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Any views expressed or remaining errors are solely the responsibility of the authors.

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EXECUTIVE SUMMARY

In the late 1990s, several governments in Sub-Saharan Africa (SSA) embarked on various market reforms to improve commodity market performance. The success of such market reforms depends partly on the strength of the transmission of price signals between spatially separated markets and between different levels of commodity value chains. This study takes a look at these issues through an analysis of coffee producer prices for Zambia and Tanzania. Coffee is an important export commodity in both of these countries and contributes significantly to the creation of foreign exchange and employment. Both countries liberalised their coffee markets during the economic reforms to differing extents. The effects of these reforms on coffee price transmission remain largely unexplored, particularly in the context of asymmetric price movements, which are, in part, caused by high transaction costs.

The study employs momentum threshold cointegration and error correction models to examine the impact of policy reforms on the transmission of prices between the world coffee market and domestic prices in Zambia and Tanzania. Threshold models are used in order to assess the price adjustments of two cointegrated price series towards their long-run equilibrium where the adjustment is asymmetric. In addition, unlike previous studies, structural breaks due to agricultural policy shifts have been identified endogenously to determine the true effects on the data.

The study uses monthly observations of Arabica coffee producer prices for Tanzania and Zambia, measured in U.S. cents per pound (lb.). The producer price is the actual price received by the farmers obtained from the International Coffee Organisation (ICO). The response of producer prices is examined in relation to the world prices taking the producer composite indicator prices (CIP). The CIP is calculated by ICO based on market share of exports of each group of coffee weighted. All the price series have 273 monthly observations covering the period January 1986 to September 2008.

Results of the momentum cointegration estimation show that in every case, the null hypothesis of no cointegration can be rejected, indicating that both the Zambian and Tanzanian coffee prices have a long-run relationship with the world producer price series. Similarly, the null hypothesis of symmetric adjustment can be rejected, with the notable exception of the pre-reform period for Zambia.

Further findings show that in Zambia where the policy reforms fully liberalized the coffee markets, negative deviations from long-run equilibrium resulting from decreases in world prices are passed on quickly to domestic producers, whereas positive deviations resulting from increases in world prices are transmitted at a slower rate. For example, with Zambia-World prices, the estimates for the period after the reforms suggest that approximately 12% of a positive deviation and 75% of a negative deviation from the threshold are eliminated within a month. This finding is consistent with asymmetric transmission of prices from the world market to domestic market.

However, in the case of Tanzania, where the economic reforms did not fully liberalize the coffee markets, in contrast, negative discrepancies from the long-run equilibrium are eliminated faster in the pre-reform period, while positive discrepancies are eliminated faster in the post-reform period. The point estimates indicate that 52% of negative discrepancies are eliminated while only 9% of positive discrepancies are eliminated monthly in the pre-reform period. The figures for the post-reform period show that 19% of negative and 43% of positive discrepancies from the equilibrium are eliminated within a month.

In other words, after the government introduced coffee mandatory auction through the Tanzania Coffee Board and the introduction of producer floor prices, positive deviations arising from increases in world prices appeared to be eliminated faster than negative deviations. Thus, the government passes on world price increases to producers quickly, but price declines are passed on at a slower rate. However, results show that this rate of transfer, either for price increases or price decreases is slower than the rate of transfer in the case of Zambia which could lead to negative implications of the domestic price share in the world prices.

The results show significant increase in producer price share in the world price after economic reforms for Zambia, while a reduction in the share of Tanzania prices in the world price is noticed. These results reflect the differences in the extent of liberalisation of the coffee markets between the two countries. In Zambia, the reforms which led to a more liberalised coffee market had a positive impact while in the Tanzania markets, the reforms which led to more government intervention, resulted in a negative impact on producer price shares in world prices. Thus having negative implications on the farmers' welfare because where producer prices do not respond to changes in world prices, the producers are not able to benefit from world price increases.

Further results confirm that, the long-run adjustment of the price pairs followed a Momentum Threshold Auto Regression (MTAR) adjustment process. The results revealed that the MTAR model with the consistent estimate of the threshold fits the data much better than the Threshold Autoregression (TAR). Finally, the results indicated that examining price transmission without taking into account structural breaks inevitably leads to false rejection of the null hypothesis of symmetric transmission.

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ACRONYMS

ADB	African Development Bank
ADF	Augmented Dickey-Füller test
AIC	Akaike Information Criteria
APT	Asymmetric Price Transmission
CIP	Composite Indicator Price
DW	Durbin-Watson
IAPRI	Indaba Agricultural Policy Research Institute
ICO	International Coffee Organisation
IMF	International Monetary Fund
IRFs	Impulse Response Functions
KAAD	Katholischer Akademischer Auslander-Dienst
lb.	pound
LSLM	Lee and Stracizichi Lagrange Multiplier
MTAR	Momentum Threshold Autoregression
SBC	Schwartz Bayesian Criteria
SSA	Sub-Saharan Africa
SSR	Sum of Squared Residuals
TAR	Threshold Autoregression
TCB	Tanzania Coffee Board
Tsh	Tanzanian shilling
U.S.	United States
US$	United States Dollar
ZCGA	Zambia Coffee Growers Association

1. INTRODUCTION

Economic reforms have been undertaken in many developing countries over the past two to three decades. The reforms which included removal of price controls, trade liberalisation, and privatization of the government owned agricultural enterprises, were partly aimed at improving producer prices and enhancing trade efficiency (White and Leavy 2001). As widely documented in the economic literature, the measures implemented during the economic reforms have varied widely across the countries. For example, while some countries have greatly reduced the role of state-related marketing institutions and control of international trade, other countries still have marketing boards controlling the exports of commodities (World Bank 1994; Baquedano, Liefert, and Shapouri 2011).

Given that agricultural reforms took place as part of overall economic reforms in developing countries, it is useful to examine the extent to which these policy reforms have affected the world-domestic commodity price transmission. To the extent that coffee continues to play a crucial role in the economies of most of the countries in eastern and southern Africa, even for countries like Zambia and Tanzania that have relatively small world market shares, an analysis of the impacts of policy reforms on price transmission would provide useful insights for policy makers. Coffee offers employment to more than 400,000 smallholders in Tanzania and is the largest export earner for the country (Baffes 2005). The sector also employs about 17,000 seasonal workers in the rural areas in Zambia (ZCGA 2007). Both countries have liberalised their coffee markets during the economic reforms of the late 1990s to differing extents. While coffee markets have remained fully liberalised in Zambia, in Tanzania, cooperative unions still dominate the industry, with high government regulation through the Tanzania Coffee Board (TCB). Furthermore, as prices of major agricultural commodities declined over the last decade, coffee showed the greatest fall, resulting in declining and volatile domestic prices. This led to reduced investments in the coffee sector in most countries. In some cases, farmers resorted to uprooting coffee trees and replacing them with food crops like maize (Baffes 2005).

Since the policy reforms in the agricultural sector were geared towards getting prices right for farmers, an issue of economic significance is the extent to which changes in world market prices of export crops are transmitted to domestic producers. Particularly for export crop producers, the success of such market reforms depends partly on the strength of the transmission of price signals between international markets and domestic producer prices (Kilima 2006). Thus, the extent to which small-scale farmers benefit from price increases on the world markets remains a crucial issue in the trade liberalization debate (Coxhead, Linh, and Tam 2012).

Moreover, the extent of adjustment and speed with which shocks are transmitted from global to domestic prices is a significant factor reflecting the actions of market participants along the market channel (Esposti and Listorti 2013). The nature and extent of adjustments of domestic prices to market shocks may further have significant implications for marketing margins, spread, and mark-up pricing practices. Concerns about the rate and symmetry of price responses are normally raised, if one or more sectors in the marketing channel are highly concentrated and dominated by few firms (Wilcox and Abbott 2004).

The significance of identifying the nature and degree of price transmission from world to domestic markets has been widely documented in the literature (Baffes and Gardner 2003; Wilcox and Abbott 2004; Krivonos 2004; Kilima 2006; Katsushi, Gaiha, and Thapa 2008; Subervie 2011; Baquedano, Liefert, and Shapouri 2011; Coxhead, Linh, and Tam 2012).

However, the empirical literature has not sufficiently dealt with the impact of domestic policies on the transmission of prices between the world markets and domestic producer prices. For example, Kilima (2006) and Katsushi, Gaiha, and Thapa (2008) also examined world-domestic price transmission, without considering the impacts of policy reforms. The study by Baffes and Gardner (2003) analysed price transmission between world and domestic markets of developing countries under policy reforms. However, their framework assumed a linear relationship between world and domestic prices, without considering the role of asymmetric impact of shocks or threshold effects. Asymmetric price transmission takes into account the fact that negative and positive changes to prices in one market may have different impacts on price changes in another connected market. Threshold price transmission means that the price changes in one market may not immediately induce change in other markets until the price changes reach a certain level or threshold that's when prices in other markets tend to react.

The study by Krivonos (2004) on impacts of policy reforms on price transmission in the coffee market employed Autoregressive Distributed Lag and error correction models to capture the role of asymmetric impact shocks. However, the analysis completely ignored threshold effects in price transmission. Baquedano, Liefert, and Shapouri (2011) studied the world market integration for export and food crops in Mali and Nicaragua, using a generalized error correction model, but without threshold effects. The recent study by Subervie (2011) employed threshold cointegration to analyze the dynamics of world price transmission to coffee growers in Columbia, India and Salvador. Although the study took into account the threshold effects in price transmission, it ignored the possibility of accumulation of changes in the price spread in one direction or the other, before reverting to equilibrium state.

The main objective of this study is to examine the impacts of policy reforms on the nature and speed of transmission of world prices to domestic prices in Zambia and Tanzania. In contrast to the other studies mentioned above, our study employs a momentum-based threshold cointegration model and asymmetric error correction framework to analyze how policy reforms have affected the transmission of price changes from the world to domestic markets in the two countries. Unlike the ordinary threshold cointegration model, the momentum-based threshold cointegration is able to show if the price differences between two price series are accumulatively bigger above or below the threshold.

A second objective is to assess the impact of the reforms on the share of producer prices in the world price. This will provide further understanding of the producer welfare effects of coffee market reforms.

Our empirical evidence reveals that economic reforms did have significant impacts on world-domestic price transmissions. In particular, producer prices in Zambia were found to respond more swiftly to decreases than increases in world market prices, and the magnitude of this swiftness increased substantially after policy reforms. In the case of Tanzania, producer prices were found to respond faster to increases than decreases in world market prices over the entire period. However, the period before reforms showed domestic prices responding more swiftly to decreases than increases in world prices, while the post-reform period was characterized by faster responses to increases than decreases in world prices.

The next section presents an overview of the economic reforms and coffee markets in Tanzania and Zambia. Section three discusses the data used in the analysis and outlines the empirical strategy employed in the paper. It briefly presents the momentum-based threshold

cointegration and asymmetric error correction models employed in the price transmission analysis. The empirical results from the long and short-run analyses are presented in the fourth section, while the final section presents conclusions.

2. COFFEE MARKETS AND ECONOMIC REFORMS IN TANZANIA AND ZAMBIA

As indicated previously, coffee is Tanzania's largest export crop, with 95% of coffee grown by smallholders on average holdings of 1-2 hectares. The 110 large scale farmers form the remaining 5% of the coffee farmers. The coffee sector in Tanzania has a history of structural changes and government interventions. Between 1961 and 1976, primary societies, which actually joined together to form cooperative unions, handled coffee procurement, paid farmers, and delivered the coffee to the cooperative processing factories, which then sold the coffee to exporters (Baffes 2005). The primary societies were abolished in 1976, and all post-harvest functions were handed over to the Tanzania Coffee Board. As a result of poor performance, the new structure was dissolved in 1984, with the cooperatives and primary societies being reinstated. In 1991, the Cooperatives Act was passed by the government, resulting in the recognition of the cooperatives as private institutions owned and managed by the members. A notable improvement from the sector reforms was the prompt payment (within three weeks) to the unions by the Coffee Board. In addition, the Board delegated to the unions the responsibility of paying primary societies and growers (Baffes 2005).

Further reforms in the coffee sector, which became part of the structural adjustment programme, affected the cooperatives. In particular, the devaluation of the national currency and deregulation of the financial markets did affect the functioning of the cooperatives. As a result of the devaluation, the Tanzanian shilling (Tsh) depreciated from Tsh 15.29/US$ in 1985 to Tsh 140.33/US$ in 1989 and Tsh 509.63/US$ in 1994. The decline in the Tanzanian Shilling resulted in an increase in the Shilling-value of coffee exports and the local price of imported chemical inputs (Winter-Nelson and Temu 2002). At the same time, the deregulation in the financial markets led to substantial increases in interest rates and greater restrictions in access to finance, with the nominal lending rates increasing from 12.25% in 1985 to 40% in 1994.

The high interest rates and greater restrictions in access to finance for public enterprises contributed to the financial difficulties of the cooperatives, as they lacked liquidity to make initial payments to farmers and were indebted to farmers for past deliveries (Baffes 2005). To improve efficiency in the system, the government allowed private traders to engage in trade starting in the 1994-95 marketing season.

As part of the reforms, the Tanzanian Coffee Marketing Board was replaced with the Tanzania Coffee Board (TCB), with a prime mandate of conduction compulsory coffee auction sales. The TCB continued to operate the auction for exports, issued export permits and licenses for domestic trade, and also monitored the industry (Winter-Nelson and Temu 2002). The reforms resulted in many private traders entering the domestic trade, with their share of auction deliveries rising from 13% in 1994 to 69% in 1996. According to Baffes (2005) these reforms resulted in an increase in the prices received by the growers with producer price share in the export price rising from 60% to 73% for Arabica coffee. However, Baffes (ibid) notes that taxes remained high which further reduced the prices received by producers, because some taxation took the form of flat fees. Consequently, the effective tax rate increased when world prices declined. In the 1997/98 farming season, the producers paid Tsh 1,242/kg tax, which was later reduced to Tsh 1,000/kg in 1998/99 season. Although this indicated a 24% decline in the amount of tax, it actually resulted in a 3% increase in tax on producer price as producer prices had significantly declined over the same period.

While the reforms led to improvements in producers' share of export prices and private sector participation, the functioning of input markets, particularly provision of credit, deteriorated sharply, as the multinationals did not engage in supply of inputs to the farmers. Moreover, the quality of services in areas such as research and extension declined significantly, resulting in a dramatic decline in the overall quality of coffee produced in the country (Baffes 2005). As a result, despite the increase in producer price share in the export price, some studies have shown that the reforms did not have positive effects on the share of the producer prices in the average world producer price. In particular, Krivonos (2004) found that Tanzania was the only country, out of 15 coffee producing countries, where the target share of the producer prices in the world price did not improve after market liberalisation. Tanzanian coffee prices continued to trail far below world prices, and have remained the lowest in Sub-Saharan Africa (ICO data over the years).

Given these experiences, the TCB decided to implement changes in 1999/2000. Mandatory auction by the TCB was introduced. Policies aimed at promoting the operations of farmer cooperatives where re-introduced and export licenses for some traders were revoked (Baffes 2005). By 2004, only about 30% of the coffee was sold directly to international traders (mainly by large estates and some certified products like the fair trade coffee), while 80% went through an auction run by the TCB. Currently, of the coffee that is traded at the TCB auctions, about 70% is from the traders that buy from the farmers at the primary markets in the villages while 30% comes from farmer groups and cooperatives (discussion with the TCB) [1]. Floor prices were also re-introduced, to shield farmers from the declining world prices at that time.

Tax obligations also shifted from the farmers to the traders, cooperatives and farmers groups who purchased from the farmers and participated at the auction market. Currently, tax amounting to 3.5% to 5% of producer farm-gate price is paid to the local government authorities. In addition, the traders, cooperatives and farmer groups have to the pay other contributions in the form of: i) research taxes to the TCB (0.75% of auction proceeds); ii) coffee development trust fund (0.2% of auction proceeds) and; iii) auction contribution to TCB (0.2%). Baffes (2005) has argued that these complex taxes and intrusive licensing procedures discourage the private sector, and that the power of the Coffee Board weakens private sector participation. He observes that the government became too involved in the coffee market.

Turning to Zambia, although the significance of the coffee industry for the Zambian economy is less than that in Tanzania, it nevertheless makes a substantial contribution to agricultural output and employment creation. The sector employs about 17,000 seasonal workers in the rural areas (ZCGA 2007). Large-scale producers appear to dominate coffee production in Zambia, accounting for almost 99% of total output. Marketing of coffee in the country is also much less complex than in Tanzania. Coffee from farmers is normally exported directly to roasters in consuming countries through the Zambian Coffee Growers Association (ZCGA). All coffee producers are members of the ZCGA, which provides marketing, quality control, milling, warehousing, shipping, and extension services to its members. The association also issues certificates to members who decide to market their own products.

Prior to economic reforms, the Zambian economy was characterized by strong state intervention in agricultural markets, which involved the fixing of producer prices, the

[1] The private traders are not allowed to buy from the farm gate but only from designated central markets where farmers bring the unprocessed coffee.

provision of transportation, storage and inputs, and subsidizing of credit for agricultural commodities (Wichern, Hausner, and Chiwele 1999). The exchange rate was constantly overvalued, which had an indirect impact on the production of tradable commodities. Private traders were not allowed in agricultural commodity trading and were also discouraged by the fixed market margins stipulated by the government.

After 1990, the government implemented a series of liberalization policies that aimed at decontrolling prices, privatization of state-owned enterprises, reducing inflation and introducing market-based exchange and interest rates. The privatization included large scale coffee estates, which under government management had become insolvent. Although the liberalization policies were constantly reversed for some crops (especially for maize after some shocks such as droughts), the coffee industry in Zambia remains fully liberalized where producers sell directly to international traders and roasters. In comparison to other SSA countries, Zambian coffee prices are relatively high and move closely with world coffee prices. For example, Zambian producers received the highest prices for mild Arabica in the whole of SSA in 2009 (AfDB 2010). ??

The preceding discussions on the different farming systems (large-scale dominated Zambia's coffee sector verses small-scale dominated Tanzania's coffee sector), the marketing of coffee in the two countries and the different policy reforms implemented in the coffee sector indicate there could be differences in the linkages between world market and domestic producer prices. The nature of such linkages, in particular, the speed and degree of price transmission between the two levels can signal the extent to which the markets perform efficiently. As pointed out by Baffes and Gardner (2003), it is expected that policy reforms will reduce the gaps between domestic and world prices, and will also result in changes in world prices being transmitted more completely and quickly to domestic prices.

3. MODELLING ASYMMETRIC PRICE TRANSMISSION

3.1. Threshold Cointegration Specification

Our analysis of price transmission involves the long-run relationship between the world price and the domestic price in the following price relation:

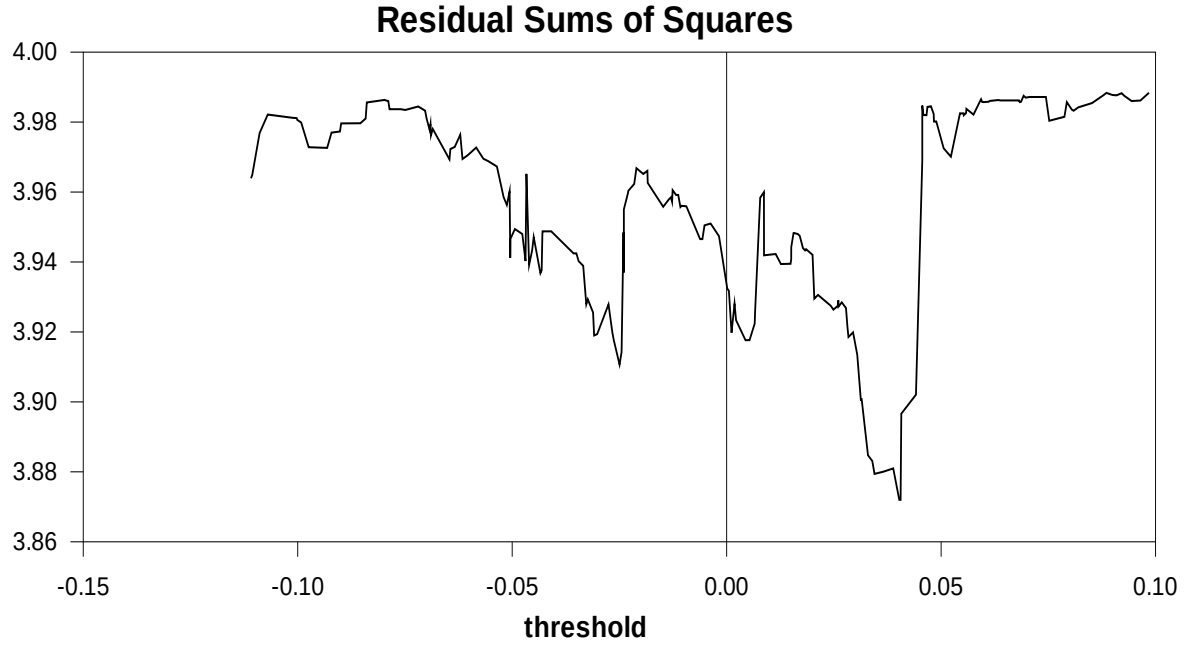
$$P_t^p = \delta + \beta P_t^w + \varepsilon_t \quad (1)$$

where P_t^p and P_t^w are producer and world prices, respectively, at time *t* for coffee; δ, and β are parameters to be estimated and ε_t is a random error term with constant variance that can be contemporaneously correlated. As indicated earlier, long-run price transmission analysis within this framework verifies whether any stable long-run relationship exists between the two price series. That implies ε_t (the price spread) should be stationary (Engle and Granger 1987). Short-run price transmission tests aim to establish whether prices in different markets or at different levels respond immediately to this long-run relationship. This framework, however, assumes a linear movement where tendency to move to long-run equilibrium is always present. However, movement towards equilibrium may not occur in every period. In particular, the presence of transaction costs may prevent economic agents from adjusting continuously (Abdulai 2000). Moreover, price adjustments towards the long-run equilibrium is not always symmetric as positive and negative price changes may not always be transmitted in the same way.

Threshold cointegration models recognize thresholds that are caused by transaction costs that deviations must exceed before provoking equilibrating price adjustments. Thus, threshold effects occur when larger shocks -shocks above some threshold-lead to a different response than smaller shocks do. The threshold model provides both the probability of being outside the band as well as a measure of the speed with which it eliminates these violations (Enders and Granger 1998). A number of threshold specifications have been suggested in the literature. For example, the Band-TAR, in which the autoregressive lags and threshold variables can be chosen to estimate the nonlinear mean reverting behavior of the price series. This specification was employed by Chen and Lee (2008) in their analysis of the law of one price for wholesale hog prices in Taiwan. Abdulai (2000) employed the TAR model suggested by Enders and Granger (1998) to examine maize markets in Ghana, while Subervie (2011) recently employed it to analyze coffee markets in Salvador, India and Columbia. Other threshold specifications that take into account the accumulation of changes in the price-spread in one direction or the other before moving back to the equilibrium position, include the Smooth-transition TAR, the Equilibrium TAR and the Momentum TAR (MTAR).

For threshold short-run adjustments to the long-run equilibrium, Balcombe and Rapsomanikis (2008) also used the Threshold Vector Error Correction Model to examine the sugar-ethanol-oil nexus in Brazil. Sjölander (2013) recently employed a ridge bootstrap method to analyze asymmetric price transmission on the Swedish mortgage loan market. In estimating threshold models, many researchers normally set zero as a threshold coinciding with long run equilibrium. However, Enders (2004) points out that a non-zero threshold has an advantage in that it captures strategic behaviors and adjustment costs that are rarely observed with small changes. He argues that a TAR model with threshold equal to zero does not display significant degree of asymmetry, possibility that the threshold could not be zero. Chan (1993) introduced a method of estimating a consistent threshold through grid search over all possible values. Enders (2004) explains the application of the Chan's (1993) procedure in TAR models.

Figure 1. A Threshold of 0.04 Identified from the Minimum RSS Based on MTAR Estimation for Tanzania and World Prices



Source: Author's computation based on MTAR estimation for Tanzania and world prices.

First, the threshold variable is sorted in ascending order. Ideally, the first and last 15% values of the threshold variable are excluded such that the search is limited to the middle 70%.

Then a search is done over the potential threshold in order to minimize the Sum of Squared Residuals (SSR). The estimated threshold that minimizes the SSR is the optimal threshold.

Although threshold models can have different regimes, Applying Chan's (1993) grid search method to our data showed the presence of one threshold in the residuals of the price pairs analyzed, indicating a two-regime threshold model. One of the results of the grid search is presented in Figure 1.

The two-regime momentum threshold cointegration model (MTAR) proposed by Enders and Siklos (2001) is therefore employed to address the limitations of the linear cointegration model proposed by Engel and Granger (1987). It allows the deviations from the long-run equilibrium to behave as a threshold autoregressive process:[2]

$$\Delta\varepsilon_t = \mathrm{I}_t\rho_1\varepsilon_{t-1} + (1-\mathrm{I}_t)\rho_2\varepsilon_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\hat{\varepsilon}_{t-i} + \mu_t \quad (2)$$

where I_t is the Heaviside Indicator function so that:

$$\mathrm{I}_t = \begin{cases} 1, & if\ \Delta\hat{\varepsilon}_{t-1} \geq \tau \\ 0, & if\ \Delta\hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (3)$$

[2] Their model can also be presented as a three-regime model. Most empirical work using TAR has largely ignored specification testing of the imposed TAR models. Specification testing is particularly important in threshold analysis of price transmission because the transaction cost theory that motivates the empirical specification of the TAR model imposes strong testable restrictions on the model (Lo and Zivot 2001).

where τ is the value of the threshold. Equations (2) and (3) represent a momentum threshold autoregressive cointegration model, in which the indicator variable I_t depends on the previous period's change in $\hat{\varepsilon}_{t-1}$, that is, the change in the spatial price spread. The adjustment is then estimated by $\rho_1\hat{\varepsilon}_{t-1}$, if $\Delta\hat{\varepsilon}_{t-1}$ is above the threshold and by the term $\rho_2\hat{\varepsilon}_{t-1}$, if $\Delta\hat{\varepsilon}_{t-1}$ is below the threshold. The threshold value τ is estimated by using the sample mean of ε_{t-1} and if the null hypothesis of cointegration is rejected, the null hypothesis of symmetric adjustment $\rho_1 = \rho_2 = 0$ can then be tested using the standard *F*-statistic. Enders and Granger (1998) and Lo and Zivot (2001) argue that if data are generated by TAR models such as the one above, then standard unit root tests can have very low power, explaining why some cointegration tests have rejected long-run relationships. Diagnostic checks of the residuals (such as the autocorrelogram of the residuals and Ljung-Box tests) and various model selection criteria (such as Akaike Information criteria [AIC] or Schwartz Bayesian Criteria [SBC]) are required to determine the appropriate lag length in equation (2).

When adjustment is asymmetric to the degree that the series exhibits more momentum in one direction than the other, then it is particularly useful to employ the MTAR specification. Thus, if $|\rho_1| > |\rho_2|$, the MTAR model exhibits little decay for negative $\Delta\hat{\mu}_{t-1}$, but substantial decay for positive $\Delta\hat{\mu}_{t-1}$. Thus, decreases tend to persist but increases tend to revert quickly toward the attractor.[3] A significant advantage with the MTAR model is that it can capture an accumulation of changes in the price spread below and above the threshold followed by a sharp movement back to the equilibrium position.

3.2. Threshold Error Correction Model

The consistency of (1), (2), and (3) with a wide variety of error correction models allows an error correction representation for the system. If asymmetric cointegration is revealed in the long-run adjustment estimated by the MTAR, it would be incorrect to estimate short-term adjustments through a symmetric error correction model (Enders and Siklos 2001). An asymmetric error correction model that reveals differential adjustments to positive and negative short-term deviations can be represented as:

$$\Delta P_t^p = \sum_{s=1}^{k} \alpha_s \Delta P_{t-s}^p + \sum_{s=1}^{k} \beta_s \Delta P_{t-s}^w + \gamma_1 Z\_plus_{t-1} + \gamma_2 Z\_minus_{t-1} \qquad (4)$$

where P_t^p and P_t^w still represent producer and world prices, respectively; Z_plus_{t-1} and Z_minus_{t-1} are the error correction terms from the cointegration regressions defined as:

$$Z\_plus_{t-1} = I_t(P_{t-1}^p - \alpha_0 - \alpha_1 P_{t-1}^w)$$

$$Z\_minus_{t-1} = (1 - I_t)(P_{t-1}^p - \alpha_0 - \alpha_1 P_{t-1}^w)$$

I_t is the momentum Heaviside indicator function with the consistent threshold.

[3] If adjustment is asymmetric, the sample mean is a biased estimate of the attractor (Tong 1983). In such cases, the sample mean will exceed that of the attractor (i.e., zero). Chan (1993) has shown that a super-consistent estimate of the threshold can be obtained by searching over all values so as to minimize the sum of squared errors from the fitted model.

4. ESTIMATION RESULTS FOR COFFEE IN ZAMBIA AND TANZANIA

4.1. Data and Stationarity Tests

4.1.1. The Data

The data used in this analysis are monthly observations from January 1986 to September 2008, and were obtained from the ICO. The ICO was set up in London in 1963 under the auspice of United Nations because of the great economic importance of coffee. As the main inter-governmental organisation for coffee, one of the activities of ICO is providing information on the world coffee sector by means of statistics and market studies (ICO website). The organisation collects average price data from member countries and compiles daily, monthly, quarterly and annually.

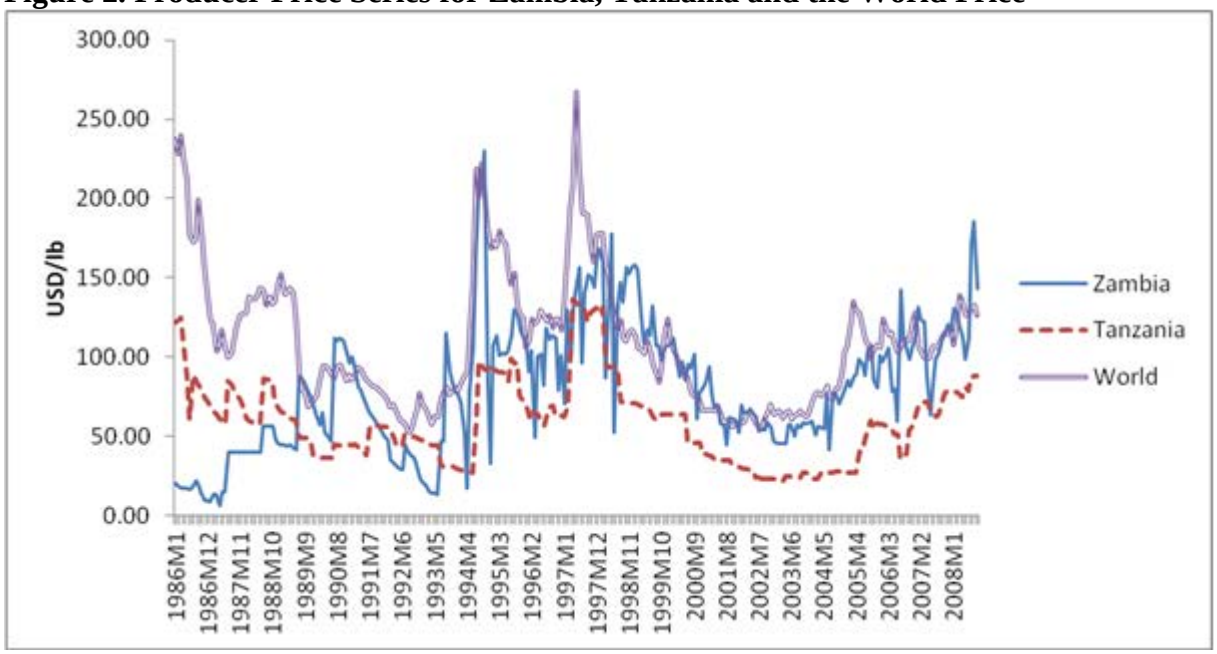
The producer price series used in this study are based on monthly observations of Arabica coffee producer prices for Tanzania and Zambia, measured in U.S. cents per lb.[4] In the case of Zambia, ZCGA collects daily information on all volumes traded and prices for all coffee export transactions and submits the records to ICO at the end of the each month. The ICO then computes daily, monthly, quarterly and annual averages. These prices reflect prices paid to the farmers before tax, and it remains up to the farmers to meet their tax obligations. As most coffee producers in Zambia are large-scale registered companies, the tax rates differ according to the nature and size of the company.

In Tanzania, the TCB working with the local authorities monitors volumes and prices at the primary markets in the villages, the only places where traders, cooperatives and farmer groups are allowed to buy the coffee from. TCB records the daily prices and reports to ICO on a monthly basis and ICO calculates the weekly and monthly averages. At the primary market coffee is sold in parchment (raw) and in local Tanzanian currency and the ICO converts the price to the price of processed coffee. ICO also converts the Tsh to dollars. This price is exclusive of tax as the smallholder farmers in Tanzania do not pay tax on revenue from coffee, particularly when they sell to the traders. It is the traders, cooperatives and farmer groups that pay the tax to the local authorities as well as other contributions to the TCB. The cooperatives and farmer groups may reclaim tax from the farmers in full or partial, while the traders do not get back to the farmers.

The world price is the average indicator price at major markets such as New York and Bremen/Hamburg.[5] The response of producer prices is examined in relation to the world prices taking the producer CIP.[6] During the period under consideration, world prices had an average of $1.10 per pound, which was much higher than the two producer prices. Zambian prices averaged $0.80 per pound, while Tanzanian prices recorded an average of $0.58 per pound. Figure 2 displays the sample time series of the prices analyzed in this study.

[4] One pound is equivalent to 0.453 kilograms.
[5] All producer prices and world market prices are in U.S. dollars. The producer prices in Zambia are already quoted in U.S. dollars, while the Tanzanian prices were converted into dollars from the domestic currency by the ICO.
[6] CIP is the price calculated based on market share of exports of each group of coffee weighted in accordance with Annex 1 of EB-3776/01 rev. 1 of the (ICO).

Figure 2. Producer Price Series for Zambia, Tanzania and the World Price



Source: International Coffee Organization data. Provided to author upon request.

Statistical properties of the series are reported in Table 1. If the standard deviation is considered as a measure of volatility, Zambian prices are the most unstable, with a standard deviation of 0.297, while Tanzanian prices appear to be less volatile, but still with a standard deviation that is 0.03 higher than world prices. Furthermore, all the price series show evidence of fat tails (excess kurtosis), since they are all above the normal distribution value of 3. Skewness is positive and significantly different from zero for Zambia and world prices, an indication that there are more values above the zero mean than below. It is abnormally high in the Tanzanian prices, probably due to regulated markets in that country during most of the period under consideration.

4.1.2. Stationarity Tests

In testing for stationarity, it is important to apply a test that accounts for structural break in the series, since the presence of structural breaks can lead to a greater likelihood of falsely rejecting the null hypothesis of symmetric transmission. Moreover, it is equally important to employ strategies that involve searching over all possible breakpoints to determine significant breakpoints, particularly when the impact of policy change on price transmission is under investigation.

Table 1. Descriptive Statistics for the Series

	Zambia	Tanzania	CIP
Mean	0.007	-0.001	-0.002
Std Dev.	0.297	0.112	0.082
Skewness	0.833	2.0533	0.563
Kurtosis (excess)	7.169	13.010	3.669

Source: Author.

Table 2. Unit Root Test Results

	ADF(Intercept, no trend)		LSLM (Intercept no trend)		
	Level	1st difference	Structural Break	Level	1st Differences
Log Zambia 9 lags	-2.470	-7.656***	1998:05	-2.586	-7.308***
Log Tanzania 13 lags	- 2.162	- 4.627***	2000:06	-2.511	-4.681***
Log World Price (CIP) 10 lags	-2.287	-4.723***	1989:06	-2.2415	-4.974***

Source: Author. Note: Number in parentheses are t-values. The Values are significantly different from zero at ***1%, **5% and *10% level. Critical values for ADF tests are from MacKinnon (1996). Critical Values for LSLM Unit Root Test (Crash model) are from Schmidt and Phillips (1992).

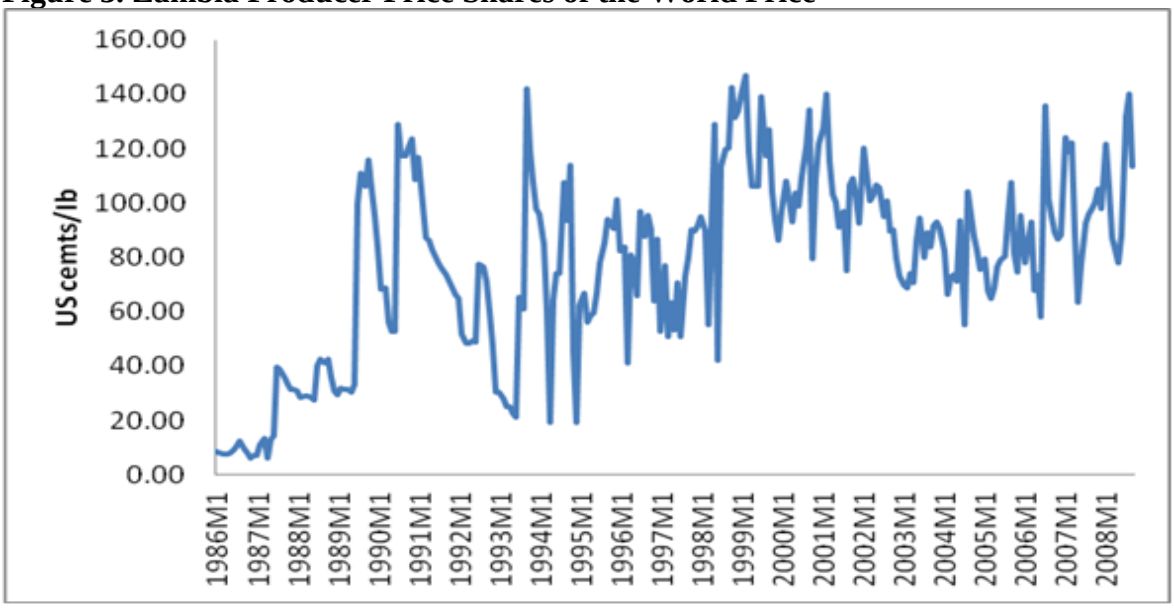
As noted by Cashin and McDermott (2002), identifying breakpoints through data mining is inappropriate, because the probability of false significant tests occurring is normally greater than assumed. In this study, the hypothesis that the price series are nonstationary is tested using both the Augmented Dickey-Füller (ADF) test and the Lee and Stracizichi Lagrange Multiplier (LSLM) structural break unit root test suggested by Lee and Stracizichi (2004). In particular, the LSLM procedure searches over all possible break points to test for a structural break and accounts for the fact that the breakpoints are dependent on the data. This study applied the Lee and Stracizichi (2004) single structural break unit root test in order to identify economic reforms breakpoint in the data. Given that the objective of the study was to establish the effect of economic reforms, a search for a single structural break was appropriate. The AIC was employed to determine the appropriate lag length which varied across the series.

Table 2 presents the results of the unit root tests. Both the ADF and the LSLM tests indicate that all the series are non-stationary at levels, but stationary at first differences. As shown in the Table, the identified structural break for Zambia was May 1998, which coincides with the completion of economic reforms in the agricultural sector. For Tanzania, the revealed structural break was in June 2000, a period that witnessed reversal of liberalization policies and new marketing policies for the coffee sector. For World prices, a structural break occurred in June 1989, coinciding with the collapse of the international coffee agreement. The Durbin-Watson (DW) values confirmed the absence of autocorrelation.

4.2. Effects of Economic Reforms on Domestic to World Coffee Price Shares

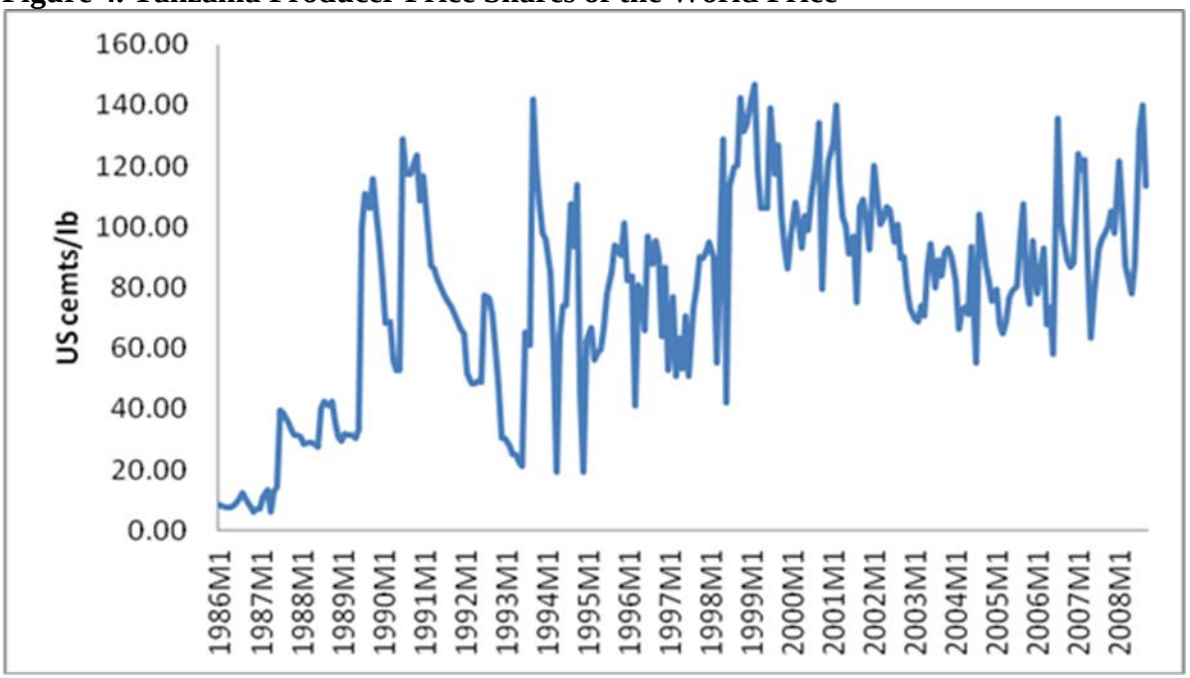
The estimated shares of producer prices to world prices are presented in Figures 3 and 4. From the figures, it is quite clear that Zambia's producer price shares of the world price increased significantly after the economic reforms. While the average price share before the reforms was 61.5%, it rose to 96.7% after the reforms. The fact that Zambia's coffee market was liberalised with minimal government intervention, left the prices to respond more efficiently to price changes at the world market. This is a clear indication of positive impact of the economic reforms on prices received by coffee growers in Zambia.

Figure 3. Zambia Producer Price Shares of the World Price



Source: Author's Calculation based on ICO data.

Figure 4. Tanzania Producer Price Shares of the World Price



Source: Author's Calculation based on ICO data.

In the case of Tanzania, the graph shows a relative decline in the producer share of the world price after the policy changes in 2000. While the average producer share of the world price was 57% before the 2000 trade policies that increased government's intervention in the domestic coffee markets, the shares dropped to an average of 48.9% after the reforms. Even examining the effects of the 1994 trade liberalisation policies that led to an increase in the number of private traders, results still show a decline from 54.5% producer price share of the world price before the reforms to 53.4% after the reforms. As Baffes (2005) points out, the

coffee market in Tanzania, unlike in the case of Zambia, still has high levels of government intervention, resulting in producer prices not responding efficiently to changes in the world price.

4.3. Cointegration and Threshold Estimations

Table 3 presents test results for the co-movement of world and domestic prices, using the Engle-Granger cointegration framework. Given the presence of structural breaks in the data, there is a high possibility of higher rejection of the hypothesis of no cointegration than appropriate. Hence, price transmission is examined before and after the structural break, in order to account for the policy changes.

Thus, for Zambia, the periods 1986-1998 and 1998-2008 were considered as pre-reform and post-reform periods, respectively, while the corresponding periods for Tanzania were 1986-2000 and 2000-2008.

In the case of Tanzania, the point estimates for the long-run coefficient β_1 are relatively stable across the chosen samples and lie between 0.81 and 1.06. However, they vary from 0.33 to 0.99 for Zambia. The Engle-Granger *t*-statistics show evidence of long-run equilibria among the pairs of world prices and the two domestic prices for the entire period for both countries. However, there are differences in significance levels for the two periods. While Zambia shows a long-run equilibrium relationship after the policy reforms, Tanzania appears to exhibit a long-run relationship before the reforms.

Table 3. Engle-Granger Cointegration Results

Zambia-World Prices					
Sample	β_0 [a]	β_1	R^2	ρ_1 [b]	DW
1986:01-2008:09	2.690 (5.433)	0.330 (3.096)	0.978	-0.124*** (-3.595)	2.006
1986:01-1998:05	2.000 (2.616)	0.428 (2.667)	0.967	-0.091 (-2.024)	2.022
1998:05-2008:09	-0.042 (-0.127)	0.998 (13.705)	0.998	-0.332 (-3.845)***	2.006
Tanzania-World Prices					
Sample	β_0	β_1		ρ_1 [b]	
1986:01-2008:09	-0.661 (3.039)	1.001 (21.389)	0.995	-0.117*** (-4.093)	1.985
1986:01-2000:06	0.285 (1.193)	0.816 (16.210)	0.997	-0.150*** (-3.301)	1.974
2000:06-2008:09	-1.088 (-2.320)	1.068 (10.145)	0.994	-0.111 (-2.422)	2.051

Source: Author. Notes: β_0 and β_1 are the estimated coefficients from the cointegration regression. a) ρ_1 are the estimated coefficients from the ADF test. b) Number in parentheses are t-values for the null hypothesis of no-cointegration (i.e., $\rho_1 = 0$). The Values are significantly different from zero at ***1%, **5%, and *10% level. Critical MacKinnon values at the 1% , 5%, and 10% level of significance are -3.455.

4.4. Threshold Cointegration Results (Long-run Adjustment)

Both the TAR and MTAR models were estimated for world and domestic producer prices for Zambia and Tanzania. We employed the SBC and AIC tests suggested by Enders and Granger (1998) to ascertain whether long-run adjustment follows a TAR or MTAR adjustment process. The results revealed that the MTAR model with the consistent estimate of the threshold fits the data much better than the TAR. We therefore present only the results from the MTAR model in Table 4.

Presented in the table are the consistent estimate of the attractor τ, the estimated parameters from equation (3), ρ_1 and ρ_2, the associated *t*-statistics as well as the *F*-statistics, F_C and F_A, for the cointegration test. The estimated values for the threshold in almost all the regressions are significantly different from zero.

Thus, in every case, the null hypothesis of $\rho_1 = \rho_2 = 0$ (no cointegration) can be rejected. Similarly, the null hypothesis of $\rho_1 = \rho_2$ (symmetric adjustment) can be rejected, with the notable exception of the pre-reform period for Zambia.

The estimates suggest that negative deviations from long-run equilibrium resulting from decreases in world prices are passed on quickly to domestic producers, whereas positive deviations resulting from increases in world prices are transmitted at a slower rate.

Table 4. MTAR Cointegration Results

Zambia-World Prices

Sample	τ	$\rho_1{}^a$	ρ_2	ϕ^b	φ^c	DW
1986:01-2008:09	-0.149	-0.094** (-2.702)	-0.327*** (-3.869)	10.535***	6.760**	2.039
1986:01-1998:05	-0.159	-0.1003* (-1.988)	-0.348** (-2.897)	5.787*	3.806	2.019
1998:05-2008:09	-0.167	-0.127 (-1.235)	-0.753*** (-4.315)	9.399***	11.467***	2.049

Tanzania-World Prices

Sample	τ	$\rho_1{}^a$	ρ_2	ϕ^b	φ^c	
1986:01-2008:09	-0.040	-0.207** (-3.546)	-0.055 (-1.249)	6.532*	5.048*	1.990
1986:01-2000:06	-0.098	-0.089 (-1.639)	-0.393*** (-4.331)	9.982***	9.191***	2.032
2000:06-2008:09	0.042	-0.280** (-3.692)	-0.018 (-0.337)	7.353**	6.043*	1.995

Source: Author. Note: Numbers in parentheses are t-values. The Values are significantly different from zero at ***1%, **5%, and *10% level. a) ρ_1 and ρ_2 are the estimated coefficients from the threshold cointegration regression. b) ϕ are F-statistic values for the null hypothesis of no-cointegration (i.e., $\rho_1 = \rho_2 = 0$). c) φ are F-statistic values for the null hypothesis of symmetric cointegration (i.e., $\rho_1 = \rho_2$). *, **, ***, denote rejection of the null hypothesis at the 10%, 5%, and 1% level respectively. Critical values at the 1%, 5%, and 10% level of significance are 8.35, 6.29, and 5.39 respectively for a consistent threshold (Enders 2004).

This finding is consistent with asymmetric transmission of prices from the world market to domestic market. Evident is the fact that the estimated parameters within the same periods, as well as between the periods vary in magnitude. In all cases, the estimated coefficients for deviations above the threshold ρ_1 are lower than the estimated parameters for discrepancies below the threshold ρ_2, indicating that a higher speed of adjustment toward the long-run equilibrium takes place when the price spread deviates below the equilibrium. For example, with Zambia-world prices, the point estimates of ρ_1 and ρ_2 reported for the entire period suggest that approximately 9% of a positive deviation and 33% of a negative deviation from the threshold are eliminated within a month.

The estimates for the pre-reform and post-reform periods also show similar results, with ρ_2 (negative deviation) being much greater than ρ_1 (positive deviation) in each case. However, the magnitudes of the coefficients appear to differ between the two policy regimes. Specifically, the speeds of adjustment to both positive and negative deviations appear to have increased after the reforms, with the difference between the two speeds of adjustment widening after economic reforms. In the post-reform period, 75% of negative deviations from the threshold are eliminated, while only about 13% of positive deviations are eliminated within a month. These findings suggest that the improvement in price transmission in Zambia following the policy reforms explains the increase in prices shares of producers in world prices.

These results are consistent with the findings of Subervie (2011), who found that largest increases in world prices are transmitted quickly to growers in the pre-reform period, while negative asymmetric transmission replaced positive one in the post-reform period, with largest decreases in world prices being transmitted faster to growers in the post-reform period. The results are also in line with those reported by Baquedano, Liefert, and Shapouri (2011) for Nicaragua, who also found that long run price transmission of world price changes to the domestic retail price increased after reforms.

The estimates for Tanzania-world prices reveal that the null hypothesis of no cointegration can be rejected for all sample periods, suggesting a long-run relationship between world market prices and producer prices in the country. Similarly, the null hypothesis for symmetric adjustments can be rejected in all cases, indicating asymmetric price transmission of world prices to producer prices. The results contradict the finding of no cointegration reported earlier with the Engel and Granger framework. The findings also contrast with the results of Kilima (2006), who reported no cointegration between world market and producer prices in Tanzania, using Engel and Granger cointegration tests. As indicated earlier, the linear cointegration test assumes that the tendency to move to long-run equilibrium is always present, although movement towards equilibrium may not occur in every period. In particular, the presence of transaction costs may prevent economic agents from adjusting continuously.

The magnitudes of the estimated parameters for the pre-reform and post-reform periods in Tanzania differ from those of Zambia. For the entire period, whereas 21% of a positive deviation from long-run equilibrium is eliminated within a month, the corresponding figure for negative deviations is just about 5%, suggesting that positive deviations from equilibrium are eliminated quicker than negative deviations. However, when the policy reforms are considered, the results appear to differ for the different policy regimes. Specifically, the estimated parameters for the pre-reform period indicate that only 8% of positive deviations are eliminated within a month, while 39% of negative deviations are eliminated. After the

reforms, as much as 28% of positive deviations appear to be eliminated within a month, while just about 2% of negative deviations are eliminated.

The results are generally in line with the policy reforms in the two countries. In Zambia, reforms were implemented to ensure privatization of the coffee sector and to allow private firms to purchase coffee from producers and sell on the world markets. In Tanzania, reforms that took place in 2000 rather reversed the previous privatization policy, and re-introduced policies to improve the quality of coffee which had deteriorated as the multinational companies did not provide extension services. The policies also were meant to ensure that farmers benefitted from increased world market prices, while price declines on the world market were absorbed by the government through guaranteed producer prices.

4.5. Short-term Dynamics

Given the findings from the MTAR model, we estimated asymmetric error correction models for each world-price/producer price pairing to examine the short-run dynamics. Estimations were performed for the three periods for both Zambia and Tanzania. The results of the estimated coefficients are presented in Table 5. The AIC was used to determine the lag length. The estimates reveal asymmetric adjustments for the entire periods, as well as the pre-reform and post-reform periods. Specifically, the *t*-statistics indicate that the coefficients of the positive and negative error correction terms (i.e., z_plus_{t-1} and z_minus_{t-1}) are significantly different from zero at conventional levels (with the notable exceptions of the z_minus_{t-1} coefficient in the pre-reform period for Zambia and post-reform period for Tanzania), indicating that changes in producer prices respond to both positive and negative deviations in the long-run price equilibria. However, world market prices do not appear to respond to disequilibria in producer prices, a finding that is not surprising, given that the world market shares of both countries are insignificant.

Table 5. Threshold Error Correction Results

Zambia-World Prices

	Producer price		World Prices	
Sample	$Z-Plus$	Z – minus	$Z-Plus$	Z – minus
1986:01-2008:09	-0.106 (-2.918)**	-0.302 (-3.416)**	0.002(0.245)	-0.048(-1.827)*
1986:01-1998:05	-0.135(-2.477)**	-0.072(-0.727)	0.013(0.869)	0.023(0.879)
1998:05-2008:09	-0.319(-2.233)**	-0.747(-4.146)***	-0.033(-0.518)	0.001(0.014)

Tanzania-World Prices

	Producer price		World Price	
Sample	$Z-Plus$	Z – minus	$Z-Plus$	Z – minus
1986:01-2008:09	-0.163(-3.298)**	-0.112 (-3.235)**	0.0137(0.439)	-0.142(-1.552)
1986:01-2000:06	-0.087(-1.811)*	-0.523(-6.033)***	0.024(0.672)	-0.161(-2.450)**
2000:06-2008:09	-0.427(-3.046)***	-0.191(-1.202)	-0.161(-1.703)	-0.197(0.052)

Source: Author. Note: Number in parentheses are t-values. The Values are significantly different from zero at ***1%, **5%, and *10% level.

Focusing on the entire sample periods, the point estimates for Zambia imply that producer prices adjust so as to eliminate about 30% of a unit negative change, but only 11% of a positive change in the deviation from the equilibrium relationship created by changes in world market prices.

On the other hand, Tanzanian producer prices adjust so as to eliminate approximately 11% of a unit negative deviation and 16% of a unit positive deviation from the long-run world market-Tanzanian equilibrium relationship created by changes in world market prices. Overall, there seems to be a substantial difference in the way in which positive and negative discrepancies are eliminated.

If the sub-samples are considered, the estimates for Zambia indicate that in the pre-reform period with government interventions, positive discrepancies are eliminated faster than negative discrepancies, while negative discrepancies appear to be eliminated faster than positive discrepancies in the post-reform period. Specifically, about 14% of positive discrepancies from the equilibrium are eliminated, while only 7% of negative discrepancies from the equilibrium are eliminated in the pre-reform period. The corresponding figures for the post-reform period are 32% and 75% for positive and negative discrepancies, respectively.

In contrast, the results for Tanzania appear to be different, with negative discrepancies being eliminated faster in the pre-reform period, while positive discrepancies are eliminated faster in the post-reform period. The point estimates indicate that 52% of negative discrepancies are eliminated, while only 9% of positive discrepancies are eliminated in the pre-reform period. The figures for the post-reform period show that 19% of negative and 43% of positive discrepancies from the equilibrium are eliminated.

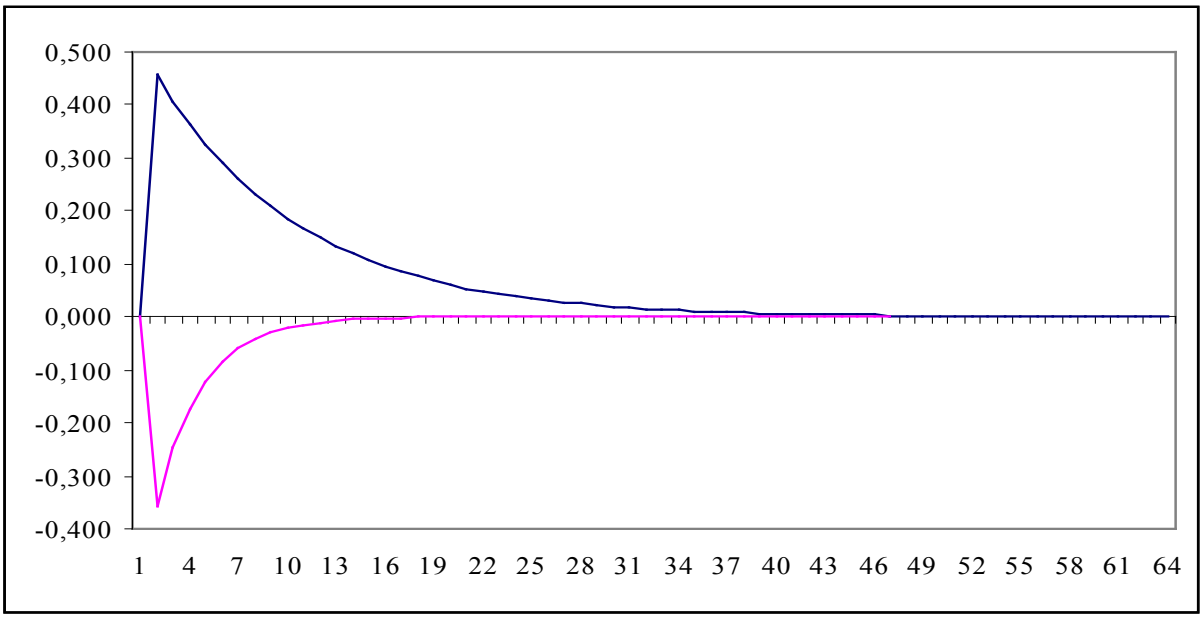
As indicated previously, the pre-reform period in Zambia was characterized by government interventions to stabilize producer prices. Hence, world market price increases that resulted in positive deviations from the long-run equilibrium were passed on faster to producers, while price decreases that resulted in negative deviations were not immediately passed on the producers. In the case of Tanzania, the pre-reform period was characterized by private intermediaries that controlled coffee marketing. As is widely documented in the literature, such market agents tend to pass on negative shocks that result from declines in world market prices faster to producers than positive shocks that result from increases in world market prices (Abdulai 2002; Baquedano, Liefert, and Shapouri 2011; Sjölander 2013). It is therefore not surprising that negative discrepancies are eliminated faster than positive discrepancies in the pre-reform period. However, after the government intervention to stabilize producer prices during the post-reform period, positive discrepancies appeared to be eliminated faster than negative discrepancies.

We also employed impulse response functions (IRFs) to illustrate the dynamic interrelationships between world market and domestic producer prices. As suggested by Goodwin and Grennes (1998), IRFs provide richer inferences regarding the dynamics of price adjustments than standard regression analyses, since the impulse responses evaluate the dynamic time-path of responses to market shocks. In particular, asymmetric adjustment models produce impulse response functions that are themselves functions of the history of the price series and the sign and magnitude of the shock (Potter 1995). This is in contrast to symmetric adjustment models, where the response to a price shock is independent of the history of the time series and the sign and magnitude of the postulated shock.

The impulse response function which we employ in the analysis estimates the impacts of positive and negative shocks to the price spread between the world and domestic markets. Figures 5 to 9 illustrate responses of the Zambian and Tanzanian producer prices to price shocks in the world market. Figures 5 and 6 illustrate responses over the entire period for Zambia and Tanzania, respectively. Figure 7 shows the response for pre-reform sub-period for Tanzania.[7] The impulse response functions for the post-reform periods for both countries are shown in Figures 8 and 9.

The responses in all five figures are generally consistent with long-run market relationship between world market and domestic producer prices for both Zambia and Tanzania. For example, the responses in Figure 5 indicate that the price spread between the world and Zambia markets returns to its equilibrium level within 13 months after experiencing a negative shock (i.e., a decline in world prices). In contrast, a positive shock to the price spread (increase in world prices) takes about 35 months to return to its original level. Thus, there is a strong tendency for producer prices to reverse themselves with negative, but not positive, shocks to the price spread, indicating asymmetric responses. The results for Tanzania, presented in Figure 6 reveals that positive shocks revert faster to the equilibrium level than negative shocks. Figures 7, 8, and 9 also confirm asymmetric responses to shocks in prices. The varying response rates for both countries in the two periods are consistent with the results of the momentum threshold cointegration model.

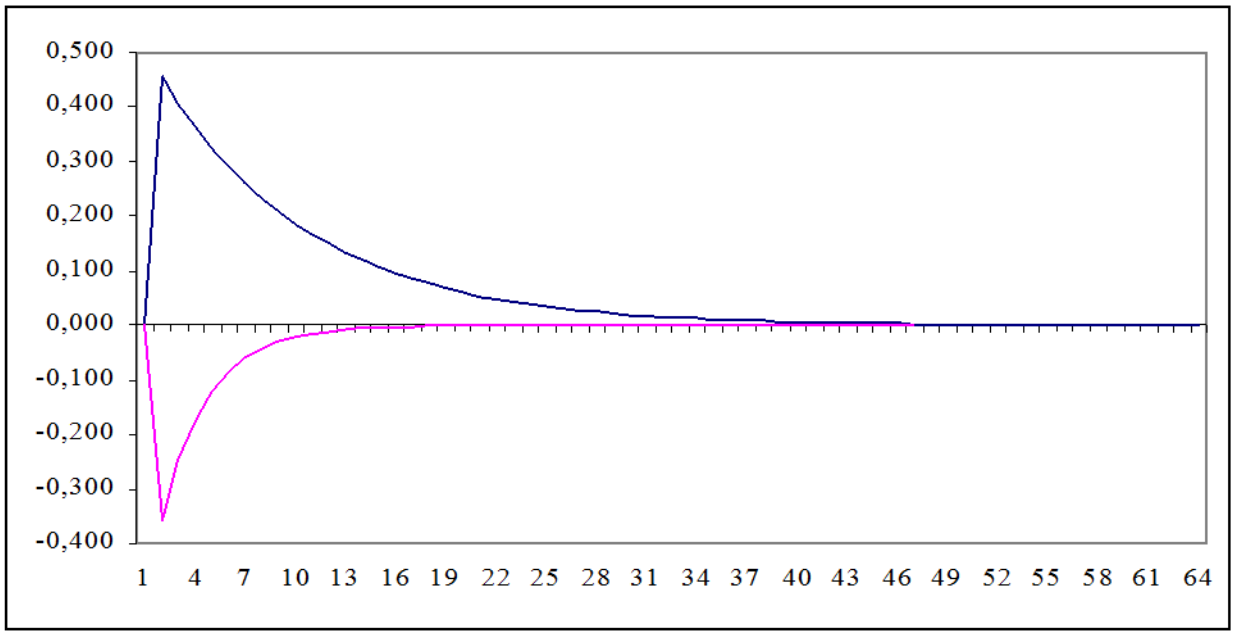
Figure 5. Response of Zambia Producer Prices to Price Shocks in the World Market over the Entire Sample



Source: Author's Calculation based on ICO data.

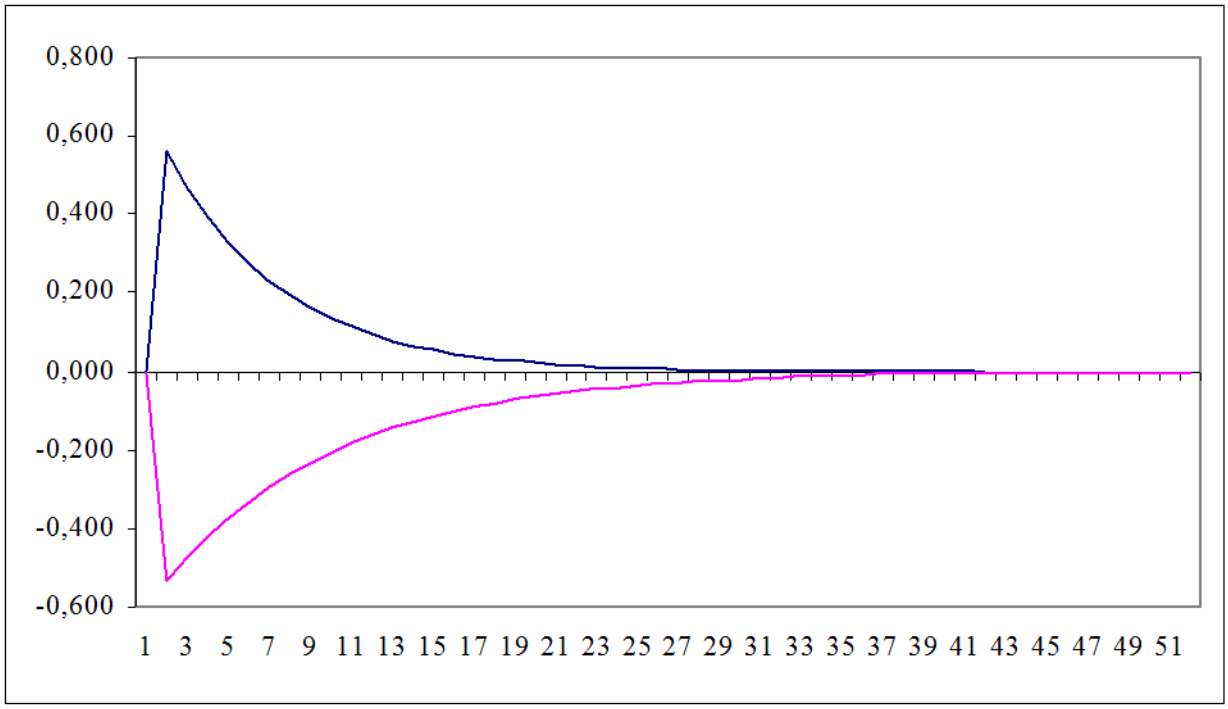
[7] Given the finding of symmetric adjustment for world price-producer price for Zambia in the pre-reform period, no impulse response function was estimated for this period.

Figure 6. Response of Zambia Producer Prices to Price Shocks in the World Market over the Entire Sample



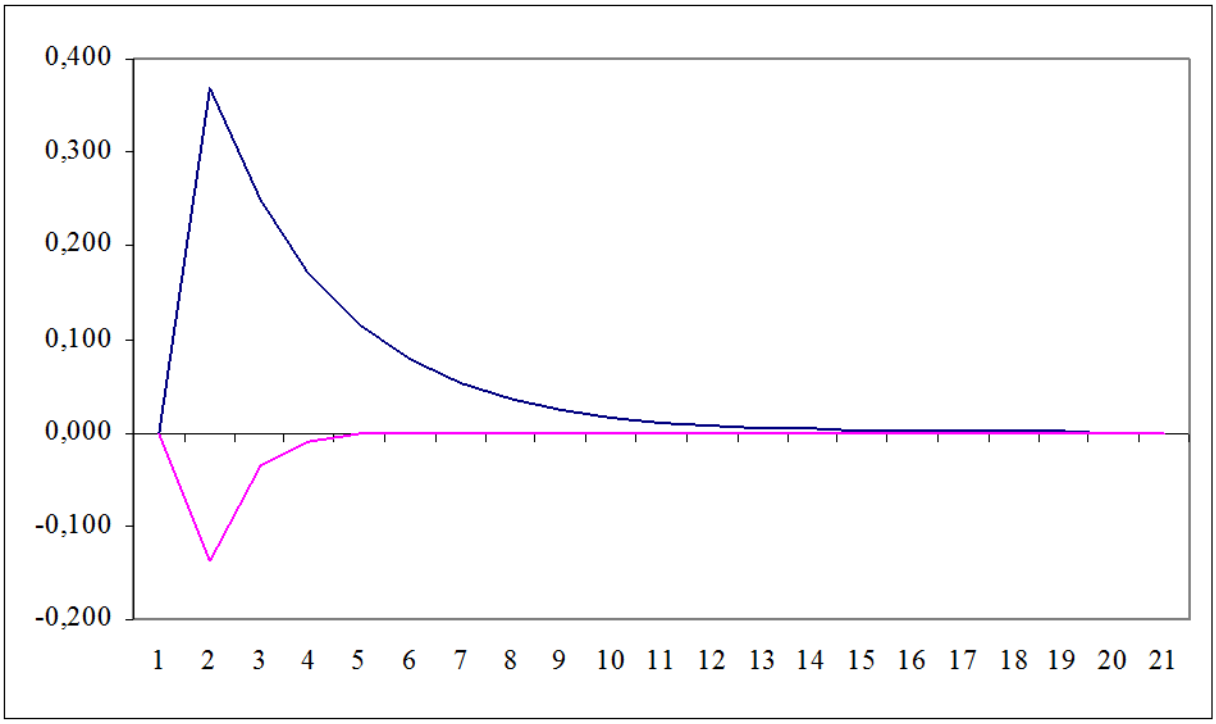
Source: Author's Calculation.

Figure 7. Response of Tanzania Producer Prices to Price Shocks in the World Market over the Entire Sample Period



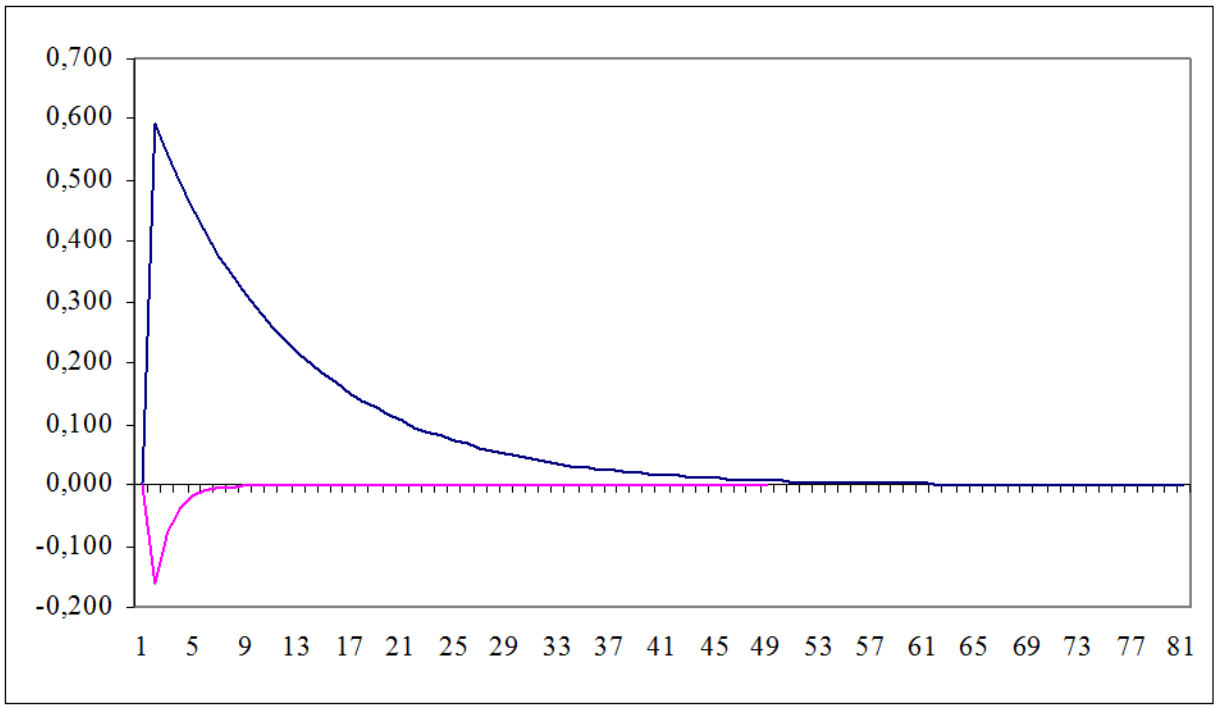
Source: Author's Calculation.

Figure 8. Response of Zambia Producer Prices in the Post-economic Reform Period to Price Shocks in the World Market



Source: Author's Calculation.

Figure 9. Response of Tanzania Producer Prices to Price Shocks in the World Market for the Pre-economic Reform Period



Source: Author's Calculation.

5. CONCLUSION

Over the past three decades, governments in Sub-Saharan Africa have implemented policy reforms in the agricultural sector. These policy reforms were partly aimed at getting prices right for farmers. In this paper, we employ momentum-based threshold cointegration and threshold error correction models to examine the impact of these policy reforms on producer price shares of the world prices and on the magnitude and speed of transmission of price changes from the world coffee market to producer prices in Zambia and Tanzania.

Results show significant increase in producer price share in the world price after economic reforms in Zambia, while a reduction in the share of Tanzania prices in the world price is noticed. These results reflect the differences in the extent of liberalisation of the coffee markets between the two countries. In Zambia, the reforms which led to a more liberalised coffee market had a positive impact while in the Tanzania markets, the reforms which led to more government intervention resulted in a negative impact on producer prices. This could have negative implications on the farmers welfare because where producer prices do not respond to changes in world prices, the producers are not able to benefit from world price increases.

Our findings generally indicate asymmetric price transmission between the world market and domestic markets in Zambia and Tanzania. The results show that in the case of Zambia, producer prices tend to respond more swiftly to decreases than increases in world market prices, and this swiftness increased after policy reforms. As part of the economic reforms, in the 1990s in Zambia, the government completely liberalized the coffee sector to allow private marketing agents into the exports of coffee. Many studies have documented the concerns about the rate and symmetry of price response that are normally raised if a sector in the marketing channel is highly concentrated and dominated by few firms or marketing agents (White and Leavy 2001; Abdulai 2002). While the pre-reform policies ensured some price stabilization in the sense that declines in world market prices were not fully and quickly passed on to producers, they also resulted in some delays in passing on price increases to producers.

Although the results for Tanzania did reveal that producer prices generally respond quicker to increases than decreases in world market prices over the entire period, this asymmetric price transmission appeared to differ between the pre-reform and post-reform periods. Specifically, the period before reforms showed domestic prices responding more swiftly to decreases than increases in world prices, while the post-reform period was characterized by faster responses to increases than decreases in world prices. These varying speeds of responses of producer prices to changes in the world prices over the two periods result from the different policy regimes during the two periods. The pre-reform period was characterized by few private intermediaries that controlled coffee marketing. As indicated previously, such oligopolistic market agents may react quicker to shocks that squeeze their margins than to shocks that stretch it. Hence, negative deviations from the equilibrium are eliminated quicker than positive deviations in the pre-reform period. However, after the government introduced the mandatory auction through TCB and introduction of producer floor prices, positive deviations arising from increases in world prices appeared to be eliminated faster than negative deviations. Thus, the government passes on world price increases to producers quickly, but price declines are passed on at a slower rate.

Overall, the findings from the study show that economic reforms in the two countries did have diverse impacts on the market structure and the transmission of price changes from

world markets to domestic producers. The different impacts are attributable to the policies implemented in the two countries. Policy reforms in Zambia greatly reduced the role of state-related marketing institutions, price regulation and control of international trade, resulting in faster transmission of prices from world to domestic markets. By contrast, the reforms in Tanzania went in the opposite direction, by increasing the government's role in trade, pricing and exports of coffee, and thus resulting in reduced transmission of world-domestic prices.

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