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Impact of trade reform on coffee in Tanzania: A time series Analysis

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Abstract

This study empirically investigates the impact of Tanzania's trade reforms on coffee export. The study employs a time series analysis from 1970 to 2010. Sources of data are from Food and Agriculture Organization data base, Ivan Kushnir's Research Center and World Economic Indicators data base. Specifically, the study uses coffee export earnings as dependent variable whereas world price, real exchange rate, coffee production and trade reform (dummy variable) as independent variables to examine the impact of trade reform on coffee. The empirical investigation done in this paper employed cointegration and error correction modeling (ECM) as well as trend analysis using EViews 7. The results suggest that, world price, real exchange rate, coffee production in metric tons and trade reform (dummy variable) have greater impact on coffee export earnings in Tanzania. Interestingly, world price and coffee production have most significant impacts on coffee export earnings both in long run and short run. However, real exchange rate and dummy variable have positive impacts on coffee export earnings but statistically insignificant. Error correction term found with the expected sign and quickly adjusted to the long run equilibrium at the speed of 98.2 percent per annum. Trend analysis reveals that, trade reform has a positive impact on coffee export an earnings since the trending coefficient has a positive sign as such has an upward trending.

Keywords: Trade reform or trade liberalization, agricultural export, coffee and time series analysis.

1.0 Introduction

Agriculture has been the most important activity in Tanzania's economy whereby almost 80 percent of manpower's are engaged in it. For instance, before trade reform in 1972/73 crop season, just before massive nationalization of coffee estates undertaken by Tanzania's government, smallholders and large estates contributed 76% and 24% of coffee output respectively in Tanzania's economy (Mmari, 2012). Tanzanian government liberalized trade in 1986 including agriculture crops as well. Prior to trade liberalization strategy, Tanzanian economy implemented protectionism policy under the name of import substitution industry strategy in which favored production for domestic market and less effort was vested in production for export purposes. Protection policy worsened the economic performance of the country at large. Bias against export sector created severe economic problems such as trade imbalance and inadequate foreign currencies (Kanaan, 2000). Again trade protectionism controlled the exchange rate, normally the government used to appreciate price of domestic currency against foreign currencies (Bigsten and Danielson, 1999 and Kanaan, 2000). In line with trade reform undertaken in 1986, coffee in particular was liberalized officially in 1994/95. It is important to note that before trade reform, the Tanzania marketing board and cooperative unions handled all coffee marketing such as input provision, transportation and processing. Trade reforms on coffee started gradually in 1990s by removing control on inputs provisions, dollar export earnings retention and price announcements. It is important to note that, full trade reform on coffee was implanted in 1994/95. It was from that point where individual traders were allowed to purchase coffee directly from growers and process it in their own factories. The immediate changes noticed following trade reforms on coffee were producer's share of export prices increased, coffee processing capacity increased and marketing efficiency increased as well as investment in new planting increased tremendously (Baffes, 2003). However, it should be clear that, trade reform on agricultural sector in Tanzania particularly coffee was implemented at gradual pace as compared with other sectors.

Coffee in particular it has been largest export crop from Tanzania. It contributes approximately $115 to export earning in Tanzanian economy. It provides employment to about 400,000 families who are engaged in agricultural activity. It is important to note that coffee is intercropped with other food crops like banana, beans, vegetables and maize. Generally, coffee production in Tanzania is grown by smallholders who account about 95 percent of all producers of coffee and the rest 5 percent is grown on estates. On average smallholders holding

about 1to 2 hectares and only a quarter of smallholders use purchased inputs from dealers (Baffes, 2003). On average Tanzania produces approximately 800,000 kilogram bags equivalent to 0.7 percent of world output of 117 million bags. It is of interest to note that about two third of coffee from Tanzania is mild Arabica and rest is hard Arabica and robusta (Baffes, 2003). The main regions involved in growing coffee in Tanzania are Kilimanjaro, Arusha, Ruvuma, Mbeya and Kagera. There are some regions also produce coffee in small areas such as Mara region at Tarime district but mention a few. Kilimanjaro and Arusha regions mostly produce arabicas as well as Ruvuma and Mbeya grown the same whereas robustas are mostly produced in Kagera region. Generally, large portion of coffee produced in those regions are exported and some are left for domestic consumptions. By 2004/05, the smallholders in Tanzania produced 93% of the country's coffee output, and this proportion has not changed significantly since then and the rest 7 percent it has been produced by estates respectively (Mmari, 2012).

Despite of an effort taken by Tanzanian government to liberalize trade and agricultural sector in particular, export performance on agricultural sector remains a problem since the exports are decreasing drastically. For instance in 2010 the value of coffee exports decreased from USD 111.2 million in 2009 to USD 101.7 million in 2010, which was equivalent to the decrease of 8.6 percent. This was due to decrease in the volume of coffee exports from Tanzania. The volume of coffee exports was 35,600 tons in 2010 as compared to 56,000 tons in 2009, equivalent to a decrease of 36.4 percent. It is of interest to note that, the average price of coffee in the world market in 2010 increased to USD 2,852.4 per ton from USD 1,984.6 per ton in 2009 respectively (URT, 2010). For that matter, this study intends to examine the impact of trade reform on coffee in Tanzania before and after trade liberalization due to the fact that, coffee is among of the largest export crop from Tanzania.

2.0 Literature

The term trade reform and trade liberalization used interchangeably in this study since many literatures viewed so far have discussed trade reform as trade liberalization. In brief the term trade liberalization has been defined differently by various scholars such as Mackay et al. (1997:131) defined trade liberalization as the removal of restrictions on imports and reduction of discrimination against export. On other hand Zulfiqar and Kausar, (2012: 32) defined Trade liberalization as the reduction and gradual elimination of tariff and non tariff trade barriers which may obstruct the free flow of goods and service across national borders. Not only Mackay et al as well as Zulfiqar and Kausar defined trade liberalization but also World Bank 2001 cited in Allaro, (2012) defined trade liberalization as reduction of government incentives and trade restrictions between trading countries. Generally, we can summarize trade liberalization as the removal or reduction of trade barriers which prevent the smooth trade transactions of goods and services among trade partners. Trade barriers removed or reduced under trade reform include tariff and non tariff. On top of that non tariff under trade reform includes duties, import quotas, export subsidies and import regulations such as licensing regulations amongst others. In tandem with the definitions above, this study considered trade reform as the tendency of Tanzanian government to relax trade restrictions to nearly free trade among trade partners so as to prosper from trade reform policy.

Many studies undertaken so far on the impact of trade reform on agricultural crops in developing countries had revealed mixed findings. Some studies found positive impact between trade liberalization (trade reform) and export growth whereas others found negative or weak impact between trade liberalization (trade reform) and export growth to some developing countries. Anwar et al. (2010) conducted a study in Pakistan over the period of 1971 to 2008 to analyze the impact of trade liberalization on export of cotton lint. Their empirical findings revealed that there were positive impacts between trade liberalization and export growth of cotton lint in Pakistan since the world demand influenced the cotton lint export positively as well as export competitiveness and trade openness improved the export of cotton lint in Pakistan significantly. A study by Kusi (2002) also examined the impact of trade liberalization on export performance in South Africa using time series regression analysis from 1980s to 1990s. The empirical results showed that, the external market conditions were significant determinants of export performance in South Africa under the period of study. This signifies that trade liberalization in south Africa was important policy in their export sector.

In same vein Ahmed (2000) examined the impact of trade liberalization on export performance in Bangladesh. In order to ascertain the impact of trade liberalization on export performance, the study employed the vector autoregressive (VAR) and vector error correction model (VECM) from 1974 to 1995. Ahmed's results revealed that, trade liberalization in Bangladesh improved the export performance tremendously since the variables employed in the study showed positive impact on export performance. Therefore, it should be clear that both studies have supported the notion of trade liberalization in the countries under study. Again, other studies affirmed the theory of trade liberalization that improves export growth (performance) in liberalized countries. Such studies are Bashir, (2003), Santos-Paulino (2003), Pacheco-López (2004). These studies were conducted in

different countries such as Pakistan, Dominican Republic and Mexico respectively. Their empirical findings revealed that, trade liberalization improved export growth of the countries under study. It is of interest to note that the impact of trade liberalization or trade reforms across the continents are still giving similar results that trade reforms have managed to improve the export growth or performance of the liberalized countries particularly in developing countries which depends more on agricultural exports.

Again, Blake et al. (2001) they examined the impact on Uganda of agricultural trade liberalization. They evaluated the impact on Uganda in the agricultural commodities. Their findings showed that, the impact of multilateral liberalization on a low income country like Uganda appeared to be quite slight though it was positive on world prices in agricultural commodities exported. Again, the study revealed a positive gain after trade reform especially in unilateral trade liberalization. Generally, in Uganda trade reforms found to be significant in agricultural products since it benefited almost all categories of rural household. Mahmood et al. (2010) reviewed various papers on the impact of trade liberalization on agriculture in Pakistan. Their findings showed that, trade reform regime affected the social and economic conditions of the farming community. They pointed out that, the overall economic performance of the country after trade reform had marked by increased gross domestic product rates, increased in foreign direct investment and increased in export performance on agricultural crops. It is of interest to note that increased in openness deteriorated the balance of payment, level of poverty and unemployment in Pakistan. All in all the general remark concluded that trade reform in Pakistan was beneficial to farming community. Also a study by Malik (2007) evaluated the impact of economic reforms and trade liberalization policies on agricultural export performance from 1961 to 2000 in Pakistan. Malik's empirical findings revealed that, agricultural export performance in Pakistan were sensitive to the domestic supply side factors rather than world demand factors. Results supported the notion that trade liberalization had positive impact on agricultural sector in Pakistan. Similarly, Mesike et al. (2008) analyzed the effect of trade liberalization policy on Nigerian rubber industry. The study examined the effect of trade liberalization on rubber industry using external factors such as average world price and internal factors like quantity of rubber output, average producers price, annual rainfall, exchange rate as well as average domestic consumption. Their empirical results revealed that, trade liberalization had positive impacts on rubber industry particularly internal factors found to be significant determinants of export performance of rubber in Nigeria.

In contrast with many studies undertaken so far which supported that trade reform had positive impact on export growth in many liberalized countries, a study by Niemi (2001) conducted in Association of Southern Asian Nations (ASEAN) to examine the effects of trade liberalization on ASEAN agricultural commodity exports to the EU. The results showed that trade liberalization (trade reform) in the form of tariff removal were not very significant in changing the quantity of imports demanded by the European Union countries. In the same line Ghani (2011) evaluated the impact of trade liberalization on export performance in Organization of Islamic Conferences countries. The empirical results revealed that, trade liberalization did not improve export performance of Organization of Islamic Conferences countries (OIC) in long term as compared in medium term as such that article did not affirm the notion of trade liberalization always should improve the export growth of the liberalized countries. In some sub Saharan African countries a study by Shafaeddin (1995) and Ackah and Morrissey (2005) also revealed weak impact between trade reform and export growth as well as increased imports significantly as such there were trade deficit in countries under study.

However, in other countries trade reforms remains important policy in improving export growth of country. For instance Chitiga et al. (2008) they examined agricultural trade policy reforms in South Africa. Their findings found that, trade policy reforms had positive impact on agricultural export performance. The study pointed out that, trade reform increased export growth three times after trade tariffs were implemented extensively to trade partners. Similarly, sixteen West African countries found that, trade liberalization improved export growth the countries under study (Yeboah, 2008). Again, Susanto et al. (2012) examined the impact of trade liberalization on agricultural products for seventy eight countries from the period of 1980 to 2010. Their empirical findings revealed that, trade liberalization improved export growth of the liberalized countries as such trade reforms remains a necessary condition in developing countries in order to stimulate their agricultural export growth and economic growth at large. An influential study by Prina (2007) in Mexico also examined the impact of trade liberalization in agricultural products. Essentially the study evaluated the NAFTA tariff cut to border prices of Mexican exports and imports between Mexico and trade partner that is the US. The empirical finding revealed that, NAFTA tariff cut benefited a lot small farmers than bigger farmers. Conversely trade liberalization hurtled more the corn producer's particularly bigger farmers. Generally, results suggested that trade liberalization in agricultural products in Mexico increased the level of earning of poor farmers in relation to larger farmers particularly in central region of Mexico as compared with other regions like northern and southern regions. It is

important to note that, fruits and vegetables producers benefited more than corn producers under trade liberalization policy in Mexico. Point to note from Mexico's findings is that, trade liberalization prosperity cannot be universal even in the same country across the variety of goods and serves produced.

Therefore, the ongoing debates on the impact of trade liberalization in developing countries on agricultural export motivated this study to be taken in Tanzania particularly on coffee. However, we are aware that the included literatures are not exhaustive ones in the board of literatures available so far but we pick up the one we think are closely related with our study in order to accomplish our research objective.

3.0 Methodology

Our study employed the cointegration technique to examine the impact of trade reform on coffee in Tanzania similar to many other researchers like Ahmed (2000), Bashir, (2003), Penélope-López, (2005) Agasha, (2009), Allaro, (2010) , Allaro, (2012) and Kingu, (2014a), Kingu (2014b), Kingu (2014c) but to mention a few. This technique currently has been found to be superior to other techniques like gravity modeling and panel technique since it has the power to establish the short run and long run relationship amongst variables. Again this technique requires the study to estimate the unit root and cointegration test. Testing for cointegration of the regression residual is important condition so as to avoid the possibility of producing spurious regression output (Granger, 1986 cited in Gujarati, 2004).

3.1Modeling the impact of trade reform function on Coffee

This study signifies the impact of trade reform on coffee as a function of world price, real exchange rate, production of coffee and dummy variable so as to capture the impact of trade reform before and after. This study adopted the analysis of imperfect substitute model as expressed by Goldstein and Khan (1985) cited in Allaro's paper in (2010) with the key assumption that neither export nor imports are perfect substitutes for domestic goods particularly coffee. We formulated a model as follows:

Export values of coffee is the function of

$$(Xcf)=f(WP,RER,P,D) \quad (1)$$

Where Xcf is export values of coffee, WP is world price, RER is real exchange rate, P is production of coffee and D is a dummy variable a measure of trade reform. This study employed secondary data from different sources such as Food and Agriculture Organization data base (FAO STAT), Ivan Kushnir's Research Center and World Economic Indicators data base.

We instituted the natural logarithm in equation (1) so as simplify the interpretations and variables to suit the linearity behaviors. After instituting natural logarithm equation (1) appears as follows:

$$LnX_t=\alpha_0+\alpha_1 LnWP_t+\alpha_2 LnRER_t+\alpha_3 LnP_t+\alpha_4 D_t+U_t \quad (2)$$

Our study included the main variables like coffee export earnings (X_t) as dependent variable and independent variables are world price (WP_t), real exchange rate (RER_t), production of coffee (P_t) and dummy variable as a measure of trade reform. World price is key variable in this model since it is expected that as the world prices increases will increase the export performance of coffee in Tanzania. Similarly Real Exchange Rate (RER) also is among of important variable in this study because as we depreciate our domestic currency the agricultural export particularly coffee expected to increase and vice versa is true under ceteris peribus condition (other factors remain constant). Computation of real exchange rate is done multiplying the Tanzanian nominal exchange rate with the ratio of Tanzanian consumer price index (CPI) and USA consumer price index (CPI). This study uses real exchange rate as a measure of export competitiveness. Again, production of coffee is a key factor in determining the impact of trade reform on coffee. It is clear that as production increases will increase the export value of coffee other factors remain constant. Dummy variable is instituted so as capture the impact before and after trade reform. Dummy variable will pick the value of zero (0) before trade reform from 1970 to 1985 and value of one (1) after trade reform from 1986 to 2010. U_t is random disturbance term with its normal classical assumptions and Ln is natural logarithm. It should be clear that we expected that α_1, α_3 and $\alpha_4 > 0$ and $\alpha_2 < 0$.

We estimated the coefficients of long run relationship amongst the variables using equation (2) above after ascertain that the regression residual of equation (2) found to be stationary. This is done using Augmented Dickey Fuller (ADF) test. This test was done purposely since Engle –Granger (1987) and Gujarati, (2004) pointed out that if the regression residuals of equation (2) above are stationary, then obtained coefficients are not spurious and hence representing long run relationship amongst the variables. But if the regression residuals are non stationary then regression coefficients obtained in equation (2) will be spurious as such should not be

reported.

Again, the study examined the time series variables of Lnx_t, $LnWP_t$, $LnRER_t$ and LnP_t if have unit roots, and thereafter the study under taken the first difference of the variables (as in equation (3)) in order to obtain a stationary series:

$$\Delta LnX_t=\alpha_0+\alpha_1\Delta LnWP_t+\alpha_2\Delta LnRER_t+\alpha_3\Delta LnP_t+\alpha_4D_t+u_t \quad (3)$$

Ahmed, (2000) pointed out that Equation (3) above represents the short run information due to the fact that differencing equation (2) results into loss of valuable long run information. In addressing this issue the theory of cointegration introduces an error correction term in the model. The use of error correction (EC_t) term helped to tie the short run behaviors of variables to its long run. The error correction model (ECM) was propounded by Sargan and thereafter was popularized by Engle –Granger corrects for disequilibrium. Engle-Granger in its presentation he employed Error Correction Model (ECM) under the name of "Granger representation theorem". He states that if two variables are cointegrated, then the relationship between the two can be expressed as error correction model or mechanism (ECM) (Gujarati, 2004: 825). It is of interest to note that, Error- correction term (EC_t) lagged one period (EC_{t-1}) so as to integrate short run dynamics in the long run. This study specified a general error correction model (ECM) as follows:

$$\Delta LnX_t=\beta_0+\sum_{i=1}^{n}\beta 1i\,\Delta LnWP_{t-i}+\sum_{i=0}^{n}\beta 2i\,\Delta LnRER_{t-i}+\sum_{i=0}^{n}\beta 3i\,\Delta LnP_{t-i}+\beta_4EC_{t-1}+\beta_5D_t+\varepsilon_t \quad (4)$$

EC_{t-1} is an error-correction term lagged one period. And its coefficient expected to have a negative sign signifies that variables are adjusting towards log run equilibrium. While ε_t is an error term with usual classical assumptions.

3.2 Trend Analysis

Also our study examined the trend analysis of coffee export earnings against time. We formulated linear trend analysis model in which we regress coffee export earnings (X) in natural log on time. Model is called a linear trend model and the time variable (T) is known as the trend variable. We find it important to undertake such as regression so as to see the trend of coffee in Tanzania after trade reform is improving or not. In order to answer this question, Gurajati, (2004:180-181) provided the decision criteria as follows: if the slope coefficient in model is positive, there is an upward trend on export earnings, where as if it is negative, then there is a downward trend on export earnings on the variable under study, in our case is a coffee.

Trend analysis model of coffee covered the period from 1970 to 2010.

$$LnX_t=\beta_0+\beta_1T+U_t \quad (5)$$

Where X_t is coffee export earnings, β_0 is a constant, T is trending variable and U_t is error term. β_1 is a trend coefficient and it is expected to be positive if there is upward trend and negative if there is downwards trend. This result is very important for policy formulation of any country if at all wanted to in line with external trade earnings.

4.0 Empirical Analysis

4.1Unit root test

We performed unit root tests at levels for all variables which are coffee export earnings, world price, real exchange rate and production of coffee in metric tons. All variables were in natural logarithms. Again, we estimated those variables in first difference to see if all variables are stationary. The study employed the Augmented Dickey-Fuller (ADF) tests and the results show the existence of unit roots as such the variables are non stationary at level. The computed value of tau statistic does not exceed the critical tau value in 1, 5 and 10 percent significant level. Insert table one to four in appendix. Also variables found stationary at first difference. The computed absolute value of tau statistic exceeds the critical Augmented Dickey Fuller tau value and then we conclude that variables at first difference are stationary. See table five to eight in the appendix below for more clarifications.

4.2 Cointegration Test

Having seen that variables are non stationary at level and stationary at first difference, we conducted a cointegration tests, the study employed three tests so as to ascertain our findings. We employed Johansen cointegration test, Engle-Granger (EG) test and Cointegrating Regression Durbin-Watson (CRDW) test. Under Johansen cointegration test, test indicates there two cointegrating variables or equations at 5 percent significant level. Likelihood ratio (71.65601) exceeds the critical value (47.21) at 5 percent level and also Likelihood ratio

(30.60068) exceeds the critical value (29.68) at 5 percent level at trace statistic whereas at Maximum Eigenvalue its lokehood ratio (41.05533) exceeds the critical value (27.58434) at 5 percent level as such there is one cointegrating variable. Insert table nine in the appendix below.

Also we tested cointegration under Cointegrating Regression Durbin-Watson (CRDW) test, the results reveal that the computed Durbin (d) value (1.970279) is greater than the critical values of (0.511) and (0.386) at 1pecrent level and at 5 percent level respectively. Therefore we cannot reject null hypothesis of cointegration amongst the variables. Hence variables are cointegrated. Gujarati, (2004:824) pointed out that if the computed Durbin (d) value is greater than the critical values, we cannot reject null hypothesis of cointegration. Refer table 10 in appendix.

Engle-Granger cointegration test also reveal the similar results as in Johansen and Cointegrating Regression Durbin-Watson (CRDW) tests that, variables are cointegrated since the cointegrating parameter (β) obtained in the regression has a negative sign (-0.052388) as such we concluded that variables are stationary and therefore are cointegrated (Gujarati, 2004:818).Insert table 11 in the appendix attached in this paper.

4.3 Long run estimations

After Engle –Granger cointegration test affirmed that residuals of the regression in equation (1) above are stationary as such variables are cointegrated, then the regression output obtained in equation (1) are not spurious rather they are meaningful. Hence those results represented the long run relationship among variables and equation (4) above represented short run relationship among the variables. The empirical results reveal that, world price has expected sign (1.075907) and statistically significant at 5 percent level whereas real exchange rate as well has a negative sign as expected (-0.051635) but statistically insignificant. On other hand, coffee production has a positive sign (0.276942) and statistically significant at 5 percent level. Similarly, dummy variable as a measure of trade reform has a positive sign (0.054827) but statistically insignificant. Generally, long run empirical results are line with theoretical expectations. For more references see table 10 below.

4.4 Estimation of an error-correction model

Having established that variables have long run relationship, we estimated an error-correction model (ECM) so as to determine the speed of adjustment of variables from short run dynamics behavior to the long run equilibrium. It should be clear that if the error term is non zero, this implies that the model is out of equilibrium. The greater the coefficient of the error-correcting term, this signifies that the model is adjusting quickly from the short run to the long run equilibrium. In our model, error term has a negative sign (-0.981863) and statistically significant at 5 percent level. Other variables too found with an expected signs as in long run relationship. World price has a positive sign (1.025853) and statistically significant at 5 percent level. Real exchange rate has a negative sign (-0.041513) as measure of competitiveness but it is statistically insignificant. Production as well has a positive sign (0.369670) and statistically significant at 5 percent level. On other hand, dummy variable has a positive sign (0.007988) as expected but statistically insignificant. All these results are presented in table 12 below.

4.5 Trend analysis

After examined long and short run relationship amongst the variables and the empirical results affirm that trade reform had positive impact on coffee export earnings in Tanzania, also we estimated the trend analysis of coffee export earnings over time. Empirical result under trend analysis reveals that trend coefficient has a positive trend (0.171036) and statistically significant at 5 percent level. This implies that coffee export earnings had improved by 17 percent over time under the period of study. This result is well presented by table 13.

5. Discussions

Positive signs in world price imply that one percent increase in world price increases coffee export earnings for 0.1076 percent in long run and 0. 1026 percent in short run respectively. These results are in line with Abolagba et al. (2010), Amoro and Shen (2012), Kingu (2014a) and Kingu (2014b) who reported that increase in the world price increases export performance of countries under study. This implies that world price have positive impact on coffee export earnings in Tanzania both in long run and even in short run since a variable is statistically significant at 5 percent level. Also the appropriate signs obtained in real exchange rate both in long run and short run, implies that devaluing a domestic currency by one percent increase coffee export earnings for 0.052 percent in long run and 0.042 percent in short run respectively. Therefore, real exchange rate has greater impact on coffee export earnings in Tanzania. However, it is statistically insignificant. These results are similar with other researcher's work like Diakosavvas and Kirkpatric (1990), McKay et al. (1997), Mesike (2005), Folawewo and Olakojo (2010), Kingu (2014a), Kingu (2014b) and Kingu (2014c) where the devaluation of currencies were

insignificant in the countries under study. Insignificant result signifies that, in most cases the devaluation of domestic currency is not reflected directly to farmers as well as perennial crops it is difficult to respond to the devaluation of currency spontaneously as compared to manufacturing industrial goods or services or other seasonal crops. It should be clear that, a short-term response to price changes is difficult to attain in coffee production as such real exchange rate cannot be effective as intended. Therefore, message brought forward from this variable (real exchange rate) is clear that, on agricultural commodities particularly perennial crops, devaluation of domestic currency cannot be effective in generating foreign currencies in many developing countries which depend much on exporting agricultural products.

Production of coffee being used as independent variable found with a positive sign means that one percent increase in production increase export of coffee in Tanzania by 0. 277 percent in long run and 0.369 percent in short run respectively. It is clear that production of coffee in Tanzania has a significant impact on coffee export earnings both in long run and short run. This is in agreement with Okoruwa et al. (2003) cited in Abolabga et al. (2010) who reported a positive contribution of production on agricultural exports.

Dummy variables obtained both in long run and short run reveal that trade reform had positive impact in Tanzania's coffee export earnings though it is statistically insignificant. In long run trade reform had improved coffee export earnings by 0.055 percent and in short run improved coffee export earnings improved by 0.01 percent respectively. These results are the same with Folawewo and Olakojo (2010) and Kingu (2014a). These results were expected since coffee in Tanzania was liberalized very later in 1994/95 onwards while trade reform was launched in 1986 as such dummy variable reflected the reality being having a positive sign but statistically insignificant. All in all trade reform had positive impact on coffee export earnings in Tanzania.

Error correction term obtained (-0.981863), this implies that variables are adjusting to long run equilibrium at the very high speed of 98.2 percent per annum. This signifies that variables are non zero as such are adjusting towards long run equilibrium. This means market forces can adjust the variables over time into equilibrium. This result is in line with Ahmed (2000), Kingu (2014a), Kingu (2014b) and Kingu (2014c). Trend coefficient suggests that coffee export earnings in Tanzania are improving over time due to fact that trend coefficient has positive trend.

6. Concluding remarks

The results of study revealed that, world price; real exchange rate, production and dummy variable have greater impact on coffee export earnings in Tanzania. In order to improve the agricultural export in Tanzania, there are important steps which should be taken into account such as: adding value of exported coffee so as to attract more foreign currencies as well as improving the availability of agricultural facilities like pesticides and fertilizers but to mention a few. Also it is important to set up good agricultural infrastructures in order to simplify the supply chain management between farmers and traders (consumers). The findings from dummy variables also pointed out that, there is a need for Tanzanian government to reduce interventions on agricultural sector to the required level in order to attain the competitive price. Again, nature of crop grown is perennial crop, so it important for government to insists on replacement of older coffee trees so as to raise growth of coffee output. Ignoring this will affect the coffee export earnings in Tanzania even though coffee prices in the world market go up tremendously.

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Appendices

NB: Coffee export earnings denoted by ser01, World price denoted by ser02, Real exchange rate denoted by ser03 and Production denoted by LnPr in this regression output and error term denoted by ser05.

Unit root test

Table 1

ADF Test Statistic	-1.421271	1% Critical Value*	-3.6067
		5% Critical Value	-2.9378
		10% Critical Value	-2.6069

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER01)
Method: Least Squares
Date: 03/12/14 Time: 09:59
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SER01(-1)	-0.039792	0.027998	-1.421271	0.1638
D(SER01(-1))	-0.046204	0.158835	-0.290890	0.7728
C	1.088642	0.646894	1.682875	0.1011

R-squared	0.055735	Mean dependent var	0.165407
Adjusted R-squared	0.003276	S.D. dependent var	0.357724
S.E. of regression	0.357137	Akaike info criterion	0.852410
Sum squared resid	4.591690	Schwarz criterion	0.980376
Log likelihood	-13.62199	F-statistic	1.062455
Durbin-Watson stat	1.939191	Prob(F-statistic)	0.356193

Table 2

ADF Test Statistic	-0.982190	1% Critical Value*	-3.6067
		5% Critical Value	-2.9378
		10% Critical Value	-2.6069

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER02)
Method: Least Squares
Date: 03/12/14 Time: 10:01
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SER02(-1)	-0.026081	0.026554	-0.982190	0.3326
D(SER02(-1))	0.125095	0.163629	0.764502	0.4496
C	0.465757	0.330511	1.409202	0.1674

R-squared	0.041102	Mean dependent var	0.165531
Adjusted R-squared	-0.012170	S.D. dependent var	0.341447
S.E. of regression	0.343519	Akaike info criterion	0.774653
Sum squared resid	4.248185	Schwarz criterion	0.902620
Log likelihood	-12.10574	F-statistic	0.771543
Durbin-Watson stat	1.963294	Prob(F-statistic)	0.469792

Table 3

ADF Test Statistic	-0.788078	1% Critical Value*	-3.6067
		5% Critical Value	-2.9378
		10% Critical Value	-2.6069

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER03)
Method: Least Squares
Date: 03/12/14 Time: 10:02
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SER03(-1)	-0.012911	0.016383	-0.788078	0.4358
D(SER03(-1))	0.339978	0.154310	2.203214	0.0341
C	0.421622	0.288036	1.463783	0.1519

R-squared	0.132025	Mean dependent var	0.301037
Adjusted R-squared	0.083804	S.D. dependent var	0.443345
S.E. of regression	0.424362	Akaike info criterion	1.197341
Sum squared resid	6.482977	Schwarz criterion	1.325308
Log likelihood	-20.34815	F-statistic	2.737920
Durbin-Watson stat	2.005384	Prob(F-statistic)	0.078186

Table 4

ADF Test Statistic	-0.094615	1%	Critical Value*	-2.6227
		5%	Critical Value	-1.9495
		10%	Critical Value	-1.6202

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNPR)
Method: Least Squares
Date: 03/12/14 Time: 10:20
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPR(-1)	-0.000346	0.003660	-0.094615	0.9251
D(LNPR(-1))	-0.469149	0.151771	-3.091159	0.0038

R-squared	0.205763	Mean dependent var	-0.005567
Adjusted R-squared	0.184297	S.D. dependent var	0.274459
S.E. of regression	0.247881	Akaike info criterion	0.098187
Sum squared resid	2.273471	Schwarz criterion	0.183498
Log likelihood	0.085346	F-statistic	9.585564
Durbin-Watson stat	2.350499	Prob(F-statistic)	0.003728

Unit root test at first difference

Table 5

ADF Test Statistic	-7.886253	1%	Critical Value*	-3.6117
		5%	Critical Value	-2.9399
		10%	Critical Value	-2.6080

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNPR,2)
Method: Least Squares
Date: 03/12/14 Time: 10:06
Sample(adjusted): 1973 2010
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPR(-1))	-2.093377	0.265446	-7.886253	0.0000
D(LNPR(-1),2)	0.441124	0.159491	2.765822	0.0090
C	-0.003867	0.037406	-0.103379	0.9183

R-squared	0.768634	Mean dependent var	-0.012935
Adjusted R-squared	0.755413	S.D. dependent var	0.466129
S.E. of regression	0.230528	Akaike info criterion	-0.021236
Sum squared resid	1.860003	Schwarz criterion	0.108047
Log likelihood	3.403493	F-statistic	58.13784
Durbin-Watson stat	2.150979	Prob(F-statistic)	0.000000

Table 6

ADF Test Statistic	-3.440923	1%	Critical Value*	-3.6117
		5%	Critical Value	-2.9399
		10%	Critical Value	-2.6080

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER03,2)
Method: Least Squares
Date: 03/12/14 Time: 10:09
Sample(adjusted): 1973 2010
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SER03(-1))	-0.664682	0.193170	-3.440923	0.0015
D(SER03(-1),2)	0.000344	0.168789	0.002036	0.9984
C	0.207499	0.090358	2.296396	0.0278

R-squared	0.332331	Mean dependent var	0.011002
Adjusted R-squared	0.294178	S.D. dependent var	0.516359
S.E. of regression	0.433810	Akaike info criterion	1.243235
Sum squared resid	6.586678	Schwarz criterion	1.372518
Log likelihood	-20.62146	F-statistic	8.710573
Durbin-Watson stat	1.990408	Prob(F-statistic)	0.000851

Table 7

ADF Test Statistic	-4.316379	1%	Critical Value*	-3.6117
		5%	Critical Value	-2.9399
		10%	Critical Value	-2.6080

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER02,2)
Method: Least Squares
Date: 03/12/14 Time: 10:10
Sample(adjusted): 1973 2010
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SER02(-1))	-0.962750	0.223046	-4.316379	0.0001
D(SER02(-1),2)	0.097901	0.169374	0.578018	0.5670
C	0.161472	0.066918	2.412991	0.0212

R-squared	0.440342	Mean dependent var	0.009286
Adjusted R-squared	0.408361	S.D. dependent var	0.456666
S.E. of regression	0.351259	Akaike info criterion	0.821069
Sum squared resid	4.318392	Schwarz criterion	0.950352
Log likelihood	-12.60031	F-statistic	13.76907
Durbin-Watson stat	1.994548	Prob(F-statistic)	0.000039

Table 8

ADF Test Statistic	-4.115025	1%	Critical Value*	-3.6117
		5%	Critical Value	-2.9399
		10%	Critical Value	-2.6080

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SER01,2)
Method: Least Squares
Date: 03/12/14 Time: 10:12
Sample(adjusted): 1973 2010
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SER01(-1))	-0.987802	0.240048	-4.115025	0.0002
D(SER01(-1),2)	-0.028830	0.163661	-0.176158	0.8612
C	0.154386	0.071403	2.162191	0.0375

R-squared	0.514435	Mean dependent var	-0.014188
Adjusted R-squared	0.486688	S.D. dependent var	0.512978
S.E. of regression	0.367527	Akaike info criterion	0.911616
Sum squared resid	4.727661	Schwarz criterion	1.040899
Log likelihood	-14.32071	F-statistic	18.54046
Durbin-Watson stat	2.001054	Prob(F-statistic)	0.000003

Cointegration test

Johansen cointegration test

Table 9

Date: 03/18/14 Time: 15:05

Sample (adjusted): 1972 2010

Included observations: 39 after adjustments

Trend assumption: Linear deterministic trend

Series: SER01 SER02 SER03 LNPR

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.651006	71.65601	47.85613	0.0001
At most 1 *	0.360193	30.60068	29.79707	0.0403
At most 2	0.259099	13.18375	15.49471	0.1082
At most 3	0.037438	1.488128	3.841466	0.2225

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.651006	41.05533	27.58434	0.0005
At most 1	0.360193	17.41693	21.13162	0.1532
At most 2	0.259099	11.69562	14.26460	0.1226
At most 3	0.037438	1.488128	3.841466	0.2225

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

SER01	SER02	SER03	LNPR
8.401607	-7.552281	-0.314631	3.856840
5.210084	-6.904426	0.880234	-7.240580
-1.094606	6.425790	-2.595235	1.465135
1.094372	0.098539	-0.817631	-0.139337

Unrestricted Adjustment Coefficients (alpha):

D(SER01)	-0.055629	-0.095841	-0.116257	0.029008
D(SER02)	0.103981	-0.076296	-0.117278	0.025826
D(SER03)	0.113393	-0.086310	-0.108058	0.046861
D(LNPR)	-0.103004	0.114725	0.001492	0.010573

1 Cointegrating Equation(s): Log likelihood 60.77913

Normalized cointegrating coefficients (standard error in parentheses)

SER01	SER02	SER03	LNPR
1.000000	-0.898909	-0.037449	0.459060
	(0.08721)	(0.04325)	(0.12598)

Adjustment coefficients (standard error in parentheses)

D(SER01)	-0.467373
	(0.46664)
D(SER02)	0.873610
	(0.44567)
D(SER03)	0.952680
	(0.52995)

D(LNPR)	-0.865399	
	(0.31102)	

2 Cointegrating Equation(s): Log likelihood 69.48760

Normalized cointegrating coefficients (standard error in parentheses)

SER01	SER02	SER03	LNPR
1.000000	0.000000	-0.472669	4.357505
		(0.02571)	(0.76719)
0.000000	1.000000	-0.484165	4.336863
		(0.02700)	(0.80573)

Adjustment coefficients (standard error in parentheses)

D(SER01)	-0.966710	1.081849
	(0.52373)	(0.54209)
D(SER02)	0.476100	-0.258515
	(0.50771)	(0.52551)
D(SER03)	0.502995	-0.260448
	(0.60563)	(0.62687)
D(LNPR)	-0.267672	-0.014196
	(0.30814)	(0.31895)

3 Cointegrating Equation(s): Log likelihood 75.33541

Normalized cointegrating coefficients (standard error in parentheses)

SER01	SER02	SER03	LNPR
1.000000	0.000000	0.000000	6914.464
			(1535.85)
0.000000	1.000000	0.000000	7082.503
			(1573.23)
0.000000	0.000000	1.000000	14619.33
			(3247.88)

Adjustment coefficients (standard error in parentheses)

D(SER01)	-0.839454	0.334805	0.234855
	(0.48696)	(0.59157)	(0.13505)
D(SER02)	0.604474	-1.012119	0.204490
	(0.46871)	(0.56940)	(0.12999)
D(SER03)	0.621276	-0.954807	0.168786
	(0.57989)	(0.70446)	(0.16082)
D(LNPR)	-0.269305	-0.004606	0.129520

(0.31002) (0.37661) (0.08598)

Long run estimation and Cointegrating Regression Durbin-Watson (CRDW) test

Table 10

Dependent Variable: SER01
Method: Least Squares
Date: 03/12/14 Time: 08:59
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.673792	1.745416	4.396539	0.0001
SER02	1.075907	0.121284	8.870985	0.0000
SER03	-0.051635	0.063970	-0.807183	0.4249
LNPR	0.276942	0.138228	2.003521	0.0527
DUMMY	0.054827	0.133036	0.412123	0.6827
R-squared	0.995218	Mean dependent var		22.99905
Adjusted R-squared	0.994687	S.D. dependent var		2.132550
S.E. of regression	0.155442	Akaike info criterion		-0.771243
Sum squared resid	0.869836	Schwarz criterion		-0.562271
Log likelihood	20.81049	F-statistic		1873.191
Durbin-Watson stat	1.970279	Prob(F-statistic)		0.000000

Engle-Granger cointegration test

Table 11

Dependent Variable: DRES
Method: Least Squares
Date: 03/12/14 Time: 09:27
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SER05	-0.052388	0.246738	-0.212323	0.8330
R-squared	-0.000202	Mean dependent var		0.008285
Adjusted R-squared	-0.000202	S.D. dependent var		0.225228
S.E. of regression	0.225251	Akaike info criterion		-0.117897
Sum squared resid	1.928043	Schwarz criterion		-0.075242
Log likelihood	3.298998	Durbin-Watson stat		2.057807

Estimation of an error-correction model

Table 12

Dependent Variable: DSER01
Method: Least Squares
Date: 03/12/14 Time: 09:55
Sample(adjusted): 1971 2010
Included observations: 40 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DSER02	1.025853	0.234592	4.372914	0.0001
DSER03	-0.041513	0.176396	-0.235338	0.8153
DLNPR	0.369670	0.099203	3.726423	0.0007
SER05	-0.981863	0.171239	-5.733870	0.0000
DUMMY	0.007988	0.040660	0.196450	0.8454

R-squared	0.837962	Mean dependent var	0.153370
Adjusted R-squared	0.819443	S.D. dependent var	0.361222
S.E. of regression	0.153490	Akaike info criterion	-0.793892
Sum squared resid	0.824573	Schwarz criterion	-0.582782
Log likelihood	20.87784	F-statistic	45.24971
Durbin-Watson stat	1.915741	Prob(F-statistic)	0.000000

Trend analysis

Table 13

Dependent Variable: SER01
Method: Least Squares
Date: 03/12/14 Time: 10:28
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.40730	0.190599	101.8225	0.0000
TREND	0.171036	0.007907	21.62987	0.0000

R-squared	0.923054	Mean dependent var	22.99905
Adjusted R-squared	0.921081	S.D. dependent var	2.132550
S.E. of regression	0.599086	Akaike info criterion	1.860726
Sum squared resid	13.99725	Schwarz criterion	1.944315
Log likelihood	-36.14489	F-statistic	467.8513
Durbin-Watson stat	0.364447	Prob(F-statistic)	0.000000