TESTING THE VALIDITY OF WAGNER'S LAW IN THE NAMIBIAN CONTEXT: A TODA-YAMAMOTO (TY) GRANGER CAUSALITY APPROACH, 1991-2013

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ABSTRACT

This paper examines the validity of Wagner's (1883) hypothesis on the direction of causality between sectoral public expenditures and economic growth in Namibia for the period 1991-2013. It focuses on public expenditure on education, health and capital goods. Wagner law states that an increase in economic activity would lead to an increase in public expenditure while Keynesian law states that an increase in public expenditure would lead to an increase in economic activity. The bounds testing to cointegration also known as Autoregressive Distributed Lag (ARDL) proposed by Pesaran et al. (2001) is used to test for cointegration between variables while the modified version of Granger Causality test proposed by Toda and Yamamoto (TY) (1995) is utilised to determine the direction of causality. The bounds test to cointegration reveals long-run relationship between economic growth proxied by real Gross Domestic product (GDP) and public expenditure components. The results of TY Granger Causality indicate bidirectional causality between education expenditure and economic growth as well as between capital expenditure and economic growth which validates both the Wagner's Law and Keynesian Law. Thus, the government of the Republic of Namibia should continue increasing the public expenditure on education and capital goods as there is simultaneous cause and effect between economic growth and public expenditure on both education and capital goods based on the results of this study.

Keywords: Public Expenditure, Economic Growth, Wagner's law, Namibia, South Africa

JEL Classification: H5; O4.

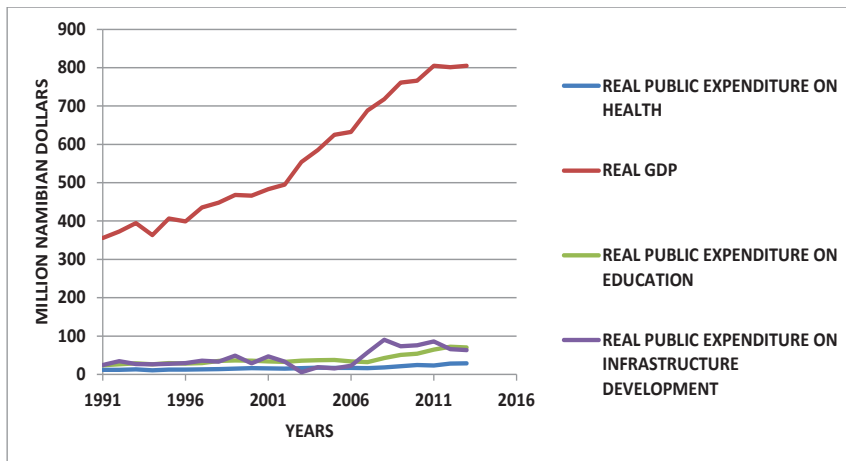* Corresponding Author. University of Namibia. Email: eziramba@unam.na.

1. INTRODUCTION

Over the past years Namibia has witnessed an upsurge in public expenditure just like most developing countries in the world. This consistent and rapid growth in public expenditure has been driven by the desire to meet the Vision 2030 goal for which Namibia is expected to become a prosperous and industrialized nation by 2030 (Ziramba & Dembure, 2015).The chosen public expenditure components have received considerable shares of National budget allocations over the years. The trends in real GDP and the public expenditure on these sectoral expenditures are depicted in Figure 1. In spite of this continuous increase in public expenditure, one question which remains a puzzle among many people is: does the continuous increase in public expenditure lead to high levels of economic growth which can enable the country to meet its Vision 2030 goal? This question is discussed in this research with special focus on education, health and capital expenditures. The ability to correctly identify the direction of causality between public expenditure and economic growth is of essence in government expenditure policy design and implementation as it can help Namibia in effectively allocating its resources among different sectors based on growth context. The debate on the nexus of public expenditure and economic growth has received some considerable research over the years and is still an unresolved issue both theoretically and empirically. The theoretical basis of the direction of causality between public expenditure and economic growth is two-fold that is, the Wagner's proposition and the Keynesian proposition. Wagnerian is validated if the direction is from economic growth to public expenditure. In this regard, higher income implies that there is more money to spend, for instance, on education, health and infrastructure development. Conversely, the Keynesian proposition is validated if the direction is from public expenditure to economic growth. For instance, rises in public expenditure such as on health and education possibly increase labour supply and productivity which eventually leads to higher income (Boussalem *et al.* 2014). There are numerous empirical studies which have tested the validity of Wagner and Keynesian hypotheses both at single and cross-country level. These include Bagdigen and Cetintas (2003), Ziramba (2008), Kesavarajah (2009), Gurgul and Lach (2010), Rauf *et al.* (2012), Yilgor *et al.* (2012), Chiawa *et al.* (2012), Gangal and Gupta (2013), Ebaidalla (2013), Boussalem *et al.* (2014), Abu-Eideh (2015), and Simiyu (2015).

Despite the abundance of empirical studies, there is no consensus on the direction of causality between public expenditure and economic growth and Namibia is not an exception. The difference in findings can be attributed to the different methodologies utilised, variables used, the sample size and countries used. This current research differs to previous studies in that it utilizes the Toda-Yamamoto (TY) Causality Approach because of its superiority to the Ordinary Granger Causality. The TY does not require pre-testing of variables for cointegration and also suitable for the standard VAR whereby the variables can be estimated in their levels rather than the first difference. Furthermore, this current research also utilizes the bounds test to cointegration also known as Autoregressive Distributed Lag (ARDL) proposed by Pesaran *et al.* (2001) for the period 1991-2013. The period 1991-2013 is chosen in this study due to availability of published data on the variables considered in this study for the period under review. The bounds test to cointegration is utilised in this study as it is more efficient in a small sample size as in our case. Furthermore, it does not require the variables to be integrated of the same order and still applicable even when variables show signs of endogenous properties as it makes corrections for any residual serial correlations as argued by Pesaran *et al.* (2001). Although Ziramba (2008) utilised the same methodology, the study focused on total expenditure and not public expenditure components. Public expenditure on education, health and infrastructure are considered in this research as they continue to receive a large portion of the Namibia national budget allocation and are widely considered in the existing empirical literature. Furthermore, Ziramba (2008) focused on South African economy while this current study focuses on Namibian economy. Apart from this, most of the previous studies focused on bivariate models (using two variables) whilst this current study focuses on multivariate model. Bivariate models usually lead to omitted variable problems such as biased and inconsistent estimators (Gujarati, 2003). In addition to this, most previous studies focused on total expenditure while this current study focuses on sub-categorical or sectoral expenditure. Moreover, to our best knowledge there is no research which has been done so far in Namibia with regard to testing validity of Wagner's law which is another contribution of this current study.

2. OVERVIEW OF PUBLIC EXPENDITURE AND GDP IN NAMIBIA

Namibia is ranked as a middle income country and one of the most industrializing countries in Africa (Ziramba & Kavezeri, 2012). Since the country obtained its political independence in 1990, the government of the Republic of Namibia has embarked on an expansionary fiscal policy as a way creating employment, fighting poverty, reduce inequality in the country and ultimately improving the standard of living of the residents. Key sectors which have received considerable government funds over the past years include infrastructure development, education and health. Although, the country has experienced continual increases in the public expenditure over the years, most analysts are skeptical on whether this trend can be transformed into sustainable economic growth which can enable the country to achieve its Vision 2030. The trend in sectorial public expenditure and real GDP for the period under review is depicted in Figure 1 below.

Figure 1: The trend in Real Gross Domestic Product (GDP), real public expenditure on health, real public expenditure on education and real public expenditure on infrastructure development.

Source: Own elaboration based on data from World Bank (1990-2013) and Bank of Namibia Annual Reports, Various Years.

As depicted in Figure 1, public expenditures on infrastructure development and education tends to follow the same pattern as GDP which gives the impression of Wagner's and Keynesian hypothesis suggest. However, this is an early assumption and cannot here be interpreted further. Public expenditure recently picked up in 2011 as the government introduced the Targeted Intervention Programme for Employment and Economic Growth (TIPEEG) which was expected to create 104 000 new jobs by 2014 (Duddy, 2011).

3. THEORETICAL AND EMPIRICAL LITERATURE

The causality of public expenditure (PE) and economic growth (EG) is like the typical egg and chicken scenario. Is it from PE to EG or from EG to PE? The theoretical basis for the direction of causality of public expenditure and economic growth is two-fold, that is, Wagner and Keynesian argument (Yilgor *et al*., 2012). Wagner (1883) postulate that public expenditure is a consequence of economic growth, thus an increase in economic activity would lead to increase in public expenditure. Conversely, Keynesian ideology is based on the work of Keynes (1936) who sees demand as the prerequisite for growth. Keynes claimed that public expenditure did not increase as a result of increases in economic activities but that economic activities increased as a result of public expenditure (Yilgor, *et al*., 2012). In this regard public expenditure is viewed as a necessary tool adopted by government to reverse economic downturn by borrowing money from the private sector and then returning the money to the private sector through various spending programs (Oyinlola & Akinnibosim, 2013). Therefore, economic growth is seen as a consequence of public expenditure. Up to date there are a number of studies which have empirically tried to evaluate the validity of the Wagner's and Keynesian proposition on a single and cross country. Some of the notable empirical studies are summarized in Table 1 in the appendix section. Some studies utilised total expenditure and others subcategory or sectoral expenditure. For those who utilised total public expenditure, Gurgul and Lach (2010), Yilgor *et al*. (2012), Gangal and Gupta (2013), and Ebaidalla (2013) found the validity of the Keynesian law in Poland, Turkey, India and Sudan respectively while the study by Chiawa *et al*. (2012) found the validity of the Wagner's hypothesis in Nigeria. However, the studies by Bagdigen and Cetintas (2003), and Rauf *et al*. (2012) found neither Keynesian nor Wagner's law to be valid in Turkey and Pakistan respectively while Ziramba (2008) and Abu-Eideh (2015) found bidirectional causality between public expenditure and economic growth in South Africa and

Palestine respectively. For those who utilised sectoral expenditures, Simiyu (2015) found no causality between public expenditure components and economic growth in Kenya using health, military and infrastructure expenditure which is in contrast to findings by Boussalem *et al.* (2014). Boussalem *et al.* (2014) found validity of Wagner's law in the Algerian context using public expenditure on health as the independent variable and GDP per capita as the dependable variable. Kesavarajah (2009) found validity of both the Wagner's law and Keynesian between public expenditure on health and economic growth in Sri Lanka but only validity of Keynesian law between public expenditure on education and economic growth. Despite this plethora of empirical studies, it can be noted that there is no consensus on the direction of causality between public expenditure and economic which is the literature gap to be filled in this research.

4. METHODOLOGICAL ISSUES

Based on the theoretical and empirical literature presented above, we specify our general model specification following Kesavarajah (2009), Boussalem *et al.* (2014) and Simiyu (2015) to determine the relationship between public expenditure and economic growth as follows:

$$\ln RGDP_t = \beta_0 + \beta_1 \ln RCPX_t + \beta_2 \ln REDX_t + \beta_3 \ln RHEX_t + e_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(l)}$$

Where: $\ln RGDP_t$ is the natural logarithm of the real GDP per capita at time t; $\ln RCPX_t$ is the natural logarithm of real public capital expenditure per capita as proxied by the gross fixed capital formation per capita minus the gross fixed private capital formation per capita, $\ln REDX_t$ is the natural logarithm of public expenditure on education per capita; $\ln RHEX_t$ is the natural logarithm of public expenditure on health per capita and e_t is the random error term which is introduced to accommodate the effect of other factors influence economic growth that are not included in the model. Data on these variables were obtained from the World Bank (1991-2013) and various annual reports of the Bank of Namibia. The variables were in nominal form and were deflated using the GDP deflator.

4.1 Testing for cointegration

Cointegration between variables can be seen as necessary for Wagner's law though not sufficient condition. If two or more time series are cointegrated, then there must be Granger causality

between them which can either be one way or bidirectional. In this paper we use the bounds testing approach for cointegration suggested by Pesaran *et al*. (2001). The ARDL approach is preferred in this study to other cointegration tests as it does not require the variables to be integrated of the same order. In this regard, the method does not require pre-testing of variables to determine the order of integration although it is inappropriate when the variables are integrated of order two or more. Therefore, pre-testing of unit root of variables is done to verify that none of the variables is integrated of order two or more. Another advantage is that the bounds testing for cointegration is more efficient in a small sample size as the case in this study. Apart from this, the method is still applicable even when variables show any signs of endogenous properties as it makes corrections for any residual serial correlation (Pesaran *et al*., 2001). The bounds test for cointegration starts from estimating the unrestricted error-correction model of the following form:

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta \ln RGDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta \ln RCPX_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta \ln REDX_{t-i}$$

$$+ \sum_{i=0}^{n} \alpha_{4i} \Delta \ln RHEX_{t-i} + \varphi_1 \ln RGDP_{t-1} + \varphi_2 \ln RCPX_{t-1} + \varphi_3 \ln REDX_{t-1}$$

$$+ \varphi_4 \ln RHEX_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where: Δ represents the first difference operator; ε_t is the error term which is assumed to be white noise and other variables are defined in equation (1)

The bounds test to cointegration is based on the null hypothesis of no cointegration against alternative hypothesis of cointegration as set below which can be determined using the Wald or F-statistics. In this study we test the null hypothesis by means of F-statistics.

Null Hypothesis $\quad\quad\quad H_0 : \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$

Alternative Hypothesis $\quad H_1 : \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq 0$

To test the joint significant of the coefficients of the lagged variables in equation (2) above, the F-statistic value is compared against the two critical value bounds (upper and lower bounds) developed by Pesaran *et al*. (2001). The upper bound applies when all the variables are integrated of order one, I(1) while lower bound assume all the variables are integrated of order zero, I(0). If the calculated F-statistics value exceeds the upper bound, then the null hypothesis of no cointegration is rejected. If the calculated F-statistics value is lower than the lower bound critical value, then the null hypothesis cannot be rejected. However, conclusive inference with

regards to cointegration cannot be reached if the calculated F-statistics falls within the critical bounds. The values of the critical bounds in this study are taken from Narayan (2005).

4.2 Granger Causality Test

To investigate the causality relationship between public expenditure and economic growth in Namibia, this study employed the Toda-Yamamoto (TY) causality approach. The TY is the modified version of the Ordinary Granger Causality. The TY has been employed in this research for the following reasons:

i) Recent research, for instance Ziramba (2008), Chiawa *et al*. (2012) and Rauf *et al*. (2012) has found the TY to be superior to the Ordinary Granger Causality as it does not require the pre-testing of variables for cointegration. This implies that researchers do not have to test for cointegration of the variables. Therefore, the TY helps in overcoming the problem of asymptotic critical values when causality tests are done in the presence of non-stationarity or no cointegration. Besides this, the TY minimize the risks associated with the possibility of wrongly identifying the order of integration of the variables. Furthermore, the TY approach is applicable for any arbitrary levels of integration for the variables.

ii) It is suitable for the standard VAR whereby the variables can be estimated in their levels rather than the first difference as in the case with the Ordinary Granger Causality and therefore researchers do not need to transform VAR into Vector Error Correction Mechanism (VECM).

The use of the TY causality approach involves 3 stages:

1) Determination of the maximum order of cointegration

The first step involves the testing of the time series to determine the maximum order of integration (d_{max}) of the variables in the system using the Augmented Dick Fuller (ADF), Phillips-Perron (PP) or the Kwaiatkowski, Phillips, Schmidt and Shin (KPSS) Tests. For the ADF and PP the null hypothesis is non-stationarity whilst for the KPSS the null hypothesis is that of stationarity.

2) Determination of the optimal lag length (p)

The p is always unknown and has to be obtained from the VAR estimation of the variables in their levels. The p can be determined using different lag length criterion such as the Akaike's Information Criterion (AIC), Schwarz Information Criterion (SC), Final Prediction Error(FPE) and the Hannan Quinn (HQ) Information Criterion.

3) Testing for causality

This is done by using the Modified Wald (MWALD) Procedure to test for the VAR (k). The optimal lag length is equal to $k = (p + d_{\max})$. The MWALD test has an asymptotic chi-squared distribution with p degrees of freedom in the limit when a $VAR(p + d_{\max})$ is estimated.

To test for TY causality between two variables, the following bivariate VAR (k) model is constructed:

$$X_t = \alpha_1 + \sum_{i=1}^{h+d} \beta_{1i} X_{t-i} + \sum_{j=1}^{l+d} \delta_{1j} Y_{t-j} + \varepsilon_{1t} \text{\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots}(3)$$

$$Y_t = \alpha_1 + \sum_{i=1}^{h+d} \beta_{2i} Y_{t-i} + \sum_{j=1}^{l+d} \delta_{2j} Y_{t-j} + \varepsilon_{2t} \text{\dots\dots\dots\dots\dots\dots\dots\dots\dots}(4)$$

Where: d is the maximum order of integration

h and d are the optimal lag length

ε_{1t} and ε_{2t} are the errors terms which are assumed to be white noise.

For the bivariate VAR equation (3) above, the null (H$_0$) and alternative (H$_1$) hypotheses are specified as follows:

$H_0 : Y_t$ does not Granger cause X_t , if $\sum_{j=1}^{l} \delta_{1j} = 0$

$H_1 : Y_t$ does Granger cause X_t , if $\sum_{j=1}^{l} \delta_{1j} \neq 0$

For the bivariate VAR equation (4) above, the null (H_0) and alternative (H_1) hypotheses are specified as follows:

$H_0 : X_t$ does not Granger cause Y_t, if $\sum_{j=1}^{l} \delta_{2j} = 0$

$H_1 : X_t$ does Granger cause Y_t, if $\sum_{j=1}^{l} \delta_{2j} \neq 0$

The causality between two variables can be described as unidirectional, bidirectional or no causality.

- Unidirectional causality occurs when either null hypothesis of equation (3) or equation (4) is rejected. For example, if we reject the null hypothesis of equation (3) and accept null hypothesis of equation (4), then we can conclude that changes in Y_t are caused by changes in X_t **OR** if we fail to reject the null hypothesis of equation (3) and reject the null hypothesis of equation (4), then we can conclude that changes in X_t are caused by changes in Y_t

- Bidirectional causality exists when both null hypotheses of equation (3) and equation (4) are rejected.

- No causality exists if neither null hypothesis of equation (3) or (4) is rejected.

5. **EMPIRICAL RESULTS**

Pre-testing for statistical properties of the variables such as non-stationarity test for time series data is important to avoid spurious results. The unit root test results for the variables used in this research is presented in Table 2 below. The unit root test results indicate that all the variables are integrated of order one, I (1).

Table 2: Results for Unit Root Tests using the Augmented Dickey-Fuller Test

Variable	Levels			First Differences		
	None	Constant	Constant &Trend	None	Constant	Constant &Trend
ln*RGDP*	3.163	1.230	-1.704	-1.361	-3.716**	-4.808**
	(-1.957)	(-3.005)	(-3.633)	(-1.959)	(-3.012)	(-3.645)
ln*RCPX*	1.729	-1.048	-2.641	-1.514	-6.537**	-6.468**
	(-1.95)	(-3.005)	(-3.633)	(-1.960)	(-3.012)	(-3.645)
ln*REDX*	1.344	-0.099	-1.127	-3.534**	-3.632**	-3.901**
	(-1.957)	(-3.005)	(-3.633)	(-1.958)	(-3.012)	(-3.658)
ln*RHEX*	1.061	-0.222	-2.009	-5.723**	-6.081**	-6.751**
	(-1.957)	(-3.005)	(-3.633)	(-1.958)	(-3.012)	(-3.645)

Notes: Number in parentheses are the critical values at 5% level of significance. ** indicate significance at 5% level.

5.1 Cointegration test results

The results in Table 2 above indicates that none of the variables is integrated of order two, I(2) or more and thus appropriate to use the bounds testing to cointegration in this case. To get the calculated F-statistics value to be compared against the two critical bounds values, a parsimonious model is estimated based on equation (2). Following Hendry's techniques we initially introduced a lag length of 2 and then gradually dropped the most insignificant variables (Hendry *et al*., 1984). Based on the parsimonious model, the calculated F-statistic value of 11.485 is found to be greater than both the upper bound critical value of 5.018 and lower bound critical value of 3.710 at 5% level of significance for case III: unrestricted intercept and no trend, with three regressors (k=3) which is taken from Narayan (2005). The results of the bounds test to cointegration are shown in Table 3 below. In this regard, the null hypothesis of no cointegration is rejected and we establish that there is a long run relationship between economic growth as

proxied by real GDP and public expenditure components (capital, education and health expenditure) which is necessary though not sufficient condition for Wagner's law. The Granger causality is then carried out to determine the direction of causality between public expenditure and economic growth in order to have concrete conclusion on the validity of Wagner's law. The parsimonious model was subjected to diagnostic tests to ensure that the model is statistically well behaved. The residuals should be normally distributed, homoskedastic and not serially correlated. The normality test carried out by Jarque-Bera (JB) indicates that the residuals are normally distributed while the Breusch-Pegan-Godfrey heteroskedasticity test results indicate that the residuals are homoskedastic. The results of the Breusch-Godfrey Serial Correlation LM test indicate that the residuals are serially uncorrelated.

Table 3: Bounds test cointegration results

	Critical value bounds of the F-Statistics at :					
	10%		5%		1%	
k	I(0)	I(1)	1(0)	I(1)	I(0)	I(1)
3	3.008	4.150	3.710	5.018	5.333	7.063
Calculated F-Statistics: (RGDP|RCPX,REDX,RHEX) 11.485**						

Notes: **indicate significance at 5% level. The critical values are taken from Narayan (2005) for 30 observations, Case 111: Unrestricted intercept and no trend

5.2 Granger Causality test results

The Toda-Yamamoto Granger Causality approach is utilised to determine the direction of causality between public expenditure and economic growth. The first step in TY approach is the estimation of the maximum order of integration (d_{max}) in the system. The results of the unit root test in Table 2 above indicate that the order of integration is one, I (1). This means the VAR Models will add one extra lag. After determining the maximum order of integration, the next step involves determining the optimal lag length as explained in the methodology section. The optimal lag length was selected based on different lag length criterions such as Akaike's Information Criterion (AIC), Schwarz Information Criterion (SC), Final Prediction Error (FPE) and the Hannan Quinn (HQ) Information Criterion. The results of the different lag length selection criteria are shown in Table 4 below. As shown in Table 4, the lag length selected by the

different selection criterion indicates lag length of 1. However, when we examined the residuals and apply the LM test for serial correlation, we found that there was serial correlation at this chosen lag length. This serial correlation was removed if we increased the maximum lag length to 2. Therefore, the value of p in this study is equal to 2. We also tested for the stability of the VAR model by checking the results of the inverse roots of the characteristic AR polynomial and found that the VAR is well behaved as all the values lie within the circle. The modulus values were less than 1 which satisfies the VAR stability condition. We then estimated the VAR with lag length of 3, that is, $\left(p + d_{max}\right)$ equal to 3. For the VAR (3), the systems of equations were estimated using the Seemingly Unrelated Regression (SUR). We applied the Standard Wald tests for the VAR (p) coefficients matrix to conduct the inference on Granger Causality, that is, the VAR was estimated with restrictions placed on lagged terms up to the pth lag.

Table 4: VAR Lag Length Selection Criteria

Lag	LR	FPE	AIC	SC	HQ
0	NA	1.32e-08	-6.790490	-6.591534	-6.747311
1	88.54077*	2.49e-10*	-10.80048*	-9.805695*	-10.58459*
	17.42961	3.26e-10	-10.72914	-8.938527	-10.34053

Notes: *Indicates lag order selected by the criterion

The results of Granger Causality based on the TY estimated by the MWALD test are reported in Table 5. The results in Table 5 below indicate that the test follows the chi-square distribution with 2 degrees of freedom which is in accordance with appropriate lag length. The results of the TY Granger causality indicate that we can reject both the null hypothesis that capital expenditure (investment) does not Granger cause economic growth and the null hypothesis that economic growth does not granger cause capital expenditure at 5% level of significance. Thus, we can conclude that there is bidirectional between public capital expenditure and economic growth which validates both the Wagner's law and Keynesian hypothesis and consistent with findings by Ziramba (2008) and Abu-Eideh (2015).

Table 5: Toda –Yamamoto Causality (modified WALD) Test Results

Null hypothesis	Chi-sq	d.f.	Probability	Granger Causality
RCPX does not Granger cause RGDP	23.709	2	0.000	Bidirectional causality
RGDP does not Granger cause RCPX	52.089	2	0.0000	RCPX ⟵ RGDP
RHEX does not Granger cause RGDP	3.78	2	0.151	No causality
RGDP does not Granger cause RHEX	0.728	2	0.695	
REDX does not Granger cause RGDP	41.156	2	0.000	Bidirectional causality
RGDP does not Granger causes REDX	11.465	2	0.003	REDX ⟶⟵ RGDP
RHEX does not Granger cause RCPX	7.126	2	0.028	Bidirectional causality
RCPX does not Granger cause RHEX	27.567	2	0.000	RHEX ⟵ RCPX
REDX does not Granger cause RHEX	14.119	2	0.001	Unidirectional causality
RHEX does not Granger cause REDX	2.7914	2	0.248	REDX ⟶ RHEX
REDX does not Granger cause RCPX	4.026	2	0.134	Unidirectional causality
RCPX does not Granger cause REDX	8.322	2	0.016	RCPX ⟶ REDX

Source: Own elaboration based on Eviews 6 results

The TY Granger causality results also indicates that we cannot reject both the null hypothesis that public expenditure on health does not granger cause economic growth and the null hypothesis that economic growth does not granger cause public expenditure on health. Thus, we can conclude that there is no causality between public expenditure on health and economic growth which refutes both the Wagner's and Keynesian Hypotheses which is consistent with findings by Chiawa *et al*. (2012) and Simiyu (2015). A possible explanation for this finding is that a large part of the Namibian government expenditure on health is made on non-

developmental issues like high salaries of health personnel which is due to shortage of skilled health personnel in the country. As shown in Table 5 above, The TY Granger Causality results also indicate that we can reject both the null hypothesis that public expenditure on education does not cause economic growth and the null hypothesis that economic growth does not granger cause public expenditure on education at 5% level of significance. Thus, we can conclude that there is bidirectional between public expenditure on education and economic growth which validates the Wagner's law and Keynesian hypothesis which consistent with findings by Ziramba (2008) and Abu-Eideh (2015). The TY results also indicate that we can reject both the null hypothesis that public expenditure on health does not granger cause public expenditure on capital and the null hypothesis that public expenditure on capital does not granger cause public expenditure on health at 5% level of significance. Thus, we can conclude that there is bidirectional between public capital expenditure and public expenditure on health. At the same time, the results also indicate that we cannot reject the null hypothesis that public expenditure on health does not cause public expenditure on education but reject the null hypothesis that public expenditure on education does not granger cause expenditure on health. Therefore, we can conclude that there is unidirectional causality between expenditure on education and health expenditure which runs from education to health. The results also indicate that we cannot reject the null hypothesis that expenditure on education does not granger cause expenditure on capital goods but reject the null hypothesis that expenditure on capital goods does not granger cause education at 5% level of significance. Thus, we can conclude that there is unidirectional causality between expenditure on capital goods and education expenditure which runs from capital expenditure to education.

6. CONCLUSION AND POLICY IMPLICATIONS

In this paper we empirically examined the validity of Wagner's law with regard to the causality of direction between public expenditure and economic growth in Namibia for the period 1991-2013 specifically focusing on public expenditure on education, health and capital goods. We employed the bounds test to cointegration proposed by Pesaran *et al*. (2001) to test for cointegration between the variables which is the necessary though not sufficient condition for determining causality. The bounds cointegration results reveal long-run relationship between economic growth as proxied by real GDP and the public expenditure components. The modern

version of the Granger Causality proposed by Toda and Yamamoto (TY) (1995) is preferred because of its superiority to the ordinary Granger causality. The TY Granger does not require pre-testing of variables for cointegration and also suitable for the standard VAR whereby the variables can be estimated in their levels rather than the first differences. The major findings from the Toda-Yamamoto (TY) Granger Causality test are that there is bidirectional causality between public expenditure on education and economic growth as well as between public expenditure on capital goods and economic growth. It can be concluded that both the Wagner's law and Keynesian hypothesis are valid in the Namibian context. The policy implication for these findings are that the government of the Republic of Namibia should continue increasing the expenditure on education and capital goods as there is simultaneous cause and effect between economic growth and public expenditure on education and capital goods which in turn can help the country to meet its Vision 2030 whereby the country is anticipated to be an industrialized nation by 2030.

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APPENDIX

Table 1: Summary of the empirical studies on the direction of causality of public expenditure (PE) and economic growth

Authors	Country investigated	Period	Variables	Methodology	Conclusion
Bagdigen and Cetintas (2003)	Turkey	1965-2000	GDP, GDP per Capita, Total Public Expenditure , Expenditure per capita	Ordinary Granger Causality	PE ≠ GDP
Ziramba (2008)	South Africa	1960-2006	Total Government Expenditure per capita, GDP per capita	TY Granger Causality	PE ⇄ GDP
Kesavarajah (2009)	Sri Lanka	1977-2009	GDP, Education(EDU), Health(HEL), Defense, Transport and Communication expenditure	Standard Granger Causality	EDU → GDP HEL ⇄ GDP
Gurgul and Lach (2010)	Poland	2000-2008	GDP, Total Budgetary expenditure	TY Granger Causality	PE → GDP
Rauf, Qayum and Zaman (2012)	Pakistan	1979-2009	GDP, GDP Per Capita, Government Expenditure(GE), GE/GDP, GE per capita	TY Granger Causality	PE ≠ GDP
Yilgor, Ertugral and Celepcioglu (2012)	Turkey	1980-2010	GDP, Current Expenditure, transfer and Total expenditure	Ordinary Granger Causality	PE → GDP
Chiawa, Torruam and Abur (2012)	Nigeria	1970-2008	GDP, Total Recurrent, Total Capital Expenditure	TY Granger Causality	GDP → PE
Gangal and Gupta (2013)	India	1998-2012	GDP, Total Public Expenditure	Ordinary Granger Causality	PE → GDP
Ebaidalla (2013)	Sudan	1970-2008	GDP, Total Government Expenditure	Standard Granger Causality	PE → GDP
Boussalem, Boussalem and Taiba (2014)	Algeria	1974-2014	GDP Per capita, Public spending on health	Ordinary Granger causality	GDP → PE
Abu-Eideh (2015)	Palestine	1994-2013	GDP, GDP Per Capita, Public Expenditure, Public Expenditure per capita, Public Exp/GDP	Ordinary Granger Causality	PE ⇄ GDP
Simiyu (2015)	Kenya	1963-2012	GDP growth, Health, Military, Infrastructure Expenditure	Ordinary Granger Causality	PE ≠ GDP

Notes: →, ⇄ and ≠ represent unidirectional causality, bidirectional causality and no causality respectively. Abbreviations are defined as follows: GDP= real Gross Domestic Product, PE= Public Expenditure.