Journal of Food Security, 2019, Vol. 7, No. 4, 109-114
Available online at http://pubs.sciepub.com/jfs/7/4/2
Published by Science and Education Publishing
DOI:10.12691/jfs-7-4-2

Factors Influencing Rice Availability in Togo

Raïfatou Affoh[1,*], Zhao Guiyu[1], Aletha Janjey Quoi[1], Kokou Dangui[2], Mohammed Sharif Swallah[3]

[1]College of Economics and Management, Jilin Agricultural University, Changchun, 130118 China
[2]Dongling School of Economics and Management, University of Science and Technology, Beijing, 100086 China
[3]School of Food Science and Technology, Jilin Agricultural University, Changchun, 130118 China
*Corresponding author: raifatouaffoh@yahoo.fr

Received June 14, 2019; Revised July 20, 2019; Accepted August 01, 2019

Abstract Rice is among the most consumed cereal crops in Togo with demand growing sharply over the years, due to the population growth and the change in consumer preference. It therefore plays a fundamental role in achieving food security in the country. This paper analyzed the determinants of rice availability in Togo. Secondary time series data from 1989 to 2013 were used. A Fully Modified Least Square (FMLOS) regression was used for the analysis. The study found that rice yield, exchange rate and total arable land had a positive and significant influence on rice supply whereas real per capita gross domestic product and foreign interest rate had negative impacts on rice supply in Togo. Therefore, government policy should focus on increasing the use of improved technologies such as improved seeds and fertilizers to improve rice yield, hence the overall food availability and indirectly food security in Togo.

Keywords: *food security, rice supply, determinants, FMOLS, Togo*

Cite This Article: Raïfatou Affoh, Zhao Guiyu, Aletha Janjey Quoi, Kokou Dangui, and Mohammed Sharif Swallah, "Factors Influencing Rice Availability in Togo." *Journal of Food Security*, vol. 7, no. 4 (2019): 109-114. doi: 10.12691/jfs-7-4-2.

1. Introduction

Availability of food is one of the major challenges worldwide, particularly for developing countries where crop yield is still very low, making those countries to be import dependent. Food availability, one of the key pillars of food security is defined as the supply of food made-up of domestic food production, food imported, food donation and the domestic stock.

Despite the Millennium Development Goals adopted in 2000 by the United Nations and replaced by the Sustainable Development Goals in 2015 which both aim to eradicate hunger, malnutrition is still a major concern. The total food security has improved extraordinarily over the past 50 years, on account of expanding worldwide per capita food availability and diminishing expenses on food, yet, famine, malnourishment and food insecurity stay across the board [1]. Undernourishment people have expanded from around 804 million in 2016 to almost 821 million in 2017 [2]. Additionally, in 2017, the World Bank noticed that 83 million people in 45 nations were starving and African nations have the most astounding predominance with 20% of their populace starving. In sub-Saharan Africa, a food insecure region, the per capita dietary energy balance is negative.

In Togo, the Demographic and Health Survey (EDST-III,) conducted in 2014 demonstrated that over 28 percent of 6-59 months old children were experiencing constant lack of healthy food and 6.5 percent from intense hunger (including 1.5 percent from extreme intense malnutrition). The severe malnourishment rate is high, especially in the locales of Kara (7.2 percent) and Savannah (11.2 percent) [3]. This can halfway be explained by the sociopolitical and financial disturbance the nation has encountered over the past fifteen years, which disturbance has added to high food instability and under nutrition levels. A sequence of destroying floods has likewise negatively affected the nation's food security. In spite of the fact that it has diminished lately, the general poverty rate still stands at 57.8 percent and the intense hunger rate countrywide is at 4.9 percent [3].

The role of rice in achieving food security is no more to be argued. In fact, rice is the staple food for more than 3.5 billion people worldwide. In 2009, rice has provided more than 20% of their daily calories, 19% of global human per capita energy and 13% of per capita protein. [4]. In Togo, rice is the third most consumed staple cereal. According to the Togolese Direction of Agricultural Statistics, Informatics and Documentation (DSID) study on the project "Strengthening the availability and access to rice statistics: a contribution to the emergency initiative for rice in sub-Saharan Africa", the average national consumption is 15 kg per year. With an average population growth rate of 2.4% per year, the annual need for white rice has been estimated by the National Strategy for Rice Development (NRDS) to reach 108,803 tons in 2018. Over the period 2000-2008, rice has counted for 3% in the food production Gross Domestic Product (GDP) estimated to 24.6% of the 40% of agricultural GDP [5]. Rice is consumed under different form: it is usually boiled and served with tomato or peanut sauce; consumed as rice porridge drunk with milk; it is also consumed as rice paste

in some parts of the country or associated with beans. According to the Togolese Agricultural Institute of Research, four types of rice cultivation are practiced within the country such as irrigated rice farming (19% of the total area), strict rain-fed rice farming (26% of the total area), rain-fed rice farming with lap and lowland rice farming (55% of the total area).

Although the country has significant water resources and irrigable land (alluvial plains, shallows) estimated at 185, 000 ha to allow a revival of its production, domestic demand exceeds supply, thus the country imports mostly half of its need mainly from China, India, Pakistan, Singapore, Thailand, USA, Cote d'Ivoire, Ghana and Benin [5]. This can be explained by the low use of improved seeds, fertilizers and the non-development of the irrigation system. To remedy this situation, the Togolese government has implemented many policies and strategies. The latest strategy was the National Rice Development Strategy which derived its orientations from the National Program for Agricultural Investment and Food Security (PNIASA) which finds anchored in Comprehensive Africa Agriculture Development Programme (CAADP/ECOWAP).

There are numerous determinants of food security in general and food availability in particular. The most important challenges that constitute a barrier for many countries achieving food security are the underdeveloped agricultural, poverty, barriers to market access, effects of globalization, rapid population growth and climate change [6]. Income change and its distribution; education; food prices; land availability and quality; yield of land and crop and climatic conditions are also some of the determinants of food security [7].

Rising real per capita GDP has been pointed out to increase the application of more fertilizers and agrochemicals by domestic farmers, it also increases the use of high yielding varieties and the purchase of farm equipment, hence increasing the quantity of food supplied in the country. The positive relationship between real per capita GDP and food supply sufficiency suggests that the substitution effect associated with rising real per capita GDP is outweighed by the larger production scale effect associated with real per capita GDP [8]. Since poverty and famine are highly correlated, a sharp increase in income will be followed by an enhancement in food nutrition and security. In other words, a rise in the level of income allows not only higher purchasing power but also a reduction in the share of income spent on food products, making households less vulnerable to price volatility. Some scholars also argued that rising income affects food security positively by increasing the food availability through the import and allowing consumers to have access to food at any time they need [9,10,11,12]. However, Kavallari, A. et al [13] did not come to the same conclusion. According to their findings, higher economic growth corresponds to a higher demand for food and reduction in supply; this pattern will lead to high world market prices for agricultural commodities. On the opposite side, a low GDP means lower world market prices which will increase import and indirectly the per capita food calorie intake.

The exchange rate also influences food availability. An increase in exchange rate value implies higher imported commodity's prices since the depreciation of the local currency has a negative effect on the country's ability to import food, this affects the total food available for consumption. Also, an increase in the exchange rate affects agricultural activities through its impact on input prices. Higher input prices will cause domestic agricultural production to fall and therefore affect food availability adversely. Some researchers concluded that the exchange rate has a significant impact on the food commodities real prices increase. That means an increase in the exchange rate automatically causes an increase in food commodities real prices [8,9,14-18]. But reference [19] did not find the same result. They rather found that the exchange rate is not statistically significant as a determinant of the general food price level.

Another determinant of food security is the interest rate. Some researchers on the topic found that there is a relationship between the interest rate and agricultural commodity prices. Changes in interest rates affect both demand and supply. From the demand side, the lower interest rate implies lower opportunity cost for holding inventory. However, the higher interest rate will discourage stock possessions due to higher opportunity cost for holding stock. Thus, lower interest rate or financial repression will cause a switch from Treasury bill holdings to agricultural contracts. Rising interest rates impose credit constraint especially on smallholder farmers who lack guarantee [8,18,20,21]. In emerging countries such as in sub-Saharan Africa where agricultural activities are highly subsistence-based, the rising interest rates will antagonistically influence the amplitude of crop production and subsequently food security. The higher interest rate would also mean higher cost of inputs and that will change the weigh bridge of production and the producer price of food, even for prosperous peasants. Thus, food availability is adversely affected by a higher capital cost [8]. However, reference [17] did not find any link between the interest rate and agricultural commodity prices.

Education also has been pointed to positively influence food security. The more educated a farmer is, the better the productivity and the income, due to his ability to adopt new technologies which increases the farm yield, thereby his income. Reference [22] found a positive correlation between food availability, calories and human development. Reference [23] argued that education affects both mild-to-moderate food insecurity as well as the experience of severe household food insecurity. As in [24], food insecurity is high in households with low levels of education. Reference [25] however concluded that there is no significant relationship between education and food security.

Climate change has a non-negligible effect on food security. Some scholars concluded that drought, land cover and climate changes and biological feedbacks negatively affect food security [26]. References [27,28] also showed the adverse impact of climatic variability on food security.

This study aimed to evaluate the factors determining rice availability at the national level in order to improve food security in Togo. It was hypothesized that rice yield, total arable land and per capita GDP have positive impact on rice availability. The findings of this study would serve as a compass for the Togolese government in its new

strategy on food security and on the development of rice production.

2. Materials and Methods

The study area, Togo, is one of the smallest countries in West Africa with an area of 56, 785 kilometers square and a population estimated in 2017 to be 7.6 million inhabitants. It is bordered to the north by Burkina Faso, to the south by the Gulf of Guinea, to the east by Benin and to the west by Ghana.

Secondary time series data from 1989 to 2013 were used in this study. The descriptive analysis and the unit root test were conducted in Stata 14 while the Bounds cointegration tests and the Fully Modified Least Square (FMOLS) regression were run using Eviews 10.

2.1. Theoretical Framework for Food Availability

The model of the study is adopted from [8,29]. The determinant of food availability (Q_{FA}) at the national level can be derived from equation (1):

$$Q_{FA} = Q_{DF} + Q_{FI} + Q_A + Q_{ST} \quad (1)$$

Where Q_{DF} represents the domestic food production, Q_{FI} is the food imports, Q_A is the food aid and Q_{ST} represents domestic stock. In this present study case, domestic food production and food import will be our major concern. Thus, food availability will be explained by those two aggregate variables. Food availability is given in equation (2):

$$Q_{FA} = Q_{DF} + Q_{FI}. \quad (2)$$

Domestic food supply is a function of factor inputs, technology, the quantity of infrastructural services and weather as expressed in equation (3):

$$QDF = Q(L,\ LA,\ K,\ F,\ A, V, I, IS, W) \quad (3)$$

L is units of labor, LA is the cultivation land, K is capital, F is fertilizer, A is agrochemicals, V is improved varieties of food crops, I is the irrigation services, IS is the quantity of infrastructural services and W denotes weather. The objective is to maximize profit. The revenue from farming and the cost associated with farming are specified in equations (4) and (5) respectively:

$$R = PFQ_{DF} \quad (4)$$

$$AC = C(Q_{DF}, rL, rK, rLA, rF, rA, rV, rI, rIS). \quad (5)$$

The profit function can be represented as:

$$max\Pi = PFQ - C(Q, rL, rK, rLA, rF, rA, rV, rI, rIS) \quad (6)$$

where rL, rK, rLA, rF, rA, rV, rI, rIS denote prices of labor, capital, land, fertilizer, agrochemicals, improved varieties of food crops, irrigation services, and infrastructural services, respectively. The first-order condition (dII/dQ) of equation (6) produces domestic food availability as expressed in equation (7) where PF is the price of food. The domestic food availability function is convex in the price of food and weather.

$$Q = QDF = Q(FP, rL, rK, rLA, rF, rA, rV, rI, rIS,\ W)$$
$$dQ/dFP > 0,\ dQ/dri < 0, \quad (7)$$
$$i(=\ L,\ K,\ LA,\ F,\ A,\ V,\ I,\ IS),\ dQ/dW > 0$$

Where on the other hand, food import is dependent on world food price (FWP), real per capita GDP (RGDPP) of the importing country, cost, and availability of off-shore financing (proxy by international interest rate, IIR), and exchange rate (ER). Food import is given in equation (8):

$$Q_{FI} = F(FWP, RGDPP, ER, IIR). \quad (8)$$

Equation (9) given below is obtained by the substitution of equations (7) and (8) into equation (2) deducted by food aid import and carry over stock

$$Q_{FA} = Q_{DF}(FP, ri, W) + Q_{FI}(FWP, RGDPP, ER, IIR). \quad (9)$$

2.2. Empirical Framework

The choice of the explanatory variables was based on reference [8] work. Variables such as oil prices and rice prices have been found in the previous studies also as key determinants of food availability. However, our study did not include them because of: their non-relevance in this study case (oil prices) and the lack of data within the study's time period (rice prices).

The final model for rice supply to be estimated is shown in equation (10):

$$lnQRA = \alpha + \beta_1 ARL_{t-i} + \beta_2 lnRY_{t-i} + \beta_3 RGDPP_{t-i} + \beta_4 IIR_{t-i} + \beta_5 lnER_{t-i} + \varepsilon_t \quad (10)$$
$$\beta_3, \beta_4 < 0; \beta_1, \beta_2, \beta_5 > 0$$

Where α represents the intercept (constant term), β represents the slope coefficient for each explanatory variable and ε_t is the error term.

Table 1. Definition of the Variables Used in the Study

Variables	Definition
QRA	Rice Availability (measured as the total supply of available rice in kilocalories per capita per day)
ARL	Arable Land (total arable land in Togo in ha)
RY	Rice Yield (Kg/ha)
RGDPP	Real Gross Domestic Product per capita (in constant 2005 USD)
IIR	International Interest Rate (lending interest rate charged by US banks on loans to prime customers)
ER	Exchange Rate (FCFA/US$)

Source: world rice statistics, World Bank World Development Indicators, World Bank World Development Indicators, Direction of Agricultural Statistics, Informatics and Documentation (DSID).

2.3. Econometric Technique

The Fully Modified Least Square (FMOLS) regression is the econometric technique used in this present study. The FMOLS regression was initially planned in work by Phillips and Hansen [30] to give ideal appraisals of co-integrating regressions. The technique adjusts least squares to account for serial correlation effects and for the endogeneity in the regressors that outcome from the presence of a co-integrating relationship. They proposed

an estimator which utilizes a semi-parametric correction to take out the issues brought by the long run correlation between the co-integrating equation and stochastic repressor's innovations. The subsequent Fully Modified OLS (FMOLS) estimator is asymptotically impartial and has fully efficient mixture normal asymptotic allowing for standard Wald tests using asymptotic Chi-square statistical inference [31]. One reason the technique has demonstrated to be helpful practically speaking is that one can utilize the FM corrections to decide how significant these effects are in an experimental application. This has made the technique less of a "black box" for professionals. In situations where there are real contrasts with OLS (Ordinary Least Square), the source or sources of those differences can for the most part be effectively found and this, thusly, helps to provide the investigator with additional information about important features of the data [32].

The FMOLS estimator is prearranged as:

$$\hat{\theta} = \left(\sum_{t=1}^{T} \mathcal{Z}_t \mathcal{Z}_t' \right)^{-1} \left(\sum_{t=1}^{T} \mathcal{Z}_t y_t^{+} - T \begin{bmatrix} \hat{\lambda}_{12}^{+} \\ 0 \end{bmatrix} \right) \quad (11)$$

Where $y_t^{+}$and $\hat{\lambda}_{12}^{+}$ are the correction terms for endogeneity of regressors and serial correlation in errors respectively. The correction terms for endogeneity and serial correlation are expressed in equations (12) and (13) respectively:

$$y_t^{+} = y_t - \hat{\omega}_{22}^{-1} \hat{\mathcal{V}}_2 \quad (12)$$

$$\hat{\lambda}_{12}^{+} = \hat{\lambda}_{12} - \hat{\omega}_{12} \hat{\Omega}_{22}^{-1} \hat{\Lambda}_{22} \quad (13)$$

Where $\hat{\Omega}$ and $\hat{\Lambda}$ are the long-run covariance matrices computed using the residuals $\hat{\mathcal{V}}_t = (\hat{\mathcal{V}}_{1t}, \hat{\mathcal{V}}_{2t})'$. $\hat{\mathcal{V}}_{1t}$ is the residual computed from equation (14) and $\hat{\mathcal{V}}_{2t}$ is obtained directly from equation (16) or indirectly from equation (17):

$$y_t = x_t' \beta + D_{1t}' \gamma + \mathcal{V}_{1t} \quad (14)$$

$$\Delta y_{2t} = \varepsilon_{2t} \quad (15)$$

$\varepsilon_t = (\mathcal{V}_{1t}', \varepsilon_{2t}')$ is assumed strictly stationary with zero mean and infinite covariance matrix $\sum$.

$$\Delta x_t = \hat{\Gamma}_{21}' \Delta D_{1t} + \hat{\Gamma}_{22}' D_{2t} + \hat{\mathcal{V}}_{2t} \quad (16)$$

$$\hat{\mathcal{V}}_{2t} = \Delta \hat{\varepsilon}_{2t}. \quad (17)$$

3. Results and Discussion

3.1. Descriptive Statistics

Table 2. Descriptive Statistics

Variable	Unit	Mean	Std Deviation
Rice Availability	kcal/capita/day	182.96	55.76026
Rice Yield	F CFA/US$	2153.669	487.4692
Exchange Rate	%	497.9716	131.9174
Arable Land	%	42.55929	3.147296
Real per capita GDP	%	-0.143277	5.667185
International Interest Rate	%	6.5381	2.369141

Source: author's conception using research data in STATA 10.

This study found that the mean value of rice availability was 182.96 kcal/capita/day. On average rice yield was 2153.669 kg/ha, exchange rate mean value was 497.9716 F CFA/US$. The mean of total agriculture arable land in Togo was 42.55929%, the real gross domestic product per capita (RGDPP) had a negative mean value of 0.143277% and the international interest rate on average was 6.5381%.

3.2. Regression

3.2.1. Augmented Dickey Fuller Test and Bounds Test for Co-integration

A unit root test was run to check the stationarity of the variables used in this study. The null hypothesis (H0= Presence of unit root) was tested against the alternative hypothesis (H1= absence of unit root). ADF test showed that the variables were not stationary at level I(0) but became stationary after first difference I(1) (Table 3).

Bounds co-integration test revealed the long run relationship between the variables since the F-Statistic value was greater than the lower bound critical value.

Table 3. Augmented Dickey Fuller Test

Variables	ADF test	Lag	Order of integration
‡Δ Rice Availability	-3.982	1	1
‡Δ Rice Yield	-4.287	1	1
‡Δ Exchange Rate	-3.417	1	1
Δ Arable Land	-3.455	1	1
Δ Real per capita GDP	-5.036	1	1
Δ International Interest Rate	-4.069	1	1

Source: author's conception using research data in STATA 14
‡ indicates variables in log. ADF test is the Augmented Dickey Fuller test. Lag means lagged differences. The critical value at 5% for a sample of 25 observations is -3.000. (See Dickey-Fuller table for Unit Root Tests).

Table 4. Bounds Cointegration Test

Test Statistic	Value	Significance	I(0)	I(1)
		Finite Sample: n=30		
F-statistic	5.591187	10%	2.407	3.517
k	5	5%	2.91	4.193
		1%	4.134	5.761

Source: author's conception using research data in Eviews 10.

3.2.2. Fully Modified Least Square Regression (FMOLS)

Determinant of Rice Availability

The model fitted the data quite well as indicated by R square. The coefficient of multiple determinations R^2 was 0.75 which means that the explanatory variables included in the model explained 75% variation in rice availability.

Rice yield had a significant impact on rice availability. An increase of one percent point in rice yield is expected to increase rice supply by 0.73 percent. The positive impact of crop yield on food availability is in line with [8].

The exchange rate was positively and significantly related to rice availability. A one percent change in exchange rate would result in 0.33 percent increase in rice availability. From this finding, it can therefore be

concluded that rice is a normal good since its price elasticity of supply is greater than one. A depreciation of local currency is supposed to cause an increase in food price, which would lead to a decrease of import and consequently a decrease of supplied food. This result agrees with [8,16,17,18,34]. The impact of total arable land was positive. A one percent increase in arable land will lead to an increase in rice supply in Togo by 0.05 percent. This is consistent with [8]. The real per capita GDP had a negative influence on rice availability. An increase of one percent in real per capita GDP would decrease the rice supply by 0.01 percent. This suggest that a high GDP in a country favor household food consumption, people are likely to purchase more food and when the stock is not renewed it will lead to rice scarcity. Kavallari, A. et al [13] findings are in support of this result. They concluded that the higher the economic growth, the higher the demand for food and the lesser the supply. This pattern would lead to high world market prices for agricultural commodities. On the opposite side, a low GDP means lower world market prices which will increase import and indirectly the per capita food calorie intake. However, references [8,10,11,12] found a positive link between real per capita GDP and food availability. The international interest rate had also a negative influence on rice supply. A one percent increase in international interest would lead to 0.02 percent increase in the quantity of rice available in Togo. This suggests that a high rate of interest in the US economy will lower export demand for rice. On the other hand a lower interest rate would have an opposite effect on the export. This implies more food availability in importing countries. In other words, a lower interest rate in US or in other countries would increase agricultural contracts and agricultural commodities stock holdings in the domestic economy. This result is in agreement with [8,35].

Table 5. Fully Modified Least Square Estimate

Dependent Variable= ‡Rice Availability			
Independent Variables	**Coefficient**	**Std. Error**	**t-Statistic**
‡Rice Yield	0.735585***	0.064336	11.43348
‡Exchange Rate	0.332369***	0.067398	4.931445
Arable Land	0.054985***	0.006418	8.567454
Real per capita GDP	-0.010275***	0.002605	-3.944622
International Interest Rate	-0.017163**	0.00756	-2.270236
C	-4.788808	0.514815	-9.301999

‡ indicates variables in log. ***, ** indicate 1% and 10% significance levels

N= 24 observations after adjustment. Cointegration equation deterministic: constant. Long-run covariance estimate (Prewhitening with lags=2 from AIC max lags=2, Bartlett Kernel, Newey-West fixed bandwidth=3.0000).

R-squared= 0.757147	Mean dependent var= 5.166837
Adjusted R-square= 0.689688	S.D. dependent var= 0.354302
S.E. of regression= 0.197366	Sum squared resid= 0.701163
Long-run variance= 0.004305	

Source: author's conception using research data in Eviews 10.

4. Conclusion and Policy Implication

This study used The Fully Modified Least Square regression to examine the determinants of rice availability in Togo. The study used 25 years data from 1989 to 2013. The result found that rice yield, exchange rate and arable land had positive and significant effects on rice availability. On the other hand real GDP and international interest rate had negative impact on rice availability. Following the above results, it can therefore be concluded that for rice to permanently available for Togolese people's consumption, the government need to promote the utilization of improved technologies such as fertilizer and improved seeds. Similarly, there is need to develop rice cultivation under irrigation system to adapt to the climate change effects which seriously affects dependence on rainfall only, thereby contributing to the food security of Togo.

References

[1] Barrett, C. B., "Measuring food insecurity," *Science*, 327, 825-828, 2010.

[2] FAO, IFAD, UNICEF, WFP and WHO: *The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition*, Rome, FAO, 2018.

[3] World Food Program, *TOGO Country Brief*, 2018.

[4] Ricepedia, ricepedia.org/index.php/challenges/food-security.

[5] Ministry of Agriculture, Livestock and Fisherie (MAEP) Togo, National Strategy for Rice Development, October, 2010.

[6] Astou, Dioume, *Food Imports as a Hindrance to Food Security and Sustainable development: The Cases of Nigeria and Senegal*, Master's thesis, City University of New York (CUNY) Academic Works, 2015.

[7] Laborde, D., Tokgoz, S. and Torero, M., *Long-Term Drivers of Food and Nutrition*, IFPRI, FOODSECURE working paper no. 06, February 2013.

[8] Adom, P. K., "Determinants of food availability and access in Ghana: what can we learn beyond the regression results?", *Studies in Agricultural Economics*, 116(3), 153-164, (2014).

[9] Kargbo, J.M., "Impacts of Monetary and Macroeconomic Factors on Food Prices in Eastern and Southern Africa', *Applied Economics* 32, 1373-1389, 2000.

[10] Carter, K.N., Lanumata, T. and Gorten, D., "What are the determinants of food security in New Zealand and does this differ for males and females?", *Australian and New Zealand Journal of Public Health*, 34(6), 602-608, 2010.

[11] Herath, H.M.S.P., Liang, C. and Yongbing, C., "Impacts of regional trade agreements on food security: A case of ASEAN free trade agreement", *International Journal of Social Science and interdisciplinary Research*, 3 (3), 147-157, 2014.

[12] Tadesse, G., Algieri, B., Kalkuhl, M., & von Braun, J., "Drivers and triggers of international food price spikes and volatility", *Food Policy*, 47, 117-128, 2014.

[13] Kavallari, A., Fellmann, T., & Gay, S. H., "Shocks in economic growth = shocking effects for food security?", *Food Security*, *6*(4), 567–583, 2014.

[14] Kargbo, J.M., "Impacts of Monetary and Macroeconomic Factors on Food Prices in West Africa", *Agrekon*, 44, 205-224, 2005.

[15] Asfaha, T.A. and Jooste, A., "The Effect of Monetary Changes on Relative Agricultural Prices", *Agrekon*, 46, 440-474, 2007.

[16] Mitchell, D., *A Note on Rising Food Prices*, Policy Research Working Paper 4682. Washington DC: World Bank, 2008

[17] Lombardi, M., Osbat, C. and Schnatz, B., *Global Commodity Cycles and Linkages: A FAVAR Approach*, Working Paper Series No. 1170, Frankfurt am Main: European Central Bank, 2010.

[18] Algieri, B., *A Roller Coaster Ride: An Empirical Investigation of the Main Drivers of Wheat Price*. ZEF-Discussion Papers on Development Policy No. 176. Bonn, University of Bonn, 2013.

[19] Akbari, A.H. and Rankaduwa, W., *Determinants of Inflation and Feasibility of Inflation targeting in Small Emerging Market Economy: The Case of Pakistan*, Paper presented at the SBP conference: Monetary-cum Exchange Rate: What Works Best for the Emerging Market Economies? Karachi, 14-15 November 2005.

[20] Vansteenkiste, I., *How important are common factors in driving non-fuel commodity prices? A dynamic factor analysis*, Working Paper Series No. 1072, Frankfurt am Main: European Central Bank, 2009.

[21] Byrne, J.P., Fazio, G. and Fiess, N., "Primary commodity prices: Co-movements, common factors and fundamentals", *Journal of Development Economics*, 101, 16-26, 2013.

[22] Gani, A., & Prasad, B. C., "Food security and human development", *International Journal of Social Economics*, 34(5), 310-319, 2007.

[23] Sakyi, P., *Determinants of food accessibility of rural households in the Limpopo Province, South Africa*, Unpublished MSc dissertation, Gent: Gent University, 2012.

[24] Foley, W., Ward, P., Carter, P., Conveney, J., Tsourtos, G. and Taylor, A., "An ecological analysis of factors associated with food insecurity in South Australia", 2002-7, *Public Health Nutrition*, 13 (2), 215-22, 2009.

[25] Sekhampu, T., "Determination of the Factors Affecting the Food Security Status of Households in Bophelong, South Africa", *International Business & Economics Research Journal*, 12(5), 543, 2013.

[26] Armah, F.A., Odoi, J.O., Yengoh, G.T., Obiri, S., Yawson, D.O. and Afrifa, E.K.A., "Food security and climate change in drought-sensitive savanna zones of Ghana", *Mitigation and Adaptation Strategies for Global Change*, 16(3), 291-306, 2011.

[27] Badolo, F. and Kinda Somlanare, R., *Climatic Variability and Food Security in Developing Countries*, Etudes et Document no. 05, Clermont Ferrand: CERDI, 2014.

[28] Van Dijk, M.R.M., Van Rooij, W. and Hilderink, H., "Land use dynamics, climate change, and food security in Vietnam. A global-to-local modelling approach", *World Development*, 59(C), 29-46, 2014.

[29] Fosu, K.Y. and Heerink, N., *Food security and nutrition: implications of policy reforms with a case study from Ghana*, Wageningen Agricultural University, 2009.

[30] Phillips, P.C.B. and Hansen, B.E., "Statistical inference in instrumental variables regression with I (1) processes", *Review of Economic Studies*, 57, 99-125, 1990.

[31] EViews 10 User's Guide II, October, 2017.

[32] Phillips, P.C.B., "Fully modified least squares and vector autoregression", *Econometrica*, 63, 1023-1078, 1995.

[33] Zhao, C., Liu, B., Piao, S., Wang, X., Lobell, D. B., Huang, Y., Huang, M., Yao, Y., Bassu, S., Ciais, P., Durand, J-L., Elliott, J., Ewert, F., Janssens, I. A., Li, T., Lin, E., Liu, Q., Martre, P., Müller, C., Peng, S., Peñuelas, J., Ruane, A. C., Wallach, D., Wang, T., Wu, D., Liu, Z., Zhu, Y., Zhu, Z., and Asseng, S., "Temperature increase reduces global yields of major crops in four independent estimates", *Proceedings of the National Academy of Sciences*, 114(35), 9326-9331, 2017.

[34] Headey, D. and Fan, S., *Anatomy of a Crisis: The Causes and Consequences of Surging Food Prices*, IFPRI Discussion Paper 00831. Washington DC: IFPRI. 2008.

[35] Bafes, J. and Haniotis, T., *Placing the 2006/08 Commodity Price Boom into Perspective*, Policy Research Working Paper 5371.