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Analysis of the Intensity of Burundi's Rice Imports from Tanzania

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Authors' contributions

This work was carried out in collaboration among all authors. Author JCN designed, wrote the first draft of the manuscript and performed statistical and econometric analysis. Author WMN revised and improved the statistical and econometric analysis. Authors JKL and SKK revised the whole manuscript and improved it before its submission. All authors read and approved the final manuscript.

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ABSTRACT

Neighboring countries usually exchange goods and services, taking advantage of proximity and other shared socio-economic characteristics among citizens. This study explored the intensity of Burundi's rice imports from Tanzania. First of all it determined and analyzed the evolution of the intensity of rice imports. Secondly, it estimated the factors which influence the intensity of rice imports. The results indicated that Burundi's rice imports from Tanzania remained more intensive over 2003-2018. However the financial crisis which slapped the world in 2007-2008 harmed Burundi's rice imports from Tanzania probably due to lack of finance to import. Moreover, the results revealed that the Burundian national income, its exchange rate and its trade openness significantly had a positive effect on the intensity of Burundi's rice imports from Tanzania.

Keywords: Imports; neighboring countries; intensity of trade; food trade.

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1. INTRODUCTION

Around the world, food trade considerably contributes to the improvement of citizens' welfare. Through trade, food commodities are exchanged from countries with surplus to countries challenged with food shortage. This results in enhanced food supply leading to sustainable food access in countries involved in trade. Salvatore [1] indicates that we live a globalized world where tastes converge and goods and services we usually use are provided by foreigners. Therefore, food trade's existence matters more in order to ease a smooth access to food commodities and hence improve the welfare of citizens.

Empirical studies pointed out that international trade benefits all countries and this leads to a sustainable development across nations. Marshall [2] indicates that the causes which determine the economic progress of nations belong to the study of international trade. Examining the existing nexus between trade and economic growth, Robertson [3] described exports as an engine of growth and Minford et al. [4] hailed foreign trade as an elixir of economic growth.Therefore, no matter how far countries are located from each other, still exchange of goods and services takes place and benefits to all countries involved in trade. Trade existence among nations is triggered by the phenomenon of globalization which intensifies day after day particularly in open economies.

Countries facilitate trade by partially or definitely removing tariffs and other non-tariffs barriers which are perceived to significantly hamper the movement of goods and services between them. Likewise, neighboring countries usually trade each other and establish some forms of agreements easing trade between them. It is in this context that this study sought to analyze trade in rice between Burundi and Tanzania, two neighboring countries located in the eastern part of Africa. Burundi is a landlocked country bordering with Rwanda in North, Democratic Republic of the Congo in West and Tanzania in both East and South sides. Burundi was self-sufficient in food production before 1990's [5]. Nevertheless, the civil war which struck the country over the period 1993-2005 reduced the output from all sectors, agriculture included. Since then, Burundi relies on imports to offset its deficit in domestic food needs. As an illustration, Table 1 provides a view of the balance between Burundi's exports and imports in selected food commodities suchlike cereals, meats products and dairy products for the period 2010-2015.

From Table 1, it is evident that Burundi faces a deficit in the mainly consumed food commodities. In such a situation, imports step in to offset that existing deficit. In Burundi, food commodities are imported from neighboring countries, from the region and from the rest of the world mostly Asia and/or Europe. This study was meant to explore Burundi's rice imports from Tanzania using an intensity of trade approach. More specifically, this study firstly determined the intensity of Burundi's rice imports from Tanzania. Thereafter, it estimated the factors which influence the intensity of rice imports. The broad aim of this study was to contribute towards improved performances of Burundi's rice imports from Tanzania. This study covered the period 2003-2018 due to data availability.

Tanzania was chosen over other neighboring countries with Burundi reason being that it shares a large physical border with Burundi (from East to South), with many entry points along the shared physical border. This is perceived as a comparative advantage as far as imports and/or exports are concerned. Rice was chosen among other food commodities due to the existing high rate of rice consumption in Burundi caused by a sporadic increase in number and extension of

Table 1. Burundi's total imports and exports (in 1000$) for cereals, meat products and dairy products and eggs in 2010-2015

Year	Imports			Exports			Balance
	Cereals	Dairy products and eggs	Meat products	Cereals	Dairy products and eggs	Meat products	
2010	27031.222	1850.546	74.238	829.249	4.596	0.000	Deficit
2011	47764.465	4133.476	46.174	392.610	0.000	0.000	Deficit
2012	100870.933	2651.12	56.528	5.285	0.989	0.000	Deficit
2013	47230.166	1937.866	103.596	2915.713	25.125	3.317	Deficit
2014	42276.060	1905.181	4811.558	4807.307	0.675	2.704	Deficit
2015	28756.55	1249.992	3105.931	5636.861	0.172	0.006	Deficit

Source: UNCOMTRADE, 2019

urban centres. In Burundi, there are few empirical studies related to food trade which have been carried out so far. Empirical studies done are more general and did not use the intensity of trade approach, to analyse trade flows between Burundi and Tanzania as far as rice imports are concerned. Thus, this study was meant to bridge that gap left by previous empirical studies. The results of this study firstly provided relevant quantified information to policy makers in Burundi and Tanzania. Such information could be more useful while addressing an issue related to rice demand and supply across the two neighboring countries. Secondly, the results feed into existing literature on bilateral trade between neighboring countries.

1.1 Overview of Production, Consumption and Imports of Rice in Burundi

There are three ecological zones in Burundi where rice is grown: the irrigated Imbo plain, the rain fed (non-irrigated) areas of Imbo and Moso lowlands and the non-irrigated areas of the elevated marshland region [6]. Concerning rice consumption in Burundi, the rate followed an upward trend in these years. Rice is consumed by households and mostly by communities suchlike military camps, schools, prisons and religious communities. In households, preferences depend on household income. Nzeyimana [7] indicates that the demand for rice has increased for about 70 % in 2013 and registered a peak in 2010.

Although there is a sporadic increase of rice demand in the country, domestic rice production fails to meet local demand. In such a situation, the country relies on imports. Rice is imported from the world's top rice producers such as India, Pakistan, Thailand and Vietnam for about 78% and the rest is mostly imported from the EAC region. However, Tanzanian rice is the most frequently found in Burundi's local markets although this does not appear in official statistics [7], the proximity with Tanzania being one of the reasons. Most of households in Burundi appreciate the taste of Tanzanian rice.

2. THEORETICAL FRAMEWORK

This study was grounded by the theory of country similarity. It was developed by Steffan Linder in 1961 [8]. The theory stresses that a nation exports those manufactured products for which a large domestic market exists. In other words, the theory indicates that trade takes place between countries with the same level of development. The similarity can be seen in the aspects of location, culture, political and economic interests and natural resources among other aspects. The relevance of this theory in the context of this study lies in the fact that the countries involved in this study (Burundi and Tanzania) share many features and this makes them to be similar in a way or another.

Some empirical studies conducted on the drivers of the intensity of trade are oriented at firm-level. As an illustration, we can mention Schlegelmilch and Crook [9] who estimated the determinants of export intensity at firm level. Their study employed a multiple regression analysis and found out that the export intensity is negatively related to the domestic growth of sales. Seyoum [10] explored the determinants of import intensity in US foreign trade zones. Factors affecting import intensity were categorized into three groups suchlike external factors, firm characteristics and firm business strategy. Findings reveal that the most promising predictors of import intensity of firms operating in USA free trade zones are the policy environment in the form of inverted tariff benefits and firm business strategy. Other empirical studies oriented at country level were carried out so far. This is the case of Elmorsy [11] who analysed the determinants of trade intensity of Egypt with COMESA countries. Both the intensity of trade and the gravity model was used. Findings show that the gross domestic product was the main factors which affect the intensity of trade between Egypt and COMESA countries.

3. MATERIALS AND METHODS

The methods used to meet the objectives of this study are grouped into two section. The first section deals with methods used to determine the intensity of imports and the second section is about methods utilized to estimate the determinants of intensity of rice imports.

3.1 Determination of the Intensity of Burundi's Rice Imports

In this study, the intensity of Burundi's rice imports was determined. This is a descriptive approach helping to deeply understand how intensively Burundi imported rice from Tanzania. The trade intensity technique was developed by Kojima in 1964 [12]. The intensity of trade is

defined as a ratio of two export shares [13]. The numerator is the share of the destination of interest in the total exports. The denominator is the share of the destination of interest in the exports of the world as a whole. Ambrose and Sundar [12] argued that the intensity of trade does not suffer from any size bias and one can compare the statistic across regions and over time. Across countries, there are empirical studies on intensity of trade which have been carried out so far. To determine the intensity of trade, this study adopted [12] for a reason that it is the recently improved formula to determine trade intensity. Therefore the expression of the intensity of Burundi's imports from import Tanzania was given by the following expression:

$$MTI_{ijt}^{k} = \frac{\left[\frac{M_{ijt}^{k}}{M_{itt}^{k}}\right]}{\left[\frac{X_{jt}}{X_{TZt}-X_{it}}\right]} * 100 \quad (1)$$

where:

i and j respectively refer to Burundi and Tanzania; k refers to rice; t refers to time.

MTI_{ijt}^{k} denotes intensity of imports between i and j at time t.

M_{ijt}^{k} denotes i's imports (in values) from j for commodity k at time t.

M_{itt}^{k} denotes i's total imports (in values) for commodity k at time t.

X_{jt} denotes total exports (in values) to Tanzania at time t.

X_{TZt} denotes Tanzania total export (in values) at time t.

X_{it} denotes total i's export (in values) at time t.

In the above equation X_{it} is subtracted from X_{TZt} for a reason that a country cannot export goods and services to itself. The only share it can meaningfully have in total world trade is a share in the imports of all other countries [14].

3.2 Factors Affecting the Intensity of Burundi's Rice Imports

In this study, the determinants of the intensity of Burundi's rice imports were estimated. A multiple linear regression containing these factors was estimated. Hence, the expression of the equation of factors affecting the intensity of Burundi's rice imports from Tanzania was given by the following equation.

$$LnMI_{ijt}^{k} = \beta_0 + \beta_{it} X_{it} + \varepsilon_t \quad (2)$$

The factors associated with the intensity of Burundi's rice imports were analysed using two quantitative techniques suchlike Unit root test and Johansen Maximum Likelihood test of Cointegration. The latter is very crucial since the presence of a unit root in the series is likely to lead to a spurious regression as the structure of the error term is unknown and the possibility of unbiased estimates exists. The specification of the model was done in searching the determinants that influence the intensity of imports and the model chosen was as follows:

$$\ln MI_{ijt}^{k} = \beta_0 + \beta_{1it} \log gdpbu_{it} + \beta_{2it} \log exrati_{it} + \beta_{3it} \log buagriland_{it} + \beta_{4it} \log tradeopen_{4it} + \varepsilon_t \quad (3)$$

The *loggdpbu*$_{it}$ is the variable of GDP of Burundi at the period t predicted to have a positive influence on the intensity of Burundi's rice imports; *logexrati*$_{it}$ is the exchange rate of the Burundian franc (BIF) in terms of USA dollar currency which was predicted to have a neutral influence depending on the depreciation or appreciation of the BIF against the USA dollar currency; *logbuagriland* is the arable land allocated to agricultural production in overall.

The extension of arable land of Burundi was predicted to have a negative effect on the intensity of Burundi's rice imports. Given that there is an increasing trend of highland rice production, this was predicted to eventually curb the intensity of rice imports if the domestic rice production increases tremendously. *Logtradeopen* is a variable denoting trade openness of Burundi. The trade policy instruments used to control trade are tariffs and quota and a battery of non-tariff barriers. Overall, tariff is commonly used by Burundian trade policy makers but the limit of such instrument is within the East Africa Community's agreed tariff limit on raw materials, semi-finished and finished products. This variable was predicted to have a positive effect on the intensity of Burundi's rice imports. We choose the Johansen co-integration procedure [15]. This

procedure follows a Maximum Likelihood Approach (ML) and is formulated as follows:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + ... + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + \Psi X_t + u_t \quad (4)$$

Where Z_t is a vector of I (1) endogenous variables, $\Delta Z = Z_t - Z_{t-1}$ and X_t is a vector of I (0) exogenous variables. Γ_i, Π and Ψ are (n x n) vector matrices of parameters. The above equation (4) contains the short-run and long-run adjustment to changes in Z_t represented by Γ_i and Π respectively. In co-integration analysis, the number of co-integrating relationship are given by the rank of Π and are denoted by r and trace statistics are used to test the null hypothesis of at most r co-integrating vectors against the alternative that the number of co-integrating vectors is greater than r. Another step followed in this study was to estimate the Vector Error Correction Model (VECM) in order to examine the existence of the long-run and short-run relationship among variables through autoregressive lags following [16]. The Vector Autoregressive (VAR) had to be turned into equation (5) of VECM.

$$Z_t = \beta_0 + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + ... + \beta_k Z_{t-k} + \varepsilon_t \quad (5)$$

And

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + ... + \Gamma_{k-1} \Delta Z_{t-(k-1)} + \Pi Z_{t-k} + \varepsilon_t \quad (6)$$

3.3 Data Sources

This study used time series data. Data on rice imports was collected from World Integrated Trade Solution (WITS), data on GDP and arable agricultural land were found from World Bank database, data on exchange rate was retrieved from Burundi Central Bank (BRB) and other databases where data was retrieved from include the Burundian bureau of statistics (ISTEEBU) and Food and Agriculture Organization database (FAOSTAT). The data were transformed into logarithmic function due to the model used for analysis.

4. RESULTS AND DISCUSSION

The results were discussed into two sections. The first section addresses the first objective of this study which was to explore the evolution of the intensity of Burundi's rice imports from Tanzania. The second section addresses the second objective of this study which was to estimate the determinants of the intensity of Burundi's rice imports.

4.1 Results of Intensity of Burundi's Rice Imports from Tanzania

The results on the intensity of Burundi's rice imports from Tanzania are presented in Table 2.

From Table 2 it is evident that Burundi's rice imports from Tanzania were more intensive except for the period ranging between 2008 and 2009 where low level of intensity was observed. Possible explanations to this could be the financial crisis of 2008-2009 in the World. Examining the evolution of the intensity of rice imports over time, we used histograms to depict the evolution. The results are presented in Fig. 1.

Table 2. The intensity of Burundi's rice imports from Tanzania

Year	Country	Tradingpartner	Commodity	Intensity of imports (%)
2003	Burundi	Tanzania	Rice	362.4120059
2004	Burundi	Tanzania	Rice	312.1094954
2005	Burundi	Tanzania	Rice	398.4977985
2006	Burundi	Tanzania	Rice	262.7569611
2007	Burundi	Tanzania	Rice	182.3257096
2008	Burundi	Tanzania	Rice	48.29880241
2009	Burundi	Tanzania	Rice	25.82167978
2010	Burundi	Tanzania	Rice	114.462341
2011	Burundi	Tanzania	Rice	311.2005163
2012	Burundi	Tanzania	Rice	143.9186425
2013	Burundi	Tanzania	Rice	364.5050608
2014	Burundi	Tanzania	Rice	403.1724799
2015	Burundi	Tanzania	Rice	380.0051073
2016	Burundi	Tanzania	Rice	401.3768169
2017	Burundi	Tanzania	Rice	369.8789714
2018	Burundi	Tanzania	Rice	326.0534814

Source: Authors

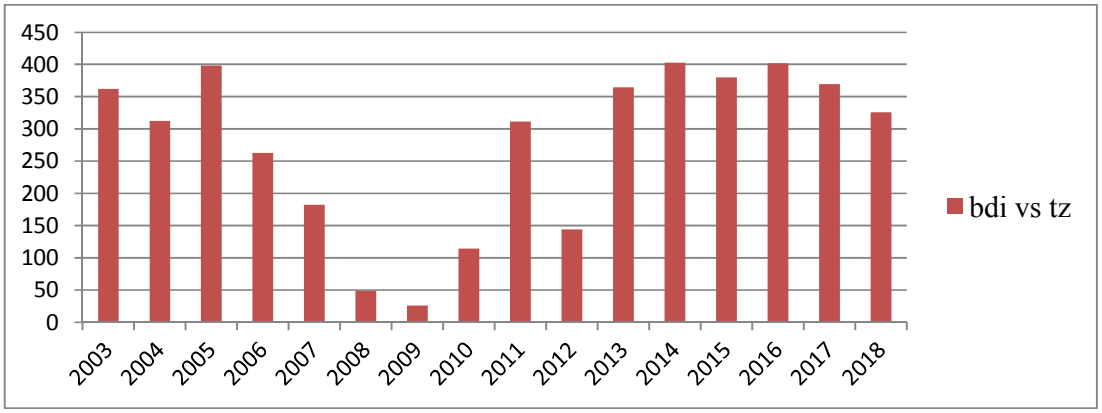

Fig. 1. Evolution of the intensity of Burundi's rice imports from Tanzania in 2003-2018
Legend: bdi: Burundi; tz: Tanzania

Table 3. Unit root test

Unit root test	Level	lnMI	lngdpbu	Lnexrati	lnbuagriland	Lntradeopen
ADF Test	Level	-3.230 (0.0183)*	-3.940 (0.0018)*	-2.646 (0.082)	-1.573 (0.4973)	-2.169 (0,2176)
	1st Difference	-	-	-2.502 (0.1150)	-1.569 (0.4993)	-2.199 (0.2066)
Philips-Peron Test	Level	-3.246 (0,0174)*	-3.954 (0.0017)*	-2.188 (0.2105)	-1.705 (0.4286)	-2.182 (0.2130)
	1st Difference			-2.922 (0.1745)	-1.638 (0.4632)	-2.228 (0.1962)

Note: (·) [17] one-sided p-values for the reject hypothesis of unit root at 5 percent

From Fig. 1, it is clear that the intensity of Burundi's rice imports followed an upward trend. However, an exception was observed around the period between 2008 and 2010 whereby the trends followed a decreasing slope for the reasons explained in previous paragraphs.

4.2 Results of Factors Affecting the Intensity of Burundi's Rice Imports from Tanzania

Before embarking on the estimation of factors which affect the intensity of rice imports, tests related to the nature of data used were performed. Dealing with time series data requires to test for unit root so that we know the stationary and non-stationary variables. The results obtained using STATA 15 are presented in Table 3.

Table 3 shows that for three variables, the statistics of the ADF and PP tests are lower than the criterion statistics of the different thresholds than after a prior differentiation, so they are integrated with orders I (1) and we conclude that there may be a co-integrated relation. We then carried out a co-integration Johanson test. The method enables us to know the number of co-integration relationships that remain between our long-term variables. The maximum likelihood method was used and the results obtained are presented in Table 4.

Results from Table 4 reveal the existence of long-run relationship among the variables. If the trace statistics and the maximum Eigen statistics are greater than the 5% critical values, the null hypothesis of no-cointegration is rejected in favour of the alternative hypothesis at the level. The trace statistic and the Maximum Eigen statistic show that there is co-integration among the variables implying a long run equilibrium relationship. Table 4 shows that at least there are 4 co-integration equations. Hence, there is a long run equilibrium relationship between the intensity of imports and related independent variables in the rice sub-sector of Burundi.

4.3 Summary Statistics (1993-2018)

The intensity of rice imports is far above zero and reveals high trade intensity between Burundi and Tanzania. Since the bilateral negotiation exists between the two countries, the leading theme in

negotiation was to find out ways on how to revamp the cooperation and development of trade along the central corridor. Table 5 provides summary statistics of the intensity of trade.

Before Burundi used to have access to Indian Ocean through the port of Mombasa but recently Dar-Es-Salaam becomes the right choice for export and import goods from abroad. This strategy of diversifying trade had to help Burundi to solve its salient challenge of land-locking state. The statistics show obviously that the economic size of Tanzania is four time that of Burundi. Though land-locked, Burundi has taken an opportunity offered by the EAC regional trade integration by open up to other countries for trade as evidenced by the indicator of trade openness. In order to estimate the determinants of the intensity of rice imports, we carried out a vector error correction model to find out short-run and long-run effects when equilibrium holds. The results of dynamic VEC model present rich and interesting findings. These results are presented in Table 6. There is long-run causality running from gdpbu to trade intensity.

Table 4. Johanson maximum likelihood test of co-integration, unrestricted co-integration rank test (Trace and maximum Eigen values)

Level		Trace	Maximum Eigen value	
Hypothesized no. of CEs	**Statistics**	**5% critical value**	**Statistics**	**5% critical value**
None	181.80	94.15	80.60	39.37
At most 1	101.30	68.52	45.13	33.46
At most 2	56.17	47.21	25.15	27.07
At most 3	31.01	29.68	21.56	20.97
At most 4	9.46*	15.41	9.29	14.07
At most 5	0.17	3.76	0.17	3.76
Number of observation: 24 Lags: 2				

Notes: Trace and Max-Eigen value test indicate 1 cointegrating eqn(s) at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*
[18] p-values

Table 5. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Intensity	26	546.1839	981.617	19.71346	3717.735
gdpbu	26	23.19585	7.068962	1.000186	33.16152
gdptz	26	82.96239	31.49074	37.68172	140.3346
exrate	26	19.4653	4.855291	10.86137	25.73841
buagrland	26	74.89965	4.188339	67.48443	82.67135
tzagrland	26	40.78571	2.930922	36.80289	44.81824
tradeopen	26	3.467752	.2758828	3.042809	3.854394
Note: gdpbu and gdptz (in million USA$)					

Where: gdpbu= GDP of Burundi, gdptz= GDP of Tanzania, exrate= Exchange rate of Burundi (1US$ to Burundi francs), buagriland= Agricultural land or arable land of Burundi, tzagrland= Agricultural land of Tanzania and tradeopen= Trade Openness

Table 6. Results of Vector Error Correction Model (VECM)

Short-run relationship			
	Coefficient	**Z**	**P-Value**
Logintensity	1.00		
Loggdpbu	9.10	13.63	0.00
Exrati	20.88	4.67	0.00
Logbuagriland	56.28	8.13	0.00
Tradeopen	8.97	15.23	0.00
ECM	-0.72	-2.58	0.01
Log likelihood = 1641.37, Det (Sigma_ml) = $-1.08e^{7}$			

The model sought to relate the trade intensity in rice to its explanatory variables such as GDP of Burundi (gdbbu), exchange rate (exrati), land allocated to agriculture in Burundi (buagriland) and indicator of openness (tradeopen). The results revealed that there is a long-run causality running from the listed explanatory variables to the intensity of import.

The adjustment error correction of -72% is significant and indicates a higher speed adjustment (that is, the speed at which the deviation from long-run equilibrium is adjusted slowly where 72% of the disequilibrium is removed each period). This shows that, the speed of adjustment to where rice imports equilibrate the real Gross Domestic Product in Burundi is at the rate of 72%. In the short run, all explanatory variables are positive and statistically significant ($p<0.01$). For instance, a unit increase in GDP of Burundi, land allocated to agriculture in Burundi, exchange rate and trade openness leads to about more than proportionate increase in the intensity of Burundi's rice imports from Tanzania. When the Burundian franc appreciates, this causes an expansion of Burundi's rice imports from its neighbour (Tanzania). Albeit the political instability of 2015, the economy of Burundi (a member of East African Community) has slightly increased since 2014 and settled at 3.8 percent in 2018. The economic performance is attributed to the performance of primary sector that is agriculture, the increasing production of mining sector and diversification of exports. Since Burundi has put in place trade policies that favour trade flows, the implementation of such policies has promoted both the intensity of trade and economic growth on overall [19].

These results go along with those of [20] which states that the key drivers of production and demand, including trade and related policies, shape the patterns of trade with potentially important implications on food security. The trade link between Tanzania and Burundi is due to the greater participation of Burundi in regional trade (EAC trade). This enshrined in Burundi's national trade strategies and good management of the process of trade openness and at the end, trade obviously works in favour of economic growth and food security as evidenced by the results of this study.

5. CONCLUSION AND POLICY IMPLICATIONS

The results from this study revealed that the intensity of Burundi's rice imports from Tanzania was too high. Hence, we conclude saying that Burundi intensively imports rice from Tanzania and the trend of the intensity of rice imports follows an upward slope. However, an exception was observed in the period between 2007 and 2010 whereby the intensity of Burundi rice imports decreased. This decrease could be attributed to the financial crisis erupted in the world causing a lack of finance to import. Furthermore the results pointed out that the economic performance boosts the intensity to trade in rice. Arable land expansion, trade openness and appreciation of exchange rate have positive effects on the trade intensity between Tanzania and Burundi. We here forecast that the findings are the precursor of the intensity of trade in other sectors of economy if the central corridor will be developed and the finalisation of construction of railway linking Tanzania, Burundi and Democratic Republic of the Congo will castigated a more dynamic and prosperous regional trade in Great Lakes region.

In line with these results, trade policy makers should then encourage trade between the two neighbouring countries. They should establish an efficient policy framework favouring trade by removing all impediments to trade between the two countries. However, provided that Burundi agronomic conditions are favourable to rice, policy makers in the agricultural sector should take appropriate actions to optimally boost the level of domestic rice production, to prevent the country from being more depending on rice imports. The money used in importing rice to offset the domestic production could be used in other sectors in order to enormously contribute to the economic growth of the country. Burundi should manage well the exchange rate policies since this study shows a close relationship between exchange rate and the intensity of rice imports.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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