# Wagner versus Keynes: the causal nexus between Government Expenditures and Economic Growth: An Empirical study of Burkina Faso

Isaac Kwesi Ampah[1]& Balázs Kotosz[2]

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*Abstract: The spending patterns of governments in the world especially developing economies have changed significantly over the last several decades. The main objective of this paper is analysing the relationship between government expenditures and growth in Burkina Faso's economy. The study focuses on testing the various versions of Wagner's hypothesis using the Burkina Faso data between 1960-2015 by an Autoregressive-Distributed Lag (ARDL) model. Cointegration tests, the long-run parameters and causality tests found valid Keynesian and Wagnerian relationship, but results are sensitive to the variable definition; the use of relative and absolute measures, local and international currency leads to a different conclusion.*

Keywords: *Wagner's hypothesis, Keynesian multiplier, ARDL model, Burkina Faso, cointegration*

JEL Classification: *E62, E12, H50, C22*

[1]PhD student, University of Szeged, Faculty of Economics, 6722 Szeged, Kálvária sgt. 1. Hungary, ampah.isaac@eco.u-szeged.hu

[2]Associate Professor, University of Szeged, Faculty of Economics, 6722 Szeged, Kálvária sgt. 1. Hungary, kotosz@eco.u-szeged.hu, corresponding author

# 1. Introduction

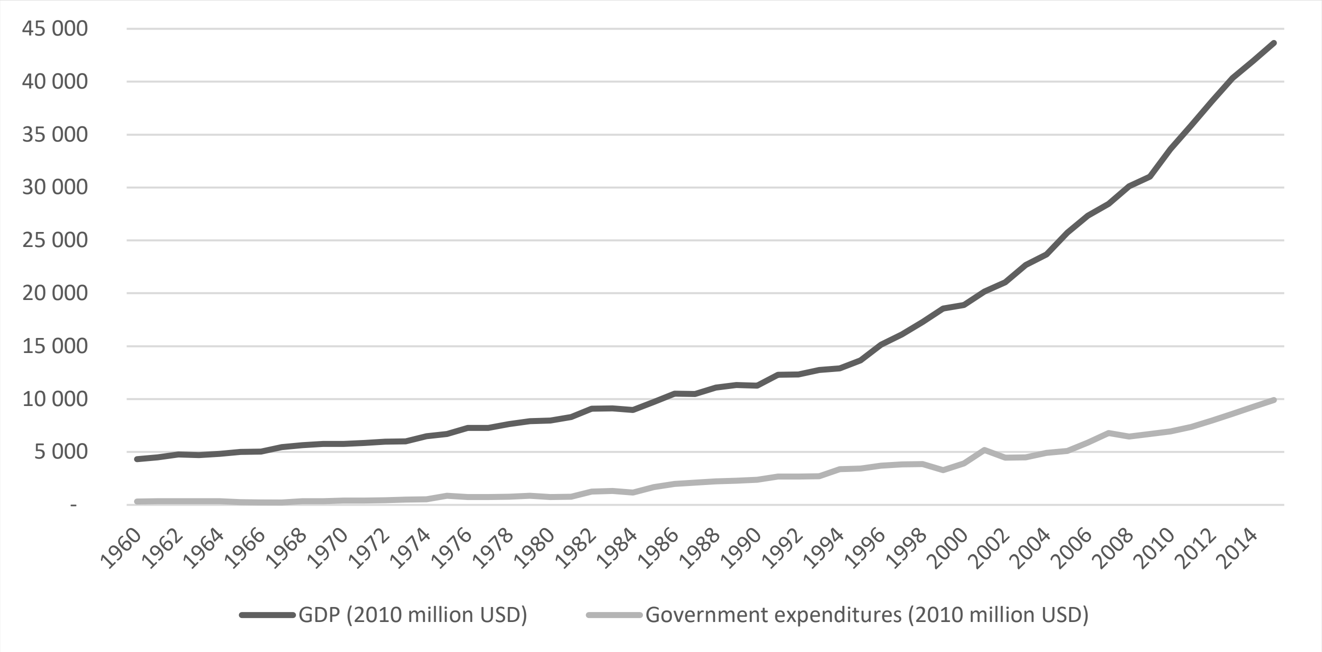
It has been recognized that as countries grow and progress, their spending on goods and service in addition to administration and governance also increase and even at a higher rate than their growth and this was initially observed by Adolph Wagner (1893) in the late 1800's (Ghartey, 2006).In his book called *Grundlegung der Politischen Ökonomie*, Wagner noted that as economiesgrow, industrialisation, modernization and urbanisation also grow, which inevitably put pressure on the demand on social, education, health, infrastructure and security services, especially in the urban areas. There is, therefore, the need for government to play a significant administrative and productive capacity role by expanding these services resulting in higher government expenditure. Also, in the event of economic growth, the growth in real income of people leads to more demand for essential services such as education, health and security services. Just as the state provides these services more effectively and efficiently, Wagner asserts that government will not have any option but to continue to provide these services which will result in a perpetual growth in government outlays.

Furthermore, Wagner added that during the course of economic growth and development, the advancement of trade and industrialization would increase the role of the private sector. This continuous increase in economic activity by the private sector will eventually result in more government expenditure for regulating the now vibrant private sector. Finally, Wagner added that since the ultimate aim of every government is to ensure continuous growth and development, investment projects, which come along as result of economic growth but overlooked by the private sector owing to its risky nature would necessarily need to be provided by the government (Bird, 1971). Alesina and Perotti (1999) added that during an economic expansion, government expenditure is growing, while in restriction also taxes are increasing, so by any action of the government, the relative role of the government increases. Wagner, therefore, seeseconomic growth in the domestic economyasa critical ingredient that causes more growth in government spending. These reflections of Wagner has successively become law, known as 'Wagner's Law.'

However, in the course of the Great Depression in the early1930s, Keynes (1936) observed that countries over-reliance on the interpretations of the Wagner's hypothesis in the early 1900s is what has hindered their economic recovery process. Therefore, in 1936, he advised nations to champion the growth of their economies from the depression by actively engaging in public expenditure. According to him, government expenditure is autonomous and exogenous variable and not endogenous as illustrated in the Wagner's hypothesis. He argued that during an economic depression, government intervention smooths out fluctuations in the business cycle, which subsequently enhances economic activities. For this reason, public expenditure should not be regarded as the consequence of economic growth but rather the cause(Tang 2008). This stream is what is currently known as the Keynesian economics.

Several studies have empirically verified the existence of Wagner hypothesis or the Keynesian economics over the years either using time series or cross-sectional data. In the time series analysis, researchers have tested the association among growth in the economy and government expenditure for one specific country over an extended period whereas, in the cross-section time-series type, scholars assess the relationship among several countries. However, the result and conclusion from all these studies have been different and even conflicting (Masan, 2015).

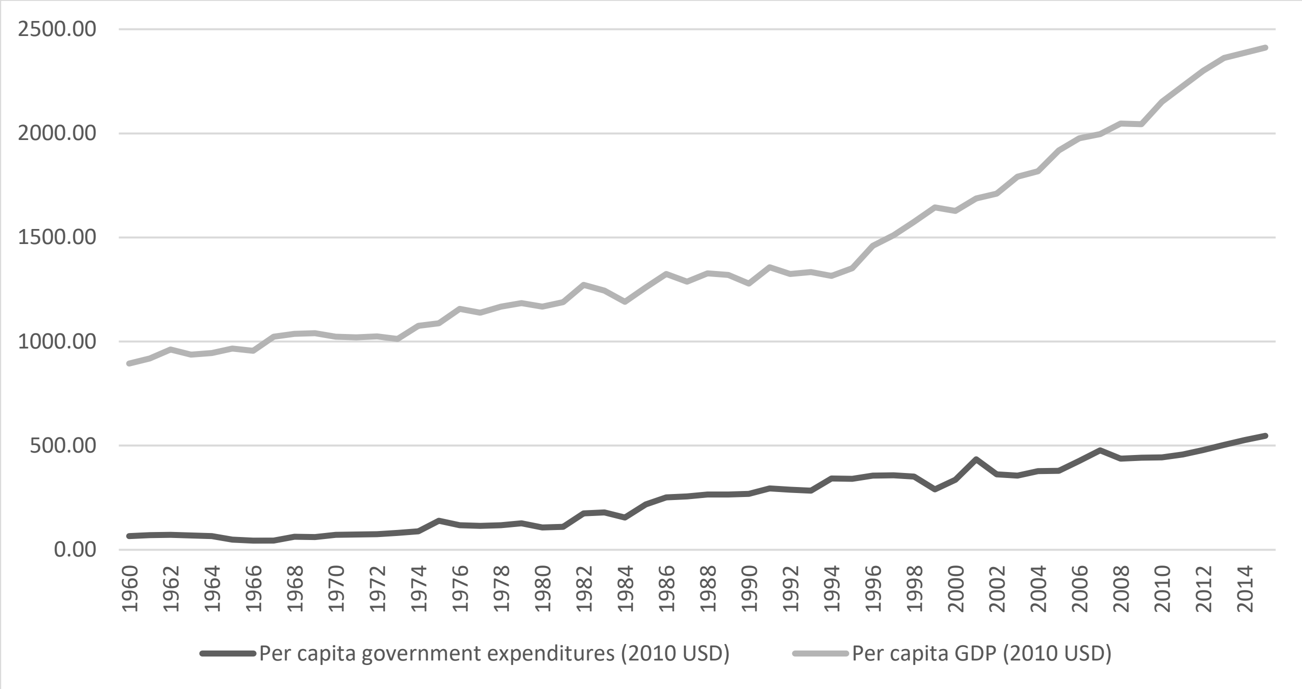
Figure 1: Evolution of real government expenditure and real GDP




Source: Own construction based on WDI dataset

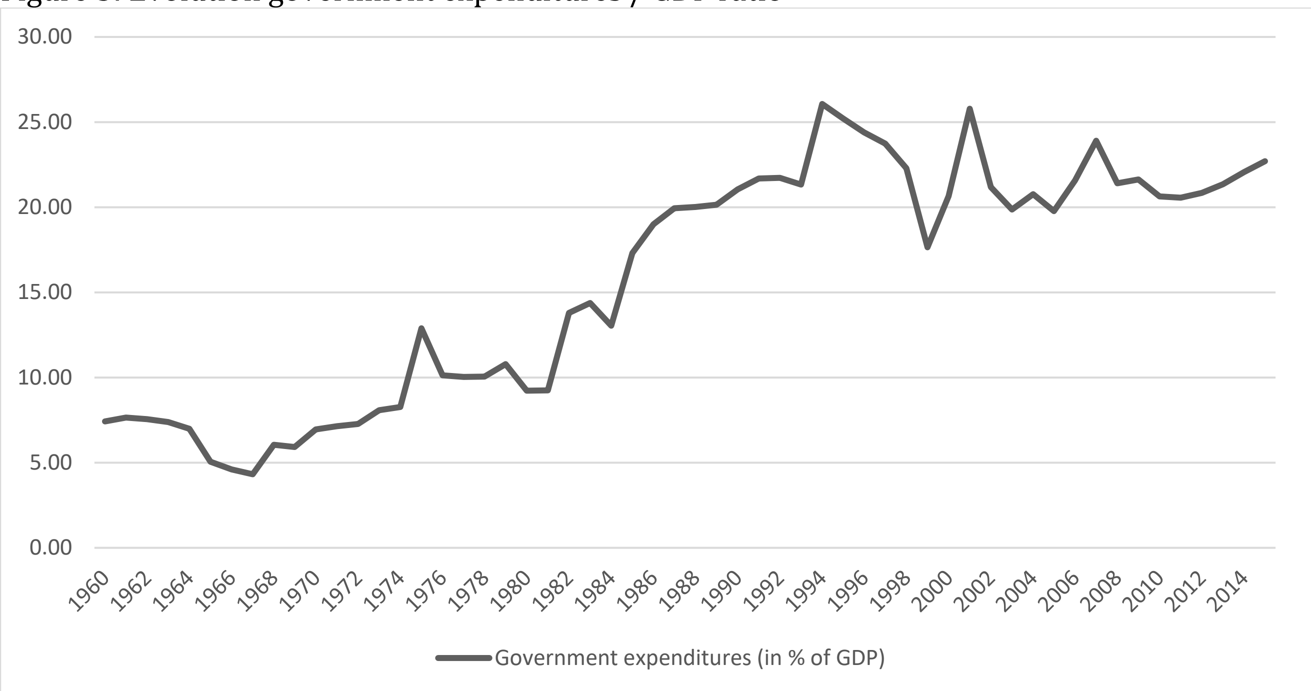
Burkina Faso is a Western African country that became independent in 1960 under the name of Upper Volta. After political instability in the 1960s and 1970s and coups d'état in the 1980s, since the 1991 constitution, it is relatively stable, we can survey the difference of GDP and GDP per capita growth rate in Figures 1 and 2, respectively. The 3.3% growth rate until 1990 is outraged by the 5.5% rate since 1991. Government expenditures had an increasing trend until the beginning of the 1990s (from 5% to 20-25%), and it fluctuates at the 20-25% level, which is relatively low compared to developed economies, but quite common in Africa. Despite the quick development since 1994, Burkina Faso remains on the list of least developed countries of the world. The government has recently inherited an economy in 2015, with oversized public debt as well as a budget that is too short on investment. Current expenditure is still too high, and capital investment is also insufficient. It is a now perplexing task for the government to change the composition of the government expenditure, increase efficiency and contain economic growth as expected. The government has some tough economic decision to make; either reactivating growth and reducing poverty and unemployment or redirecting or restraining public expenditure.

Figure 2: Evolution of per capita real government expenditure and real GDP




Source: Own construction based on WDI dataset

Figure 3: Evolution government expenditures / GDP ratio




Source: Own construction based on WDI dataset

It is against this background; this study is being conducted to raise some awareness into this causal relationship in Burkina Faso. The study chose Burkina Faso with an effort to

provide a more detailed evaluation of the relationship between government spending and economic growth. By estimating this relationship, the study hopes to shed some light on this highly deliberated issue in this developing country for the first time and also, how to move forward by offering some possible recommendation for dealing with these issues.
The remaining part of the paper is organized as the following. In section 2, we provide a literature review on theoretical model versions and their empirical estimations to show the heterogeneity of the subject. Section 3 is devoted to econometric methods used in the following section (4), in which our empirical findings and their discussion can be found. Section 5 concludes the findings of the study.

## 2. Literature review

### 2.1. Theoretical literature

Several scholars in both developing and developed nations of the world have analyzed the association between government spending and economic growth. The findings, however, have generated various conclusions and even serious debate among scholars and policy analyst. Both Wagner's and Keynesian hypothesis are short-run phenomena in which the causality testing alone does little to identify the short-run interaction between growth in the economy and government spending. Though Wagner did not pre-test his proposition in a precise form, currently, different economists have empirically tested the hypothesis in six (6) different versions. Table 1 provides a preview of these different versions.

Table 1: Different versions of the Wagner's hypothesis

| S. No. | Functional Form | Version |
|---|---|---|
| | | **Absolute Version** |
| 1. | $Ln\ (RGE) = \boldsymbol{b}_1 + \boldsymbol{b}_1\ Ln\ (RGDP) + u_t$ | Peacock and Wiseman (1961) |
| 2. | $Ln\left(\frac{RGE_t}{P_t}\right) = a_2 + b_2\ ln\left(\frac{RGDP_t}{P_t}\right) + u_{2t}$ | Gupta (1967) |
| 3. | $Ln\ \mathrm{RGE}_t = a_3 + b_3\ ln\left(\frac{RGDP_t}{P_t}\right) + u_{3t}$ | Goffman (1968) |
| 4 | $Ln\ (RGCE) = b_4 + b_4\ Ln\ (RGDP) + u_{4t}$ | Pryor (1969) |
| | | **Relative Version** |
| 5. | $Ln\left(\frac{NGE_t}{NGDP_t}\right) = a_5 + b_5\ ln\left(\frac{RGDP_t}{P_t}\right) + u_{5t}$ | Musgrave (1969) |
| 6. | $ln\left(\frac{NGE_t}{NGDP_t}\right) = a_6 + b_6\ ln(RGDP) + u_{6t}$ | Mann (1980) |

Sources: Adil, Ganaie, & Kamaiah (2017). NGDP: Nominal Gross Domestic Product.
RGE: Real Government Expenditure; RGDP: Real Gross Domestic Product; P: Population;
RGCE: Real Government Consumption Expenditure; NGE: Nominal Government Expenditure;

Peacock and Wiseman (1961) were the first to provide empirical verification to the relationship between growth in the economy and government spendingas suggested by Wagner. They measured both economic growth and government expenditurein real terms as indicated in Table 1 and expressed real government expenditure (RGE) as a function of real GDP. Gupta (1967) also in a related study measured the size of government by real government expenditure (RGE) per capita, and economic growth by real GDP per capita. This approach filters out the impact of the population change. Goffman (1968) also interpreted the Wagner's hypothesis as in the general functional form. By Verma and Arora (2010), this model is known as the absolute version of the Wagner's hypothesis, but its asymmetry makes it difficult to interpret in countries with high population growth rate. In the Goffman (1968) model, real government expenditure (RGE) is reliant on real GDP per capita (RGDP/*P*).Pryor (1968)also interpreted the Wagner's hypothesis in a different way from the earlier interpretations by Goffman, Gupta and Peacock and Wiseman. He slightly narrowed the definition of government expenditure to include only government consumption expenditure and not the general government expenditure considered in the earlier versions. These four versions of the Wagner's hypothesis are tested using absolute (real) values of government expenditure or government consumption expenditure and GDP growth.

Musgrave's (1969) and Mann (1980) interpretation focused on nominal values. In Musgrave view, the share of nominal government expenditures in nominal GDP (NGE/NGDP) is determined by the real GDP per capita (RGDP/*P*). In his opinion, this interpretation is the closest to Wagner's idea. Mann (1980) understood the relationship in a more relative way. He did not use real GDP per capita in Musgrave's model, but Mann (1980) interpreted the hypothesis in a more relative sense. He used the real GDP as opposed to real GDP per capita used in Musgrave's model as an explanatory variable.

Due to data limitation, this study shall test all the various versions model of the Wagner hypothesis except Pryor (1968) model and again, used the inverse of those models to test for the Keynesian view as well. In all, the study shall estimate five out of the six models. We have to conclude here that models Peacock-Wiseman, Gupta, and Goffman gives proof of Wagner's hypothesis if the elasticity (b1, b2, b3 parameters in practice) is more significant than one, while in Musgrave and Mann models when the relevant regression coefficient (b5, b6) is positive.

## 2.2. Empirical literature

The evidence from the above theories on the relationship between Government Expenditure and Economic Growth has been an attractive area of research. An extensive, but not the full selection of the empirical studies in this area are reviewed and presented in Table 2. Nevertheless, it is evident that the relationship between public spending and economic growth can run either way in both the developed and developing countries where studies have been conducted. In addition, these studies have generated conflicting results for both the Keynesian economics and the Wagner's hypothesis. According to Wang et al (2016), the main reason for these differences are that the different versions of the Wagner's Law proposed by Gupta (1967), Goffman (1968), Musgrave (1969), Peacock-Wiseman (1979), and Mann (1980) make Wagner's Law hard to grasp and apply. Furthermore, some econometric estimation techniques, which should not be used in small samples, were wrongly applied and some assumptions for the use of a particular technique were not met but utilized in some studies resulting in the differences.

Table 2: Sample empirical evidence of Wagner's law and Keynes's Law

| Author(s) | Country | Timeframe | Estimation Technique | Major Finding(s) |
|---|---|---|---|---|
| Singh and Sahni (1984) | India | 1950-1981 | Granger-Sims framework | Mixed evidence |
| Abizadeh and Yousefi (1988) | USA | 1950-1984 | Granger-Sims framework | Wagner |
| Chletsos and Kollias (1997) | Greece | 1958-1993 | Cointegration and Error Correction method | Wagner |
| Ansari et al. (1997) | South Africa, Ghana, and Kenya | 1957-1990 | Cointegration and Granger causality | Wagner |
| Sinha (1998) | Malaysia | 1952-1992 | Johansencointegration tests and Granger causality tests | Neither |
| Biswal et al. (1999) | Canada | 1950-1995 | Engle-Granger cointegration and Granger causality procedure | Mixed evidence |
| Islam (2001) | USA | 1929-1996 | Johansen and Julius cointegration and homogeneity tests | Wagner |
| Burney (2002) | Kuwait | 1969-1995 | Cointegration tests, Error-Correction Model | Neither |
| Al-Faris (2002) | GulfCooperation Council countries | 1970-1997 | Cointegration and causality test | Wagner exception of Bahrain |
| Chow et al.(2002) | UK | 1948-1997 | Multivariatecointegration and causality tests | Wagner |
| Muhlis andHakan (2003) | Turkey | 1965-2000 | Cointegration testand the Granger Causality test | Neither |
| Halicioglu (2003) | Turkey | 1960-2000 | Cointegration testand the Granger Causality test | Neither |
| Abu-Bader and Abu-Qarn (2003) | Israel, Syria | 1963-1998 | Granger causality test | Mixed evidence |
| Loizides and Vamvoukas (2005) | UK, Ireland, and Greece | 1960-1990 | Granger causality test | Mixed evidence |
| Huang (2006) | China (including Taiwan) | 1979-2002 | Bounds test and Toda-Yamamoto causality test | Neither |
| Kotosz (2006) | Eastern European Countries | 1990-2003 | VAR and Granger causality | Mixed evidence |

Table 2: Sample empirical evidence of Wagner's law and Keynes's Law **(continues)**

| Author(s) | Country | Timeframe | Estimation Technique | Major Finding(s) |
|---|---|---|---|---|
| Narayan et. al. (2007) | Fiji | 1970-2002 | Cointegration and Error Correction | Wagner |

| | | | | |
|---|---|---|---|---|
| Ziramba (2008) | South Africa | 1960-2006 | ADL bounds test | Mixed evidence |
| Mohammadi et al. (2008) | Turkey | 1951-2005 | ARDL bounds test | Wagner |
| Kumar et al. (2009) | New Zealand | 1960-2007 | ARDL | Wagner |
| Katrakilidis and Tsaliki (2009) | Greece | 1968-2004 | ADRL cointegration | Both |
| Abdullah and Maamor (2010) | Malaysia | 1970-2007 | ARDL bounds test | Wagner |
| Jamshaid et al. (2010) | Pakistan | 1971-2006 | Toda-Yamamoto | Wagner |
| Balamurali, and Sivarajasingam(2010) | Sri Lanka | 1977-2009 | Granger causality tests | Mixed evidence |
| Azgun(2010) | Turkey | 1980-2009 | Granger causality test | Wagner |
| Babatunde (2011) | Nigeria | 1970-2006 | Bounds Test Toda-Yamamoto causality test | Keynes |
| Govindaraju et al. (2011) | Malaysia | 1970-2006 | ARDL | Keynes |
| Pahlavaniet al. (2011) | Iran | 1960-2008 | Granger causality test, Toda-Yamamoto | Wagner |
| Cosimo (2012) | Italy | 1960-2008 | Granger causality test | Keynes |
| Ebaidalla(2013) | Sudan | 1970-2008 | Granger causality test | Keynes |
| Kotosz and Peak (2013) | Hungary | 1960-2011 | VAR | Neither |
| Korkmaz(2013) | Turkey | 1998-2013 | Granger causality test | Wagner |
| Barra et al. (2015) | Italy | 1951-2009 | Cointegration and causality tests | Wagner |
| Thabane and Lebina (2016) | Lesotho | 1980-2012 | Cointegration and causality tests | Wagner |
| Wang et al. (2016) | Romania | 1991-2014 | ARDL | Wagner |
| Kotosz (2016) | Eastern European countries | 1991-2003 | OLS, Dynamic panel regression | Keynes |

Compiled by the authors

# 3. Methodology
## 3.1. Estimation model specification

There are several empirical models employed to examine the Wagner's Law and Keynesian hypothesis in a particular economy as indicated in the previous section. All these models can be specified in a standard economic relationship as.

$$\ln Y_t = f(X_t) + \varepsilon_t \quad (1)$$

Where $Y_t$ represent government expenditure in time t and $X_t$ is economic growth in time t in the instance of the Wagner's hypothesis. Whereas $Y_t$ represent economic growth and $X_t$ is government expenditure in time t in the event of the Keynesian economics. $\varepsilon_t$ is also the residual at period t.

## 3.2. Data type and sources

The study uses secondary data drawn mainly from the World Bank online database (World Development Indicators). These data sets have been crossed checked with other sources for consistency and were proven to be consistent with each order before being used. The study considers a sample period of 55 annual observations ranging from 1960 to 2015.The main variables for this study are General Government Expenditure and Gross Domestic Product (GDP).

This study shall use three different data configurations. The first is government expenditure, and economic growth in constant local currency, the second is government expenditure and economic growth in constant foreign currency (US Dollars),and finally, the third is government expenditure and economic growth in annual percentages. The main reason for the three different types of the dataset is to examine whether changes in the dataset have a significant impact on the result for the same country and the same models.

## 3.3. Estimation procedure
### 3.3.1. Stationarity test

It is essential to test for the stationarity properties of variables when dealing with annual data. Annual data are rarely stationary in level forms, and regression involving them often leads to the problem of spurious regression. This occurs when the estimation results disclose a very high and significant association between the variables when no association exists in reality. Therefore, this study will begin by examining the stationarity characteristics of the data by using the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests. Both tests are relevant to ensure reliable results of the test for stationarity due to the inherent individual weaknesses of the techniques. Overall, the aim of the stationarity test is to avoid the problem of spurious regression by choosing the appropriate model for the estimation.

## 3.3.2. Cointegration test

Several past studies have used the Engle and Granger test, fully modified OLS procedure (FMOLS) of Phillips and Hansen's, maximum likelihood based on Johansen and Johansen-Juselius tests to determine the long-term associations among variables of interest. In fact, Johansen cointegration technique, for instance, remains the technique of choice for many researchers who argue that this is the most accurate method to apply for I(1) variables. However, a series of studies by Pesaran and Pesaran (1997),Pesaran and Shin (1999) and Pesaran et al. (2001) in the late 1990's and early 2000's have introduced an alternative cointegration technique known as the 'Autoregressive Distributed Lag (ARDL)' bound test. This technique has numerous econometric benefits over the Johansen cointegration techniques. First, the ARDL model is the most statistically significant method to examine the degree of cointegration if the sample size of the data for the study is small, whereas the Johansen co-integration procedure rather needs enormous data for validity. In other words, the ARDL method is more vigorous and provides more accurate long-run coefficients for small sample sizes than the usual Johansen co-integration techniques (Pesaran & Shin, 1999). Furthermore, Tang (2006) stated that the ARDL procedure is also appropriate when the explanatory variables are considered endogenous. In addition, a dynamic Error Correction Term (ECT) can be derived from ARDL that incorporates the short-run parameters with the long run without losing the long run parameters estimated.

This study examines the long run association between government expenditure and economic growth in Burkina Faso by specifying the conditional ARDL as

$$\Delta \ln GE_t = \beta_o + \beta_1 GE_{t-1} + \beta_2 \ln GDP_{t-1} + \sum_{i=1}^{p} \alpha_1 \Delta \ln GE_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta \ln GDP_{t-i} + \upsilon_t \quad (2)$$

$$\Delta \ln GDP_t = \beta_o + \beta_1 GDP_{t-1} + \beta_2 \ln GE_{t-1} + \sum_{i=1}^{p} \alpha_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta \ln GE_{t-i} + \eta_t \quad (3)$$

Where $\Delta$ denotes the first difference operator, $p$is the lag order selected by Akaike's Information Criterion (AIC), $\beta_0$is the drift parameter while $\upsilon_t$ and $\eta_t$are the respective white noise error term which is ~ N(0, $\delta^2$). The parameters $\alpha_i$ are the short-run parameters, and $\beta_i$is the long-run multipliers. All variables are defined as before.
The ARDL method commences by regressing equation (2) and (3) specified using the Ordinary Least Square(OLS) method. The calculated F-test from the OLS regression is then used to investigate the presence of a long run association among the series. Therefore, the null hypothesis of no long-run association between the variables in equation (2) and (3)is tested against the alternative hypothesis as:

$$H_0: \beta_1 = \beta_2 = 0 \qquad H_1: \beta_i \neq 0$$

The existence of cointegration between government expenditure and economic growth is tested based on the F-statistics. Since the asymptotic properties of the F-statistics is non-standard because of the nature of the explanatory variables which are $I(1)$or $I(0)$, Pesaran and Pesaran (1997) have generated and presented the appropriate critical values to compare depending on the numbers of explanatory variables ($k$), and whether there is a trend and/or intercept in the model. So, the value of the $F$-statistic computed during the OLS regression is matched with this sets of critical values created based on the explanatory variables and on the assumption that the series are not $I(2)$ series. The rule of thumb is that if the $F$-statistic computed surpasses the higher critical value, then the null hypothesis of no cointegration should be rejected regardless of whether the series is $I(1)$ or $I(0)$. This implies a long-run association among the series. Likewise, if the calculated F-statistic drops less than the lower critical value, then the null hypothesis of no cointegration should be accepted. However, if the F-statistic value lies within the lower critical and higher critical bounds, then the test results are indecisive (Pesaran & Pesaran, 1997).

Once co-integrating association is discovered amongst the series, the ensuing step is to estimate the following equations to obtain their long-run estimates;

$$\ln GE_t = \mu_0 + \sum_{i=0}^{p} \beta_1 GE_{t-i} + \sum_{i=0}^{p} \beta_2 \ln GDP_{t-i} + \nu_t \quad (4)$$

$$\ln GDP_t = \mu_0 + \sum_{i=0}^{p} \beta_1 GDP_{t-i} + \sum_{i=0}^{p} \beta_2 \ln GE_{t-i} + \eta_t \quad (5)$$

The short-run estimates and the speed of convergence are also obtained by estimating the model with the error correction version of the ARDL model. This is specified as

$$\Delta \ln GE_t = \phi_0 + \sum_{i=0}^{p} \delta_1 \Delta \ln GE_{t-i} + \sum_{i=0}^{p} \delta_2 \Delta \ln GDP_{t-i} + \gamma ECT_{t-1} + \Omega_t \quad (6)$$

$$\Delta \ln GDP_t = \phi_0 + \sum_{i=0}^{p} \delta_1 \Delta \ln GDP_{t-i} + \sum_{i=0}^{p} \delta_2 \Delta \ln GE_{t-i} + \gamma ECT_{t-1} + \Phi_t \quad (7)$$

Where the estimated parameters are the coefficients of the short-run dynamics,$\gamma$ is the speed of adjustment and $ECT_{t-1}$ is the residual attained.

The accepted lags for the study were chosen based on the Swartz Information Criterion (SIC),and the Akaike Information Criteria (AIC) and the models used for the analysis were subjected to diagnosis and stability test to ensure how stable and diagnostic they are over the study time periods. The model was subjected to heteroskedasticity and autocorrelation test. The normality test was also performed to determine if the residuals of the model were normally distributed and subsequently, the functional test was carried out to conclude if the models were correctly specified. Also, the stability test of the model was also conducted by plotting their cumulative sum of squares (CUSUMQ) and the cumulative sum (CUSUM) since Pesaran (1997) suggested that conducting these tests are of great importance for the model.

## 3.3.3. Toda and Yamamoto causality test

After cointegration test and determining the presence of a long-run association between and among the variables, we must capture the direction of causality among the variables by testing the significance of the $F$-statistic as well as the error correction term derived

from the long run association. However, when the variables are integrated of different orders, the standard Granger causality test have some inherent specification bias and when used will lead to spurious regression. Therefore, Toda and Yamamoto (1995) have established another procedure of testing for Granger causality regardless of the stationarity properties of the data or whether they are cointegrated or otherwise (Karimi, 2009). This study subsequently adopts this Toda and Yamamoto causality test to examine the causality between and among the variables since the primary variables consist of both I(0) and I(1)characteristics.
The Toda and Yamamoto causality model for the study can be estimated as follows:

$$\Delta GE_t = \mu_0 + \sum_{i=1}^{h+p} \beta_{1i} \Delta GE_{t-i} + \sum_{i=0}^{k+p} \phi_{1i} \Delta GDP_{t-i} + \psi_t \quad (8)$$

$$\Delta GDP_t = \mu_0 + \sum_{i=1}^{h+p} \beta_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{k+p} \phi_{2i} \Delta GE_{t-i} + \Omega_t \quad (9)$$

Where $p$ is the optimal order of integration of government expenditure and economic growth variables in the model and also, $h$ and $k$ are the maximum numbers of the lag length of these variables in the model.

# 4. Empirical results and discussion

## 4.1. Result of the stationarity test

In order to investigate the association between government expenditure and economic growth in Burkina Faso, the stationarity characteristics of all the series specified for the study were determined. This was performed to confirm that the series was not integrated of I(2) in order to avoid spurious results. This is because, in the event of $I(2)$ variables, the F-statistic calculated, as generated by Pesaran et al. (2001) in the ARDL model cannot be relied upon. Due to this, stationarity test was conducted for all the series, and the results are reported in Appendix I.As expected from the results of the unit root test in Table 1 to 8 in Appendix I, at levels, the null hypothesis of a unit root for all the variables could not be rejected. This is because the p-values of the ADF and the PP statistic are not significant at all the conventional levels of significance apart from the log of government expenditure and a log of nominal government expenditure over GDP in the constant local currency. Never the less, at first difference, all the variables are stationary. This indicates that the variable for the study under the constant local currency is integrated of either order zero $I(0)$ or order one $I(1)$. An analogous situation is also found in the case of the annual growth rate. GDP growth rate is $I(0)$ while the government expenditure growth rate is $I(1)$ for both the ADF and the PP test. However, in the case of the constant currency (constant US Dollars), the null hypothesis of unit root could also not be rejected for all the variables using both the ADF and the PP statistic. Since the variables comprise different levels of integration, the study tests the cointegration between them using the ARDL technique (Bounds Test) to cointegration.

## 4.2. Cointegration result

The presence of cointegration between government expenditure and economic growth for all the versions of the Wegner's hypothesis considered in this study were examined,and the resultsare presented in Table 3.As revealed in Table 3, the null hypothesis of no cointegrationfor constant local currency is rejectedfor all the various varieties of the Wagner's hypothesis.On the other hand,when variablesare calculated in constant 2010 US dollars, the null hypothesis of no cointegration in Gupta and Musgrave versions of the Wagner's hypothesis was rejected, so cointegration is not proved. For the Keynesian economics, the null hypothesis of no cointegration was accepted for the Peacock-Wiseman and Mann model using the constant local currency.Asimilar result isalso obtained using the constant 2010 US dollars. However, for the growth rate, the null hypothesis of no cointegration was rejected for both the Keynesian economics and the Wagner's hypothesis. Since all the versions of the Wagner's hypothesis were significant, this study estimates these models to obtain the long run and short run coefficient of the relationship between government spending and economic growth.

**Table 3.Results of Bounds Tests for the Existence of Cointegration**

| | 10% Sign. Level | | 5% Sign. Level | | 2.5% Sign. Level | | 1% Sign. Level | |
|---|---|---|---|---|---|---|---|---|
| K | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| 1 | 4.04 | 4.78 | 4.94 | 5.73 | 5.77 | 6.68 | 6.84 | 7.84 |

| | | Local Currency | | 2010 USD | |
|---|---|---|---|---|---|
| **Models** | **Dependent Variable** | **F-Test** | **Coin.** | **F-Test** | **Coin.** |
| A: Peacock-Wiseman | (LNRGE \| LNRGDP) | 11.365*** | YES | 6.826** | YES |
| | (LNRGDP \| LNRGE) | 0.658 | NO | 0.753 | NO |
| B: Gupta | (LNRGEPC \| LNRGDPPC) | 5.269** | YES | 2.419 | NO |
| | (LNRGDPPC\| LNRGEPC) | 7.004*** | YES | 5.043** | YES |
| C: Goffman | (LNRGE \| LNRGDPPC) | 10.041*** | YES | 6.554** | YES |
| | (LNRGDPPC\| LNRGE) | 7.048*** | YES | 6.377** | YES |
| D: Musgrave | (LN (NGE/NGDP)\| LNRGDPPC) | 5.605** | YES | 2.462 | NO |
| | (LNRGDPPC\| LN (NGE/NGDP) | 7.652*** | YES | 6.292** | YES |
| E: Mann | (LN (NGE/NGDP)\| LNRGDP) | 11.076*** | YES | 7.047** | YES |
| | (LNRGDP \| LN (NGE/NGDP) | 0.219 | NO | 0.227 | NO |
| Others: | | | | | |
| Model B | GE growth rate \| GDP growth rate | | | 34.106*** | YES |
| | GDP growth rate \| GE growth rate | | | 31.264*** | YES |

Source: Computation of the authors * significant at 10%, ** significant at 5%, *** significant at 1%

## 4.3. Long run and short run result

Since all the various versions of the Wagner's hypothesis (government expenditure and economic growth)are cointegrated, it is essential to estimate the long-run coefficients that can show the exact association between them. The result of the long-run and short-run association between government expenditure and economic growth for all the various versions and the different data set estimated are presented in Table 4 and 5, respectively. As expected, the signs of the variables and their coefficient differ as predicted in the theoretical background across all the various versions of the model. From an econometric point of view, In the case of the constant local currency, the long run results show that only Gupta model and Goffman model are significant. In the case of the Peacock and Wiseman, Mann as well as Musgrave model, the long-run coefficients are insignificant. In the case of the foreign currency, the results are similar, but Musgrave model which was insignificant at the local currency was now significant. These results are mixed when local currency is used (Gupta and Musgrave's versions proved, other versions rejected Wagner's hypothesis), and the Wagner's hypothesis unanimously rejected when calculated in USD.

**Table 4: Estimated Long-Run Coefficients using the ARDL Approach**

| Variable | Dependent Variable | Regressors | Constant Local Currency | | Constant Foreign Currency | |
|---|---|---|---|---|---|---|
| | | | Coefficient | Prob. | Coefficient | Prob. |
| Model A: Peacock-Wiseman | LNRGE | LNRGDP | 0.7774 | 0.234 | 0.9406 | 0.190 |
| | | C | 1.6417 | 0.805 | -0.0323 | 0.974 |
| Model B: Gupta | LNRGEPC | LNRGDPPC | 1.7413*** | 0.001 | 0.0570*** | 0.009 |
| | | C | 2.0510 | 0.220 | 0.1547 | 0.980 |
| Model C: Goffman | LNRGE | LNRGDPPC | 0.4135 | 0.501 | -0.9570*** | 0.009 |
| | | C | 8.3941*** | 0.000 | 7.3068*** | 0.005 |
| Model D: Musgrave | LN (NGE/NGDP) | LNRGDPPC | 1.2497*** | 0.002 | -1.2078*** | 0.000 |
| | | C | 0.1632 | 0.522 | -0.1642 | 0.302 |
| Model E: Mann | LN (NGE/NGDP) | LNRGDP | -0.1005 | 0.873 | -0.2354 | 0.712 |
| | | C | 0.3888 | 0.952 | 1.1660 | 0.812 |

Source: Computation of the authors
* significant at 10%, ** significant at 5%, *** significant at 1%

In the short run model, all the error correction term for the various versions and the various data set were negative and significant as expected. For the local currency, all the various versions except the Mann model were found to be significant, and all of them supported the Wagner's hypothesis. A very different result is obtained for the foreign currency. Only the absolute government expenditure version (A, B, and C) were significant, but all them rejected Wagner's law. By the Musgrave and Mann model, the short-run law is proved, but the relationship is not significant.

**Table 5: Estimated Short-Run Coefficients using the ARDL Approach**

| Variable | Dependent Variable | Regressors | Constant Local Currency | | Constant Foreign Currency | |
|---|---|---|---|---|---|---|
| | | | Coefficient | Prob. | Coefficient | Prob. |
| Model A: Peacock-Wiseman | LNRGE | LNRGDP | 1.4389** | 0.018 | 0.7832*** | 0.001 |
| | | D(LNRGDP(-1)) | 0.3904 | 0.524 | 0.4105 | 0.120 |
| | | ECM | -0.2562*** | 0.000 | -0.1032** | 0.048 |
| Model B: Gupta | LNRGEPC | LNRGDPPC | 2.2096*** | 0.001 | 0.2020*** | 0.004 |
| | | D(LNRGDPPC(-1)) | 0.7215 | 0.267 | 0.1033 | 0.109 |
| | | ECM | -0.2473*** | 0.001 | -0.0033*** | 0.000 |
| Model C: Goffman | LNRGE | LNRGDPPC | 1.5885** | 0.017 | 0.2333*** | 0.002 |
| | | D(LNRGDPPC(-1)) | 0.6310 | 0.306 | 0.0679 | 0.457 |
| | | ECM | -0.2145*** | 0.003 | -0.1038*** | 0.001 |
| Model D: Musgrave | LN (NGE/NGDP | LNRGDPPC | 0.1836** | 0.006 | 0.1107 | 0.397 |
| | | D(LNRGDPPC(-1) | 0.2635 | 0.901 | -0.0853 | 0.279 |
| | | ECM | -0.7354*** | 0.000 | -0.1150*** | 0.002 |
| Model E: Mann | LN (NGE/NGDP) | LNRGDP | 0.0248 | 0.874 | 0.2118 | 0.113 |
| | | D(LNRGDP(-1)) | 0.1833 | 0.135 | 0.0227 | 0.731 |
| | | ECM | -0.2467*** | 0.000 | -0.0966** | 0.040 |

Source: Computation of the authors
* significant at 10%, ** significant at 5%, *** significant at 1%

**Table 6: Estimated Long- and Short-Run Coefficients for the Keynesian hypothesis using the ARDL Approach**

| Variable | Dependent Variable | Regressors | Coefficient | Std. Error | Prob. | |
|---|---|---|---|---|---|---|
| | GDP | GE | 0.140775 | 0.052034 | 0.0093 | *** |
| | | C | 2.093228 | 0.905586 | 0.0249 | *** |
| | GDP | GE | 0.166945 | 0.064792 | 0.0129 | ** |
| | | ECM | -1.185895 | 0.137891 | 0.0000 | *** |

Source: Computation of the authors
* significant at 10%, ** significant at 5%, *** significant at 1%

As Table 6 shows, the test of the Keynesian hypothesis has a positive in the long- and the short-run (positive and significant coefficients of government expenditures). However, by the empirical evidence, 1 unit of government expenditures increases the GDP only by 0.17 units in the short-run and 0.14 units, in the long run, thereby the Keynesian multiplier is less than 1. This fact fits well the recent literature, with higher long-run and lower short-run impact, and close-to-zero multipliers in developing countries (Ilzetzki et al., 2013).

## 4.4. Coefficient diagnosis statistics and stability

In order to check for the estimated ARDL model, the significance of the variables and other diagnostic tests such as serial correlation, functional form, normality; heteroskedasticity and structural stability of the model are considered. Table II.1 in the appendix shows the result of the model Diagnostics and Goodness of Fit.

The diagnostic test indicates that except for normality they pass all assumptions. Goffman and Musgrave models in local currency violate the RESET test, suggesting that another function form can better fit the data. The plots of the CUSUM and the CUSUMSQ depicted in Figures III.1. and III.2 in Appendix III indicate that the estimated parameters, as well as the various models, are steady over the time periods the study was conducted since the parameters all lies within the 5 percent critical bounds (with slight border cases at the end of the 1990s).

## 4.5. Toda-Yamamoto Causality Test

The null hypothesis of government expenditure does not Granger cause economic growth is rejected at 5% percent level of significance for the first three versions of the Wagner's versions (Peacock and Wiseman, Gupta and Goffman model) for the local currency. Therefore, unidirectional causality running from government expenditure to economic growth is therefore confirmed in Burkina Faso. On the contrary, the null hypothesis of economic growth does not Granger cause government expenditure cannot be rejected for any versions of the Wagner's hypothesis. Thus, the causality from government expenditure to economic growth is not observed. This result means that Burkina Faso's economy supports the Keynesian view which argues that causation runs from government expenditure to economic growth using the local currency. By means of the foreign currency, the causality results show mix results regarding the existence of validity of Wagner's and Keynesian hypothesis in four different ways. Firstly, neither unidirectional nor bidirectional causality as shown in the Goffman model. Secondly, there is unidirectional casualty running from economic growth to government expenditure which advocates validity of Wagner's law in Musgrave model and thirdly, there is unidirectional casualty running from government expenditure to economic growth in favour of the existence of Keynesian hypothesis in the Peacock and Wiseman and Mann model. Finally, there is bi-directional casualty running in the Gupta model.

**Table 7: Toda-Yamamoto Causality Test**

| Model | Null hypothesis | Constant local Currency Chi-square | Constant local Currency Prob. | Constant Foreign Currency Chi-square | Constant Foreign Currency Prob. |
|---|---|---|---|---|---|
| Model A: Peacock-Wiseman | LNRGE does not Granger Cause LRGDP | 50.606*** | 0.000 | 7.4756** | 0.024 |
| | LRGDP does not Granger Cause LNRGE | 0.5449 | 0.762 | 1.3643 | 0.506 |
| Model B: Gupta | LNRGEPC does not Granger Cause LRGDPPC | 5.8290** | 0.044 | 5.5280* | 0.063 |
| | LRGDPPC does not Granger Cause LNRGEPC | 1.6191 | 0.445 | 5.7718* | 0.056 |
| Model C: Goffman | LNRGE does not Granger Cause LRGDPPC | 12.131*** | 0.002 | 4.4996 | 0.105 |
| | LRGDPPC does not Granger Cause LNRGE | 1.0580 | 0.589 | 3.0228 | 0.221 |
| Model D: Musgrave | LNNGE/NGDP does not Granger Cause LRGDPPC | 1.9475 | 0.378 | 0.1492 | 0.928 |
| | LRGDPPC does not Granger Cause LNNGE/NGDP | 1.3036 | 0.521 | 9.1023** | 0.011 |
| Model E: Mann | LNNGE/NGDP does not Granger Cause LRGDP | 1.9977 | 0.368 | 0.1932* | 0.076 |
| | LRGDP does not Granger Cause LNNGE/NGDP | 0.9635 | 0.618 | 5.1681 | 0.908 |

Source: The authors' computation
* significant at 10%, ** significant at 5%, *** significant at 1%

## 5. Conclusion

In this study we examined the relationship between government expenditure and economic growth in Burkina Faso using the autoregressive distributed lag (ARDL) approach of cointegration for the period 1960 to 2015. Our main goal was to find the causal relationship for the verification of Keynesian and Wagner's hypothesis. The study adopted five versions of Wagner's law interpretation as a theoretical model for the verification of the two hypotheses.

The empirical models we estimated indicates that there is substantial evidence of cointegration between government expenditure and economic growth in all the varieties of the Wagner's hypothesis considered for this study and also consistent for both the constant local currency and US dollars. It means the existence of long-run relationship between total government expenditure and economic growth in Burkina Faso. However, the coefficient seems to be significant for only Gupta model and Goffman model for both the local and the foreign currency.

**Table 8: Summary of results for Wagner's hypothesis**

| Model | Cointegration | | Long-run | | Short-run | | Causality | |
|---|---|---|---|---|---|---|---|---|
| | Local | US | Local | US | Local | US | Local | US |
| Model A: Peacock-Wiseman | + | + | – | – | + | – | – | – |
| Model B: Gupta | + | – | + | – | + | – | – | + |
| Model C: Goffman | + | + | – | – | + | – | – | – |
| Model D: Musgrave | + | – | + | – | + | + | – | + |
| Model E: Mann | + | + | – | – | + | + | – | – |

Source: The authors' compilation

In the short run, all the various versions except the Mann model were found to be significant, but the proof or the rejection of Wagner's law is mixed (proof for local currency, rejection for US dollars).

Regarding the existence of validity of Wagner's or Keynesian hypothesis for Burkina Faso, the causality tests show mixed results. In the local currency, it supported the Keynesian hypothesis in three different models and no causality in the Musgrave and Mann model. In the foreign currency, evidence for both Keynesian and Wagner's hypothesis was found.

Altogether, it indicates that there is mixed evidence of both short-run and long-run relationship between government expenditure and economic growth in Burkina Faso. There is more proof of Wagner's law in the short run, and in local currency. It suggests that the government tends to spend more succeeding a growth period, but the relationship is not persistent. However, this empirical evidence disaffirms Wagner's original explanation accusing the long-run development of the country to the higher need of infrastructural, educational and health expenditures. The tests of the Keynesian view show a more stable, but a fragile relationship, so the increase of government expenditures lift the GDP of the following years, but this increase is far from the textbook fiscal multipliers.

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# APPENDIX I

## UNIT ROOT TEST

**Table I.1. Results of Unit Root Test: ADF Test for Constant Local Currency**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| LNRGDP | -0.662465(0.8471) | 1 | LNRGDP | -5.724264(0.0000) *** | 0 | *I*(1) |
| LNRGDPPC | -1.471466(0.5405) | 0 | LNRGDPPC | -5.925400(0.0000) *** | 0 | *I*(1) |
| LNRGE | -3.170298(0.0272) ** | 0 | LNRGE | -8.076725(0.0001) *** | 0 | *I*(0) |
| LNRGEPC | -2.449068(0.1335) | 0 | LNRGEPC | -7.671313(0.0000) *** | 0 | *I*(1) |
| LN(NGE/NGDP) | -3.345385(0.0175) ** | 0 | LN(NGE/NGDP) | -8.147818(0.0000) *** | 0 | *I*(0) |

**Table I.2. Results of Unit Root Test: PP Test for Constant Local Currency**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| LNRGDP | -0.710455 (0.8353) | 4 | LNRGDP | -5.767592 (0.0000) *** | 0 | *I*(1) |
| LNRGDPPC | -1.411316 (0.5703) | 3 | LNRGDPPC | -5.951655 (0.0000) *** | 3 | *I*(1) |
| LNRGE | -3.327678(0.0183) ** | 3 | LNRGE | -8.066566(0.0001) *** | 3 | *I*(0) |
| LNRGEPC | -2.504747(0.1199) | 3 | LNRGEPC | -7.663944(0.0000) *** | 3 | *I*(1) |
| LN(NGE/NGDP) | -4.755106(0.0003) *** | 8 | LN(NGE/NGDP) | - -8.168404(0.0000)*** | 2 | *I*(0) |

**Table I.3. Results of Unit Root Test: ADF Test for Constant 2010 USD**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| LNRGDP | -0.676024 (0.8440) | 0 | LNRGDP | -6.280508 (0.0000) *** | 0 | *I*(1) |
| LNRGDPPC | -1.964577 (0.3013) | 0 | LNRGDPPC | -6.282836 (0.0000) *** | 0 | *I*(1) |
| LNRGE | -0.697548 (0.8386) | 0 | LNRGE | -7.550121 (0.0001) *** | 0 | *I*(1) |
| LNRGEPC | -1.416234 (0.5679) | 0 | LNRGEPC | -7.558203 (0.0000) *** | 0 | *I*(1) |
| LN(NGE/NGDP) | -1.106924 (0.7070) | 0 | LN(NGE/NGDP) | -8.032344 (0.0000) *** | 0 | *I*(1) |

**Table I.4. Results of Unit Root Test: PP Test for Constant 2010 USD**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| LNRGDP | -0.676024 (0.8440) | 0 | LNRGDP | -6.280508 (0.0000) *** | 0 | *I*(1) |
| LNRGDPPC | -1.964577 (0.3013) | 0 | LNRGDPPC | -6.282836 (0.0000) *** | 0 | *I*(1) |
| LNRGE | -0.697548 (0.8386) | 0 | LNRGE | -7.550121 (0.0001) *** | 0 | *I*(1) |
| LNRGEPC | -1.416234 (0.5679) | 0 | LNRGEPC | -7.558203 (0.0000) *** | 0 | *I*(1) |
| LN(NGE/NGDP) | -1.106924 (0.7070) | 0 | LN(NGE/NGDP) | -8.032344 (0.0000) *** | 0 | *I*(1) |

**Table I.7. Results of Unit Root Test: ADF Test GDP growth rate and growth rate of Government expenditure**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| GDPG | -7.793638 (0.0000) *** | 1 | LNRGDP | -10.11610 (0.0000) *** | 1 | *I*(0) |
| GE | -1.151407 (0.6889) | 0 | GE | -7.351702 (0.0000) *** | 1 | *I*(1) |

**Table I.8. Results of Unit Root Test: PP Test**

| Levels | | | First Difference | | | |
|---|---|---|---|---|---|---|
| Var. | ADF-Statistic | Lag | Var. | ADF-Statistic | Lag | *OI* |
| GDPG | -7.793638 (0.0000) *** | 1 | LNRGDP | -10.11610 (0.0000) *** | 1 | *I*(0) |
| GE | -1.151407 (0.6889) | 0 | GE | -7.351702 (0.0000) *** | 1 | *I*(1) |

## APPENDIX II

## DIAGNOSIS AND STABILITY TEST

**Table II.1. Diagnosis and stability tests**

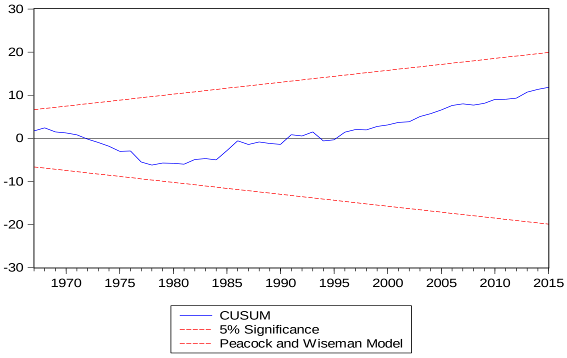
| | Normality test | Heteroskedasticity test | ARCH Test | RESET Test |
|---|---|---|---|---|
| Constant Local Currency | | | | |
| Peacock and Wiseman | 10.10716 | 0.596547 | 0.538988 | 1.421599 |
| | (0.000) | (0.667) | (0.587) | (0.162) |
| Gupta | 13.14936 | 0.103269 | 2.288302 | 0.277996 |
| | (0.000) | (0.996) | (0.112) | (0.782) |
| Goffman | 14.56734 | 0.252831 | 1.430245 | 7.723787 |
| | (0.000) | (0.956) | (0.250) | (0.008) |
| Musgrave | 14.37458 | 0.535913 | 0.506745 | 3.282201 |
| | (0.000) | (0.778) | (0.606) | (0.002) |
| Mann | 72.4843 | 0.719642 | 1.216761 | 1.042091 |
| | (0.000) | (0.545) | (0.305) | (0.303) |
| Constant Foreign Currency | | | | |
| | Normality test | Heteroskedasticity test | ARCH Test | RESET Test |
| Peacock and Wiseman | 13.32347 | 1.353201 | 0.567354 | 0.560212 |
| | (0.001) | (0.254) | (0.571) | (0.578) |
| Gupta | 20.35095 | 1.711039 | 1.73055 | 0.810499 |
| | (0.000) | (0.176) | (0.188) | (0.372) |
| Goffman | 19.84473 | 0.957316 | 0.911381 | 0.173089 |
| | (0.000) | (0.464) | (0.409) | (0.863) |
| Musgrave | 21.58164 | 1.411059 | 0.841198 | 1.890646 |
| | (0.000) | (0.251) | (0.438) | (0.265) |
| Mann | 18.74974 | 1.293821 | 0.822089 | 1.913806 |
| | (0.000) | (0.189) | (0.446) | (0.162) |

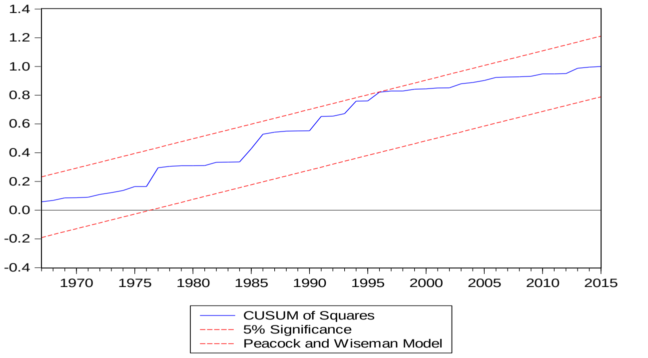
Source: The authors' computation
p-values in parentheses

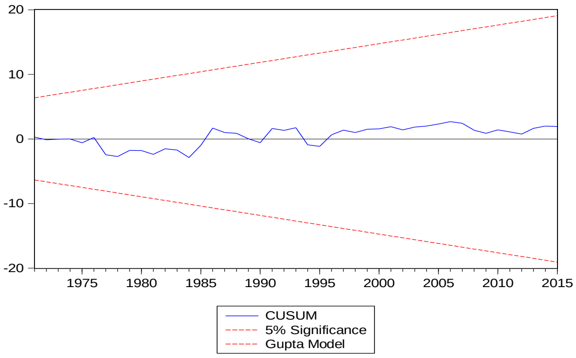
## APPENDIX III

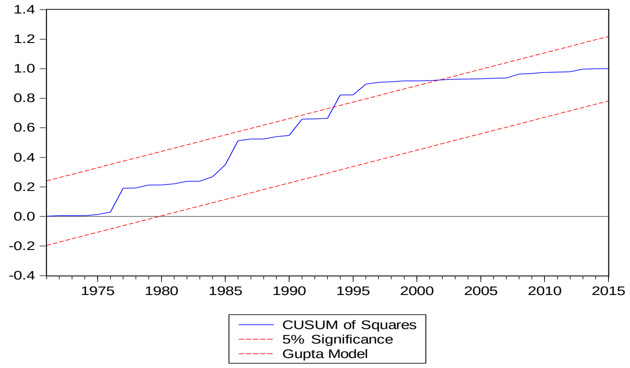
### CUSUM STABILITY TESTS

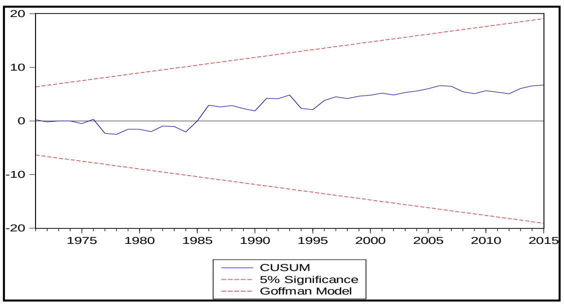
**Figure III.1. CUSUM and CUSUM of Squares for models in Constant Local Currency**

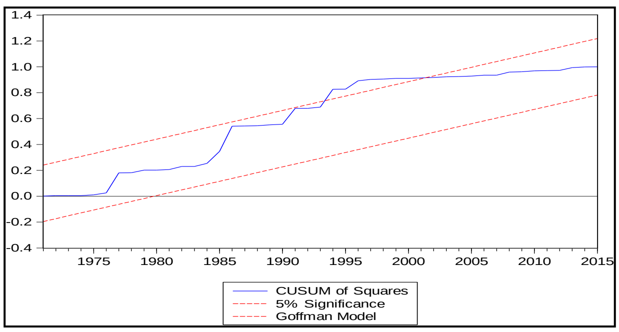


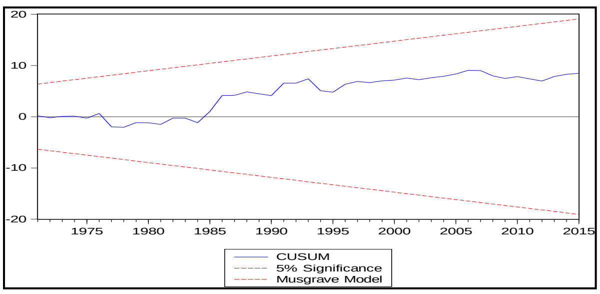



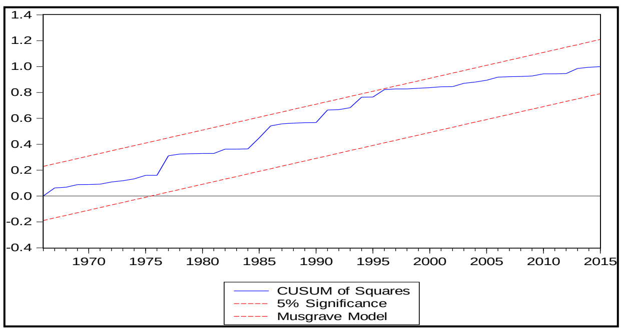



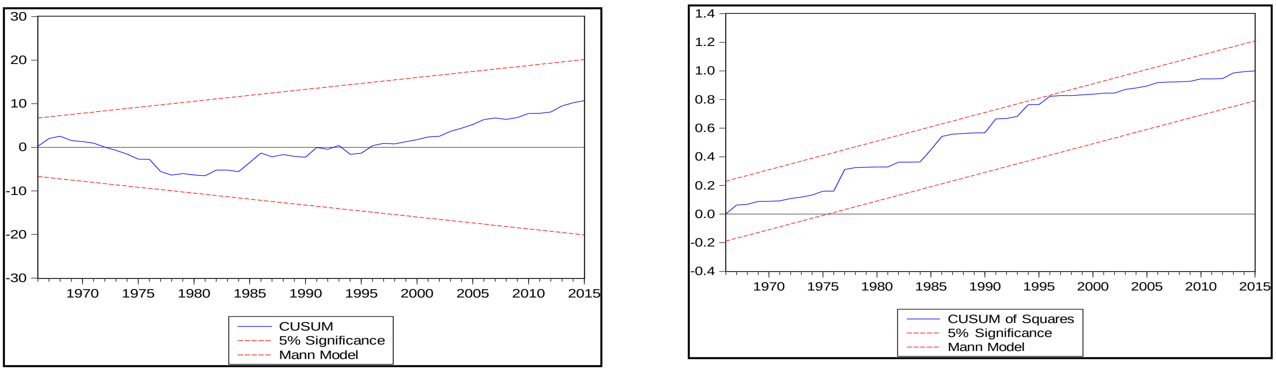
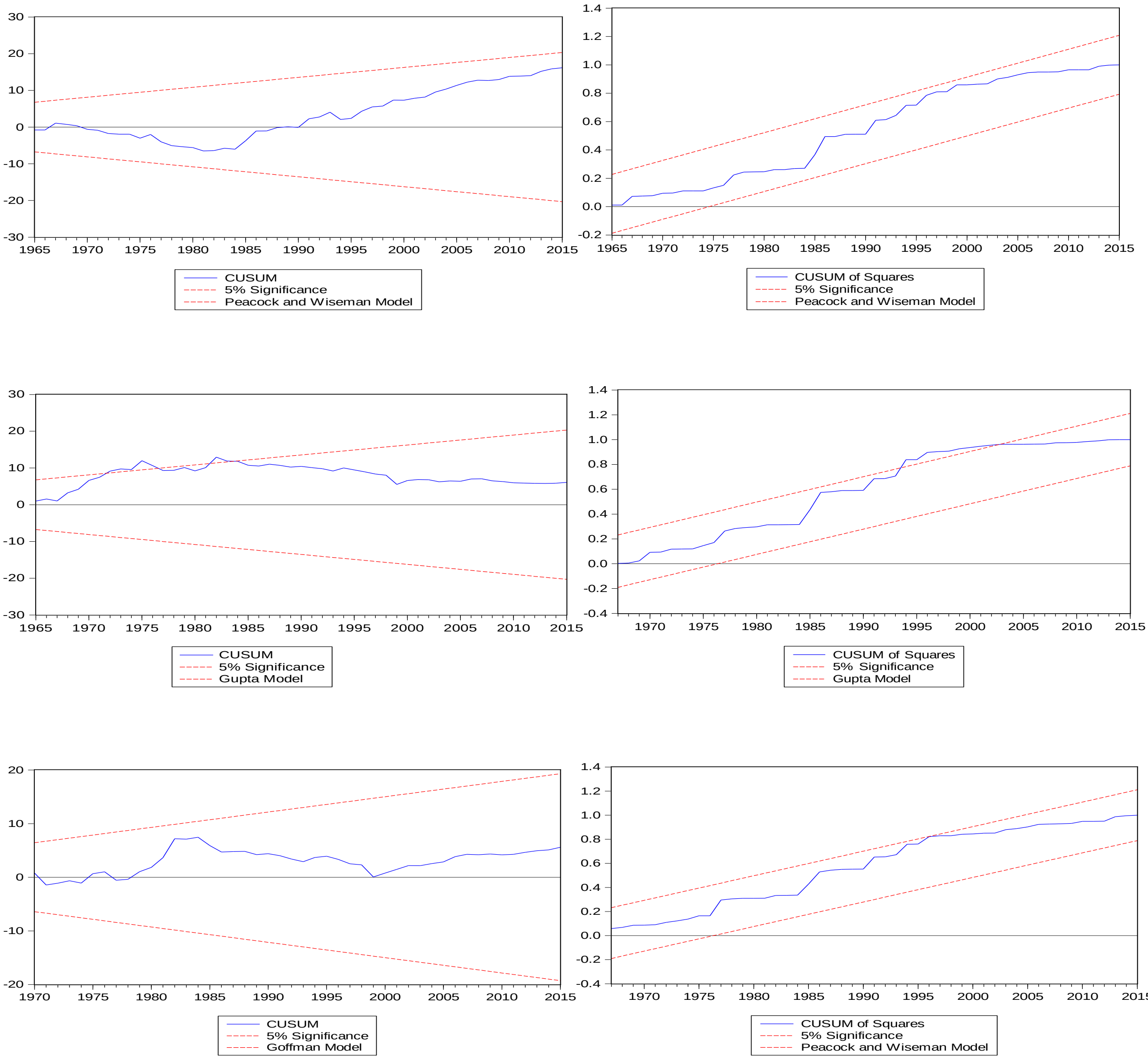
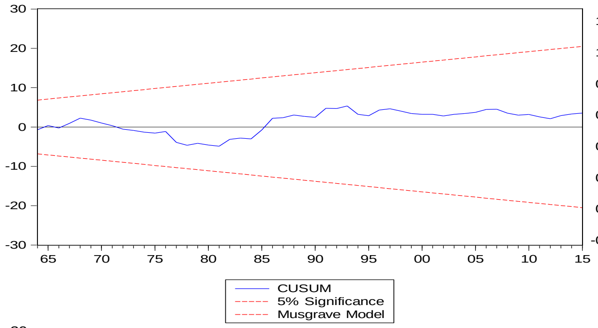
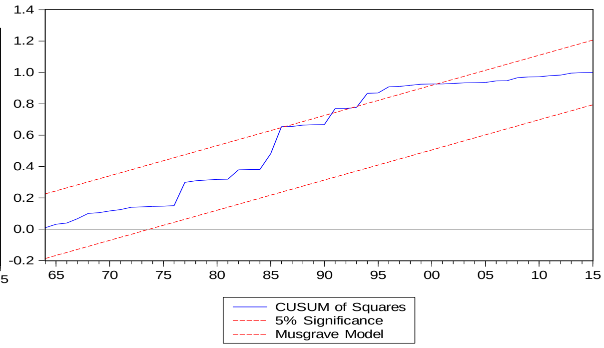
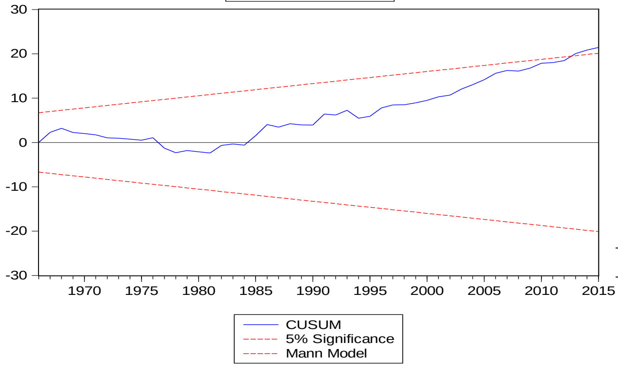


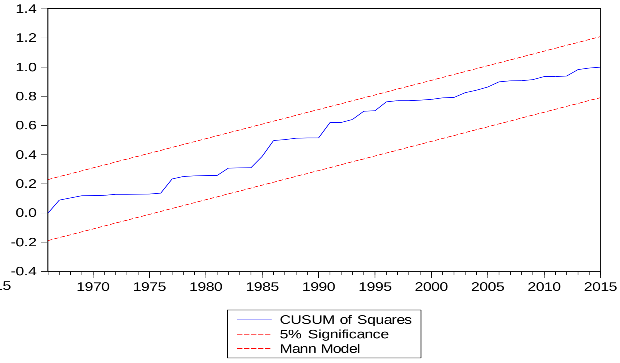

**Figure III.1. CUSUM and CUSUM of Squares for models in Constant Foreign Currency (US Dollars)**




30
20
10
0
-10
-20
-30
65 70 75 80 85 90 95 00 05 10 15
CUSUM
5% Significance
Musgrave Model


1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
65 70 75 80 85 90 95 00 05 10 15
CUSUM of Squares
5% Significance
Musgrave Model


30
20
10
0
-10
-20
-30
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015
CUSUM
5% Significance
Mann Model


1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015
CUSUM of Squares
5% Significance
Mann Model