the equation (2), which includes the producer and world prices, marketing costs, and demand and supply shifters. As reported in table 4, the trace statistics indicate that there is a single cointegration relationship among the producer price, world price and marketing costs, but there are two cointegration relationships among the five variables (producer price, world price, marketing costs, and demand and supply shifters).

The existence of cointegration indicates that Granger causality should exist at least in one direction (Enders 2004). The causality refers to the direction of price movements along the supply chain. According to the price determination theory, the downstream price changes usually determine the upstream price changes. That is, price transmission flows downward along the supply chain. However, the empirical results from table 5 show the null hypothesis that producer price does not Granger-cause world price, is rejected. This indicates that the causality is unidirectional, from the world price to producer price.

Based on the results of Johansen test and Granger causality test, the VECM is estimated under the two assumptions. The results are summarized in table 6 for the long-run relationships
and table 7 for the short-run speeds of adjustment. The long-run relationship of the world price, producer price, and marketing costs with the producer price normalized is

$$\ln PP = 0.968^{***} \ln WP + 0.463^{***} \ln M$$

(5)

The prices are influenced by the extent of any deviation from the long-run equilibrium. Then at least one of the prices must respond to the magnitude of the disequilibrium. The producer price corrects 14.1% of the previous period’s deviation for the long-run equilibrium. We can conclude that the producer price and the world price respond to the disequilibrium asymmetrically.

Two long run equilibriums are identified under the assumption of imperfect competitive market conditions. The two cointegrating equations are presented as

$$\ln WP = -0.784^{***} \ln M + 1.884^{***} \ln D$$

(6)

$$\ln PP = -0.84^{***} \ln S + 1.439^{***} \ln D$$

(7)

The world price moves together with the marketing costs and the demand shifter in the long run. In the short run, the producer price still responds to the disequilibrium of equation (6). In equation (7), the producer price is cointegrated with the supply and demand shifters in the long run and the short-run speed of adjustment is 16.5%, which is the ratio of deviation from equilibrium corrected by the producer price. The world price has no response.

Moreover, the coefficients of demand shifter are significant in equation (6) and (7), the supply shifter is also significant with an expected negative sign. According to the theoretical model, the null hypothesis of perfect competition is rejected and we can conclude that market power an imperfect competition may exist in the Colombian Milds coffee market. Intuitively, a shift in demand function will increase both producer price and the world price while a shift in supply will cause the price spread narrow.
Summary and Conclusions

This goal of this study was to explain the “paradox” between the producer and world price of Colombian Milds. A theoretical framework for testing the null of perfect competition and a vector error correction model were adopted to test the potential existence of market power. In a perfect competitive market, the world price, producer price and the marketing costs reach a long-run equilibrium. The estimation of the producer price, world price and marketing costs were consistent with the theoretical model. The world price moves together with the marketing costs and the demand shifter in the long run. The producer price is cointegrated with the demand and supply shifter. It implies that market power may affect the long-run relationship between the world price and the producer price. The demand shifter is cointegrated with both the producer price and the world price, while the supply shifter is only cointegrated with the producer price. The analysis provides arguments on linking price adjustment with noncompetitive market structure.

The asymmetric price adjustment indicates that the producer price responds more to fluctuations in the supply chain than the world price. This in turn has an impact on farmers’ production decisions and their ability to adjust to shocks from both downstream sectors and unexpected natural shocks on the supply side. Moreover, consumers who paid a high price for premium coffee cannot fully benefit from a decrease in farm-gate prices, and farmers cannot get the benefit of higher downstream prices. This provides explanations for why the coffee consuming countries experience “coffee boom” while coffee producing countries suffer “coffee crisis.”

Theoretically, downstream prices contain upstream prices plus costs but it does not imply causality. For Colombian Milds, it is the world price that causes the producer price but not vice
versa. Moreover, when the demand and supply shifters enter the model, the two prices are no longer cointegrated anymore, which implies that the market shifters influence the changes of the prices significantly.

The existence of producer organization is a response to the potential market power. The Colombian coffee industry is characterized by a high degree of National Federation of Colombia (NFC) intervention. The system mostly benefits the producers, not government bureaucrats or exporters like other coffee producing countries (Krivonos, 2004). The NFC can earn a negotiating position for the domestic producers, lowering the market power position held by the large buyers. Winfree and McCluskey (2005) found that producer organizations helped build up a collective reputation for regions or specialty products. The NFC also sets strict quality control schemes to assure premium coffee beans.

The results from this study indicate that NFC still has a long way to go to help producers increase their gains from the value chain. Furthermore, other coffee producing countries can build producer organizations/institutions to balance the bargaining market power of the buyers along the coffee supply chain.
References


International Coffee Organization. Historical Data. Online. Available at


**Table 1: Data Definitions and Sources**

<table>
<thead>
<tr>
<th>Label</th>
<th>Variable</th>
<th>Source</th>
<th>Missing Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP</td>
<td>World Price</td>
<td>International Coffee Organization</td>
<td></td>
</tr>
<tr>
<td>PP</td>
<td>Producer Price</td>
<td>International Coffee Organization</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Manufacturing Industry Real</td>
<td>National Administrative</td>
<td>Colombia</td>
</tr>
<tr>
<td></td>
<td>Wage Index</td>
<td>Department of Statistics, Colombia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the U.S Ground Coffee</td>
<td>Department of Labor</td>
<td>Dec.2007-Nov.2008;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sep- Dec.2012</td>
</tr>
<tr>
<td>S</td>
<td>Real Monthly Trade Weight</td>
<td>U.S. Department of Agriculture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange Rate for Coffee</td>
<td></td>
<td></td>
</tr>
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</table>

**Table 2: Descriptive Statistics for the Variables, 1990-2012**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std.Dev.</th>
<th>Max</th>
<th>Min</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Price</td>
<td>130.98</td>
<td>59.29</td>
<td>318.5</td>
<td>56.18</td>
<td>276</td>
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<td>Producer Price</td>
<td>97.97</td>
<td>47.85</td>
<td>268.52</td>
<td>44.57</td>
<td>276</td>
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<tr>
<td>Marketing Costs</td>
<td>127.32</td>
<td>16.49</td>
<td>153.46</td>
<td>89.82</td>
<td>276</td>
</tr>
<tr>
<td>Demand Shifter</td>
<td>3.58</td>
<td>0.90</td>
<td>2.35</td>
<td>6.07</td>
<td>276</td>
</tr>
<tr>
<td>Supply Shifter</td>
<td>95.32</td>
<td>11.72</td>
<td>76.2</td>
<td>125.6</td>
<td>276</td>
</tr>
</tbody>
</table>
Table 3: Augmented Dickey-Fuller (ADF) Test Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>ADF</th>
<th>First Differences</th>
<th>Lag</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP</td>
<td>6(trend)</td>
<td>-1.79</td>
<td>4</td>
<td></td>
<td>-8.37***</td>
</tr>
<tr>
<td>PP</td>
<td>2(trend)</td>
<td>-1.86</td>
<td>1</td>
<td></td>
<td>-11.66***</td>
</tr>
<tr>
<td>M</td>
<td>12(drift)</td>
<td>-2.05</td>
<td>12</td>
<td></td>
<td>-3.63***</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>-1.27</td>
<td>1</td>
<td></td>
<td>-9.45***</td>
</tr>
<tr>
<td>S</td>
<td>1</td>
<td>-1.22</td>
<td>1</td>
<td></td>
<td>-11.54***</td>
</tr>
</tbody>
</table>

*** p <0.01

Table 4: Johansen’s Test of the World Price and Producer Price for Colombian Milds

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Null Hypothesis</th>
<th>Trace Statistic</th>
<th>5% Critical Value</th>
<th>Eigenvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect competitive</td>
<td>r=1*</td>
<td>8.572</td>
<td>15.41</td>
<td>0.104</td>
</tr>
<tr>
<td></td>
<td>r=2</td>
<td>1.951</td>
<td>3.76</td>
<td>0.024</td>
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<tr>
<td>Imperfect competitive</td>
<td>r=1</td>
<td>64.13</td>
<td>47.21</td>
<td>0.19</td>
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<tr>
<td></td>
<td>r=2*</td>
<td>24.66</td>
<td>29.68</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>r=3</td>
<td>8.706</td>
<td>15.41</td>
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<td></td>
<td>r=4</td>
<td>1.847</td>
<td>3.76</td>
<td>0.025</td>
</tr>
</tbody>
</table>

* denotes the number of rank for each scenario
Table 5: Results of Granger Causality Test for the World Price and Producer Price

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>$X^2$</th>
<th>Prob&gt;$X^2$</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Grower price does not Granger-cause world price for</td>
<td>3.12</td>
<td>0.078</td>
<td>Fail to reject</td>
</tr>
<tr>
<td>Colombian Milds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World price does not Granger-cause grower price for</td>
<td>15.14</td>
<td>0.00</td>
<td>Reject</td>
</tr>
<tr>
<td>Colombian Milds</td>
<td></td>
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Table 6: The Long-Run Relationships under Perfect and Imperfect Competitive Markets

<table>
<thead>
<tr>
<th>Assumption</th>
<th>WP</th>
<th>PP</th>
<th>M</th>
<th>D</th>
<th>S</th>
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<tbody>
<tr>
<td>Perfect</td>
<td>1</td>
<td>-1.032***</td>
<td>0.479***</td>
<td></td>
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<tr>
<td>competitive</td>
<td></td>
<td>(22.01)</td>
<td>(3.13)</td>
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</tr>
<tr>
<td></td>
<td>1</td>
<td>0.784**</td>
<td>-1.844***</td>
<td>0.25</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(2.53)</td>
<td>(-7.91)</td>
<td>(0.68)</td>
<td></td>
</tr>
<tr>
<td>Imperfect</td>
<td>1</td>
<td>-0.122</td>
<td>-1.439***</td>
<td>0.84***</td>
<td></td>
</tr>
<tr>
<td>Competitive</td>
<td></td>
<td>(-0.47)</td>
<td>(-7.44)</td>
<td>(2.76)</td>
<td></td>
</tr>
</tbody>
</table>

**p<0.05, *** <0.01, $t$-values in brackets
Table 7: The Empirical Estimates of the Speeds of Adjustment

<table>
<thead>
<tr>
<th>Speed of Adjustment</th>
<th>Perfect competitive</th>
<th>Imperfect competitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>0.141*** (3.32)</td>
<td>0.165*** (3.54)</td>
</tr>
<tr>
<td>WP</td>
<td>-0.071 (-1.43)</td>
<td>-0.008 (-0.15)</td>
</tr>
<tr>
<td>M</td>
<td>-0.015 (-0.82)</td>
<td>-0.035 (-1.69)</td>
</tr>
<tr>
<td>D</td>
<td>-0.021 (-1.49)</td>
<td>0.064*** (3.11)</td>
</tr>
<tr>
<td>S</td>
<td>0.014 (0.84)</td>
<td>0.014 (0.84)</td>
</tr>
</tbody>
</table>

**p<0.05, *** <0.01, t-values in brackets

Figure 1: Prices Paid to Growers in Selected Coffee Exporting Countries.

Source: International Coffee Organization
Figure 2: Prices Paid by Consumers in Selected Coffee Importing Countries

Source: International Coffee Organization

Figure 3: World and Producer Prices of Colombian Milds

Source: International Coffee Organization
**Figure 4: The Marketing Costs**

Source: National Administrative Department of Statistics, Colombia

**Figure 5: The Demand Shifter**

Figure 6: The Supply Shifter

Source: U.S. Department of Agriculture
Figure 7: Scatter Plots of Model Variables

Note: PP refers to the producer price, WP refers to the world price, M refers to the marketing costs, D is the demand shifter, S is the supply shifter, and DRP refers to the price difference between world and producer prices.