Effect of Exchange Rate Fluctuation on Rwandan Tea Price and Exports

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Abstract: In small and developing economies, exchange rate volatility is important as it creates gains or losses to farmers and exporters. This paper analyses the effect of exchange rate volatility on Rwanda tea price and exports. The analysis used monthly time series data on bilateral exports and real effective exchange rates from January 2001 to December 2016. The analysis is done with the co-integration methods and error correction model using the autoregressive distributed lag procedure and GJR-GARCH model. The findings show that an increase in exchange rate volatility resulted in an increase in Rwandan tea exports price in the long run and decrease in tea exports in the short run. The real income in importing country increases tea price and volume exports in the long run and short run. There should be the review of monetary policy to address the volatility of exchange rate and hedging system introduction to respond and to stabilize the exchange rate.

Key words: Real exchange rate, exchange rate volatility, Rwandan tea price and exports.

Introduction

The agriculture sector remains the engine of the Rwandan economy (UNDAP, 2013). It provided more than 30% of the GDP for the last decade and is still offering employment opportunities to 68% of the Rwandan population with 76% living in rural areas (NISR, 2015). It is dominated by small-scale subsistence farming under traditional agricultural practices and rain-fed agriculture (Broka *et al.*, 2016). Tea and Coffee are major agricultural export crops and origin of foreign currencies since 1930 (NAEB, 2011). Other exports come from crops including cassava, maize, Irish potatoes, sweet potatoes, plantain, beans, rice, etc., and animal products like milk and beef jointly make up 80% of agricultural production value (Broka *et al.,*2016).

Following the genocide of 1994, tea industry averagely experiences good returns resulting from using the best clones grown and efficient and diligent plucking allowing to produce the brightest, briskest and most aromatic tea in the world (MINAGRI, 2013). The volume of tea production and exports have almost doubled in Rwanda in the recent decade, which helped to triple the earnings from tea exports, bringing it to above US$60 million in 2016 (World Bank, 2017).

To boost exports, Rwanda has amongst others set up the exchange rate policy whose core objective is to preserve the external value of the national currency and also to ensure the effective operation of the foreign exchange market (Mukunzi, 2004). Rwanda introduced a flexible exchange rate regime in 1995 (BNR, 2015) with the goal to stabilize the exchange rate and prices to enhance the economic growth as well as to link that national foreign exchange market to the world market (Mukunzi, 2004). However, the export share percentage of GDP from 2000 up to 2015 showed a fluctuation where the highest share was 16% in 2007, the lowest share was 6% in 2000, and the recent statistics shows that the share was 15% in 2014 (BNR, 2015).

According to Kenen and Rodrik (1986), DeGrauwe (1988), Pozo (1992) and McKenzie (1999), there exists a long-run relationship between the volume of a countries exports and the level of economic activity of the importing country, the real exchange rate as well as the measure of exchange rate risk. The end results of exchange rate volatility on trade have long been at the center of the discussions on the optimality of different exchange-rate regimes (Buguk *et al.,* 2003). The exchange rate volatility impacts on exports by creating gains or losses to farmers and exporters. The total value of export earnings depends not only on the volumes of exports traded abroad

but also on the worth paid for them (Faridi, 2012). This paper investigates the effect of exchange rate volatility on price and exports of Rwandan Tea.

Materials and methods

The study used secondary data consisting of monthly time series data on bilateral exports and real effective exchange rates from January 2001 to December 2016 for tea in Rwanda. These data on real exchange rate and export prices for tea were gathered from National Bank of Rwanda, National Institute of Statistics of Rwanda, National Agriculture Export Development Board and Food and Agriculture Organization Statistics. The analysis of data was done using the cointegration methods complemented with error correction and the GARCH models. Based on the assumption that there are expectations about the real exchange rate series to follow an ARIMA process, an important assumption was made where the conditional variance is specified as a GARCH process using equation (1), (2) and (3).

$$A\phi_m(L)DLX_t = \gamma_0 + A\phi_m(L)\varepsilon_{1,t} \tag{1}$$

$$\varepsilon_{1,t} = Z_t \sqrt[2]{h_t} \tag{2}$$

$$Z_t \sim N(0,1) \tag{3}$$

Where

- DLX_t is the first difference of the real exchange rate expressed in logarithm. It represents the percentage fluctuation in the monthly real exchange rates.
- $\varepsilon_{1,t}$, in equation (1) are residuals which are normal and independent and identically distributed, - Z_t and h_t are the model's conditional variance.

The GARCH model, as specified in equation (4.1), was used to examine the dynamic conditional exchange rate volatility.

$$h_t = W_0 + \sum_{j=0}^{q} \alpha_j \varepsilon_{1,t-j}^2 \sum_{k=1}^{p} \beta_k h_{t-k} \tag{4.1}$$

The GARCH model allows h_t to vary over time and is modeled as a function of the lagged squared residuals $\left(\varepsilon_{t-k}^{i}{}^2\right)$ as well as the conditional variance $\left(h_{t-k}^{i}\right)$ suggested by Glosten, Jagannathan and Runkle GARCH (GJR-GARCH (p,q) (Glosten *et al.*, 1993). The conditional variance specification to maintain the tractability of conventional GARCH models while accommodating a leverage effect by adding a term to permit asymmetry in the GARCH model in specified as follows;

$$h_t = W_0 + \sum_{j=0}^{q} \alpha_j \varepsilon_{1,t-j}^2 \sum_{k=1}^{p} \beta_k h_{t-k} + \eta S_{t-1} \varepsilon_{1,t-j}^2 \tag{4.2}$$

The leverage effect variable S_{t-1} takes on the value of 1 if $\varepsilon_{1,t-1} < 0$, and $S_{t-1} = 0$ otherwise. The leverage effect is captured by the parameter η; if $\eta = 0$ the GJR model reduces to the conventional GARCH specification. The imposed restrictions are as such as $W_0 > 0; \beta_k \geq 0, \forall k; \alpha_j \geq 0, \forall j, and \ \eta \geq 0$.

These conditions are parameters that are imposed in such a way that they strictly ensure positive conditional variance. The value of the summation of the parameters in equation (4.2) has to less than one to satisfy the necessary as well as the sufficient conditions of covariance of stationarity. The summation of the parameters may be interpreted as a measure of the persistence of variance. The first difference in the real exchange rate in natural logarithms (DLRX$_t$), as specified in equation (1), (AR (1)-GARCH process is then used to derive the successive periods $(DLRX^e_{t-k2})$ for $k2$-period-ahead and $(h^e_{i,t-k3})$ for $k3$-period-ahead changes in the expectations of the real exchange rate (conditional variance estimates for exchange rate risk).

$$DLRX^e_t = \gamma_0 \sum_{i=0}^{k-1} \phi^i_1 + \phi^k_1 DLRX_{t-k} \qquad (5)$$

$$h^e_t = w_0 \sum_{i=0}^{k-1} \beta_1 + \alpha_1 k^{k-1}_1 \varepsilon^2_{1,t-k} + \beta^k_1 h_{1-k} \quad (6)$$

The DLRX$_t$ series is then undifferentiated back to exchange rate levels (RX^e_{t-k2}), which indicates the expected level of exchange rate while $h^e_{i,t-k3}$ reflects exchange rate volatility. The expected values are regressors in the model as specified in equation (7).

According to Kenen and Rodrik (1986), DeGrauwe (1988), Pozo (1992) and McKenzie (1999), there exists a long-run relationship between the volume of a country's exports and the level of economic activity of the importing country, the real exchange rate as well as the measure of exchange rate risk. Holding this assumption true, the reduced form of the error correlation model was specified as:

$$LnQ_{i,t} = \delta + \sum_{k1=1}^{a} \delta_{1,k1} \ln(IP_{t-k1}) + \sum_{k2=1}^{b} \delta_{2,k2} \ln(RX^e_{i,t-k2}) +$$
$$\sum_{k3=1}^{c} \delta_{3,k3} \ln(h^e_{i,t-k3}) + \sum_{k4=4}^{d} \delta_{4,k4} S_{k4,t} + \sum_{k5=1}^{e} \delta_{5,k5} \ln(Q^e_{i,t-k5}) + \varepsilon_{2i,t}$$
(7)

Where $Q_{i,t}$ is Rwandese tea i export to its export partner in time t, IP_{t-k1} is the monthly industrial production of export partner. The industrial production was used as a proxy for the exogenous component in period t-$k1$. RX^e_{t-k2} is the expected rate that is predicted for traders at time t during t-$k2$ period as generated in equation (5), $h^e_{i,t-k3}$ is the analogous estimates of the expected monthly exchange rate volatility as predicted by traders in

equation (6) and *k1, k2,* and *k3* are optimal lags and leads that were identified using Hendry non-standard method.

The quarterly dummy variable, $D_{k4,t}$, was introduced to control the seasonality effect that is inherent in export plots. $Q_{i,t-k5}^{e}$ is the lagged export volume that was included in the model specification so as to allow for an estimable lag length (*k5)* of the autoregressive persistence in export volumes. The equation error term, $\varepsilon_{2i,t}$, is assumed to hold Gauss-Markov properties. Variables in equation (7) are natural log transformation except $D_{k4,t}$, thus capturing elasticity effect.

Because the time series data is inherently non-stationary and unpredictable, the regression estimates obtained from the analysis of time series data may be misleading. Consequently, the time series used in this study has been tested for their stationarity and have been transformed to stationary where necessary. The Augmented Dickey-Fuller Test (ADF) were used. The ARDL bounds testing procedure was used to test for the co-integration of variables in equation (7) since variables were not integrated of the same order. This involved modeling equation (7) as an ARDL model. The general ARDL representation was specified as follows:

$$\Delta LnQ_{i,t} = \delta + \sum_{k1=1}^{a} \delta_{1,k1} \Delta \ln(IP_{t-k1}) + \sum_{k2=1}^{b} \delta_{2,k2} \Delta \ln\left(RX_{i,t-k2}^{e}\right) + \sum_{k3=1}^{c} \delta_{3,k3} \Delta \ln\left(h_{i,t-k3}^{e}\right) + \sum_{k4=4}^{d} \delta_{4,k4} \Delta S_{k4,t} + \sum_{k5=1}^{e} \delta_{5,k5} \Delta \ln\left(Q_{i,t-k5}^{e}\right) + \beta_{1,k1} \ln(IP_{t-k1}) + \beta_{2,k2} \ln\left(RX_{i,t-k2}^{e}\right) + \beta_{3,k3} \ln\left(h_{i,t-k3}^{e}\right) + \beta_{5,k5} \ln\left(Q_{i,t-k5}^{e}\right) + \varepsilon_{2i,t}$$

(8)

The terms that have the "*gammas*" are the short-run dynamics while the "*betas*" represent long-run estimates. F-test was implemented to test for co-integration of the variables. The F-test tests the null hypothesis that $\beta_{1,k1} = \beta_{2,k2} = \beta_{3,k3} = \beta_{5,k5} = 0$. The Pesaran et al. (2001) provide lower and upper bound critical F-values and were scrutinized for co-integration. The null co-integration hypothesis is not rejected when the computed lower bound F values is less than the critical F value but it is rejected when the computed upper bound F value exceeds the critical F value or otherwise the F test is inconclusive. When there is co-integration among variables, the Error Correction Model (ECM) can be used to describe the short-run dynamics of the variables (Maddala, 1992). Equation (9) specifies the ECM.

$$\Delta LnQ_{i,t}$$
$$= \delta + \sum_{k1=1}^{a} \delta_{1,k1} \Delta \ln(IP_{t-k1}) + \sum_{k2=1}^{b} \delta_{2,k2} \Delta \ln\left(RX_{i,t-k2}^{e}\right)$$
$$+ \sum_{k3=1}^{c} \delta_{3,k3} \Delta \ln\left(h_{i,t-k3}^{e}\right) + \sum_{k4=4}^{d} \delta_{4,k4} \Delta S_{k4,t}$$
$$+ \sum_{k5=1}^{e} \delta_{5,k5} \Delta \ln\left(Q_{i,t-k5}^{e}\right) + \pi ECM_{t-1} + \varepsilon_{2i,t}$$
(9)

The equation (9) presents a description of the variation in $LnQ_{i,t}$ around its long-run trend regarding a set of I (0) exogenous factors. The negative error term implies that the predicted variable has to fall in the next period for equilibrium to be restored. On the other hand, when the residual is positive, the predicted variable has to rise in the next period for equilibrium to be restored. The variables used in the estimation of tea exports price (USD/Kg) is denoted by TP, the industrial production of export partner denoted IP, real effective exchange rate denoted REER which is an average of basket of foreign currencies and real exchange rate volatility (denoted h_t or $ExVol$) which is the level of change in the trading price series over time as measured by the standard deviation of logarithmic return. In other words, it measures uncertainty/risk associated with exchange rate fluctuations.

Results and Discussion
Times series properties
Table 1: Unit root test of tea export function variable

Variables	ADF		PP	
	Level	First difference	Level	First difference
Industrial production	-2.27	-20.70[c]	-1.50	-27.80 [c]
Tea export	-5.51 [c]	-13.71 [c]	-5.49 [c]	-14.06 [c]
Tea export price	-2.04	-21.48 [c]	-1.38	-24.55 [c]
Exchange rate volatility	-5.05 [c]	-18.09 [c]	-5.05 [c]	-18.09 [c]
Real effective exchange rate	-2.37	-7.07 [c]	-2.37	-7.07 [c]

Note:[c] Denotes rejection of the null hypothesis of a unit root at 5 percent level of significance (MacKinnon, 1991).

Results in Table 1 indicates that the computed ADF and PP test statistics for the exchange rate volatility exceeds the absolute critical values at 5% significance level. This implies that the variable is stationary in level. The computed values for ADF and PP tests for tea export prices, industrial production and real effective exchange rate are less than the absolute critical values. This implies that they are not stationary at level and the variables must be differentiated for making them stationary. Thus, the variables were differentiated of order one I (1) process and found to be stationary.

Effect of exchange rate fluctuation on price of tea
Estimation of long run relationships of tea export prices function
The following table 2 points out the results of estimation of long run coefficients for tea exports price function.

Table 2: Long-run coefficients for tea export price function

Variable	Coefficient	Std. Error	t-Value	Prob
Industrial Production	-2.78	2.13	-1.30	0.20
Real Effective Exchange Rate	10.79*	4.93	2.19	0.03
Exchange Rate Fluctuation	-1.41	1.34	-1.05	0.29
Trend	0.01**	0.00	2.69	0.01

Note: * means significant at 5 percent

The results of the long-run dynamics are consistent with economic theory and have the correct signs; the tea exports prices are elastic to the real effective exchange rates in long-run. An increase by 1 percent in the Rwandan francs price of the currencies of the trading partners or a depreciation increases tea exports prices by 10.79 percent in the long-run. This result is consistent with findings by Khaledi*et al*. (2016) who found that the change in exchange rate in long-term was one of the most important factors that affecting export prices of dates in Iran. Jumah and Kunst (2001) found that dollar/sterling exchange rate volatility on futures markets for coffee and cocoa was the main source of risk for the commodity futures price. However, the current results are not consistent with the ones of Brun *et al*. (2015) who found that there was no statistically significant influence of the exchange rate over the physical prices of soybean.

Estimation of error correction model
The estimated results of short-run coefficients for tea export price function are shown in Table 3. The results of the short-run dynamics are consistent with economic theory and have the correct signs. The previous month's prices of tea have a negative and significant effect on the current prices in short-run. The coefficient of the lagged prices implies that a 1 percent increase in the export prices results in the previous one month leads to a reduction in the current prices of tea exports by 0.41 percent in short-run. This may be due to previous performance on the international market. An increase of 1 percent in conditional variance result in a decline by 0.29 percent in the current Rwandan tea export price in the short-run. This result is consistent with the findings by Zhang and Buongiorno (2010) who found that exchange rate volatility affects export prices of US forest products negatively. The results also corroborate with Kantike and Eglite (2013) who found that the currency exchange rate fluctuation was among the most significant factors that affect grain prices in the world.

Table 3: Short-run coefficients for tea export price function

Variable	Coefficient	St. Error	*t*-Value	Prob	
C	11.58	2.42	4.77	0.00	
D (TP (-1))	-0.41***	0.12	-3.24	0.00	
D(IP)	-0.19	0.51	-0.38	0.70	
D(EXRATEF)	2.48	2.41	1.03	0.31	
D(HtF)	-0.29*	0.17	-1.71	0.09	
X_1	0.07	0.05	1.47	0.15	
X_2	0.03	0.02	1.19	0.24	
X_3	0.02	0.05	0.32	0.75	
CointEg (-1)*	-0.43***	0.09	-4.76	0.00	
R-squared					0.
Prob (F-statistic)					0.
Breusch-Godfrey LM Test (Prob>. Chi-Square)					0.
Breusch-Pagan-Godfrey (Prob>. Chi-Square)					0.
Ramsey RESET Test (Prob F)					0.
Jarque-Bera (Prob)					0.

Note: *, **, *** means significant at 10, 5 and 1 percent respectively.

The error correction term is negative and significant thereby confirming the existence of real long run relationship between tea price and exchange rate volatility, real effective exchange rate and industrial production. The coefficient of the error correction term implies that 43 percent of the disequilibrium is corrected within a month. Since the error correction term is significant and large, the speed of adjustment towards the long-run equilibrium is therefore high.

Effect of exchange rate fluctuation on exports of tea
Estimation of the long run relationships
Table 4 reports the estimation results of long-run coefficients for tea export function. Results show that the long-run export elasticity concerning the income of the trading partner is 1.15. A 1% increase in industrial production of the trading partner resulted in 1.15% increase in tea exports volumes in the long-run. Goudarzi et al. (2012) reported similar results in a study that estimated the effect of industrial production on Iranian pistachio export volumes. Contrastingly, Ragoobur and Emamdy (2011) established a negative association between foreign income and Mauritius exports. Moreover, Anagaw and Demissie (2012) found a positive but insignificant

impact of an increase in the trading partner's real gross domestic product on Ethiopian exports.

Table 4: Long-run coefficients for tea export function

Variable	Coefficient	Std. Error	*t*-Value	Prob
Industrial Production	1.15**	0.48	2.39	0.02
Real Effective Exchange Rate	1.47**	0.63	2.32	0.02
Exchange Rate Fluctuation	0.29	0.18	1.59	0.11
Trend	0.00	0.00	0.77	0.44

Note: ** means significant at 5 percent.

Tea exports are elastic to the real effective exchange rates. An increase in the Rwandan franc's exchange rate against the currencies of the trading partners or a depreciation increases tea exports by 1.48% in the long-run. Similarly, Fedoseeva (2016) found that, in the long-run, exchange rate changes influenced tea export volumes asymmetrically. Relative to the depreciation of the Euro that is usually beneficial to the European agri-food exports, the appreciation of the Euro was less harmful to exportation the Rwandese tea.

The current finding is consistent with results by Anagaw and Demissie (2012) who established a positive and significant influence of exchange rate on Ethiopian exports. Contrary to the current result, Menji (2013) found that the real effective exchange rates had an insignificant impact on Ethiopian merchandise exports. Agasha (2009) also indicated that the real effective exchange rate had a negative and significant relationship with the Ugandan coffee exports.

Estimation of error correction model

The error correction term is negative and significant thereby confirming the existence of real long run relationship between tea export volumes and exchange rate volatility, real effective exchange rate and industrial production in Table 5. The real income (industrial production) of the trading partner positively impacted on both short and long-run tea export volumes. The reason for the reported positive coefficient is that as the economies of the trading partner grow, they may channel their resources towards processing of the same commodity. This may lead to more processed tea activities than production, leading to increased importation of tea. The short-run export elasticity concerning the income of the trading partner was 1.11%, implying that 1% increase in the income of the trading partner results in 1.11% increase in tea exports. Ragoobur and Emamdy (2011) reported similar results by indicating that industrial production of the trading

partner positively influenced Mauritius export volumes in the short-run. The previous three months of IP was found to have an adverse short-run effect on the current tea export volume. This means that a 1% increase in IP from the previous three months leads to a decline in tea export volume by 0.93 percent.

Table 5: Short-run coefficients for tea export function

Variable	Coefficient	Std.error	*t*-Value	Prob
c	-20.32***	2.91	-6.97	0.00
D(TEXP(-1))	0.19*	0.10	1.85	0.06
D(TEXP(-2))	0.13	0.08	1.49	0.13
D(TEXP(-3))	0.29***	0.07	4.14	0.00
D(IP)	1.11**	0.42	2.58	0.01
D(IP(-1))	-0.15	0.53	-0.29	0.77
D(IP(-2))	0.58	0.53	1.10	0.27
D(IP(-3))	-0.92*	0.50	-1.83	0.06
X_1	-0.02	0.06	-0.33	0.74
X_2	0.09*	0.05	1.66	0.09
X_3	-0.29***	0.06	-4.93	0.00
CointEq (-1)*	-0.81***	0.11	-7.06	0.00
R-squared				0.78
Prob (F-statistic)				0.00
Breusch-Godfrey LM Test (Prob>. Chi-Square)				0.14
Breusch-Pagan-Godfrey (Prob>. Chi-Square)				0.06
Ramsey RESET Test (Prob F)				0.18
Jarque-Bera(Prob)				0.39

Note: *, **, *** means significant at 10, 5 and 1 percent respectively.

The error correction term is negative and significant which affirms that the variables are co-integrated. Results show that a 1% increase in industrial production of the trading partner resulted in 1.15% increase in tea exports in the long-run. Goudarzi et al. (2012) reported similar results in a study that estimated the effect of industrial production on Iranian pistachio export volumes. Tea exports are elastic to the real effective exchange rates. An increase in the Rwandan franc's exchange rate against the currencies of the trading partners or a depreciation increases tea exports by 1.48% in the long-run. Similarly, Fedoseeva (2016) found that, in the long-run, exchange rate changes influenced tea export volumes asymmetrically to European

region. Relative to the depreciation of the Euro that is usually beneficial to the European agri-food exports, the appreciation of the Euro was less harmful to exportation of the Rwandese tea. This finding is consistent with results by Anagaw and Demissie (2012) who established a positive and significant influence of exchange rate on Ethiopian exports. Contrary to the current result, Menji (2013) found that the real effective exchange rates had an insignificant impact on Ethiopian merchandise exports. Agasha (2009) also indicated that the real effective exchange rate had a negative and significant relationship with the Ugandan coffee exports.

The previous month's tea exports volume was significantly encouraging in influencing the current level of tea exports. The coefficient indicates that a 1% increase in the previous month's tea export volumes resulted in augmentation in the current volume of tea exports by 0.19% and 0.29% one and three preceding months, respectively, in the short-run. This may be due to prior performance on the international market. If a nation exported more in previous months and gained profit, then the current period's export volumes increase.

Seasons two and three had positive and negative short-run effect on the current tea exports respectively. This means that during season two, the volume of tea exports rose by 9.79%. Regarding season three, the results imply a decline in tea export by 29.76 percent. The error term coefficient is high reflecting a faster speed of adjustment from disequilibrium to a long-run equilibrium. This implies that 81.38 percent of the disequilibrium is corrected within one month.

Conclusion

The Rwandan economy remains dependent to agriculture sector which contributes more than one third to the GDP. Tea and coffee greatly contribute to GDP (above 15%) and agricultural exports (above 80%). However, from 2000 to 2016, statistics of Rwandan exports show that the contribution of tea and coffee to GDP significantly fluctuated. As the exchange rate volatility impacts on trade, this article analyzed effect of exchange rate volatility on Rwanda tea price and exports from 2000 to 2016.

The findings show that there has been a reduction in tea price due to increased exchange rate volatility in the short-run. In the long run, tea price increased due to the increase in real exchange rate. The exchange rate volatility impacted negatively and significantly the Rwandese tea exports. There should be the review of monetary policy to address the volatility of exchange rate and hedging system introduction to respond and to stabilize

the exchange rate. Economic policies stabilizing the exchange rate would be likely to increase the tea exports volumes. Hedging would contribute to tea price stability in the short term.

References

Agasha, N. (2009). *Determinants of export growth in Uganda (1987-2006)* (Doctoral dissertation, Makerere University).

Anagaw, B. K. and Demissie, W. M. (2012). Determinants of Export Performance in Ethiopia: VAR Model Analysis. *Journal of Research in Commerce & Management, 2* (5): 94 -109.

BNR. (2015). *Recent Economic and Financial Developments and Monetary Policy Orientation in 2015Q3*, National bank of Rwanda. Kigali, Rwanda.

Broka, S., Giertz, A., *Christensen*, G., Hanif, C. and Rasmussen, D. (2016). *Tajikistan: Agricultural Sector Risk Assessment. Agriculture Global Practice Technical Assistance Paper*; World Bank. Washington, DC.http://documents.worldbank.org/curated/en/395161468196164557/Tajikistan-Agricultural-sector-risk-assessment, July 15th, 2019.

Brun-Aguerre, R., Fuertes, A., & Greenwood-Nimmo, M. (2013). Heads I Win, Tails You Lose: New Evidence of Long-Run Asymmetry in Exchange Rate Pass-Through by Exporting Firms.

Buguk, C., Isik, M., Dellal, L. and Allen, A. (2003). The Impact of Exchange Rate Variability on Agricultural Exports of Developing Countries: The Case of Turkey. *Journal of International Food and Agribusiness Marketing*, 13(1):83-105.

De Grauwe, P. (1988). Exchange Rate Variability and the Slowdown in Growth of International Trade. *IMF Staff Papers, 35*(1): 63-84.

Faridi, M. Z. (2012). Contribution of Agricultural Exports to Economic Growth in Pakistan, *Pakistan Journal of Commerce and Social Sciences, 6* (1): 13-34

Fedoseeva, S. (2016). Same Currency, Different Strategies The (Asymetric) Role of The Exchange Rate in Shaping European Agri-food Exports. *Journal ofApplied Economics*, 48(11): 1005-1017.

Glosten, L.R., Jagannathan, R. and Runkle, D. (1993). On the Relation between the Expected Value and the Volatility of the Nominal Excess Returns on Stocks, *Journal of Finance, 48*(5): 1770-1801.

Goudarzi, M., Khanarinejad, K. and Ardakani, Z. (2012). Investigation the Role of Exchange Rate Volatility on Iranian Pistachio Exports. *International Journal of Agronomy and Plant Production, 3*(3): 94-99.

Jumah, A.and Kunst, R. M. (2001). The Effects of Dollar/Sterling Exchange Rate Volatility on Futures Markets for Coffee and Cocoa. *European Review of Agricultural Economics*, 28 (3): 307-328

Kantike, I. and Eglite, A. (2013). Factors Affecting Wheat Bread Prices. *Proceedings of the International Scientific Conference on Economic Science for Rural Development*. Jelgava, Latvia. April 25-26, 2013.

Kenen, P.B. and Rodrik, D. (1986). Measuring and Analyzing the Effects of Short-term Volatility in Real Exchange Rates. *Review of Economics and Statistics,* 68:311-315.

Khaledi, K., Naser Esfahani, A., Haghani, F. and Hafarardestani, M. (2016). Exchange Rates Translation Effect on Export Price of Dates Iran: Application Model ARDL. *Iranian Journal of Agricultural Economics and Development Research*, 46 (4): 719-727

Mackinnon, J. (1991). Critical Values for Cointegration Tests in R. F. Engle and C. W. Granger (Eds.), Long-run Economic Relationships: Readings in Cointegration, Oxford University Press,1991, 267-276.

Maddala, G. (1992). Introduction *to Econometrics*. New York: Macmillan Publishing Company.

McKenzie, M.D. (1999). The Impact of Exchange Rate Volatility on International Trade Flows. *Journal of Economic Surveys,* 13(1): 71-106.

Menji, S. (2013). Export Performance and Determinants in Ethiopia. *Munich Personal RePEc Archive*.

MINAGRI.(2012). *National Coffee Strategy, 2009-2012*. Ministry of Agriculture and Animal Resources. Kigali, Rwanda.

MINAGRI. (2013). *Strategic Plan for the Transformation of Agriculture in Rwanda (Phase III).* Ministry of Agriculture and Animal Resources. Kigali, Rwanda.

Mukunzi, S. (2004). *Monetary Policy Strategy in Rwanda* (Master's Thesis). University of Kwazulu Natal. Durban, South Africa.

NAEB. (2011). *Annual Report 2010*. National Agricultural and Export Development Board. Kigali, Rwanda.

NISR. (2015). *Seasonal Agricultural Survey*. National Institute of Statistics of Rwanda. Kigali, Rwanda.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. Journal *of Applied Econometrics*, 16(3): 289-326.

Pozo, S. (1992). Conditional Exchange Rate Volatility and the Volume of International Trade: Evidence from The Early 1900s. *Review of Economics and Statistics,* 74:325-329.

Ragoobur, V. T. and Emamdy, N. (2011). Does Exchange Rate Volatility Harm Exports? Evidence from Mauritius. *Journal of Emerging Trends in Economics and Management Sciences,* 2 (3): 146-155.

UNDAP. (2013). *Rwanda United Nations Development Assistance Plan 2013-2018.*Republic of Rwanda. Kigali, Rwanda.

https://planipolis.iiep.unesco.org/en/2013/rwanda-united-nations-development-assistance-plan-undap-2013-2018-6051. June 20th 2018.

World Bank, 2015. *World* Development *Indicators 2015.* World Bank. Washington DC, USA

World Bank. (2017). *Rwanda Economic Update Sustaining Growth by Building on Emerging Export Opportunities*. World Bank. Washington DC, USA.

Zhang, S. and Buongiorno, J. (2010). Exchange Rate Volatility Impacts on Export Volume and Price of U.S Forest Products. *Canadian Journal of Forest Research*, 40:2069-2081.