THE IMPACT OF COFFEE MARKET REFORMS

ON PRODUCER PRICES AND PRICE TRANSMISSION

Ekaterina Krivonos[*]

Abstract

This paper evaluates the impact of coffee sector reforms during late 1980s and early 1990s on coffee growers in the main coffee producing countries. Earlier evidence suggests that the reforms increased the share of producer prices in the world price of coffee. This hypothesis is tested in the paper with the help of cointegration analysis, and the results show that in most countries the long-term producer price share has indeed increased substantially after the liberalization. Moreover, the results suggest that the reforms induced a closer cointegrating relationship between grower prices and world market prices. Finally, estimation of an error-correction model reveals that short-run transmission of price signals from the world market to domestic producers has improved, such that domestic prices adjust faster today to world price fluctuations than they did prior to the reforms. However, there is some evidence of asymmetries in the way positive and negative world price changes are transmitted to domestic markets.

[*] University of Maryland and World Bank. Email: ekrivonos@arec.umd.edu.

NON-TECHNICAL SUMMARY

Coffee growers in developing countries have historically received a very small share of the export price of green coffee. One reason often mentioned in the literature is heavy government intervention in the sector. Government regulation of domestic markets in the form of fixed producer prices and monopsony power of marketing boards put a substantial wedge between producer prices and the world price of coffee, imposing an implicit tax on producers. During the 1980s and 1990s most countries in Sub-Saharan Africa and Latin America implemented structural adjustment reforms, which included liberalization of export crop markets. With the view to improve the efficiency of marketing channels, marketing boards were replaced by private traders and exporters. The liberalization experience varied across countries, both in the scope of the reforms and their outcomes, however some conclusions can be drawn regarding the overall achievements of the reforms.

This paper explores the extent to which the reforms were successful in raising the share of the world market price received by growers and improving transmission of price signals from the world market to domestic markets. Short-run price transmission, the speed of adjustment and the equilibrium producer price shares are estimated prior and after the reforms. Asymmetric price transmission is tested in both periods to check whether price increases are passed through to producers as fast as price decreases and whether the nature of the asymmetry has changed after the reforms.

The results suggest that the long-run shares of producer prices in the world price have indeed increased in most cases. The short-run transmission and speed of adjustment of domestic prices have also improved, meaning that producer prices react faster today to changes in the world market price than they did before the reforms. The extent of the reforms seems to have an impact on how much price transmission has changed: the countries that have liberalized fully experience almost instant pass-through of prices today, while for those that still uphold restrictions the change in price transmission has been smaller. This study also shows that reforms may have created asymmetries in the way positive and negative world price changes are transmitted to domestic markets. There is evidence that in some countries the transmission has risen more for price decreases than for price increases.

1. Introduction

Coffee growers in developing countries receive a notoriously small share of the export price of green coffee, which often is explained with excessive government regulation of the domestic markets and market inefficiency. Producer price shares vary substantially across countries, even when comparing countries with seemingly similar exporting systems. For example, producers in Tanzania received only 42% of the export price of arabica coffee and 30% of the price for robusta in 1998/99 (Baffes, 2003), while in Uganda the share of export price accruing to growers of robusta at the same time was 75% (ITF, 2002b).

The governments of developing countries are known for intervening intensively in their agricultural markets for two main reasons. One is revenue collection, since agriculture, often being the largest sector of the economy and the main export sector, represents an easy to monitor base for taxation. Another reason is reducing domestic price volatility with the view of lowering risks to producers that depend on the prices of export crops and to consumers of staple foods, which constitute a large part of consumption of the poor. For their impact on producer welfare the stabilization schemes are in general regarded as unsuccessful. The cost of reduced volatility seemed too high, given that the administered prices usually were far below the certainty equivalent that would be accepted by farmers (see for example McIntire and Varangis, 1999). In other words, the gap between the producer and the world prices was higher than what farmers would be willing to pay to avoid risk. Inefficiency associated with stabilization policies was further exacerbated by prevalence of overstaffed and often corrupt marketing boards that were formed to execute the policies. In addition to fixing prices, the boards were directly involved in domestic marketing of commodities, controlling purchasing as well as exporting, in effect acting as a state monopsony vis-à-vis producers.

Following structural adjustment reforms, most countries in Sub-Saharan Africa and Latin America implemented substantial liberalization of export crop markets, dissolving marketing boards and allowing private agents to operate as traders and exporters. Liberalization's pace and scope varied across countries. Most countries undertook reforms of their coffee sectors at the end of the 1980s or beginning of the 1990s by lowering export taxes and replacing state-controlled marketing systems with markets run by private agents. The key objectives were the introduction of more efficient markets, lower marketing margins and higher producer prices.

This paper addresses the question whether the reforms were successful in raising the share of the world market price received by growers and improving transmission of price signals from the world to domestic markets in the case of coffee. An error-correction model is specified to account for the dynamic nature of price adjustment. Short-run price transmission, the speed of adjustment and the equilibrium producer price share are estimated prior and after the reforms. Asymmetric price transmission is tested in both periods to check whether price increases are passed through to producers as fast as price decreases and whether the nature of the asymmetry has changed after the reforms.

It should be noted that the existence of price intervention does not *per se* imply imperfect price transmission. A constant export tax is perfectly compatible with full transmission. Other policies, such as export quotas, may impede transmission. At the limit, fixed producer prices imply zero transmission of world market signals. However, administered prices tend to change over time in response to world market prices, so positive transmission is usually found when time-series data are used. Applying an error-correction model allows evaluation of how the transmission works under different policies.

Several previous papers investigate the responsiveness of domestic prices in developing countries to fluctuations on the world commodity markets. The evidence of the relationship between world market prices and domestic prices has been mixed. The estimates of the elasticity of transmission from border to domestic markets seem to be highly sensitive to the methodology applied.

Hazell *et. al.* (1990) examine whether the volatility in the world market prices has been passed through to producer prices in developing countries. The authors use data from 22 countries during 1961 to 1987 to test whether price instability has increased over time and whether fluctuations in domestic markets followed the variability of the world prices. The methodology involves obtaining the residuals from a trending price regression and regressing their absolute values on the time component to test whether variability has increased over time. The authors find that world market prices indeed grew more volatile over time, but that price variation was explained more by declining average prices than by absolute variability. The fluctuations in world market prices were in general transmitted to countries' export unit values, but not to producer prices, since the real exchange rates and government intervention in agriculture played a buffering role. In the case of coffee high correlation between producer prices and export prices is found, but as with other commodities there is no evidence of greater integration between domestic and export prices.

Mundlak and Larson (1992) estimate a direct relationship between domestic and world market prices. Their estimates of price transmission elasticities for 58 countries are obtained by using a simple logarithmic specification of the relationship between internal and world market prices and the exchange rates. The authors find evidence of almost perfect price transmission. Cross-commodity OLS for each country independently as well as between-commodity and within-commodity regressions suggest that for most countries the elasticity of transmission is close to unity. Separate estimations are carried out for wheat, coffee and cocoa. Price transmissions in those markets are found to be lower than those obtained from the pool of commodities, indicating that these particular markets are highly distorted.

A different approach to estimating a relationship between two price time series is the error-correction model. Unlike the static framework, the error-correction model includes a dynamic component, which captures the effect of adjustment of the dependent variable when it deviates from its long-term equilibrium level. This approach was taken by Quiroz and Soto (1995), and their results differ substantially from the ones obtained by Mundlak and Larson. A dynamic econometric model is specified and estimated on a country-by-country basis for 78 countries (both developed and developing) using the data for 30 years and 15 commodities. The authors conclude unambiguously that in the vast majority of cases the international price signals are transmitted very poorly to domestic markets or are not transmitted at all.

Baffes and Gardner (2003) also use the error-correction model to estimate the responsiveness of the domestic prices to fluctuations on the world market. The authors analyze price transmissions for 10 commodities on a country-by-country basis for the period mid 1970s to mid 1990s. Again, estimation of price adjustment suggests that changes in the world prices account for only a small share of the variation in domestic prices. Taking one step further, the authors assess whether policy reforms under the structural adjustment programs improved price transmission. Structural breaks are introduced corresponding to the years of substantial market reforms. The results show that in most countries the reforms had very limited effect on price transmission. Out of 31 country-commodity cases only six showed closer integration with the world market following the reforms.

Focusing entirely on the coffee sector, Cárdenas (1994) takes a closer look at the role of stabilization funds in managing the coffee price fluctuations. The paper analyzes the relationship between the redistribution and the stabilization functions of a marketing board using a political economy model. The findings are that in Costa Rica and Kenya, where government intervention in pricing is limited,

the fluctuations in the world prices are fully transmitted to producers. In Colombia and Côte D'Ivoire, on the other hand, producer prices are more stable, but the coffee sector faces high taxation, reflecting the government's desire for sectoral redistribution.

Another issue affecting coffee producers is the growing gap between the consumer prices in the importing (mostly developed) countries and the price of green coffee traded. Today by far the largest share of the total value-added is created within the marketing chains of the importing countries. We witness an apparent paradox: How can the international coffee prices continue to plunge, causing disarray in producing countries, when consumers spend several dollars per cup for specialty coffees in coffee houses? Ponte (2002) argues that one of the reasons is the low coffee content of the new "coffee consumption experience", which is characterized by highly diversified and specialized final products. Another reason is that since the collapse of the International Coffee Agreement (ICA) in 1989 the power relationship in the coffee trading system has shifted to the advantage of transnational corporations. The roasters dominate the coffee value chain and the producing countries' role in coffee interactions is fading.

Morisset (1997) examines in more detail the growing spread between world and domestic commodity prices in the consuming countries and evaluates the losses to developing countries caused by this spread. He finds that the gap has widened over time because of the asymmetric response of consumer prices to movements in the world prices. Throughout the period examined, the increases in the world prices have been passed through to consumers more fully than price decreases, causing a loss of over $100 billion a year in export earnings for developing countries. Coffee is the sector which is characterized by the greatest price asymmetry. Apart from fuels, coffee is also the commodity which bears the greatest losses associated with the increasing price spread between the world prices and the domestic consumer prices. The author argues that the asymmetric price response is largely caused by the dominant position of the international trading companies on the world market.

This paper focuses exclusively on the coffee sector and measures the responsiveness of the domestic producer prices to the international prices, leaving the markets in the consuming countries out of the picture. The major assumption is that exporting countries act as price takers on the world market. For the period following the collapse of the International Coffee Agreement (ICA) in 1989 this is not an unreasonable assumption. Even during the ICA regulatory system, the difficulties associated with negotiating and insuring compliance with the agreements suggested that in fact the producing countries were not able to collude perfectly, making the agreement ineffective. Karp and Perloff (1993) test the

price-taking hypothesis in the case of Brazil and Colombia, the two largest exporters. A dynamic feedback oligopoly model is estimated and the conclusion is that Brazil and Colombia are closer to price taking than to collusion.

This paper follows the dynamic approach adopted by Quiroz and Soto (1995) and Baffes and Gardner (2003) and also incorporates asymmetric price transmissions. The principal question that the paper addresses is whether the reform processes in the coffee producing countries resulted in a closer relationship between the world market prices and the internal prices paid to growers. The model allows us to estimate whether the short-run price transmission, the speed of adjustment and the target share of the domestic price have changed after the reforms. Using the estimated parameters we can compare how long it would take the domestic prices to adjust to a one-time change in the world market price. Another question is the existence of asymmetric responses to world price increases and decreases. If prior to liberalization neither price increases nor price decreases were fully transmitted to producers, an interesting question is whether the reforms equally affected the transmission of the upward and downward price movements to domestic markets.

2.   The coffee market reforms

Each country followed its own distinct liberalization path. The degree of liberalization, the timing and the sequencing of the reforms were different in each particular case, producing different outcomes in different countries. The main components of the reforms by country are summarized in Table 1. Four groups of countries can be identified describing the scope of the reforms. In many countries the reforms covered the full range of measures: complete withdrawal of the state from marketing, facilitation of entry of private traders, abolishment of minimum prices, lower export taxes and simpler procedures for firm registration and licensing. This category includes Brazil, Mexico, India, Uganda, Madagascar, Togo, Cameroon and Ghana.

The second group covers the countries, where some reforms took place, but the government retains substantial power over marketing, and the sector continues to be heavily regulated. In Kenya and Tanzania the parastatal organizations are not officially involved in marketing, but the mandatory auctions are still in place, meaning that no coffee can be traded outside the system. The Coffee Board of Kenya (CBK) remains highly influential, and the Kenya Coffee Growers and Employers Association (KCGEA) has called for its dissolution, demanding direct marketing of coffee by the growers to be permitted (East African Standard, 2003). In Tanzania, a large proportion of coffee is

marketed by cooperative unions which maintain close ties to the Coffee Board and enjoy special protection. The licensing procedures for coffee traders are overly restrictive and in 2000/2001 the Coffee Board revoked the buying licenses of private traders, effectively handing the monopsony power to the unions (Baffes, 2003).

In other countries, such as Ethiopia, Angola and Central African Republic, internal marketing is liberalized, but the government maintains some level of control over the producer prices. The Angolan National Coffee Institute announces the minimum prices to producers at the beginning of each season. In Ethiopia the minimum export differentials are set daily, but there is no floor producer price. In Central African Republic the prices are indicative and are used as the basis for negotiations.

Finally, in the case of Colombia, the reforms of the coffee sector were very limited. The Federación Nacional de Cafeteros (FNC) continues to be the most powerful player on the market, controlling both domestic marketing and exporting and fixing grower prices and marketing margins.

The contents and the achievements of the reforms in each country are described in more detail in Appendix A. To get a preliminary idea of how the reforms affected producer prices, the shares of the domestic prices in the world prices before and after the reforms are shown in Figure 1. As expected, in almost all countries the producer price share seems to be larger after the reforms. The two exceptions are Angola and Tanzania (in the case of arabica coffee). In Angola, in the whole period 1983-1990 the producer prices changed only twice, so when the world coffee prices started dropping in 1989, the local prices in Angola were kept artificially high, exceeding the world prices by over 50%. As a result, for the pre-reform period on the whole, the average producer prices were close to 100% of the world robusta prices. Post-reform prices vary more often. Although the minimum prices are still fixed, they change far more frequently than before, reflecting to some degree fluctuations in the world coffee market. In Tanzania, the price share for arabica coffee decreased slightly, whereas the price share for robusta increased. This could potentially be due to the fact that the quality of the Tanzanian coffee has been decreasing in the last years. The data on coffee export by coffee class in Ponte (2001) shows that the quality has been declining steadily since 1995/1996. In all other countries the producer price share increased substantially, in particular in Brazil, Ethiopia, Kenya, Mexico, Madagascar and Uganda. Remarkably, in the latter the price share increased by almost 50 percentage points following the liberalization.

3.   The model

To test for cointegration between domestic and world prices, an error-correction specification can be used, following Engle and Granger (1987). Error-correction models incorporate dynamic elements into estimation of price transmission, allowing the domestic prices to adjust to their long-term equilibrium in the period following a change in the world price.

Take an autoregressive distributed lag model ARDL(1,1), which includes lagged values of the domestic price and the world price as independent variables.

$$p_t^d = \alpha + \beta_1 p_t^w + \beta_2 p_{t-1}^d + \beta_3 p_{t-1}^w + \varepsilon_t \tag{1}$$

This can be rearranged to yield an error-correction specification

$$p_t^d - p_{t-1}^d = \alpha + \delta(p_t^w - p_{t-1}^w) + \theta(p_{t-1}^d - \gamma p_{t-1}^w) + \varepsilon_t \tag{2}$$

where $\delta = \beta_1$, $\theta = -(1 - \beta_2)$ and $\gamma = \dfrac{\beta_1 + \beta_3}{1 - \beta_2}$

Equation (2) describes the variation of the domestic price p^d in terms of its reaction to fluctuations in the world price p^w and adjustment to own long-term equilibrium. δ captures the immediate responsiveness of the domestic prices to changes in the world price, and θ is the 'error-correction' term, which measures the speed of adjustment of p^d to its long-run equilibrium γp^w. Note that θ is expected to be negative, since it would imply correction downward when p^d exceeds γp^w and upward when p^d falls short of γp^w.

To capture both the impact of the reforms on the parameters and to test for asymmetric price transmission, two sets of dummies are used. One is a set of policy dummies,

$$D_t^{ref} = \begin{cases} 1 & \text{if } t \text{ indicates a period prior to reform} \\ 0 & \text{if } t \text{ indicates a period after reform} \end{cases}$$

The other is a set of dummies that describes whether a price increase or price decrease has occurred:

$$D_t^\Delta = \begin{cases} 1 & \text{if } \Delta p_t < 0 \\ 0 & \text{if } \Delta p_t \geq 0 \end{cases}$$

where $\Delta p_t = p_t - p_{t-1}$.

The policy dummies were interacted with all the independent variables and the dummies that denote the sign of the price change were interacted with the short-run elasticity of transmission δ to test for the presence of asymmetric short-run price transmission.

For the error-correction model to be valid, we first need to insure that the time series used in the estimation are stationary. Otherwise we are at risk of estimating a relationship that is spurious, leading to a false conclusion that there is a steady relationship between the internal and the world market prices where there may be none.

The stationarity properties of the price time series (both levels and first differences) are tested using the Augmented Dickey-Fuller procedure (ADF)[1]. In each case the hypothesis tested is that the time series follow a nonstationary process with a unit root. Rejecting the null hypothesis allows treating the time series as stationary. In addition, the existence of a long-term cointegrating relationship between the world and the domestic prices is tested, in order to check the validity of the error-correction part of equation (2). The basic model without a structural break is

$$p_t^d = \gamma p_t^w + \upsilon_t \tag{3}$$

The constant is restricted to be zero, so that γ can be interpreted directly as the share of producer prices in world market prices. Three OLS regressions are estimated: separate regressions before and after the reforms and a pooled regression with a structural break. The latter model allows estimation of two different slope coefficients while utilizing all available data:

$$p_t^d = \gamma_1 p_t^w D_t^{ref} + \gamma_1 p_t^w (1 - D_t^{ref}) + \upsilon_t \tag{4}$$

In each case an ADF test on the residuals is performed to determine whether the OLS results adequately describe the cointegrating relationship between p^d and p^w. The residuals $\hat{\upsilon}_t$ from the pooled

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[1] The ADF test for a unit root without trend involves estimating the following equation for a time-series variable y_t:

$$\Delta y_t = \mu + \lambda y_{t-1} + \sum_{j=1}^{k} \eta_j \Delta y_{t-j} + \varepsilon_t$$

where k is the number of lags of the first differences used. The null hypothesis is $\lambda = 0$, which is tested against $\lambda < 0$. The failure to reject the null hypothesis produces an ARIMA(k, 1 ,0) process, indicating that the time-series are nonstationary.

regression (4) are then used to estimate the error-correction model for each country, given that the ADF tests support the validity of the model:

$$\Delta p_t^d = \delta_1 \Delta p_t^w D_t^{ref} D_t^{\Delta} + \delta_2 \Delta p_t^w D_t^{ref} (1 - D_t^{\Delta}) + \delta_3 \delta \Delta p_t^w (1 - D_t^{ref}) D_t^{\Delta} + \delta_4 \Delta p_t^w (1 - D_t^{ref})(1 - D_t^{\Delta}) + \theta_1 \hat{v}_{t-1} D_t^{ref} + \theta_2 \hat{v}_{t-1} (1 - D_t^{ref}) + \varepsilon_t$$ (5)

All prices used in estimation are in current US dollars. The implicit assumption in the model is that the changes in the countries' exchange rates immediately translate into changes in domestic prices in local currencies, so that the price of coffee in US dollars in unaffected by currency fluctuations. In other words, perfect transmission of exchange rates to domestic prices is assumed.

The δs describe the short-term responsiveness of the domestic prices to world price increases and decreases before and after the reforms. The θs are the parameters capturing the pre- and post-reform speed of adjustment to the long-term equilibrium in domestic prices. The estimated coefficients can be used to calculate how long it will take the domestic prices to fully adjust to a one-time change in the world price. With a change in the world market price occurring at time $t = 0$, the new long-term equilibrium level of the domestic price is $\gamma(p^w + \Delta p^w)$. In the initial period the domestic price changes by $\delta \Delta p^w$. In the following period the error-correction component is added. The degree of adjustment of the domestic price relative to full adjustment n periods after the change in the world price equals

$$m_n = 1 - \frac{(\gamma - \delta)(1 + \theta)^n}{\gamma},$$ (6)

For derivation see Appendix B.

4.   The data

The data for this exercise are monthly world market prices and prices paid to producers in approximately 20 coffee exporting countries for the past 20 years collected by the International Coffee Organization (ICO). Prices paid to growers are the farmgate prices reported to ICO by the national coffee authorities and constitute the average of all grades purchased from the farmers. The exchange rates used by the ICO to convert the prices in local currencies to US cents are the monthly average exchange rates published by the IMF.

Prices received by the exporting countries for their coffee on the world market vary depending on the coffee type exported. The "indicator prices" are calculated by the ICO on the basis of the daily spot prices of the relevant types coffee traded in the New York and Bremen/Hamburg markets. The ICO prices distinguish between four main groups of coffee: Colombian milds, Brazilian milds, other milds robustas. The main exporters of each type of coffee are listed in Table 2. In the country-by-country analysis the price of the appropriate coffee type is used as the world market price.

The quality of coffee and, correspondingly, the actual price paid for it varies within each of the four groups depending on the origin. The quality may change over time. In fact, in some countries the quality has been declining in the recent years. The actual export prices for each country cannot be inferred from the ICO data, which represents an average price for all coffee traded within each type. An indication of how export prices vary across countries and over time can be obtained from other sources, for example from trade statistics. US import data can be used to calculate the per unit import price of coffee. In 2002 the US imported one third of all green coffee traded on the world market. The per unit prices of US imports of raw coffee can therefore serve as an estimate of the actual export price received by a country. The monthly US import prices can obtained from the Tariff and Trade DataWeb of the US International Trade Commission[2]. As can be seen from Figures 2-5, the US import prices followed closely the ICO indicators in most cases, Ethiopian coffee being a notable exception.

It would not be appropriate to use the US import prices to explain the variation in the domestic producer prices, however. First, per unit prices that are calculated using the trade data are not observable until the transactions take place and customs collects all the information on values and quantities traded and publishes it. ICO indicators, on the other hand, can be easily observed as they are published daily and can be used as a basis for negotiating local prices. Second, interpreting the data correctly may be problematic because of the methodological difficulties. USITC reports imports of arabica and robusta together until 1989. After that the classification distinguished between "arabica" and "other" green coffee, the latter not necessarily being robusta. For example, a great deal of coffee from Colombia and Mexico, both of which only produce arabica, are classified as "other" in the USITC statistics. According to US Customs[3], misclassification is very common. If the invoice for the coffee sale does not specifically mention that the coffee is of the arabica sort, the importer automatically lists coffee as "other". Since both types have zero tariff, it makes no difference for the

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[2] http://dataweb.usitc.gov
[3] A phone interview with an Imports Specialist from the US Customs Service Center

collection of customs duties whether the coffee enters as one or the other tariff line. Thus, the tariff line "other" encompasses both arabica and robusta coffee, and the import unit values for the arabica and robusta coffee cannot be calculated separately. Therefore in Figures 2-5 all imports of green coffee are pooled together and a single import price is calculated. These prices can only be used for comparison with producer prices in countries which predominantly produce and export either arabica or robusta coffee. For countries that export both (Brazil, India, Tanzania) the US import unit values are not good indicators of world prices, as they represent a composite price for both arabica and robusta coffee. Lastly, US import prices are not available for all countries for every month in the considered period. Green coffee from a number of countries, namely Madagascar, Togo, Angola, Cameroon, Central African Republic and Ghana was not imported every month in the period under investigation, and the monthly price data would therefore have a lot of missing observations.

5.   The estimation results

The results of the stationarity tests conducted for the price variables are reported in Tables 3 and 4. The properties of each price time series are analyzed first. In all cases, except Ghana and to a smaller degree Tanzania, the ADF test does not reject the null hypothesis that the price time series follow a unit root process. However, testing the same hypothesis for first differences allows us to reject the unit root hypothesis at 1% level for all countries. This leads us to conclusion that price differentials can be used in the error-correction model.

Turning to the long-term cointegration between the domestic and the world prices we note that for most countries we cannot reject the hypothesis of no cointegration before the reforms, which is consistent with our expectations. Given the high degree of government intervention in the sector prior to liberalization we can expect the domestic prices to be driven by policy decisions, rather than by the world market prices. After the reforms cointegration is detected in some countries: In almost half of the cases the null of the residuals following a unit root process was rejected at 5% level of significance. In the pooled model with structural breaks the null of no cointgration is rejected at 10% significance in 9 countries out of 14. The exceptions are Colombia, Togo, Angola, Cameroon and Central African Republic. In all these countries, except Angola, a cointegrating relationship was found in the period after the reforms.

The estimates of the pre- and post-liberalization shares of producer prices in world prices are reported in Table 5, together with the results of the error-correction model. For countries where the model with

a structural break failed to reject the null of no cointegration, only the results of the post-liberalization error-correction model are reported. Since in Angola no long-run cointegration was detected in any of the three models no error-correction model is estimated for Angola. The conclusion in this case is simply that the reforms did not produce greater integration of domestic and world prices, and therefore the Angolan coffee prices remain isolated from the international prices.

In nearly countries the reforms significantly increased the target share of producer prices in the world prices. The only exception is Tanzania, where the price share decreased from 0.56 to 0.53, although the difference is significant only at 10%. In other countries the share increased dramatically. For example, in Uganda the target share in the world market price increased from 0.32 to 0.91 and in Ethiopia it grew from 0.40 to 0.73. In India, both arabica and robusta growers received around 0.56 of the world price earlier – now the share has increased to 0.69 and 0.85, respectively.

Short-term transmission has either remained unchanged or improved in all cases, most notably in Kenya, Tanzania, India and Uganda, where prior to the reforms the transmission was close to zero and increased considerably after. Post-liberalization transmission varied across countries and in some cases was very high, implying that domestic prices adjust almost immediately to the new equilibrium. Asymmetric short-run price transmission did not seem to be a big issue at play, but there are a few interesting cases. In Kenya the transmission of both price increases and price decreases changed from zero to positive values after liberalization, but the negative price changes are now transmitted faster to growers than the positive changes. While farmgate prices only increase by 40 cents as world prices go up 1 dollar, price decreases are passed through one to one, placing the full burden of falling coffee prices on growers. In Madagascar, where price transmission improved for price decreases, price increases are today passed through with a negative sign, leading to a surprising conclusion that producer prices fall in the short-run in both cases – when the world market price increases and when it decreases. A similar situation is observed in post-reform Cameroon, where no short-term transmission of price decreases was found, but price increases lead to immediate downward changes in producer prices. There are no cases where prices increases were transmitted more fully than price decreases.

To better understand how the transmission of price decreases changed relative to the transmission of price increases, a measure of the net change is constructed and presented in Table 5. In five out of nine countries, for which the error-correction model was estimated, the transmission of price decreases went up by more than the transmission of price increases. These countries are Ethiopia, Kenya, Mexico, Uganda and Madagascar. While previously all price movements were transmitted poorly to

producers in these countries, the liberalization made the pass-through of the negative price changes easier than the transmission of the positive changes. Out of the countries mentioned, only in Kenya the change was significantly greater for price decreases than for price increases at 10% significance. This simple calculation of the relative changes illustrates, nevertheless, that the reforms may have had an uneven impact on positive and negative price transmissions.

The speed of adjustment improved in many cases, increasing from zero to around 0.2 in Ethiopia, Kenya and Tanzania. It did not improve significantly in Brazil or in Mexico, probably because the scope of the reforms in these countries was limited given the initial conditions that were less restrictive than in the African countries.

No conclusions can be drawn regarding the reform-induced changes in price transmission and price shares in the countries, where no long-term cointegration between the world market and the domestic market was found. In Colombia, Togo, Cameroon and Central African Republic cointegration was detected after the reforms, but not during the whole period considered. However, both the price transmission and the producer price share after the reforms was higher in Colombia than in the three African economies. This is consistent with the expectation that in a country where producers are organized and pursue their interests collectively, as it is the case in Colombia, grower price shares will in general be higher than in other countries.

To understand how the reforms affected the speed at which the domestic prices react to changes in the world prices, it is useful to calculate the degree of adjustment of the internal price to a one-time change in the world price. The results for adjustment 6 and 12 months after the change in the world price are reported in Table 6 and Table 7. In the majority of the countries prices adjust faster today to changes in world market prices than they used to. In Ethiopia, Tanzania, India, Uganda and Kenya the degree of adjustment after six months has increased drastically from less than half to around 90% and higher. In Brazil and Mexico, on the other hand, the adjustment is slower now than prior to change in policy. Note that in Brazil before the liberalization the domestic prices were overshooting following the change in the world price, since the immediate response parameter δ_1 and δ_2 were higher than the target price share γ_1, especially for robusta coffee. In all three cases where asymmetric price transmission was detected (Kenya, Madagascar and Cameroon), price increases are transmitted slower today than price decreases. Moreover, in Madagascar the domestic prices adjust faster to world price decreases now relative to the period before the reforms, but adjustment to price increases is slower.

**6.	The impact of the reforms**

In nine out of 14 countries investigated the grower prices were integrated with the world market prices in the longrun. In the remaining countries (except Angola) a cointegrating relationship between the price series was detected in the post-reform period only. The short-run transmission improved in almost all cases where the comparison of the coefficients before and after the reforms was possible. In other cases (Mexico, Madagascar and Ghana) the changes were not significant. The speed of adjustment increased in all countries, except Brazil, Mexico and Uganda.

In general, the greatest impact of the reforms was detected in countries where the liberalization was complete, leading to full withdrawal of parastatals from marketing, significantly simplified procedures for export licensing and a surge of private traders into the market. For example, in Uganda the liberalization process covered the whole marketing chain from farm purchasing to exporting. Traders are now free to negotiate their own overseas contract and payments are passed quickly to coffee growers. The result is almost tripling of the target producer price share and large and significant improvement in the immediate transmission of the world market signals. Less striking but equally important results were achieved in India and Brazil – both countries with substantial reforms involving a switch from state trading to a market-based system. The changes were tremendous in Kenya and Ethiopia as well, although in these countries the reforms were more limited. In Mexico, where the starting point was a less restrictive system, the reforms increased the target share of grower prices, but did not influence the price transmission significantly.

In some countries several important reforms took place, but they were less far-reaching or happened more gradually than in the cases described above. In Tanzania, cooperative unions, which were controlled by the coffee board prior to the reforms, still account for a large share of trade. The Tanzania Coffee Board runs the obligatory coffee auction. The coffee sales taxes are quite high and their structure is complicated. The taxes have been increasing in the last couple of years. All this combined, in particular the increase in taxes, could have an impact on the reform outcome. Tanzania is the only country where the target share of grower prices in world market prices didn't increase following the liberalization.

In Colombia no structural reforms occurred, only the domestic pricing mechanism was changed slightly. The FNC, which was founded in 1927, remains the most dominant player in the market and fixes grower prices. This fact puts restraints on the integration between the domestic and the world

market prices. Subsequently no long-term cointegration in a model with structural break was found in Colombia. However in the period 1995-2002 grower prices were cointegrated with the world prices, indicating that the long-run relationship between the internal and the international prices has improved.

Similarly, in a number of the African countries (Togo, Cameroon and Central African Republic) no cointegrating relationship between the price time series was found during the whole period considered, but cointegration existed in the post-reform period. This means that we cannot reliably estimate an error-correction model with a structural break, and it is therefore not possible to compare the coefficients of price transmission and producer price shares before and after the reforms. However, given that the null hypothesis of no cointegration between the local and the world prices can not be rejected in the pre-reform period, but is rejected when only post-reform years are considered, the conclusion is that the reforms were successful in creating greater linkages between the internal and the external prices.

Lastly, in the case of Angola, where the reforms had no impact on the cointegration between the domestic and the world prices, it is clear that the reforms have not been far reaching enough to produce a lasting result. The domestic prices are still fixed by the government, providing little incentives for private traders to enter the market. Moreover, many remote markets are disrupted because of the war and the infrastructure has been destroyed, cutting off some of the coffee growing areas.

7.   Conclusions

With the help of the cointegration analysis and an error-correction model, this paper examined price transmission from the world coffee market to local markets in the producing countries before and after sector reforms. In addition, the impact of the policy changes on the share of grower prices in world prices was estimated. The results show that the share of producer prices in the world price has increased substantially in all countries except one. There is greater integration between the domestic and world markets today than prior to the reforms, and the transmission of world price signals has improved in most cases.

The impact of the liberalization process seems to have been limited if the reforms were incomplete. Administered producer prices, continuing government involvement in marketing and lack of private initiative in trading appear to be detrimental to greater integration and higher domestic prices. When the government sets the floor prices in the post-reform period, the prices tend to stay at the minimum,

and upward movements in the world market price are not passed through to growers. A possible explanation is that excessive regulation discourages entry of private traders, which in turn curtails competition and obstructs upward movements of the grower prices when the world price is high. However, even with many traders operating on the market, the positive effect of liberalization on producer prices may be undermined if the traders engage in collusive behavior.

Finally it should be noted that greater price transmission of world market prices may in fact work to the disadvantage of producers in the short run. With world market prices on a steady decline since the end of 1990s, fixed domestic prices at a pre-crisis level would have been preferred by the producers. Moreover, this study shows that in some cases the impact of the reforms on price transmission has been somewhat asymmetric – the transmission has risen more for price decreases than for price increases in some countries, meaning that the growers now bear the full costs of price drops, while the transmission of the positive price shocks has not changed much. A greater pass-through of prices changes at the time of falling prices is unfavorable to producers who may lack resources to cope with price risks. In many post-reform systems the coffee growers are left entirely uninsured against low prices. Artificially high government-supported producer prices are, however, unsustainable in the long run because of the large public outlays such support schemes would require. An alternative approach would be giving growers access to price risk management instruments, such as an opportunity to buy futures and option contracts or offer them private insurance that would shield them against price falls. This approach is consistent with the recent initiatives by the World Bank to help the coffee authorities in the exporting countries to apply risk management techniques. Pilot price insurance schemes have been launched in several countries and more are expected to be initiated in the near future[4].

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[4] For more information see, for example, ITF(2002a), ITF(2002b), ITF(2002c) and Varangis *et. al.* (2003).

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Table 1   Outcomes of the coffee sector liberalization

Country	Reform year	Change in the role of the parastal agency	Price control after the reform	Domestic marketing after the reform	Exporting after the reform
Brazil	1990	From price stabilization to industry supervision	None	Liberalized	Liberalized
Ethiopia	1992	From state trading to industry supervision; mandatory auction	Minimum export differentials	Partly done by ECPE	Partly done by ECEE
Kenya	1993	Producer-dominated, reforms limited; mandatory auction	None	Liberalized	Liberalized
Tanzania	1994	From state trading to industry supervision; mandatory auction	None	Liberalized, but licensing is restrictive	Liberalized, but licensing is restrictive
Colombia	1995	Producer-dominated, reforms limited	Administered prices	Partly done by the FNC	Partly done by the FNC
Mexico	1993	From state trading to industry supervision	None	Liberalized	Liberalized
India	1996	From state trading to industry supervision	None	Liberalized	Liberalized
Uganda	1992	From state trading to industry supervision	None	Liberalized	Liberalized
Madagascar	1988	From state trading to industry supervision	None	Liberalized	Liberalized
Togo	1996	From state trading to industry supervision	None	Liberalized	Liberalized
Angola	1991	From state trading to industry supervision	Minimum prices	Liberalized	Liberalized
Cameroon	1994	From state trading to industry supervision	None	Liberalized	Liberalized
Central African Republic	1991	From state trading to industry supervision	Indicative prices	Liberalized	Liberalized
Ghana	1992	From state trading to industry supervision	None	Liberalized	Liberalized

Table 2   Coffee exports by country, shares

March 2003 to February 2004

Colombian Milds	14.1%	*Robustas*	34.4%
Colombia	12.4%	Vietnam	14.4%
Kenya	1.0%	Indonesia	5.0%
Tanzania	0.7%	Uganda	2.6%
		Côte D'Ivoire	2.7%
Other Milds	24.2%	Cameroon	0.9%
Guatemala	4.4%	Madagascar	0.2%
Mexico	3.1%	Togo	0.1%
Honduras	3.0%	Central African Republic	0.04%
Peru	2.9%	Ghana	0.02%
India	1.7%	Angola	0.02%
Other	9.1%	Other	8.3%
Brazilian Naturals	27.3%		
Brazil	24.7%		
Ethiopia	2.6%		
TOTAL			100%

Source: International Coffee Organization

Table 3   Stationarity of the domestic and the world prices

Augmented Dickey-Fuller Test (without trend)[1]

	ADF statistic	
	Price level	First differential
ICO indicator prices		
Brazilian naturals	-2.11	-6.42 ***
Colombian milds	-2.09	-6.52 ***
Other mild arabica	-2.26	-5.84 ***
Robustas	-1.61	-5.68 ***
Producer prices		
Brazil arabica	-2.48	-6.60 ***
Brazil robusta	-1.77	-5.80 ***
Ethiopia	-2.20	-6.78 ***
Kenya	-2.22	-8.02 ***
Tanzania arabica	-2.76 *	-5.75 ***
Tanzania robusta	-1.83	-5.82 ***
Colombia	-1.86	-5.21 ***
India arabica	-2.31	-5.72 ***
India robusta	1.57	5.09 ***
Mexico	-2.12	-6.08 ***
Uganda	-2.17	-7.46 ***
Madagascar	-1.09	-6.77 ***
Togo	-2.12	-5.33 ***
Angola	-0.05	-8.44 ***
Cameroon	-1.53	-6.61 ***
Central African Republic	-1.59	-5.70 ***
Ghana	-5.18 ***	-5.36 ***

*   Null of unit root rejected at 10% significance

**   Null of unit root rejected at 5% significance

***   Null of unit root rejected at 1% significance

[1] 6 months lag length is used

Table 4   Cointegration between the domestic and the world prices

Augmented Dickey-Fuller Test (without trend)[1]

	Reform year	ADF statistic		
		Before	After	With structural break
Brazil arabica	1990	-1.74	-2.11	-3.22 **
Brazil robusta	1990	-1.60	-2.52	-3.28 **
Ethiopia arabica	1992	0.11	-3.59 ***	-3.15 **
Kenya arabica	1993	-1.95	-4.35 ***	-4.96 ***
Tanzania arabica	1994	-2.85 *	-2.83 *	-3.78 ***
Tanzania robusta	1994	-2.51	-1.92	-2.28
Colombia arabica	1995	-1.78	-3.43 **	-2.50
India arabica	1996	-2.66 *	-4.23 ***	-3.42 **
India robusta	1996	-2.59 *	-3.40 **	-3.21 **
Mexico arabica	1993	-2.10	-2.58 *	-3.53 ***
Uganda robusta	1992	-2.76 *	-2.10	-3.67 ***
Madagascar robusta	1988	-1.35	-3.24 **	-3.82 ***
Togo robusta	1996	-1.67	-4.27 ***	-2.56
Angola robusta	1991	-0.58	-2.45	-1.89
Cameroon robusta	1995	-1.23	-3.32 **	-2.20
Central African Republic robusta	1991	-0.91	-2.59 *	-2.27
Ghana robusta	1992	-4.37 ***	-2.82 *	-5.17 ***

*   Null of unit root rejected at 10% significance

**   Null of unit root rejected at 5% significance

***   Null of unit root rejected at 1% significance

[1] 6 months lag length is used

Table 5 The error-correction model with asymmetric price transmission

			Brazil	Brazil	Ethiopia	Kenya	Tanzania	Colombia	Mexico
Type of coffee			Brazilian natural	Robusta	Brazilian natural	Colombian mild	Colombian mild	Colombian mild	Other milds
Reform year			1990	1990	1992	1993	1994	1995	1993
Short-term transmission	price decreases	Before reforms (δ_1)	0.52 ***	0.84 ***	0.13	0.05	0.14		0.14
		After reforms (δ_3)	0.78 ***	0.69 ***	0.46 ***	1.06 ***	0.12 *	0.30 ***	0.28 **
		Change significant	Yes *	No	Yes **	Yes ***	No		No
	price increases	Before reforms (δ_2)	0.50 ***	0.81 **	0.17 **	0.01	-0.02		0.40 ***
		After reforms (δ_4)	0.77 ***	0.72 ***	0.44 ***	0.40 ***	0.17 ***	0.30 ***	0.44 ***
		Change significant	Yes ***	No	Yes **	Yes *	Yes *		No
Asymmetric price transmission significant		Before reforms	No	No	No	No	No		No
		After reforms	No	No	No	Yes⁻ ***	No	No	No
Net change in the short-term transmission[1]			-0.01	-0.06	0.06	0.62 *	-0.21		0.10
Speed of adjustment		Before reforms (θ_1)	-0.09 ***	-0.10	0.00	0.00	-0.04		-0.18 ***
		After reforms (θ_2)	-0.13 *	-0.10 ***	-0.17 ***	-0.22 ***	-0.25 ***	-0.31 **	-0.14 ***
		Change significant	No	No	Yes ***	Yes *	Yes ***		No
Target share of world price		Before reforms (γ_1)	0.50 ***	0.47 ***	0.40 ***	0.72 ***	0.56 ***		0.54 ***
		After reforms (γ_2)	0.81 ***	0.79 ***	0.73 ***	0.93 ***	0.53 ***	0.69 ***	0.82 ***
		Change significant	Yes ***	Yes ***	Yes ***	Yes ***	Yes *		Yes ***
Adjusted R-squared			0.59	0.52	0.22	0.27	0.15	0.45	0.20

*   significant at 10%
**   significant at 5%
***   significant at 1%
Yes- means that short-run transmission is significantly higher for price increases than for price decreases
1) Change in the transmission of price decreases net of change in the transmission of price increases, $(\delta_3 - \delta_1) - (\delta_4 - \delta_2)$

Table 5 (continued) The error-correction model with asymmetric price transmission

			India	India	Uganda	Madagascar	Togo	Cameroon	Central African Republic	Ghana
Type of coffee			Other milds	Robusta	Robusta	Robusta	Robusta	Robusta	Robusta	Robusta
Reform year			1996	1996	1992	1988	1996	1995	1991	1992
Short-term transmission	price decreases	Before reforms (δ_1)	0.05	0.05	-0.31 **	0.02				0.08
		After reforms (δ_3)	0.47 ***	0.47 ***	0.66 ***	0.15 *	0.30 ***	0.03	0.17 **	-0.31
		Change significant	Yes ***	Yes ***	Yes ***	No				No
	price increases	Before reforms (δ_2)	0.05	0.00	-0.16	0.01				-0.10
		After reforms (δ_4)	0.42 ***	0.56 ***	0.71 ***	-0.13 **	0.11	-0.32 ***	0.02	-0.07
		Change significant	Yes ***	Yes ***	Yes ***	No				No
Asymmetric price transmission significant		Before reforms	No	No	No	No				No
		After reforms	No	No	No	Yes⁻ **	No	Yes⁻ **	No	No
Net change in the short-term transmission[1]			0.04	-0.14	0.10	0.27				-0.41
Speed of adjustment		Before reforms (θ_1)	-0.08 ***	-0.05 **	-0.14 ***	-0.09				-0.09 ***
		After reforms (θ_2)	-0.28 ***	-0.14 ***	-0.26 ***	-0.09 ***	-0.20 ***	-0.09 **	-0.11 ***	-0.19 ***
		Change significant	Yes **	Yes *	No					Yes *
Target share of world price		Before reforms (γ_1)	0.57 ***	0.56 ***	0.32 ***	0.22 ***				0.43 ***
		After reforms (γ_2)	0.69 ***	0.85 ***	0.91 ***	0.47 ***	0.63 ***	0.49 ***	0.44 ***	0.49 ***
		Change significant	Yes ***	Yes ***	Yes ***	Yes ***				Yes *
Adjusted R-squared			0.23	0.14	0.27	0.06	0.18	0.11	0.09	0.09

*   significant at 10%
**   significant at 5%
***   significant at 1%
Yes- means that short-run transmission is significantly higher for price increases than for price decreases
1) Change in the transmission of price decreases net of change in the transmission of price increases, $(\delta_3 - \delta_1) - (\delta_4 - \delta_2)$

Table 6   Adjustment to a one-time change in the world price

Countries with no price transmission asymmetry

	Adjustment after	Before reforms	After reforms
Brazil arabica	6 months	101%	98%
	12 months	101%	99%
Brazil robusta	6 months	142%	95%
	12 months	122%	97%
Ethiopia	6 months	40%	88%
	12 months	41%	96%
Tanzania	6 months	25%	88%
	12 months	37%	98%
Colombia	6 months		94%
	12 months		99%
India arabica	6 months	43%	95%
	12 months	65%	99%
India robusta	6 months	27%	84%
	12 months	45%	93%
Mexico	6 months	85%	80%
	12 months	96%	93%
Uganda	6 months	30%	96%
	12 months	72%	99%
Togo	6 months		83%
	12 months		95%
Central African Republic	6 months		55%
	12 months		76%
Ghana	6 months	42%	66%
	12 months	67%	91%

Table 7   Adjustment to a one-time change in the world price

Countries with price transmission asymmetry

	Adjustment after	price decreases		price increases	
		Before reforms	After reforms	Before reforms	After reforms
Kenya	6 months	6%	103%	1%	87%
	12 months	5%	101%	0%	97%
Madagascar	6 months	48%	62%	44%	28%
	12 months	70%	78%	68%	59%
Cameroon	6 months		47%		7%
	12 months		70%		48%

Figure 1 Producer price shares before and after the reforms

Before liberalization
After liberalization
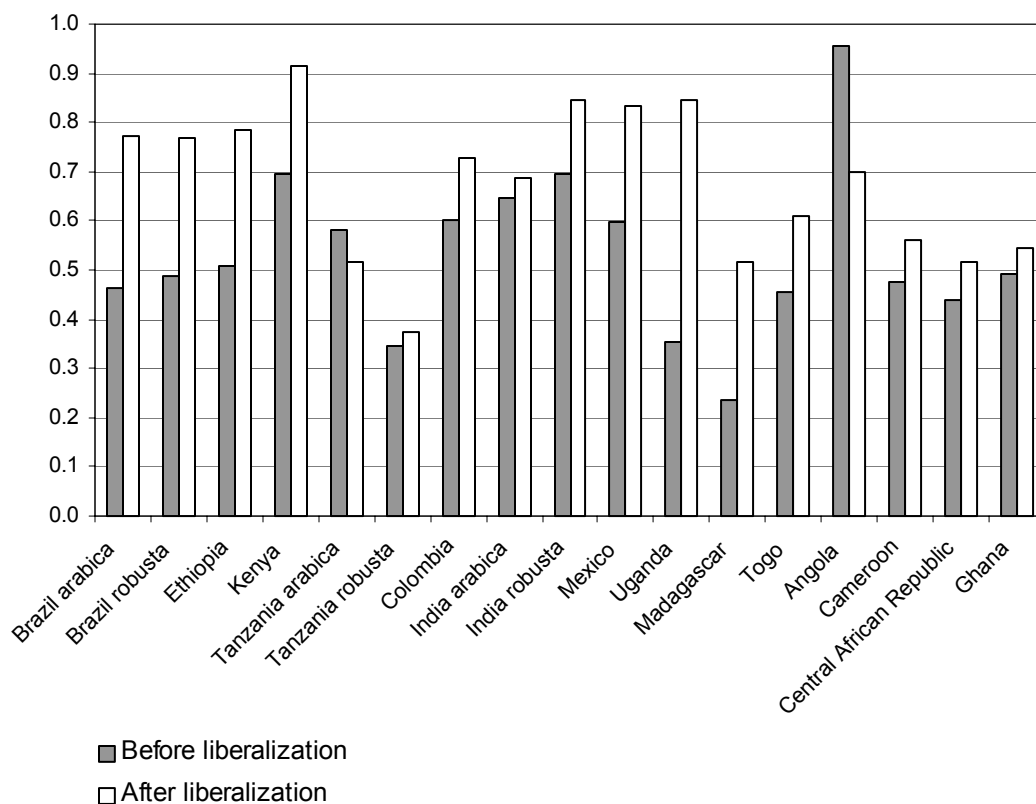
Figure 2   World market prices and US import prices -

Colombian milds

ICO indicator - Colombian milds

US import price - Colombia

US import price - Kenya

US import price - Tanzania
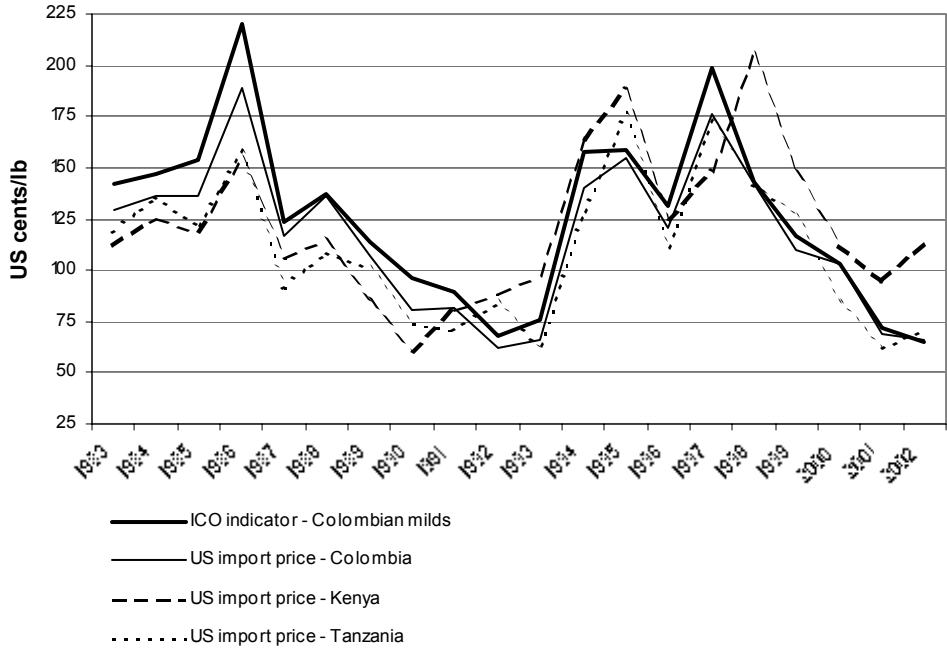
Figure 3   World market prices and US import prices -

Brazilian naturals

ICO indicator - Brazilian naturals

US import price - Brazil

US import price - Ethiopia

29
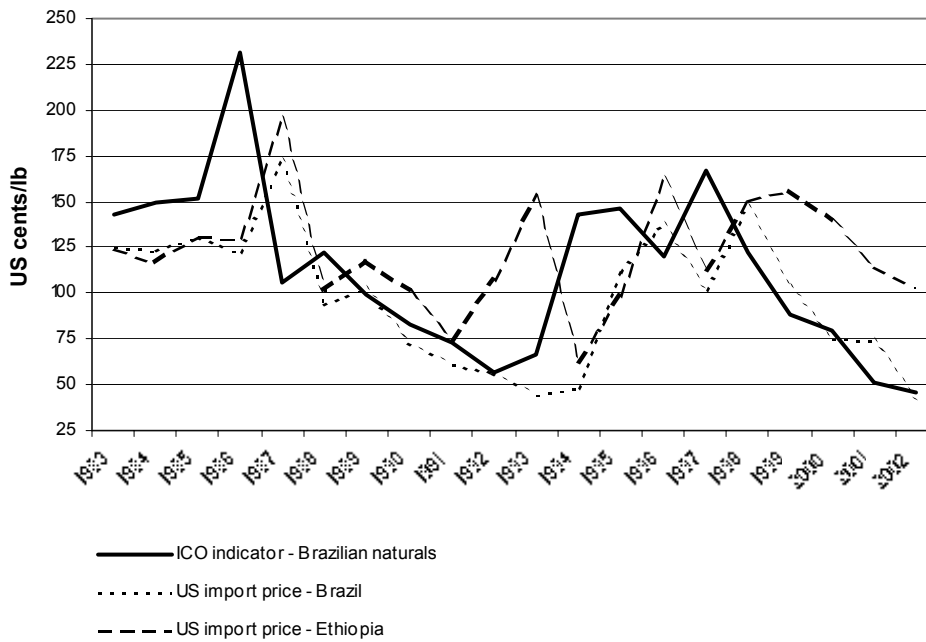
Figure 4   World market prices and US import prices -

Other milds

Legend:
— ICO indicator - Other mild arabica
– – – US import price - India
· · · · · US import price - Mexico
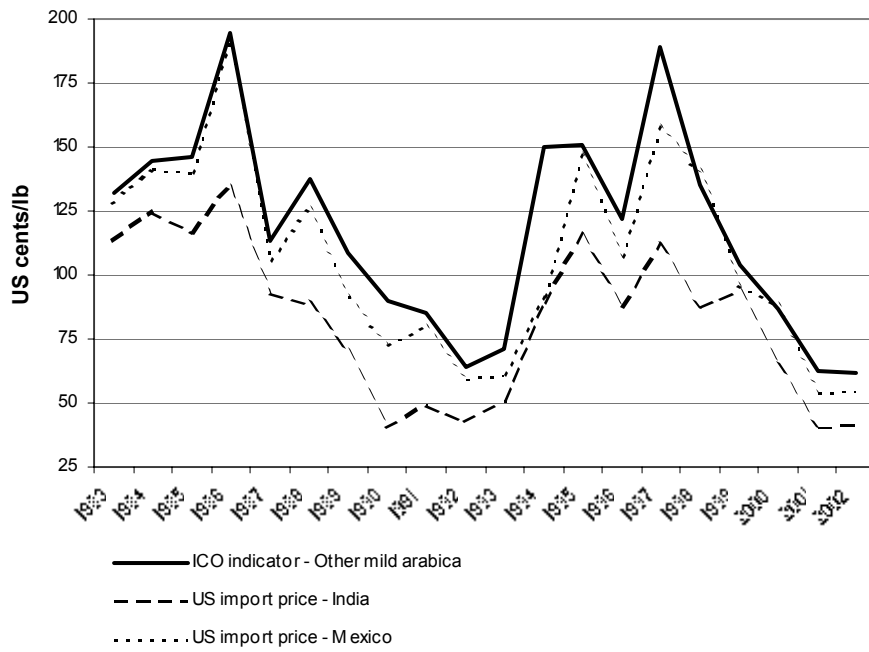
Figure 5   World market prices and US import prices -

Robusta

Legend:
— ICO indicator - robustas
— US import price - Cameroon
– – – US import price - Indonesia
· · · · · US import price - Uganda
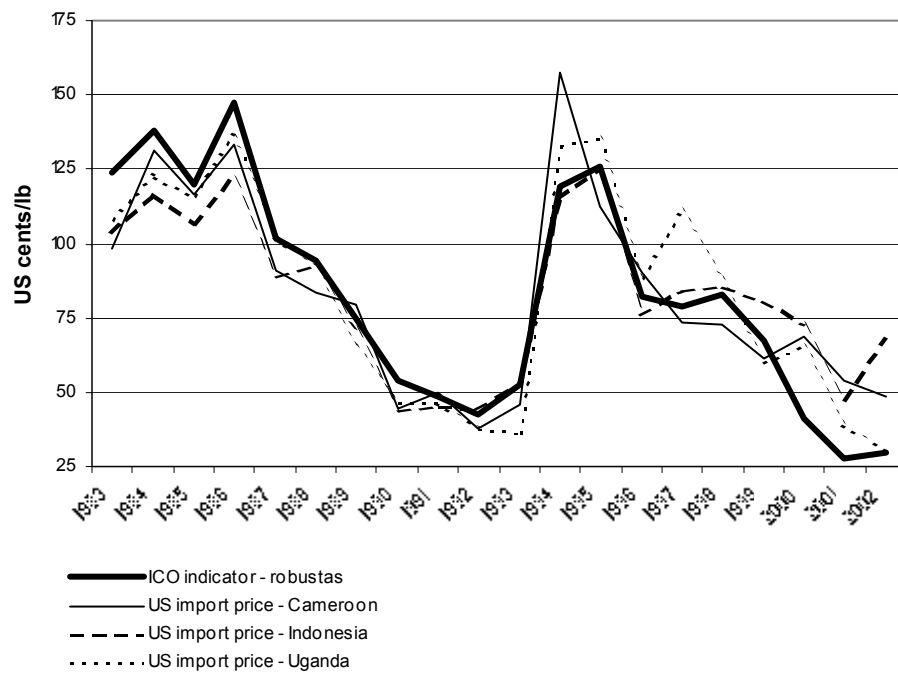
APPENDIX A: The coffee market reforms

Brazil

Prior to the liberalization in 1990 the Brazilian coffee sector was run by the parastatal Instituto Brasileiro do Café (IBC), which was responsible for a vast range of activities: setting minimum export prices, regulating standards, supervising domestic sales and exports, purchasing surplus coffee and administering stocks. Most notably, the government was involved in price stabilization, buying any surplus green coffee from millers at a guaranteed minimum price. In 1990 the sector was almost entirely liberalized, abolishing minimum prices and placing marketing in the hands of private traders.

The post-reform state involvement in the sector is limited to management and sale of publicly owned stocks, providing credit for growing, harvesting and processing and funding coffee research. Both domestic purchasing and exporting are run by the private sector. Prices are fully determined by the market. Although private exporters were allowed prior to liberalization, entry into the sector increased drastically after the reforms. Over 220 companies are listed as exporters, with none exporting more than 10% of the total. However, there is some indication of increasing collusion among exporters (ITF).

Colombia

Colombia is an outstanding example of a coffee sector entirely run by an association of producers. The powerful Federación Nacional de Cafeteros de Colombia (FNC) exerts major influence on the functioning of the sector. The FNC is contracted by the government to implement coffee policy and its involvement in coffee marketing is substantial: the FNC sets minimum producer prices, controls purchasing, processing and exporting of coffee and provides extension services, support to research and funding of infrastructure projects. FNC's agents handle half of all coffee sales, with the remaining crop being sold to private traders. In 1996 private exporters accounted for approximately 60% of all exports, while 40% were handled by the FNC. In addition, the FNC acts as a stabilization fund, buying surplus coffee from producers at a guaranteed price, which may exceed the world price net of marketing costs. In particular, between 1989 and 1994 producer received artificially high administered prices, causing losses to the FNC. Unsustainable in the long run, the system was abolished in 1995. Although no radical structural changes were made that year, 1995 is taken as the year of the reforms, because the high producer prices were suspended, which brought the internal prices closer to the world market prices.

While the Colombian coffee sector is marked by high degree of semi-governmental intervention, the system seems to benefit the growers. Acting unified, Colombian growers managed to get a substantial price premium on the world market and can influence the domestic policy to their benefit. Unlike in many other coffee producing countries, the system serves the interests of producers, not government bureaucrats or influential exporters.

Ethiopia

Until 1992 the Ethiopian Coffee Marketing Corporation (ECMC) fully controlled coffee marketing, handling 86% of all crop purchases in 1990/91. Growers were committed to deliver annual quotas at a fixed price. After the switch in the country's economic policy towards a market-based economy, ECMC was divided into two structures: the Ethiopian Coffee Purchasing Enterprise (ECPE), which purchases coffee, and the Ethiopian Coffee Export Enterprise (ECEE), which handles exports. Both compete with the private sector. The reforms facilitated entry of new traders and exporters. Around 75 exporters are now active and 240 hold an export license. Private traders account for 75% of exports, compared to only 10% prior to 1992. However, the sector remains somewhat regulated, with Coffee Price Differential Setting Committee setting daily minimum export differentials.

Kenya

Similar to the Colombian case, the parastatal coffee regulatory and monitoring authority in Kenya (the Coffee Board of Kenya, CBK) is an organization dominated by producers and serves their interests. CBK's board consists of nine growers and four government officials. Throughout the years CBK managed to get the highest price margins for exported coffee and Kenya is considered to be one of the highest quality producers of arabica in the world. To this date CBK remains in control of licensing producers and traders and is involved in marketing and research. Direct involvement in marketing is very limited, however. Coffee produced by smallholders is marketed by co-operatives, while the larger estates have their own marketing channels. All coffee in Kenya is sold to licensed traders and exporters at weekly auctions at the Nairobi Coffee Exchange.

Liberalization of the Kenyan coffee sector followed a piecemeal approach. Prior to liberalization, growers received payments for their coffee in installments as coffee passed through the various stages of processing and marketing. The final price paid to producers was based on the average auction price for the season. In 1993 the pricing system was changed, and growers began receiving one payment, equaling the actual price of the coffee auctioned less marketing costs. Another outcome of the liberalization process was greater competition in coffee processing. Prior to 1994-1995 the

Kenya Planter's Co-operative Union (KPCU) carried out all milling of coffee. The monopoly ended when two other mills were established. Finally, in 1997 the monopoly of the Kenya Coffee Auctions (partly owned by CBK) to act as broker in coffee auctions ended, and the growers were able to choose a private broker, if they wished. Because the pricing mechanism can be expected to have a direct impact on the prices received by growers, 1993 is set as the year of the most important reforms.

Tanzania

In Tanzania the liberalization took place in 1994, when private traders were allowed to purchase, process and export coffee. Prior to 1994 marketing was handled by the Tanzania Coffee Marketing Board (TCMB) and the government-controlled cooperative unions. TCMB controlled internal prices and exports. Farmers delivered coffee to primary societies at a previously announced price. The cooperative unions then performed milling and grading and brought coffee to TCMB to be sold to private exporters through auctions. The proceeds were then passed back to growers through cooperative unions and primary societies, deducting marketing and processing costs at each stage. It took at least a year for growers to receive the second portion of the payment (Baffes, 2003).

Following the liberalization, the market share of private traders in the internal market changed from zero to 67%, with vertically integrated exporters accounting for almost half of the coffee trade. The share handled by cooperative unions and other government organizations fell accordingly from 94% to 33%. (Baffes, 2003). While the reforms seem to have created greater competition in the marketing sector upon their implementation, in the last couple of years the trend has reversed. In 2000/2001 the Coffee Board revoked buying licenses of the private traders to ensure that the government-guaranteed loans to the cooperative unions get repaid. The ban was extended for the 2001/2002 season. The mandatory coffee auction is still in place. The existing tax system is too complex. The taxes are high and have been increasing in the last couple of years, eroding the revenues generated within the sector.

India

In the beginning of 1990's India switched its course from a centrally planned economy towards a free market system. Prior to the liberalization of the coffee market, the Coffee Board (CB) was in full control of coffee purchasing, processing and exporting. The CB ran two auctions: one for the domestic market and one for the export market. Similar to the pre-reform systems in many other countries, growers were paid in two stages: an advance at the delivery point and after the coffee has

been auctioned. Given the inefficiencies of the marketing system, this meant that in some cases growers had to wait up to two years after the delivery to receive their payment in full.

The reforms were introduced gradually, starting in 1992-1993 when producers were allowed to market 30% of their own crop on the domestic market, with the remaining coffee sold at the CB's auctions. By 1996 the CB's involvement in marketing ended completely, and coffee growers and exporters were free to trade the crop as they chose. Pooling of coffee into compulsory auctions had also ended. These changes meant that the producers received payment much faster, within days after sale. Coffee can be sold at farm-gate to domestic agents and exporters. The number of registered exporters increased from approximately 50 to almost 100 since early 1990's. The role of the CB today is limited to quality control, industry regulation, research and other non-interventionist functions.

Mexico

The liberalization of the Mexican coffee sector took place in 1993, when the Mexican Coffee Institute (INMECAFE), previously in charge of managing the ICO quotas, was replaced by the Mexican Coffee Council. The scope of the government intervention in the sector was reduced to promotion of Mexican coffee domestically and internationally and providing technical assistance to growers. Coffee is bought from farmers by producer organization and private traders, processed and sold to domestic roasters and exporters. In 1997 there were 230 exporters, 15 of which accounted for 68% of the total volume exported (ITF, 2002a).

Uganda

Until 1992 the exports of coffee from Uganda were fully controlled by the government, which acted through the Coffee Marketing Board (CMB) and the official cooperative societies. The farmgate prices were fixed. Liberalization of the coffee sector occurred in several stages. First, CMB lost the monopoly power over exports, and private traders and cooperatives were allowed to export directly. In 1991 a new agency, the Uganda Coffee Development Authority (UCDA), was formed with the mandate "to promote and oversee the coffee industry by developing research, controlling quality, improving the market and to provide for other matters connected therewith"[5]. The same year the administered prices were replaced by indicative prices. In 1992 the export tax on coffee was removed, but was reintroduced in 1994 as a stabilization tax.

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[5] UCDA's webpage: http://www.ugandacoffee.org/

Since the liberalization the share of CMB in coffee exports declined steadily, and full withdrawal took place in 1997/1998. Within months after the reforms 18 companies were registered as legal exporters and by 1994/95 the number reached 117. However, in the following years the number of registered exporters declined sharply: In the 2000/01 season there were only 22. At the same time, the share of top ten firms grew from 71% in 1994/95 to 87% in 2000/01 (ITF, 2002b).

Madagascar

Madagascar liberalized the coffee sector earlier than other countries. Prior to the reforms the marketing and stabilization board Caisse de Commercialisation et de Stabilisation des Prix du Café, de la Vanille et du Girofle (CAVAGI) was in charge of negotiating export contracts and managed five state owned exporting firms. Grower prices and marketing margins were fixed at the beginning of each crop year. In 1988 the sector was liberalized. The level of taxation was reduced and a large number of buyers entered the market. The number of exporters rose from five to 35. Since 1996 the concentration increased, the exports now being dominated by a few firms (between five and ten), all with strong links to multinational trade companies (ICO).

Togo

As in a typical pre-reform marketing system, the parastatal agency in Togo, OPAT (*Office des Produits Agricoles Togolais*), fixed grower prices and traders' marketing margins and acted as a monopoly exporter. Internal marketing, on the other hand, was handled by the private sector. Following the liberalization in 1996, the role of the government in commodity marketing became confined to provision of inputs and supporting establishment of farmers' organizations. The monopoly over exporting activities ended, and new traders and exporters emerged on the market. However, entry into exporting remained limited. Four companies dominate the market, accounting for approximately 75% of exports (ITF). Internal marketing is carried out by private agents and co-operatives.

Angola

Prior to 1991 Angola's coffee sector was run by two state marketing boards: Cafangol, which operated throughout the country, and Uigimex, which was responsible for coffee marketing and exporting only from Uige province. Partial liberalization began in 1991/1992, when private agents were allowed to compete Cafangol and Uigimex by buying coffee from farmers. The ICO reports that including the two parastatal agencies there are 25 licensed exporters, but five of them handled over 90% of the total exports in 1998.

There is still substantial governmental involvement in the sector. The State Secretariat for Coffee (Secafé) regulates and oversees the coffee industry, operating through the National Coffee Institute (INCA). The prices are regulated, with INCA setting the minimum producer prices at the beginning of the coffee season in May. The prices can be changed during the year. Clearly, the actual price paid to growers could exceed the minimum price, but it appears that only in very few areas of the country grower prices are higher than the announced minimum price.

Cameroon

Two marketing channels were operational in Cameroon prior to the reforms. In the anglophone areas, ONCPB, (*Office National de Comercialisation des Produits de Base*) acted as a marketing board, buying the crop from licensed agents and exporting it. In the francophone zones, private agents were allowed to export under the negotiated export contracts, but ONCBP fixed regional farm prices and marketing margins.

The liberalization of the coffee sector was gradual, ending in complete elimination of government involvement in the sector. In 1991 state licensing of domestic traders was abolished, and private exporters were allowed to export directly. While arabica marketing was fully liberalized, the state continued to fix marketing margins for robusta coffee, and a stabilization fund was established to control farm prices. The stabilization mechanism was dismantled in 1994/95. Immediately following the reforms, the number of exporters increased drastically from around 60 to over 300, but later declined to around 50, with ten firms exporting over 70% of the total (ICO). No government approval is needed to become an exporter, a simple statement of existence is sufficient (ITF, 2002c).

Central African Republic

The stabilization fund of the Central African Republic was dissolved in 1991 and a new agency, the Office for the Regulation of Marketing and Quality Control of Agricultural Products (ORCCPA), was formed to oversee coffee marketing. Today the government announces indicator prices at the beginning of the harvest season, and producer prices are negotiated on the basis of those prices. Grower prices are depressed by high transportation costs associated with getting export coffee to the port in Douala in Cameroon, which is the closest port to the landlocked Central African Republic.

Ghana

As a typical pre-reform state marketing board, the Ghanaian COCOBOD was fully controlling internal marketing, exporting, grower prices and marketing margins. The Produce Buying Company

(PBC), a subsidiary of the COCOBOD, bought coffee from producers and stored it in its warehouses after processing, inspection and grading. A different division of the COCOBOD, the Cocoa Marketing Company (CMC), handled external marketing.

Following the structural adjustment programs in 1992, the government liberalized all internal and external marketing of coffee. Private traders were allowed to enter the market, and fixed prices and trading margins were abolished. The main functions of the COCOBOD became sector regulation and management of licenses. The new marketing chain consists of Commission Agents that buy coffee from farms and registered exporters (the Licensed Buying Companies). By 1994 46 companies held export licenses (ICO).

Initially, when the world price is p^w, the equilibrium domestic price equals γp^w. When the world price changes by Δp^w, the new long-term equilibrium level of the domestic price is $\gamma(p^w + \Delta p^w)$. Thus, a full adjustment would require the domestic price to change by $\gamma \Delta p^w$. At $t = 0$, when the change in the world price occurs, the internal price changes by $\delta \Delta p^w$. The degree of adjustment is then δ/γ. Note that if $\delta = \gamma$ the degree of adjustment is one, meaning that full adjustment occurs immediately following the change in the world price. Otherwise, an error-correction component is added to the domestic price in the following period.

Note that the cumulative change in the domestic price n periods after the jump in the world prices equals the sum of all previous changes in the domestic price plus the error-correction term

$$\sum_{t=0}^{n} \Delta p_t^d = \sum_{t=0}^{n-1} \Delta p_t^d + \theta(p_{n-1}^d - \gamma p_{n-1}^w) \tag{B.1}$$

Since $p_{n-1}^d = \gamma p^w + \sum_{t=0}^{n-1} \Delta p_t^d$ and $p_{n-1}^w = p^w + \Delta p^w$ for all $n>0$, this simplifies to

$$\sum_{t=0}^{n} \Delta p_t^d = \sum_{t=0}^{n-1} \Delta p_t^d + \theta\left(\sum_{t=0}^{n-1} \Delta p_t^d - \gamma \Delta p^w\right) = \sum_{t=0}^{n-1} \Delta p_t^d (1+\theta) - \gamma\theta\Delta p^w \tag{B.2}$$

At $t = 1$, the total change in the domestic price equals

$$\sum_{t=0}^{1} \Delta p_t^d = \delta\Delta p^w + \theta(\delta\Delta p^w - \gamma\Delta p^w) = \left(\delta(1+\theta) - \gamma\theta\right)\Delta p^w \tag{B.3}$$

Note that $\delta(1+\theta) - \gamma\theta$ can be rewritten as $\gamma - (\gamma - \delta)(1+\theta)$. Then, in accordance with (B.2), the total change in p^d at $t = 2$ equals

$$\sum_{t=0}^{2} \Delta p_t^d = \left(\gamma - (\gamma - \delta)(1+\theta)\right)(1+\theta)\Delta p^w - \gamma\theta\Delta p^w = \left(\gamma - (\gamma - \delta)(1+\theta)^2\right)\Delta p^w \tag{B.4}$$

In the next period, at $t = 3$, the total change in the domestic price is

$$\sum_{t=0}^{3} \Delta p_t^d = \left(\gamma - (\gamma - \delta)(1+\theta)^2\right)(1+\theta)\Delta p^w - \gamma\theta\Delta p^w = \left(\gamma - (\gamma - \delta)(1+\theta)^3\right)\Delta p^w \tag{B.5}$$

Hence, at time $t = n$ the change equals

$$\sum_{t=0}^{n} \Delta p_t^d = \left(\gamma - (\gamma - \delta)(1+\theta)^n \right) \Delta p^w \qquad \text{(B.6)}$$

The degree of adjustment is the total change in the domestic price relative to full adjustment, which is $\gamma \Delta p^w$. Thus, n period after the change in the world price the degree of adjustment equals

$$m_n = \frac{\displaystyle\sum_{t=0}^{n} \Delta p_t^d}{\gamma \Delta p^w} = 1 - \left(\frac{(\gamma - \delta)(1+\theta)^n}{\gamma} \right) \qquad \text{(B.7)}$$