AN EMPIRICAL ANALYSIS OF COFFEE PRICE TRANSMISSION IN VIETNAM

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ABSTRACT

This paper examines the price links between the world price of Robusta and the producer price in Vietnam. A vector error correction model is employed to measure the price transmission between producer and world prices. The empirical results show that a long-run relationship exists between the producer and the world prices in Vietnam. Moreover, the short-run price transmission is asymmetric for Robusta. We conclude that the quality and the government intervention affect the results of the price link.

Keywords: Price Transmission, Vector Error Correction Model, Coffee

Introduction

The institutional framework of the global-value chain for coffee has moved from a publicly controlled (International Coffee Agreement, ICO) system in which producers had some market power, to a market dominated by consumers and their demand for quality-differentiated products (Daviron and Ponte 2005). The emergence of specialty, fair-trade, and sustainable coffees has given rise to a "coffee boom" in coffee-consuming countries where consumer are attracted by new varieties of coffee products. However, a "coffee crisis" has afflicted coffee producers since 1999 when the international coffee price began a long term decline, where many producers cannot cover their production costs (Daviron and Ponte 2005). Consequently, scholars define the global coffee situation as a "coffee paradox," where there is the coexistance of a "coffee crisis" and "coffee boom" simultaneously.

The following factors are emphasized for explaining the above divergent dynamics in coffee industry. First, the constant oversupply of the global coffee market is due to the advancements in technology and the expansion of coffee plantation (Lennart 2009). Second, a few large companies such as Starbucks, Kraft, Proctor&Gamble and Nestlé have market power, marking the coffee industry as an oligopsony (Lennart 2009). Third, price changes are asymmetrically transmitted. For instance, the reduction of the world coffee price is transmitted less rapidly than its increase to retail price in Belgium (Dellile 2008).

However, few studies have paid attention to the price transmission for a specific coffee bean since there are two commercial varieties-Robusta and Arabica. Arabica is grown at a higher elevation, lots of moisture, rich soil, Sun and is a much harder and higher quality bean (International Coffee Organization). Colombia Milds, Robusta, Brazilian Naturals, and Other Milds are the four groups categorized by regions from the International Coffee Organization

(Daviron and Ponte 2005). The major exporters of each type of green coffee are listed in Table 1. Vietnam is the largest supply of Robusta coffee beans in global market in recent years. Over 90% of its coffee production belongs to Robusta variety which represents approximately 20% of the total world coffee production (ICARD and Oxfam 2002). Therefore, Vietnam is a good representative for exploring the relationship between the producer and the world price of Robusta. This paper adds to the literature associated with price transmission for Robusta coffee beans.

The objective of this study is to investigate the price link between the world price and the producer price in Vietnam. Particularly, this paper will answer the question of the existence of a long-run relation between the producer price and the world price, as well as the short run price transmission. The next section provides a literature review of price transmission. The third section outlines the econometric specification, where a vector error correction model is applied for price analysis. Empirical results are discussed in the fourth section. The final section concludes the paper.

Literature Review

Vavra and Goodwin (2005) stated that the literature analyzing vertical price transmission has concentrated on evaluating the links between farm, wholesale and retail prices. This paper aims to study vertical links along the supply chain between the Vietnam producer price and the world coffee price for Robusta.

There are extensive list of literatures tested the vertical price transmission. Bettendorf and Verboven (2000) found that weak transmission of coffee bean prices to retail prices in Netherland which is due to a relatively large share of costs other than the costs of coffee beans. Delille (2008) concluded that the reduction of world coffee price is transmitted less rapidly than its increase to retail price in Belgium. A report from the U.K. found little evidence of systematic asymmetric transmission in the EU food chains between the evolution of farm and retail prices during 1990s for about 90 products (London Economics 2004).

Importantly, Aguiar and Santana (2002) found that in general price transmission results from previous studies cannot be applied to other products or for other periods. They showed that price increases are more rapid and fully transmitted compared to price decreases by analyzing the price transmission mechanism for coffee beans in Brazil. They also concluded that neither product storability (e.g. perishable fruits or storable beans) nor market concentration was required for an intense transmission process. The authors adopted the Wolfram–Houck (W-H) method to analyze the time series data. This method suffered from spurious regression since it fails to consider the nature of time series. Moreover, this method is incompatible with co-integration between the producer price and the world price (Von Cramon-Taubadel, 1998). Vavra and Goodwin (2005) showed that the price transmission results vary with the econometric model. For instance, Boyd and Brorsen (1988) found no evidence for asymmetric vertical price transmission of US pork market along the vertical chain, while Hahn (1990) illustrated that prices transmission at all levels of the US pork and beef marketing chains are asymmetric.

This study applied a Vector Error Correction Model (VECM) to investigate the price transmission between the producer and the world price for Robusta. It adds the literature by analyzing the price transmission of green coffee beans before they become differentiated.

Data Description

Monthly price data from January 1990 through December 2011 were obtained from the International Coffee Organization (ICO). The producer price is the price paid to the growers in Vietnam. The world price of Robusta means the Composite Indicator Price which provides an overall benchmark for the price of green coffee of all major origins and varieties, which is calculated based on the market share of exports of each group of coffee weighted according to an official document (ICO). It is the price of green coffee beans on the world market, before they become differentiated. It is not the retail coffee price. Figure 1 shows the levels of the data. The advantage of using the world price is to capture the price transmission of the green coffee beans from producers to the world market. The data were analyzed using Stata software. Descriptive of the variables with units in US dollars per pound are shown in Table 2.

Empirical Model

A Vector Error Correction Model (VECM) is applied because (1) the time series are not stationary in their levels but are in their differences (2) the variables are cointegrated. It captures both the long run and short run relation between the world price and the producer price (Von Cramon Taubadel 1998; Scholnick 1996). The function of VECM is to describe how the two variables behave in the short-run consistent with a long-run cointegrating relationship (Verbeek 2008). It is a dynamic model in which the change of the variables in any period is related to the previous deviation from the long-run equilibrium. Intuitively, if two variables are cointegrated, there must be some force that pulls the equilibrium error back towards zero.

The first step for analyzing time series data is to test the stationarity which requires that the time series values for the mean, the standard deviation, and the covariance be invariant over time (Enders 2004). Otherwise, the Ordinary Least Squares (OLS) regression is no longer efficient, the standard errors are understated, and the OLS estimates are biased and inconsistent (Enders 2004). The Augmented Dickey-Fuller (ADF) test is applied to test for stationarity with the null hypothesis that the time series is stationary. Once the series are integrated of the same order, Johansen's approach is employed to test the presence of co-integration of the variables. If the presence of cointegration is confirmed, then Engle and Granger error correction specification can be applied to determine Granger causality and show its direction. The Vector Error Correction Model (VECM) for the prices takes the following form:

$$\Delta p_{f,t} = \alpha_{10} + \alpha_{11}(L)\Delta p_{f,t-1} + \alpha_{12}(L)\Delta p_{w,t-1} + \alpha_{13}ECT_{t-1} + \varepsilon_{1t} \qquad (1)$$

$$\Delta p_{w,t} = \alpha_{20} + \alpha_{21}(L)'\Delta p_{w,t-1} + \alpha_{22}(L)'\Delta p_{f,t-1} + \alpha_{23}ECT_{t-1} + \varepsilon_{2t} \qquad (2)$$

Where Δ is the difference operator, p_f is producer price and p_w represents the world price; ε_{1t} and ε_{2t} are white noise error terms; ECT_{t-1} represents the lagged error correction term derived from the long-run effect. The coefficients of ECT_{t-1} are expected to be negative, since it would imply correction downward when the error term is positive or upward when the error term is negative.

The short-run causality can be determined by testing the null hypothesis of $\alpha_{12} = 0$ in equation (1) and $\alpha_{22} = 0$ in equation (2). To determine the long-run causality, we look at the coefficients of ECT by testing the null hypothesis of $\alpha_{13} = 0$ and $\alpha_{23} = 0$. Both the short-run and long-run coefficients measure the speed of adjustment.

Results

The unit-root is estimated by OLS and presented in Table 3. The second column of Table 3 summarizes the ADF test results for individual variables, while the third column shows the results for the first difference of each. The world price is non-stationary in level but it is stationary after first order difference. Although the producer price is stationary in level, we still take the first difference to make the two series have the same order of integration. We also take the natural logarithm for the prices to generate the percentage rate of change.

Based on the stationarity test, cointegration may exist since all of the series are integrated processes of order 1. Both the Engle-Granger method and Johansen test are methods for testing cointegration. We use the Johansen's test since it is more powerful than the Engle-Granger criterion (Enders 2004). The Johansen cointegration test is designed to determine the cointegrating rank which is referred to as the number of co-integrating relations (Verbeek 2008). The null hypothesis is that the two series are not cointegrated. Start by testing H0: $r = 0$. If it rejects, repeat for $r = 1$. When a test is not rejected, stop testing there and that value of r is the estimated number of co-integrating relations (Enders 2004). Table 4 presents the results of cointegration tests of the producer price and the world price. We reject the null hypothesis that $r = 0$ at the 5% level. But we fail to reject the null hypothesis that the cointegrating rank of the system is at most 1 at the 5-percent level. It means that the cointegrating rank is at most 1 at the 5% level. This implies that there exists a long-run relationship between the world price and producer price for Robusta.

The third step is to estimate the Vector Error Correction Model. Table 5 presents the estimation results for Robusta. The results show that the direction of the causality is from the world price to the producer price. The long run equilibrium can be expressed as follows: World Price – 0.86 Producer Price-0.839=Error (3)

It means that the world price and the producer price for Robusta from Vietnam follow a common long run path. Specifically, if the world price and the producer price have a linear combination on the left hand side in equation, the Error term will be stationary. But it will deviate from the long run equilibrium if there is a shock in the system. The coefficients of the short run adjustment indicate which variable responds more. Results from table 5 show that the speed of adjustment of the producer price is significant but the world price not. It implies that price transmission is asymmetric. In other words, the response of producer price to shock is faster than the world price.

Conclusion

This paper examines the price link between the producer price and the world price for Robusta coffee beans. Cointegration is used as a tool to evaluate market efficiency. Cointegration of prices in distinct markets is an indication of price transmission and market integration. Its convergence property is consistent with the hypothesis that arbitrage binds prices into a long-run relationship for Robusta. Intuitively, although the world price of Robusta is determined by its suppliers such as Vietnam, Indonesia, Uganda and other countries, Vietnam is the largest supplier among them. Robusta accounts for 97 % of the total coffee production (Roldán-Pérez, et al. 2009).

The conclusion indicates that the coffee crisis of low price for producer does exist in Vietnam. The quality and the government intervention can explain why it exists. A notable issue about the Robusta produced in Vietnam is the lack of proper on-farm infrastructure to ensure its quality, since harvest and post-harvest process are critical for maintaining high quality for each variety. Many farmers in Vietnam do not have the required space and material to dry the coffee and many simply spread the coffee beans onto the bare ground and results in diminished bean quality and increases off-flavors and foreign matter (World Bank 2004). Although the government of Vietnam is encouraging farmers to replace Robusta by planting more Arabica which is a higher quality coffee bean, it could not solve the issue quickly since there are already many competitive high quality coffee producing countries like Colombia. Therefore, it is more realistic to invest money on decreasing the loss of Robusta by improving the process of harvesting or post-harvesting rather than switching from Robusta to Arabica.

This paper does not account for the retail price of coffee and structural changes which may highly influence the price transmission from 1990 to 2012. We have little information about the relationship of producer prices across countries. Therefore, more research is needed to uncover these issues in coffee producing countries.

Reference

Aguiar, D., and J.A. Santana. 2002. "Asymmetry in Farm to Retail Price Transmission: Evidence from Brazil." *Agribusiness*, 18(1): 37-48.

Bettendorf, L., and F.Verboven. 2000. "Incomplete Transmission of Coffee Bean Prices in the Netherlands.*" European Review of Agricultural Economics*, 27, 1-16.

Boyd, M.S., and B.W. Brorsen. 1988. "Price Asymmetry in the U.S. Pork Marketing Channel." *North Central Journal of Agricultural Economics*, 10: 103-110.

Daviron, B., and S. Ponte. 2005. *The Coffee Paradox: Global Markets, Commodity Trade and Elusive Promise of Development*. Zed Books, London & New York.

Delille. N. 2008. "Relations between Coffee World Market Price and Retail Price in Belgium." Unpublished, Gembloux Agricultural University, Economics and Rural Development Unit, Belgium.

Enders, W. 2004. *Applied Econometric Time Series*. 2nd.ed. John Wiley & Sons.

Hahn, W.F. 1990. "Price Transmission Asymmetry in Pork and Beef Markets." The Journal of Agricultural Economics Research, 42, 2:21-31.

ICARD and Oxfam. "The Impact of the Global Coffee Trade on Dak Lak Province, Vietnam: Analysis and Policy Recommendations." Information Centre for Agricultural and Rural Development (ICARD),Oxfam Great Britain and Oxfam Hong Kong. September. 2002

International Coffee Organization. *http://www.ico.org/trade_e.asp?section=About_Coffee.*

Lennart Schüβler. 2009. Protecting 'Single-Origin Coffee' within the Global Coffee Market: The Role of Geographical Indications and Trademark. *The Estey Centre Journal of International Law and Trade Policy.* Volume 10 Number 1, pp 149-185.

London Economics. 2004. *"Investigation of the Determinants of Farm-Retail Price Spreads."* Final Report to DEFRA, U.K.

Roldán-Pérez, A., Gonzalez-Perez, M.A., Huong, T., Tien, D.N. 2009. "Coffee, Cooperation and Competition: a Comparative Study of Colombia and Vietnam." Paper Prepared for UNCTAD. UNCTAD Virtual Institute.

Scholnick, B. 1996. "Asymmetric Adjustment of Commercial Bank Interest Rates: Evidence from Malaysia and Singapore." *Journal of International Money and Finance,* 15:485-496.

Vavra,P., and B.K.Goodwin. 2005. "Analysis of Price Transmission Along the Food Chain." OECD food, *Agricultural and Fisheries Working Papers*, No.3, OECD Publishing.

Verbeek, M. 2008. *A Guide to Modern Econometrics*. 3rd ed. Chichester, England: John Wily & Sons.

Von Cramon- Taubadel, S. 1998. "Estimating Asymmetric Price Transmission with the Error Correction Representation: An application to the German pork market." *European Review of Agricultural Economics*. 25:1-18.

World Bank. 2004. *Agriculture and Rural Development Department Report No. 29358 The Socialist Republic of Vietnam Coffee Sector.* June.

Appendix

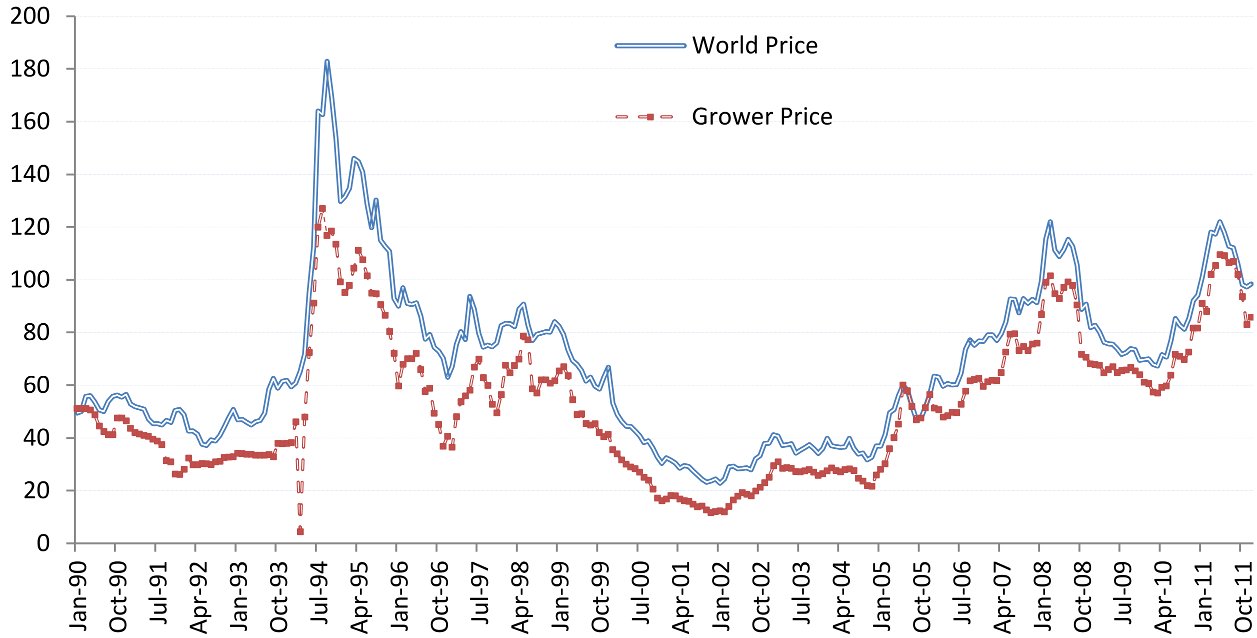

Figure 1: **Vietnam Producer Price and Monthly Average ICO Indicator Prices for Robusta, 1990-2011 (Units: US cents/lb)**

Table1. Coffee Exports by Major Countries

Colombian Milds	Robustas	Other Milds	Brazilian Naturals
Colombia	Vietnam	Guatemala	Brazil
Kenya	Indonesia	Mexico	Ethiopia
Tanzania	Uganda	Honduras	
	Other	Other	

Source: ICO

Table 2. Descriptive Statistics of Coffee Prices in the Empirical Model (Units: US cents/lb)

	Robusta World Price	Producer Price
Observations	264	264
Mean	68.05	52.54
SD	30.70	26.50
Maximum	182.78	126.94
Minimum	22.81	4.41

Data Source: ICO

Table 3. Augmented Dickey-Fuller (ADF) Test Results: Vietnam

Variables	Test Results for Variables in Levels	Test Results for Variables after First-Differencing
World price	-1.120	-11.999***
Producer Price	-3.169***	-22.855***

Note: *** 1% significance level. ** 5 % significance level. *10% significance level

Table 4. Johansen's Test for Cointegration between the World Price and Producer Price

Null Hypothesis	Trace Statistic	5% Critical Value	Eigenvalue
r=0	54.678	15.41	.
r=1*	2.807	3.76	0.179

Note: r denotes the number of cointegrating vectors

Table 5: Parameter Estimates for the Long-run Equilibrium Relationship ($\boldsymbol{\beta}$) and Short-run Parameters (α): Vietnam

Parameter Estimates		**Vietnam**
Long-run Equilibrium Relationship (β_2)		-0.844**(0.0633)
Short-run Adjustment Coefficients (α)		
Producer Price (α_f) in Equation (2)		0.335(0.107)**
	World Price lag(1)	0.951(0.212)**
	World Price lag(2)	0.711(0.214)**
	World Price lag(3)	0.565(0.220)**
	World Price lag(5)	0.417(0.196)**
	Producer Price lag(1)	-0.502(0.100)**
	Producer Price lag(2)	-0.415(0.101)**
	Producer Price lag(3)	-0.349(0.099)**
	Producer Price lag(4)	-0.372(0.094)**
	Producer Price lag(5)	-0.256(0.084)**
World Price(α_w) in Equation (3)		0.019(0.039)
	World Price lag(1)	0.329(0.076)**
	World Price lag(6)	0.134(0.065)**
	Producer Price lag(4)	-0.100(0.034)**
	Producer Price lag(6)	-0.061(0.025)**

Note: *** 1% significance level. ** 5 % significance level. *10% significance level