

**THE RELEVANCE OF WAGNER'S LAW TO ZAMBIA (1980-2013).**

**BY**

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**A DESSERTATION SUBMITTED TO THE UNIVERSITY OF ZAMBIA IN PARTIAL  
FULFILMENT OF THE REQUIREMENTS OF A MASTER OF ART DEGREE IN  
ECONOMICS.**

**THE UNIVERSITY OF ZAMBIA**

**LUSAKA**

**2015**

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## DECLARATION

I, NOTULU SALWINDI, hereby declare that this dissertation represents my own research work and that it has not been previously submitted for a degree at this or any other university.

Signed:.....

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## APPROVAL

This dissertation of Notulu Salwindi has been approved as fulfillment of partial requirements for the award of master of art degree in economics from the University of Zambia.

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## ABSTRACT

Wagner (1883), predicted that economic growth would be accompanied by an increase in state activity (growth of government Spending). Thus, the causality according to Wagner's law is running from economic growth to government spending. This study focuses on how relevant the theory postulated by Wagner can apply to the Zambian situation. The statistical software package used for all the analysis in the study is STATA (12.1). The study made use of annual secondary time series data from the World Bank database for the period 1980 to 2013. The variables used are all in real terms and were logged so as to achieve stationarity in lower levels and allow for the easy interpretation of the elasticities obtained. The first step in the analysis was the determining of the stationarity of the variables and we found the data was non-stationary but became stationary after first differencing. We then proceeded to test for cointegration; the results showed that our variables are not cointegrated. This allowed us to proceed in using the ordinary least squares method for estimation. The study used four versions out of the six versions of Wagner's law. The results show that economic growth is significant in influencing government expenditure in two versions of Wagner's law while the other two versions had invalid results.

Furthermore, Granger causality test were used to show the direction of the relationship between the variables and the results indicate that economic growth Granger causes government spending in the Peacock-Wiseman and Goffman models. There is a one-direction relationship from economic growth to government spending in the analysis. The results also proved that Wagner's law is valid for Zambia as the coefficient of economic growth was greater than one as postulated by the Peacock-Wiseman and Goffman models. It is important to note that Wagner stated that this relationship would hold irrespective of the prevailing situation hence the use of just two variables only. Emphasis must be made that the author tried introducing other variables that could affect government expenditure like population, structural adjustment programmes (SAPs), fluctuations in copper prices, even the use of dummy variables. All these variables did not significantly influence the results or change them by greater margins. This therefore strengthened Wagner's belief that the use of just the two variables was enough irrespective of the prevailing situation (in the appendix there are regression tables where population was included as an independent variable and the result prove this point).

The above results indicate that Wagner's law can be used for policy analysis and justification of increasing government expenditure with the increase in economic activity. In addition, the model stipulates that increase in government expenditure is due to increase in social spending on education, health and social protection, a condition suited for Zambia. Furthermore, the study recommends further research on this topic using a variety of appropriate econometric procedures so as to have a sufficient pool of knowledge from which policy analyst can consult when instituting certain policies to do with public expenditure and economic growth. The paper clearly shows that Wagner's law is relevant to Zambia.

## **DEDICATION**

TO MY MUM AND TWO SONS.

Ms. MARTHA BEENE MAPANZA

THANDO SALWINDI NOTULU

JOHN SALWINDI NOTULU

## ACKNOWLEDGEMENTS

The glory, praise and gratitude go to the almighty Jehovah God for having provided the life, wisdom and strength to see this through.

To the woman who is the pillar in my life, Ms. Martha Mapanza my mother, your belief in me, morale and financial support throughout my education has enabled this journey to be fruitful and to reach this far. I say thank you very much.

Professor Seshamani my supervisor, the insightful and intellect contribution throughout the working of this paper was greatly appreciated. The timeframe was limited but you endeavored to put your valuable input nevertheless.

I would also like to thank my friends and family particularly my sister Marion Mapanza, Gift, Musonda, Mulyokela, Mundia, Bravo, Zoombe and Margaret. The help and guidance on several issues of school and life were greatly recognized and appreciated.

Lastly, I would like to thank all the members of staff at the department of economics at the University of Zambia for the encouragements and the knowledge you shared with me in my pursuit of a master of art degree in economics. Thank you all.

## TABLE OF CONTENTS

List of Tables .....	x
List of Figures .....	xi
List of Abbreviations.....	xii
<b>CHAPTER ONE: INTRODUCTION</b>	
1. INTRODUCTION.....	1
1.1 BACKGROUND TO GOVERNMENT EXPENDITURE IN ZAMBIA.....	3
1.2 BACKGROUND TO ECONOMIC GROWTH IN ZAMBIA.....	4
1.3 PROBLEM STATEMENT.....	6
1.4 OBJECTIVES.....	8
1.5 HYPOTHESIS.....	9
1.6 SIGNIFICANCE OF THE STUDY.....	9
<b>CHAPTER TWO: LITERATURE REVIEW</b>	
2.1. THEORETICAL LITERATURE REVIEW .....	11
2.2. EMPIRICAL LITERATURE REVIEW.....	14
<b>CHAPTER THREE: METHODOLOGY</b>	
3.1 DATABASE.....	21
3.2 MODEL SPECIFICATION.....	21
3.2.1 ELASTICITY ESTIMATES.....	21
3.2.2 UNIT ROOT TESTS.....	22
3.2.3 JOHNSEN COINTEGRATION MODEL.....	23
3.2.4 ORDINARY LEAST SQUARES (OLS).....	23
3.2.5 POST-ESTIMATION DIAGNOSTIC TESTS.....	24
<b>CHAPTER FOUR: RESULTS AND DISCUSSION</b>	
4.1 DESCRIPTIVE STATISTICS.....	25

4.2. UNIT ROOT TESTS.....	25
4.3. TEST FOR COINTEGRATION.....	26
4.4. ORDINARY LEAST SQUARES.....	28
4.5. GRANGER CAUSALITY TESTS.....	30
4.6. POST DIAGNOSTIC TESTS.....	31
<b>CHAPTER FIVE: CONCLUSIONS AND POLICY IMPLICATIONS</b>	
5.1. CONCLUSION.....	33
5.2. LIMITATIONS.....	34
5.3. RECOMMENDATIONS.....	34
<b>REFERENCES.....</b>	<b>35</b>
<b>APPENDICES.....</b>	<b>41</b>

## LIST OF TABLES

Table.1: Descriptive statistics of the data.....	25
Table.2: ADF and PP tests for unit root with constant and trend (5% critical value-lag (1)).....	26
Table.3: Johansen test for cointegration for the Peacock-Wiseman Version (Lag 4)....	27
Table.4: Johansen test for cointegration for the Mann Version (lag 2).....	27
Table.5: Johansen test for cointegration for the Musgrave Version (lag 2).....	27
Table.6: Johansen test for cointegration for the Goffmann Version (lag 4).....	28
Table.7: Ordinary least squares results (fully modified).....	28
Table.8: Granger Causality Wald test.....	30
Table.9: Post estimation Diagnostic tests.....	31
Table.10: Wald's test of Hypothesis.....	32

## LIST OF FIGURES

Figure.1: Log of Govt Expenditure from 1980-2013.....	4
Figure.2: Log of GDP from 1980-2013.....	6
Figure.3: Log of GDP and Log of Government Expenditure 1980-2013.....	8

## LIST OF ABBREVIATIONS

ADF	-Augmented Dick-Fuller
ARDL	-Autoregressive Distributed Lag
BOZ	-Bank of Zambia
EAZ	-Economic Association of Zambia
EU	-European Union
G	-Government expenditure
GDP	-Gross Domestic Product
GNP	-Gross National Product
IMF	-International Monetary Fund
OLS	-Ordinary Least Squares
PF	-Patriotic Front
PP	-Phillip-Perron
RESET	-Regression Specification Error Test
UK	-United Kingdom
USA	-United States of America
WB	-World Bank

# CHAPTER ONE

## INTRODUCTION

### 1. INTRODUCTION

The relationship between economic growth and government expenditure has been a subject of discussion among social scientists for many years. The causality relationship between the two has been a subject of debate among economists. Wagner (1883) predicted that economic growth would be accompanied by an increase in state activity (growth of government spending). A formulation of Wagner's "law", mentioned by Bird (1971), might run as follows: as per capita income rises in industrializing nations, their public sectors will grow in relative importance. Thus, the causality according to Wagner's law is running from economic growth to government spending. On the other hand, Keynesian hypothesis supports causality to run in the opposite direction from government spending to economic growth, which is in contrast with Wagner's law. This paper will focus on Wagner's law and its relevance to Zambia.

The so-called "Law of increasing state activity" maintained that there is both absolute and a relative expansion of the public sector (including central and local government's bodies and public enterprises) at the cost of the growth in the private sector (Wagner, 1911). This statistical association is interpreted in two ways. Firstly, Wagner's law points to a positive long-run co-movement between government expenditures and economic growth, while the second way, postulates a long-run elasticity of public spending above unity.

Further, Wagner's hypothesis emphasizes that, in the process of economic development, government economic activity increases relative to private economic activity. Wagner offers three reasons why this would be the case. Firstly, with economic growth industrialization and modernization would take place, which will diminish the role of public sector for private one. This continuous diminishing share of the public sector in economic activity leads to more government expenditure for regulating the private sector. Secondly, the rise in real income would

lead to more demand for basic infrastructure particularly education and health facilities. Wagner asserts, "it is the government who provide these facilities more efficiently than private sector". Thirdly, to remove monopolistic tendencies in the country and to enhance economic efficiency in those sectors where large amounts of investment are required, government should come forward and invest in those particular areas that will again increase public expenditure (Bird, 1971). It is important to note that Wagner was of the view that all the other factors such as political, social and economic situation prevailing in a country were of little importance to the significance of the relationship that exists between government expenditure and economic growth (Wagner, 1911).

Henrekson (1992) pointed out that the test of Wagner's law should focus on time series behavior of public expenditure in a country for as long (the time) as possible rather than on a cross-section of countries at different income levels. Despite the extensive empirical studies that have examined the validity of Wagner's law in different countries, the results have been mixed, inconsistent and inconclusive. For example, empirical analyses by Peacock and Wiseman (1961), Musgrave (1969), Michas (1975), Mann (1980), Ram (1986), Olomola (2004), Chang (2002), Aregbeyen (2006) as well as Goffman and Mahar (1971) confirmed strong support for Wagner's law. In his paper Chang (2002) focused on emerging industrialized countries for the period 1951-1996, and found support for the validity of Wagner's Law (Biyase and Zwane,2011).

On the other hand, there have been emerging threads of studies that have provided no evidence in the existence of Wagner's law. These studies include the works of Vatter and Walker (1986), Henrekson (1993), Ganti and Kolluri (1979), Hayo (1994), Murthy (1994), Babatude (2008), Chrystal and Alt (1979), Yuk (2005), Ram (1986), Bagdigen and Cetintas (2003). For example, researchers such as Henrekson (1993) conducted empirical analyses using two-stage cointegration but did not find support for the law in the case of Sweden. Similarly, Hondroyannis and Papapetrou (1995) used the Johansen co-integration method for Greece; they also failed to confirm support for Wagner's law (Biyase and Zwane, 2011)

According to Babatude (2008), the conflicting and mixed results obtained by different studies mentioned above can be attributed to the use of different statistical methods, different datasets and the impact of different stages of economic development of countries under investigation. A large number of these studies used time-series and cross-section data analyses when investigating

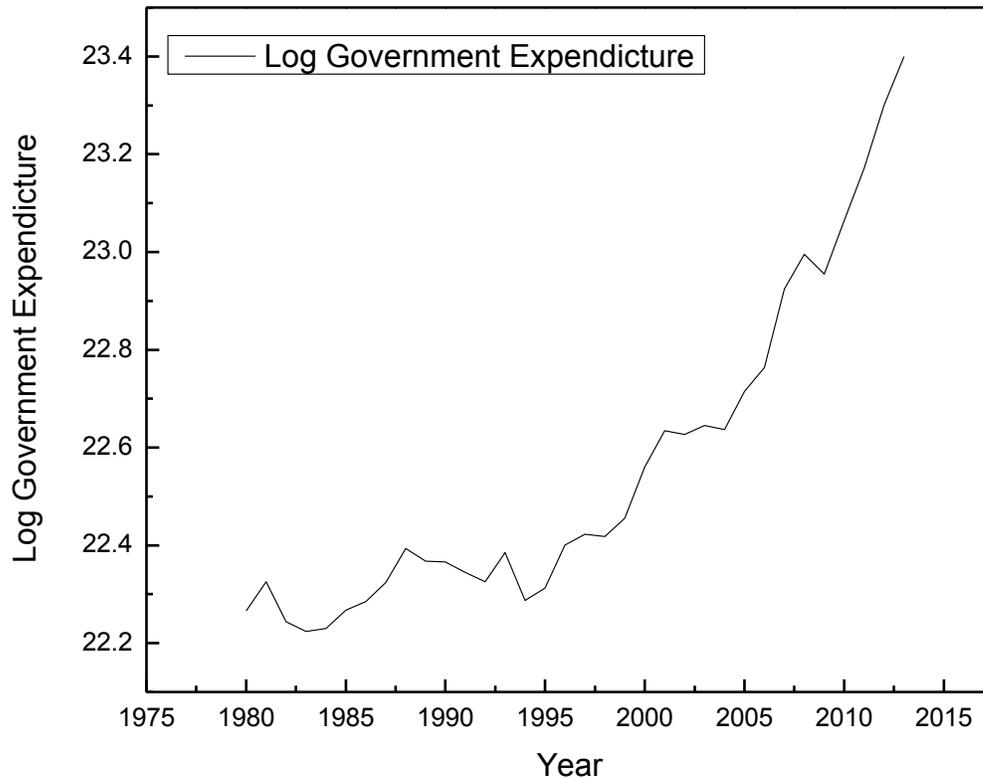
the existence of Wagner's law. Some of these studies used the two-step Engle-Granger cointegration test, the Johansen maximum likelihood procedure, McKinnon-White-Jack-Knife technique as well as the Dickey-Pentula sequential test. Another reason that might have contributed to the inconsistent and inconclusive results can also be the sample size and the number of control variables used, and these factors have created a very big gap in the literature (Biyase and Zwane, 2011). Consequently, this paper analyzed the relevance of Wagner's law to Zambia and provides some knowledge about government expenditure and economic growth in Zambia using the Peacock-Wiseman, Mann, Musgrave and Goffman versions of Wagner's law. The study also made use of Augmented Dick-Fuller (ADF) and Phillip-Perron (PP) for unit root tests, Johansen cointegration tests, Ordinary least squares method (OLS) and Granger causality tests.

## **1.1 BACKGROUND TO GOVERNMENT EXPENDITURE IN ZAMBIA**

Public expenditure is the expenditure incurred by the government authorities for the satisfaction of collective needs and economic and social welfare of the citizens of the country (Chand, 2003). Zambia's government expenditure (Total) had a growth of 1,094 (percentage) in the last 10 years from 2002 to 2012 and an average of 2.50 (billions of \$) in the same period. The combined share of education and health in total expenditure increased from 22.1 percent in 2000 to 25.7 percent in 2007; social protection also increased from 0.74 percent in 2000 to 2.96 percent in 2007. Improvements in spending on agriculture increased from 2 percent in 2000 to 7.6 percent in 2007 (World Bank, 2013).

Rapid growth in public sector from the 1960s to 1980s was reflected in the increases in both the infrastructure, number of employees and real pay in the sector. Between mid-1960s and mid-1980s, the total number of central government employees more than trebled in Zambia (World Bank, 2013). Two basic factors underpinned this rapid growth in public service numbers. First, the expansion in numbers was driven by the felt need to recruit staff to support growth in basic social services, especially education and health, these were benefits expected from the government following independence. Second, the government undertook to the role of employer of last resort for increasing numbers of school leavers in a period of rising urban unemployment (World Bank, 2013).

Figure 1: Log Government Expenditure from 1980- 2013



Source: World Bank Database (Graph by author)

## 1.2 BACKGROUND TO ECONOMIC GROWTH IN ZAMBIA

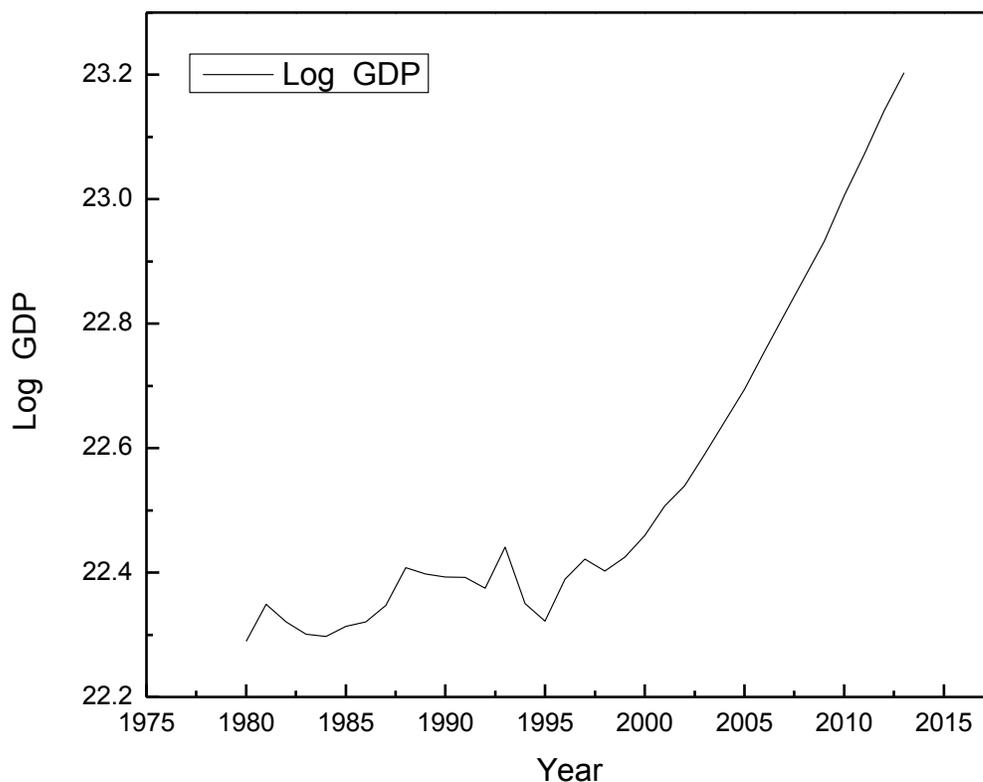
According to Sexton (2013), “Economic growth is an increase in the capacity of an economy to produce goods and services, compared from one period to another”. Economic growth represents the expansion of a country’s potential GDP or output (Samuelson and Nordhuas, 2010). For instance, if the social rate of return on investment exceeds the private return, then tax policies that encourage this can raise the growth rate and levels of utility. Growth models that incorporate public services show that the optimal tax policy lingers on the characteristic of services (Olopade and Olopade, 2010). Economic growth has provided insight into why states grow at different rates over time; and this influences government in her choice of tax rates and expenditure levels that will influence the growth rates. Growth means an increase in economic activities. Todaro

(1995) citing Kuznets defined a country's economic growth as a long-term rise in the capacity to supply increasingly diverse economic goods to its population, this growth capacity based on advancing technology and the institutional and ideological adjustment that it demands.

The Gross Domestic Product (GDP) in Zambia expanded 7.30 percent in 2012 from the previous year. Zambia GDP Annual Growth Rate averaged 2.78 percent from 1961 until 2012, reaching an all-time high of 16.65 percent in December of 1965 and a record low of -8.63 percent in December of 1994 (Bank of Zambia, 2013). During the past decade, Zambia's economy has shown impressive growth averaging above 7% per annum. Growth was driven by investments in the mining sector with spillover effects into construction, transport, communications, wholesale and retail. Growth was furthermore facilitated by favourable copper prices, underpinned by demand from China, and increasing trade with neighbouring countries. Economic turmoil in the global economy has had limited effects on the Zambian economy (UNDP, 2015).

In recent years, Zambia's economy has been growing rapidly due to expansion of copper mining industry and agriculture diversification. Apart from mining and agriculture, Zambia's diversification includes growth in manufacturing and storage. However, widespread poverty, mainly caused by fast population growth and systemic youth unemployment, remains Zambia's main economic challenge. Zambia is one of the poorest countries in the world with 60 percent of the population living below poverty line (Bank of Zambia, 2013).

Figure 2: Log GDP from 1980 - 2013



Source: World Bank Database (Graph by author)

### 1.3 PROBLEM STATEMENT

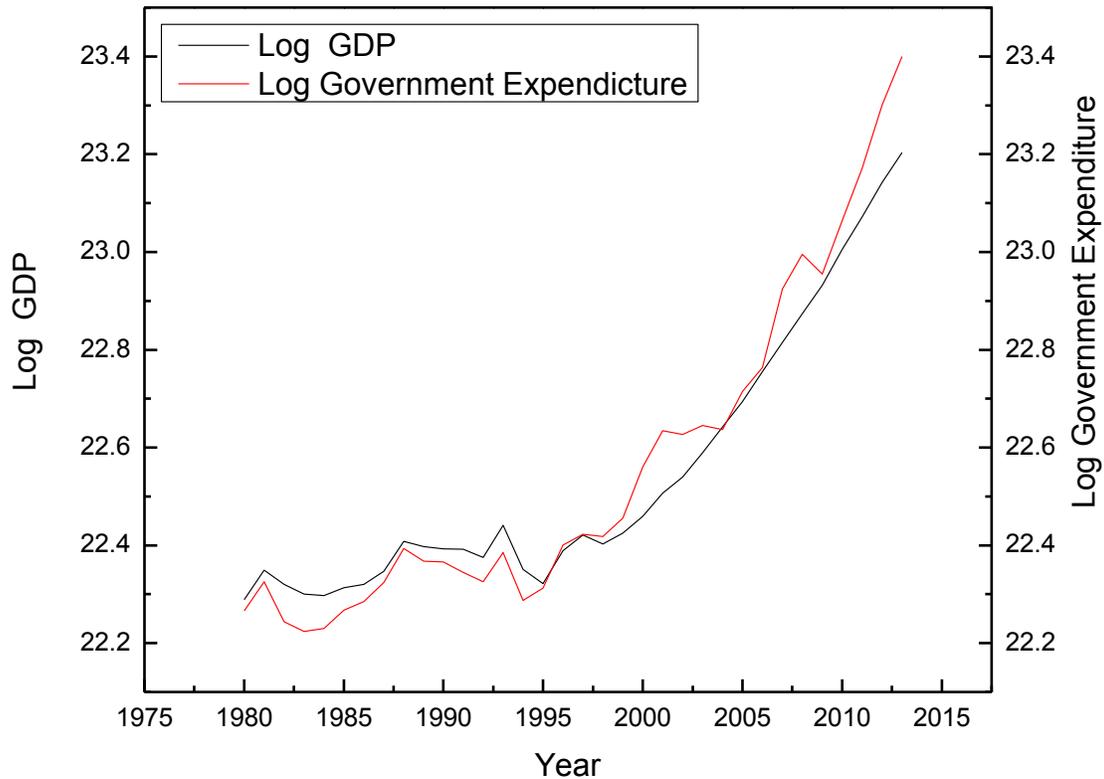
During the past decade Zambia's economy has shown impressive growth averaging above 7 percent per annum. Growth was driven by investments in the mining sector with spill over effects into construction, transport, communications, wholesale and retail. Growth was furthermore facilitated by favourable copper prices, underpinned by demand from China, and increasing trade with neighbouring countries (UNDP, 2015). With this growth the citizenry's expectations are that the benefits from the economic growth should manifest in a better living standard for all Zambians through the provision of high quality and quantity social, economic and protection services. This therefore requires an expansion in government expenditure. The study attempts to show how economic growth influences government expenditure overtime.

The Patriotic Front government unveiled an expansive 2012 budget, with big increases in social spending and farming subsidies to be paid for by a rise in mineral royalties and a debut \$ 750 million Eurobond. Overall spending would rise to 27 698.3 billion kwacha(rebased), or 26.5 percent of gross domestic product (GDP) which was projected at 104, 462 billion kwacha, from 21 percent in 2011, Minister of Finance said (Budget Address, 2012). Most of the extra spending would go on 45 percent and 27 percent increases for health and education respectively, and a 38 percent boost for a farming subsidy programme that has underpinned nearly a decade of 6 percent-plus annual growth (Budget Address, 2012). Is the increased social spending by government due to the economic growth that the country has been experiencing? Is the overall government expenditure growing due to the industrialization and economic growth that we have been experiencing over the decade as a country or its other factors leading to this growth?

Furthermore, the tradition focus of macro econometrics models is that of government expenditure being an exogenous policy instrument used to correct short-term fluctuations in aggregate expenditures. Studies conducted in Zambia have equally focused on what impact public expenditure has on the country's economic growth. Why have studies focusing on how economic growth impacts government expenditure not been conducted? Why is there little literature on this significant relationship for Zambia? If there were studies on this, they would explain many of the reasons for the increase in public expenditure as the country industrialized amidst economic growth overtime.

The study therefore, tests the relevance of Wagner's law to Zambian. The paper attempts to analyze whether there has been growing government activity due to economic growth in Zambia from 1980 to 2013.

Figure 3: Log of GDP and Log of Government Expenditure from 1980 - 2013



Source: World Bank Database (Graph by author)

## 1.4 OBJECTIVES

### 1.4.1 GENERAL OBJECTIVE

- To establish the relationship between economic growth and Government expenditure.

### 1.4.2 SPECIFIC OBJECTIVES

- To verify if the relationship between economic growth and government expenditure is positive.
- To determine how significant economic growth is in influencing government expenditure.
- To prove Wagner's law is relevant to Zambia.

- To determine if all the chosen versions of Wagner's law will have the same results in support of Wagner's law.

## 1.5 HYPOTHESIS

The paper will test the following null and alternative hypotheses

1.  $H_0$ : There is a significant relationship between economic growth and government spending  
 $H_1$ : There is no significant relationship between economic growth and government spending

## 1.6 SIGNIFICANCE OF THE STUDY

A number of economists state that Wagner's law is supposed to be valid in developing economies; after all, Wagner's proposition was conceived as applicable to countries in their early stages of development. The various studies conducted investigated Wagner's law in currently emerging industrialized economies, or developing economies with relatively small public sectors, which have time series data for recent periods (e.g. Ansari *et al.*, 1997; Iyare and Lorde, 2004). Zambia being a developing country is an excellent case study to test Wagner's law. Furthermore, there has been no research on the effect of economic growth on government expenditure in Zambia. This study will provide a new body of knowledge on this relationship. A remarkable contribution of this paper is that it will be the first one to assess the applicability of Wagner's law to Zambia. This paper will, therefore, shed more light on this relationship and provide reference for further research on the topic. In addition, the study will provide a fresh way of looking at this relationship than the tradition macroeconomics way of looking at government expenditure being a policy instrument for economic growth.

Furthermore, a number of studies using time series in order to test the Wagner proposition have been undertaken. In general, these studies suffer from various shortcomings (Henrekson, 1993). In addition, despite the extensive empirical studies that have examined the validity of Wagner's law in different countries, the results have been mixed, inconsistent and inconclusive (Biyase and

Zwane, 2011). The above reason is one of the motivating factors to the study. The study seeks to correct some of the shortcomings of the previous studies conducted on Wagner's law.

Lastly, the study will encourage further research on this relationship to determine which of the theories on public expenditure and economic growth are valid for different economic conditions and country specifics. In the same arena, it will encourage further research with better measuring instruments which will help the government in implementing policies. It provides technocrats with a different way of looking at how to implement policies relating to achieving economic growth that leads to sustainable government expenditure that does not end up destabilizing the market. The study will also allow government to focus on those sectors that need increased expenditures as the country experiences economic growth.

# CHAPTER TWO

## LITERATURE REVIEW

### 2.1 THEORETICAL LITERATURE REVIEW

The general nature of Wagner's notion makes it difficult to define uniquely the relationship between 'economic progress' and 'the growth of state activity'. Wagner suggested that the development of government spending would take place because of industrialization, social process and increasing incomes. He also recognized that this spending expansion has an upper limit and mentioned the importance of economic regulation. Alternative strands of the literature test several different specifications of Wagner's hypothesis, using various variables to approximate the theoretical variables of 'state activity' and 'economic progress'. This is because he did not provide any mathematical formulation in order to examine his hypothesis.

During the last 50 years, 6 different formulations or versions of Wagner's law have emerged; Peacock and Wiseman (1961), Gupta (1967), Goffman (1968), Pryor (1969), Musgrave (1969), Goffman and Mahar (1971) and Mann (1980). The following are the variables used in the six versions; LG is the log of real government expenditures, LGC is the log of real government consumption expenditure, LP is log of population, L (G/Y) is the log of the share of government spending in total output, L(Y/P) is the log of the per capita real output, L (G/P) is the log of the per capita real government expenditures, and LY is the log of real GDP.

#### Versions of Wagner's law

##### 1. Peacock-Wiseman version

$$LG_t = a_0 + a_1LY_t + e_t, \quad a_1 > 1 \quad (1)$$

Peacock and Wiseman (1961), who interpreted the law as follows, "public expenditures should increase by a higher rate than GDP", adopted the formulation (1). In this version, support for

Wagner's hypothesis requires that the  $\alpha_1$  parameter, which represents the elasticity of government expenditures with respect to output, exceeds unity.

## 2. Peacock-Wiseman share version (Mann version)

$$L(G/Y)_t = \beta_0 + \beta_1 LY_t + e_t, \quad \beta_1 > 0 \quad (2)$$

Then second is the Peacock-Wiseman Version as postulated by Mann (1980), in his attempt to analyze empirically the existence of Wagner's Law, Mann (1980) adopted the version, according to which "public expenditure share to GDP is a function of GDP". Mann (1980) made bivariate OLS regressions correcting for first-order autocorrelation on six different versions of Wagner's law for the period 1925-76 on Mexican data. He found strong support for the thesis in all instances. In this model, the share of government expenditures in total output is a function of real output. Here, the validity of Wagner's hypothesis requires that the elasticity of government share in total output with respect to output exceed zero (that is  $\beta_1 > 0$ ).

## 3. Musgrave version

$$L(G/Y)_t = \gamma_0 + \gamma_1 L(Y/P)_t + e_t, \quad \gamma_1 > 0 \quad (3)$$

According to Musgrave (1969), in the third equation, "the public sector share to GDP is increasing as the GDP per capita raises, during the development process". Musgrave (1969) rely on simple ratio of percentage change in government spending and GDP and interpret the obtained ratios as elasticities. With this simple method, strong support for the proposition was found (ratios larger than unity). In this version, the share of real government expenditures to output is a function of real *per capita* output. The validity of Wagner's hypothesis requires the parameter  $\gamma_1$  representing the elasticity of government expenditures with respect to real output *per capita*, exceed zero.

## 4. Gupta version

$$L(\mathbf{G}/\mathbf{P})_t = \delta_0 + \delta_1 L(\mathbf{Y}/\mathbf{P})_t + e_t, \quad \delta_1 > 1 \quad (4)$$

Gupta (1967) considered per capita government expenditure as a function of per capita GDP. Gupta (1967) tested the relation for five countries (United Kingdom, United States of America, Sweden, Canada and Germany) for different sub-periods from the late 19<sup>th</sup> century until around 1960. The elasticity was found to be larger than unity in all cases and during all periods except two. This specification models real *per capita* government expenditures as a function of real *per capita* output. Support for the hypothesis requires that the elasticity of per capita real government expenditures with respect to real *per capita* output exceed unity (where  $\delta_1 > 1$ ).

### 5. Goffman version

$$LG_t = \lambda_0 + \lambda_1 L(\mathbf{Y}/\mathbf{P})_t + e_t, \quad \lambda_1 > 1 \quad (5)$$

In the next year, Goffman (1968) expressed the law in the following way: “during the development process, the GDP per capita increase should be lower than the rate of public sector activities increase”. The real government expenditures are modelled as a function of real *per capita* output. Here, support for the hypothesis requires that the elasticity of real government expenditures with respect to *per capita* output exceed unity (where  $\lambda_1 > 1$ ).

### 6. Pryor version

$$LGC_t = \theta_0 + \theta_1 LY_t + e_t, \quad \theta_1 > 1 \quad (6)$$

Pryor (1968), who stated, “In developing countries, the share of public consumption expenditure to the national income is increasing”, created the last formulation. Real government consumption expenditures are accepted as a function of real output. Support for the hypothesis requires that the elasticity of government consumption with respect to income exceed unity (where  $\theta_1 > 1$ ).

Wagner’s law implies that the real income elasticity coefficient should exceed unity in Versions 1, 4, 5 and 6 ( $\alpha_1 > 1, \delta_1 > 1, \lambda_1 > 1, \theta_1 > 1$ ) and should be greater than zero in Versions 2 and 3 ( $\beta_1 > 0, \gamma_1 > 0$ ). Version 1 expresses the most general version of the law, Version 3 is known

as the share of income formulation and Version 4 is the *per capita* formulation of the law. Version 1 and 2 are equivalent for a monotonic transformation (with  $\beta_1 = \alpha_1 - 1$ ); so are Versions 3 and 4 (for  $\gamma_1 = \delta_1 - 1$ ). Model 5 is conceptually different and the interpretation of the elasticity  $\beta_1$  is more loosely related to Wagner's law. The above models imply causality running from income to public sector expenditure. This is how Wagner seemed to view the basis of the law. It is then important that this uni-directional causality is tested and established formally, if unambiguous support for the law is to be inferred. Of the several versions of Wagner's Law, the Mann's formulation is often used and is considered the most appropriate one (Halicioglu, 2003).

Yet, it should be underlined that earlier studies of the growth of public expenditure have not looked at the time series properties of the variables examined. There was an implicit assumption that the data were stationary. However, recent developments in time series analysis show that most macroeconomic time series have a unit root (a stochastic trend) and this property is described as difference stationarity, so that the first difference of a time series is stationary (Nelson and Plosser, 1982). So that, in testing Wagner's Law, the non-stationary property of the series must be considered first. If both series are I (1), it is necessary to perform cointegration tests. If a pair of I (1) variables are co integrated, a research then proceeds to build an error correction model in order to capture the short-run and long-run causal relationship between the two series (Magazzino, 2011).

## 2.2 EMPIRICAL LITERATURE REVIEW

Some authors who have claimed that the relationship between government spending and national income has been treated with a different way in two major areas of economic analysis (Singh and Sahni 1984, Demirbas 1999). Most of the studies in public economics support the view that the expansion of public sector spending is caused mainly by the increased economic growth (Wagner hypothesis), while most macroeconomic studies suggest that economic growth of an economy is influenced by government spending (Keynesian hypothesis). Demirbas (1999) stated, "Public finance studies, following Wagner, have considered public expenditure as a behavioral variable, similar to private consumption expenditure. By contrast, macro econometric models, essentially following Keynes, have treated public expenditure as an exogenous policy instrument designed to correct short-term cyclical fluctuations in aggregate expenditures" (Demirbas, 1999).

Alimi (2013) assessed the empirical evidence of Wagner's law in Nigeria, for the period 1970-2012, the study employed Johansen Cointegration Techniques with its associated Error Correction Model for the short run dynamics. He found bi-directional causal relation for the short run dynamics for five out of seven formulations while the long run empirical evidence seems to be most favourable to Wagner's hypothesis rather than the Keynesian one, therefore suggesting that causality run from real income to government expenditure (Alimi. 2013).

Previous studies used time series (e.g. Chletsos and Kollias 1997, Islam 2001, Liu et al. 2008) or cross section analysis (Michas 1974, AbIzabeh and Gray 1985, Dao 1995, Shelton 2007) in order to investigate the validity of these hypotheses in a country or group of countries. According to Bird (1971), studies using cross-sectional data in order to examine the validity of Wagner's law are irrelevant, since a postulated change in the public sector happens over time. Henrekson (1993) suggested that the growth of public sector is a process occurring over time in a single country.

As summed up in Sideris (2007), the empirical works on Wagner's Law can be divided in two groups, based on the different types of the econometric methodology they apply: *a*) early studies which are performed until the mid-1990s, assume stationary data series and apply simple OLS regressions to test alternative versions of the law (Ram, 1987); Courakis *et al.*, 1993); *b*) cointegration-based studies, which are performed from the mid-1990s and on, test for cointegration between government expenditure and national income (and occasionally population); *b*) early studies of this group use the Engle and Granger (1987) methodology, whereas more recent works apply the Johansen (1988) technique. Most of the recent studies also perform Granger causality tests to indicate the direction of causality between the variables (Henrekson, 1993; Murthy, 1994; Ahsan *et al.*, 1996; Biswal *et al.*, 1999; Kolluri *et al.*, 2000; Islam, 2001; Al-Faris, 2002; Burney, 2002; Wahab, 2004).

However, the empirical studies have produced mixed and sometimes contradictory results. Some of these conflicting findings (which are well documented in Bohl, 1996), have been attributed to the different econometric methodologies used, and to the different features characterizing different economies during alternative time periods (Magazzino, 2011). Oxley (1994) uses data for the British economy referring to the period 1870-1913 and provides evidence consistent with

Wagner's hypothesis. Cotsomitis *et al.* (1996) test for the long-run validity of Wagner's hypothesis applied to People's Republic of China for 1952-1992. They find that evidence supports this secular validity, as estimated residuals of cointegrating regressions are stationary. Ansari *et al.* (1997) apply both the Granger and Holmes and Hutton statistical procedures to test the income-expenditure hypothesis for three African countries (Ghana, Kenya and South Africa), from 1957 to 1990. For all these countries, a long-run relationship between government expenditure and national income was not established. In fact, over this period, government expenditure has deviated substantially and persistently from national income.

Moreover, in the short run, of these three African countries only Ghana shows evidence of government expenditure being Granger caused by national income, finding support for Wagner's hypothesis. Finally, the authors find no evidence of government expenditure causing national income. In other words, the Keynesian proposition is not supported by the data. Clethos and Kollias (1997) investigated empirically the traditional Wagner's hypothesis in the case of Greece using disaggregated data of public expenditures and employing an error correction approach. The empirical findings suggest that Wagner's Law is valid only in the case of military expenditures.

Asseery *et al.* (1999) analyze Iraq's experience; they suggest that there is some evidence for the existence of Wagner's Law when income and several forms of expenditures are in nominal terms. When expenditure in real terms is examined, the chain of causality runs in the opposite direction. In the case of spending on economic services, there is unidirectional causality. Therefore, the results of these Granger causality tests are to downplay the support for the existence of Wagner's Law in Iraq and to raise interesting questions regarding the use of real or nominal values.

Demirbas (1999) tested Wagner's Law using aggregate Turkish data for the period 1950-1990. According to the test results, there is no cointegrating relationship between the variables. Including time trends into cointegration regressions did not change the results either. These findings show that the support of Wagner's Law found by many early researchers may be spurious. In a test on Turkish data, there was no long-run positive relationship between public expenditure and GNP variables (Magazzino, 2011). Yet, in the absence of a long-run relationship between variables, it remains of interest to examine the short-run linkages between them.

However, there is no evidence to support either Wagner's Law in any of its versions or Keynes' hypothesis.

Thornton (1999) analyzes the experience of six presently developed economies (Denmark, Germany, Italy, Norway, Sweden and the UK) for the period beginning around the mid-19th century and ending in 1913, and reports results in favor of the law. Albatel (2002) studies the relationship between government expenditure and measures of economic development and growth in Saudi Arabia. The results confirm the validity of Wagner's hypothesis. Burney (2002) analyzes the long-run equilibrium relationship between public expenditure and the relevant socioeconomic variables in Kuwait, based on time-series data covering the period from 1969-94. Empirical results show little support for the existence of a long-run equilibrium relationship between public expenditure and the relevant socioeconomic variables.

Chow *et al.* (2002) using UK data for the period 1948 to 1997 included a "third" variable, money supply, which re-establishes the long run link between the income and public spending variables. Multivariate causality results also indicate unidirectional causality from income and money supply to government spending in the end, thus providing strong support for Wagner's hypothesis. These findings suggest that omitted variables may mask or overstate the long run linkages between economic development and public spending. Karagianni *et al.* (2002) employ the two-step Engle and Granger cointegration method, the Johansen maximum likelihood method and the Granger causality test, in order to investigate the long run and causal relationship between government spending and income. For this purpose, they employ six alternative functional forms, using data for the EU-15 countries over the time 1949-1998. The results, accruing from this study, are ambiguous accordingly to the method applied.

The major points that emerge from the Engle and Granger test are that in most of the EU countries, no long-term relationship has been observed, except for some sub-cases in Finland, Italy and the Netherlands. In contrast, the Johansen test supports the existence of Wagner's Law in most EU countries, with the exception of France and Italy. As far as the Granger causality test is concerned, patterns of causality between income and government expenditure display dramatic differences across various countries. Moreover, there is limited support for the pattern of

causality; Wagner's Law is completely verifiable only in two countries –Finland and Italy (Magazzino, 2011).

Florio and Colautti (2005) analyze the experience of five economies (USA, UK, France, Germany and Italy) for the period 1870-1990. They observe that the increase in the public expenditure to national income ratio is faster for the period until the mid-20th century and develop a model based on Wagner's Law. Halicioglu (2005) tests the validity of Wagner's Law for Turkey, and his empirical results show that Wagner's Law does not hold in the case of Turkey. Adopted traditional form, since neither co-integration nor causality tests were in line with the proposed implications of the law. Yet, he found a positive long-run relationship between the share of government in GDP and real per capita income growth, which supports the law. However, further analysis based on the block Granger causality test reveals that the law does not hold for Turkey, or at least the direction of flows has been rejected.

Akitoby *et al.* (2006) examine the short- and long-term behaviour of government spending with respect to output in 51 developing countries using an error-correction model. They find evidence that is consistent with the existence of cyclical ricketing and voracity in government spending in developing countries, resulting in a tendency for government spending to rise over time. So, the researchers derive three main policy conclusions: firstly, the long-term and short-term elasticity of capital spending in relation to GDP is relatively high; secondly, there may be scope for fiscal rules or fiscal responsibility laws in some countries that limit the discretion for pro-cyclical fiscal policy; thirdly, in many countries, there is a long-term relationship between the level of output and government spending.

Sideris (2007) investigates the long-run tendency for government expenditure to grow relative to national income using Greek data from 1833 to 1938. Cointegration analysis validates the existence of long-run relationship between the variables, as expressed by the six most popular versions of the Law. Moreover, Granger causality tests indicate causality running from the variables approximating income to the government expenditure variable. Using Bangladesh data from 1976 to 2007 in a bivariate as well as a trivariate framework incorporating population size as a third variable, Kalam and Aziz (2009) empirically investigates Wagner's Law. The estimated results provide evidence in favor of the law for Bangladesh, in both the short-run and

long run. There is a long-run cointegration relation among real government expenditure, real GDP and the size of population where government expenditure is positively tied with the real GDP (1.14), per capita GDP (1.51) and population size (0.21). Both the real GDP and GDP per capita Granger cause total government expenditure to change. Population size also comes as a significant stimulus for public spending to grow in both the long run and short run (Magazzino, 2011).

Kumar *et al.* (2009) examine the case of New Zealand. Results provide consistent results concerning the impact of income on shares of government spending in output with income elasticity's ranging from 0.56 to 0.84. This implies that a one percent increase in per capita income leads to a 0.56 to 0.84 percent increase in the share of government expenditure of income. These results imply that per capita income increases by more than the increase in the share of the government spending in income.

Magazzino (2009a, 2009b, 2010a; 2010b) studies the linkages between public expenditure at a disaggregated level and GDP for Italy. Empirical evidence suggests that only for gross public investment expenditure the hypothesis is satisfied. Instead, Granger-causality exhibits unclear results: the direction of causality from public spending to aggregate income is observed for these categories of public expenditure: final consumption, public wages, gross public investment, and contribution to production. Finally, Murthy (1994) suggests a broad interpretation of the law to allow for the addition of more explanatory variables related to economic development and government expenditure, such as the degree of urbanization, budget deficits, etc. into Wagner's functional forms, which would also reduce the omitted variable bias and mis-specification in econometric estimations.

Dritsakis and Adamopoulos (2004) examined the tendency of the Greek public sector as well as the existing relationship between the extent of government spending and economic growth, during the period of 1960-2001. Their empirical results support Wagner's Law because the estimated elasticity of consumption for total and partial public spending was consistent with the limitations of Wagner's Law. Finally, they concluded that Granger-causality tests on Wagner's Law and in the Keynesian model provided evidence supporting the complexity of the underlying interactions with most of the relationships being bi-directional in the causality models.

Katrakilidis and Tsaliki (2009) examined the relationship between spending and economic growth by using annual data of the Greek economy during the period 1958-2004. They applied recent developments in the theory of cointegrated processes (ARDL) and obtained empirical results indicate that the causality runs from income to government expenditures, which is in accordance with Wagner's law. Conversely, they found that causality runs from expenditures to income, which supports the Keynesian hypothesis and claimed that their study brought new evidence of two-directional causality between expenditures and income for the case of Greece (Richter et.al, 2011).

In particular, Henrekson (1993) examines the expansion of government expenditure in Sweden, for the period 1861-1988, whereas Legrenzi (2000) analyzes the pattern of the Italian government expenditure for 1861-1998. Including more recently Folster and Henrekson, 2001; Chang, 2002; Chang *et al.*, 2004; Iyare and Lord, 2004. Peacock – Wiseman's model (1999), this theory also looked at increasing public expenditure from the social-political perspective. Government expenditure will increase as income increases but because the leaders want re-election into political offices, thus provide more infrastructure in order to convince the electorate that their interests are catered for by the people they voted into power. However, the citizens of the country are less willing to pay tax but the government has to increase spending to avoid social crises in the economy. The resistance to pay tax by the people will make the state to have low revenue hence the cost of providing more facilities is borne by the government, making government expenditure to increase rapidly.

# CHAPTER THREE

## METHODOLOGY

### 3.1 DATABASE

The data for the present study is secondary annual time series data covering the period 1980 to 2013 obtained from World Bank database. The study used real gross domestic product (Y), real government expenditure (G), real share of government expenditure in real output (G/Y) and real per capita output(Y/P). The World Bank used dollar constant for all the figures. All the figures are in real terms and their natural logarithms are used in the analysis. Since, the versions of Wagner's law used required that the variables be in log form to allow for easy interpretation of the elasticity, hence the transformation of data into log form before analysis. After the variables were transformed into log form, the variables were differenced to allow for further analysis and became the following; differenced log of real gross domestic product-(DL(Y), differenced real government expenditure-DL(G), differenced real share of government expenditure in real output-DL(G/Y), and differenced real per capita output-DL(Y/P).

### 3.2 MODEL SPECIFICATION

#### 3.2.1 ELASTICITY ESTIMATES

The paper uses four out of the six versions because the study could not find the appropriate data for the analysis for the other two. The Pryor version was excluded because most of data for government consumption found produced inconsistent results that could not be used for analysis. On the other hand, the data for the Gupta version was completely unavailable. This paper adopts the Peacock-Wiseman, Mann, Musgrave and Goffman models to test Wagner's law. The four versions were chosen because the study wanted to show for which of the version Wagner's law would be valid for the Zambian case. Furthermore, in literature, most researchers tested all the available models for robustness purposes and most did not specify the econometric models. The relationships are written in logarithm form as given below:

### 1. Peacock-Wiseman version

$$LG_t = \alpha_0 + \alpha_1 LY_t + e_t, \quad \alpha_1 > 1 \quad (1)$$

### 2. Mann version

$$L(G/Y)_t = \beta_0 + \beta_1 LY_t + e_t, \quad \beta_1 > 0 \quad (2)$$

### 3. Musgrave version

$$L(G/Y)_t = \gamma_0 + \gamma_1 L(Y/P)_t + e_t, \quad \gamma_1 > 0 \quad (3)$$

### 4. Goffman version

$$LG_t = \lambda_0 + \lambda_1 L(Y/P)_t + e_t, \quad \lambda_1 > 1 \quad (4)$$

**Notes:** The estimated relationship is for annual time series data for the period from 1980 to 2013. In estimating the relative elasticity, natural logarithms of all the variables are used. The advantage of assorting the variables in natural logarithmic form is to achieve stationarity in the lower order of integration in case the logs of these variables are non-stationary at levels (Afzal and Abbas, 2010). Emphasis must be placed that the study tried using other variables that could influence government expenditure like population and other control variables but the results did not change much and in some instance the added variables were insignificant in influencing government expenditure hence the use of a bivariate model (with only two variables). In the appendix the study has included tables for regression results with population included as an explanatory variable to add substance to this argument.

## 3.2.2 UNIT ROOT TESTS

The first step is to test for stationarity of the time series data with the help of unit root tests.<sup>1</sup> The presence of unit root makes the regression results spurious<sup>2</sup> and thus disturbs the accuracy of the

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<sup>1</sup> For detailed discussion on 'Stationarity of Time-Series Data' see Asteriou and Hall, 2007, p.288.

<sup>2</sup> A problem of spurious regression can occur when two time series variables in a regression are highly correlated whereas there is no actual relationship between them. High correlation is due to the existence of time series trends in both time series variables (Granger and Newbold, 1974)

parameters estimated. An application of Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests is found suitable to detect whether the selected time series variables are stationary at their levels or not. If data are not stationary at their levels, as most of the time series variables are, then one way of achieving stationarity is to difference the time series data until stationarity is achieved (Asteriou and Hall, 2007). In light of the foregoing reasons, the augmented dickey-fuller (ADF) and Phillip-Perron (PP) tests were used to test for stationarity in the variables. In both tests, the study used a model where the trend and constant are included in the equation. The rule of thumb for the tests is that the absolute value of the test statistic must be greater than the absolute value at the chosen critical value (absolute value means we remove the negative sign) for our study the chosen critical value is 5 percent for both tests .

### **3.2.3 JOHNSEN COINTEGRATION MODEL**

Johnsen cointegration model tests the variables for cointegration; that is to see if the variables have a long-run association. Economically speaking, two variables will be cointegrated if they have a long-term, or equilibrium, relationship between them (Gujarati, 2004). As Granger notes, “A test for cointegration can be thought of as a pre-test to avoid ‘spurious regression’ situations.”<sup>3</sup>. It is also important to note that the variables are in their logarithm form only that is to say they are not in their differenced form. However, the assumption made is that when first-differenced they become stationary. The rule of thumb is that if the absolute value of the trace statistic is greater than the absolute value at the chosen critical value we reject the null hypothesis (or if the absolute value of the max statistic is greater than the value at the critical value we also reject the null hypothesis) otherwise we accept the null hypothesis.

### **3.2.4 ORDINARY LEAST SQUARES (OLS)**

The method used extensively in regression analysis is the method of OLS primarily because it is intuitively appealing and mathematically much simpler than the method of maximum likelihood. Under certain assumptions, the method of least squares has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression (Gujarati, 2004). If the probability obtained for the independent variable is less than 5 percent

then the independent variable is significant in influencing the dependent variable, furthermore, if its below one percent its very significant. The R-squared measures the percentage by which the independent variable can explain variations in the dependent variable. If Prob >F is less than 5 percent then our independent variable influences our independent variable.

### 3.2.5 POST-ESTIMATION DIAGNOSTIC TESTS

After obtaining the OLS regression results, various diagnostic tests took place to see how valid the models are in explaining the relationship between government expenditure and economic growth (GDP). Firstly, the use of the Ramsey RESET (regression specification-error test) test was appropriate to test for correct model specification and the omission of any variables. Secondly, testing residuals from the regression for normality using the Shapiro-Wilk W test for normality, this is important because inference from regression is valid when the errors are normally distributed. Furthermore, the study checks for homoscedasticity in the residuals that is the check for constant variance using Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity. In addition, the study tested for serial correlation using the Durbin-Watson d-statistic and the Bruesch- Godfrey LM test for serial correlation. The use of the two to test autocorrelation was because the first one test for first-order serial correlation in the disturbances, and assumes that all the regressors are strictly exogenous while the later tests for higher-order serial correlation in the disturbances, and does not require that all the regressors be strictly exogenous. The rule of thumb for all the above tests is that we accept the null hypothesis if the probability value is greater than 5 percent. The null hypothesis for each of the tests is in the table.9 for post-estimation diagnostic tests results (on page.30).

Lastly, the study carried out Wald's test of hypothesis to see whether the coefficients from the regression results conform to what Wagner postulated in his law (we use the **test** command in stata). The rule of thumb is to reject the null hypothesis if the p-value is less than the level of significance (5%), otherwise accept. It is important to note that the Wald test uses equality and performs two sided tests. To perform one-sided tests, first perform the corresponding two-sided Wald test and then use the results to calculate the test statistic and p-value for the one-sided test.

# CHAPTER FOUR

## RESULTS AND DISCUSSION

### 4.1 DESCRIPTIVE STATISTICS

A descriptive statistics provides a summary of the data in the study. The dependent variables in our model are the logs of real government expenditure L (G) and the log of the share of government spending in total output L (G/Y). The independent variables are the log of real gross domestic product L(Y) and L(Y/P) which is the log of the per capita real output. It is also important to note that the study used a statistical software package known as STATA (12.1) for all the analysis the paper.

**Table.1: Descriptive statistics of the data**

Variables	Obs	Mean	Std.Dev	Min	Max	Variances	Skewness	kurtosis
LY	34	22.5437	.2699	22.2892	23.2035	.0729	1.1470	3.0220
LG	34	22.5599	.3291	22.224	23.3998	.1083	1.0927	3.1008
L(G/Y)	34	.0698	.0716	-.0726	.1989	.0052	.8033	2.7431
L(Y/P)	34	6.5061	.1259	6.3228	6.7353	.0158	.1050	1.8730

Table.1 above provides a summary statistics of the variables used in the paper. It provides an overview of the overall picture of the data.

### 4.2. UNIT ROOT TESTS

To avoid spurious regression results the study used the ADF and PP tests for unit root in the data, which is for the period from 1980 to 2013. The Augmented Dick-Fuller test and Phillip-Perron tests were with lag (1) and with both the constant and trend. Table.2 below provides the results:

**Table.2: ADF and PP tests for unit root with constant and trend (5% critical value-lag (1)).**

Variables	ADF-Statistics		PP-Statistics				LAGS
	t-stat	5% c.v	t-stat	5% c.v	t-stat	5% c.v	
<b>LY</b>	0.224	-3.572*	1.221	-18.508*	0.900	-3.568*	1
<b>LG</b>	-0.165	-3.572*	1.251	-18.508*	0.685	-3.568*	1
<b>L(G/Y)</b>	-3.469	-3.572*	-13.787	-18.508*	-2.642	-3.568*	1
<b>L(Y/P)</b>	-0.132	-3.572*	0.751	-18.508*	0.586	-3.568*	1
<b>DLY</b>	-4.849	-3.576	-32.674	-18.432	-6.351	-3.572	1
<b>DLG</b>	-4.755	-3.576	-30.869	-18.432	-6.092	-3.572	1
<b>DL(G/Y)</b>	-4.272	-3.576	-26.953	-18.432	-5.183	-3.572	1
<b>DL(Y/P)</b>	-5.171	-3.576	-32.979	-18.432	-6.601	-3.572	1

H<sub>0</sub>: Variable has unit root or is non-stationary (\* means we accept null hypothesis)...

As can be seen from table.2 above, the four variables in their logarithm form have unit root or are non-stationary as the absolute value of the test-statistic is less than the absolute value at the critical value in both the ADF and PP tests, therefore, a regression run would have spurious results. Hence, the need to difference the variables (LY, LG, L (G/Y) and L(Y/P)) once in order to achieve stationarity and test for unit root thereafter. After differencing once the variables used for analysis became; DL(Y), DL(G), DL(G/Y) and DL(Y/P) and they were found to be stationary as can be seen from the table.2 above where the absolute values of the test-statistics are greater than the absolute value at the given critical value in both the ADF and PP. Since the four variables are now stationary after differencing, the study can continue with further analysis.

### 4.3. TEST FOR COINTEGRATION

Time series data usually have long-run association. It is very important therefore, that the paper establishes if the variables in the model are cointegrated in the long run to avoid spurious regression. The study used the Johansen test for cointegration and it is important to note that it uses the original data (LY, LG, L (G/Y) and L(Y/P)) while assuming that they become stationary when differenced once. The vector error correction (VEC) pre-estimation lag-selection criterion

was found suitable to select the number of lags in each model. The study used VEC to have a uniform method for selecting the number of lags if the variables were found to be cointegrated. The results for the VEC pre-estimation lag-selection are in the appendix. The importance of using this method to select the number of lags is because when the number of lag changes results changes a lot. This means that lag is an important matter that can change the result. The tables below provide the results for the four versions of Wagner’s law when tested for cointegration:

**Table.3: Johansen test for cointegration for the Peacock-Wiseman Version (Lag 4)**

Maximum rank	Eigen values	Trace statistic	5% c.v	Maximum Statistics	5% c.v
0		13.8807	15.41	8.8261	14.07
1	0.25487	5.0546	3.76	5.0546	3.76
2	0.15506				

**Table.4: Johansen test for cointegration for the Mann Version (lag 2)**

Maximum rank	Eigen values	Trace statistics	5% c.v	Maximum Statistics	5% c.v
0		21.4340	15.41	12.7641	14.07
1	0.32893	8.6699	3.76	8.6699	3.76
2	0.23733				

**Table.5: Johansen test for cointegration for the Musgrave Version (lag 2)**

Maximum rank	Eigen values	Trace statistics	5% c.v	Maximum Statistics	5% c.v
0		11.9947	15.41	11.8706	14.07
1	0.30993	0.1241	3.76	0.1241	3.76
2	0.00387				

**Table.6: Johansen test for cointegration for the Goffmann Version (lag 4)**

Maximum rank	Eigen values	Trace statistics	5% c.v	Maximum Statistics	5% c.v
0		10.2817	15.41	9.6090	14.07
1	0.26080	1.2127	3.76	1.2127	3.76
2	0.03962				

$H_0$ : At 0 or 1 rank means, we have 0 or 1 cointegrating relationship between our variables respectively and the alternative is that.

The Peacock-Wiseman and Mann version reject the null hypothesis at rank 0 and 1 for both the trace and maximum statistics and the study could therefore; conclude that there is no cointegration between the variables. However, the Musgrave and Goffman versions show that the paper accepts the null hypothesis at maximum rank 0 implying that there is no cointegration relationship between our variables in the long run. This implies that the study can go on to estimate using OLS because the variables do not have long-run association in equilibrium.

#### 4.4. ORDINARY LEAST SQUARES

The study proceeds to estimate the parameters using OLS given that stationarity is achieved in the data and the variables are not cointegrated. Instead of using the LG, LY, L (G/Y) and L (Y/P), the study now used DLY, DLY, DL (G/Y) and DL(Y/P) in the regression. Table.7 below provides the results from the regression analysis:

**Table.7: Ordinary least squares results.**

Model	Coef.	Std.Err	P >  t	Prob > F	R-Squared	Adj R-Squared	F(1, 31)
Peacock-W	1.1561	.1743	0.0000	0.0000	0.5867	0.5734	44.01
Mann	.1757	.1809	0.339	0.3389	0.0295	-0.0018	0.94
Musgrave	.1705	.1834	0.360	0.3599	0.0271	-0.0043	0.86
Goffman	1.1612	.1786	0.0000	0.0000	0.5769	0.5632	42.26

Table.7 shows that the Peacock-Wiseman version has probability value of GDP (p-value=0.000) below 5 percent implying that GDP (Y) is very significant in influencing government expenditure (G). The R-squared also shows that 58.67 percent variations in government expenditure (G) can be explained by GDP (Y). Furthermore, the probability value of the model (p-value=0.000) is also less than 5 percent implying model is significant in explaining the influence of GDP on government expenditure.

On the other hand, the Mann and Musgrave versions have probability values (p-values) of the independent variables (0.339 and 0.360 respectively) which are greater than 5 percent implying that the independent variables are not significant in influencing the dependent variables. The models are also not significant in explaining the influence of the independent variables on the dependent variables (model p-values are 0.339 and 0.360 both greater than 5 percent). The R-Squared for both the Mann and Musgrave versions are 29.5 percent and 27.1 percent implying the data used is not a good fit hence the results are inconclusive or lack credibility in explaining the relationship between the variables.

In addition, the Goffman version has probabilities of real per capita output (Y/P) and of the model (0.0000) which are less than 5 percent that shows that real per capita output is very significant in influencing government expenditure and the model is significant in explaining the influence of real per capita output on government expenditure. The R-Squared shows that 57.69 percent of the variations in government expenditure can be explained by real per capita output. Because of the data not being a good fit for the Mann and Musgrave versions, the study will focus only on the Peacock-Wiseman and Goffman versions.

Furthermore, Wagner's law focused on the coefficients of the independent variables: GDP and real per capita output in the two valid versions. The coefficients in the two models (Peacock-Wiseman and Goffman) satisfy the conditions stated under Wagner's law for each. The Peacock-Wiseman version has  $\alpha_1=1.1561$  which is greater than one, and the Goffman version has  $\lambda_1=1.1612$  which is greater than one also satisfying the conditions for validity of Wagner's law. From the regression analysis, it is clear that both versions support Wagner's law for Zambia.

## 4.5. GRANGER CAUSALITY TESTS

The study investigates the direction of the relationship between economic growth and government expenditure using Granger causality test. It is important to note that when testing for Granger causality the data has to be stationary. From earlier analysis it is established that the variables become stationary when differenced, therefore, the study uses the differenced data in testing for Granger causality. The variables used in the analysis of Granger causality are; differenced log of real gross domestic product-DL(Y), differenced log of real government expenditure-DL(G), and differenced log of real per capita output-DL(Y/P). The paper used the vector auto-regression model (VAR) pre-estimation selection criteria to select the number of lags in each model. The study carried out the lag-selection criteria to make sure the right number of lags was used as the number of lags affects the results.

**Table.8: Granger causality tests**

	Equations	Chi2	Prob > Chi2
<b>Peacock-Wiseman (lags 4)</b>	DLY granger causes DLG	9.9988	0.040
	DLG granger causes DLY	1.5707	0.814
<b>Goffman (lags 4)</b>	DL(Y/P) granger causes DL(G)	9.8543	0.043
	DL(G) granger causes DL(Y/P)	1.6459	0.801

Table.5 above indicates that GDP (DLY with probability value 0.040 which is less than 5 percent) is significant in Granger causing government expenditure (DLG) but government expenditure does not Granger cause GDP in the Peacock-Wiseman model. The direction of the relationship is from economic growth to government expenditure. In other words, gross domestic product causes government expenditure but the reverse is not true. This shows that Wagner's hypothesis of causation running from economic growth to government expenditure is valid while the Keynes hypothesis of causation running from government expenditure to economic growth does not hold for the Zambian case under the Peacock-Wiseman version. Lastly, the Goffman version also shows that causation runs from economic growth to government expenditure and not

from government expenditure to economic growth like Keynes postulates as the probability value is less than 5 percent.

#### 4.6. POST DIAGNOSTIC TESTS

After the regression analysis, the study carried several tests to see how appropriate the data and model are in explaining the relationship between government expenditure and economic growth.

Below are the results from the several tests:

**Table.9: Post estimation Diagnostic tests**

Diagnostic tests	Shapiro-Wilk W test for Normality	Breusch-Pagan/Cook-Weisberg test	Ramsey RESET test	Breusch-Godfrey LM test	Durbin-Watson d-statistic
Peacock-W	0.19221	0.1204	0.6313	0.6065	0.6219
Goffman	0.00215*	0.0855	0.8222	0.5382	0.5550
null hypothesis	H <sub>0</sub> : Residuals are normally distributed	H <sub>0</sub> : Constant variance	H <sub>0</sub> : Model has no omitted variables	H <sub>0</sub> : No serial correlation	H <sub>0</sub> : No serial correlation

\*implies we reject the null hypothesis,,,,,, Prob > 0.05 we cannot reject null hypothesis

The Peacock-Wiseman model accepts the null hypothesis for all the tests, as their probabilities are greater than 5 percent, we can therefore, conclude that our data and model is a good fit and we can make inferences based on the results. However, the Goffman version has residuals that are not normally distributed and hence the rejection of the null hypothesis. However, the Goffman version also accepts the other null hypothesis for all the tests, as their probabilities are greater than 5 percent.

**Table.10: WALD’S TEST OF HYPOTHESIS**

<b>Model</b>	<b>P-Value</b>	<b>Null hypothesis</b>
<b>Peacock-Wiseman</b>	.1886	<b>Ho: <math>a_1 \geq 1</math></b>
<b>Goffmann</b>	.1868	<b>Ho: <math>\lambda_1 \geq 1</math></b>

Table.10 above demonstrates that all the coefficients in the regression analysis satisfy the conditions stated by Wagner’s law this is because we accept the null hypothesis in all the models. The purpose of the Wald test was to verify if the elasticities found in the regression are accurately reflecting the relationship between government expenditure and economic growth ( stata sets the default function of equating the coefficients to zero, the study therefore equated each coefficient to the underlying assumption in the model). The coefficients are therefore, reliable and that allows for inference.

# CHAPTER FIVE

## CONCLUSION AND POLICY IMPLICATIONS

### 5.1 CONCLUSION

In conclusion, the paper demonstrates how the study has answered the set out objectives and hypothesis. The general objective was to establish the relationship between economic growth and government expenditure. Using the results from Granger causality test from the Peacock-Wiseman and Goffman versions, the direction of the relationship is from economic growth to government expenditure. This is to say that economic growth Granger causes government spending. The OLS results also show that there is a positive relationship between economic growth and government expenditure. From the analysis, the Keynesian theory of government expenditure preceding economic growth does not hold for dataset used in the Zambian case.

The first specific objective was to see if there is a positive relationship between government expenditure and economic growth and from the results for the Peacock-Wiseman and Goffman versions the study found positive coefficients which confirm a positive relationship between the two variables. In addition, the study has shown that Wagner's law is valid for Zambia satisfying the second specific objective. The third specific objective was to determine how significant economic growth is in influencing government expenditure and the regression analysis has proved that economic growth is very significant in influencing government expenditure in the Peacock-Wiseman and Goffman versions of Wagner's. The study has successfully answered the objectives it set out to investigate.

Furthermore, the study accepts the null hypothesis, which states that there is a significant relationship between economic growth and government expenditure. From the regression analysis  $\alpha_1 = 1.1561$  (Peacock-Wiseman) and  $\lambda_1 = 1.1612$  (Goffman) both with p-values (0.000) that show that economic growth is very significant in influencing government expenditure. The paper has successfully showed that Wagner's law is relevant to Zambia.

Zambia has experienced growth in both the gross domestic product and government spending over the past decade. This paper has revealed that economic growth (above 6 percent for the past decade) has had a significant influence on the levels of government expenditure. Government expenditure grows due to the increase in quantity and quality in service delivery sectors such as education and health which the citizenry expect to improve when the country is experiencing economic growth. Government spending is one way in which income is redistributed through the economy so that there is a certain level of equality.

Lastly, Wagner stated that irrespective of the social, economic and political prevailing situation the direction of the relationship would be from economic growth to government expenditure. That is economic growth is significant in influencing government expenditure. To add value to this argument the study carried out regression analysis adding population as a second regressor in all the four versions and the results indicate that population is not significant in influencing government expenditure while economic growth is significant in influencing government expenditure. Population was used because in theory the high the population the high the government expenditure needed to provide public goods and services. The results for the above are in the appendix.

## **5.2 LIMITATIONS**

The availability of data for use in the analysis was a challenge, as most public institutions could not avail the necessary data needed. The data used had to be sourced from the World Bank database which has a different method of calculating the two variables as compared to Central Statistics Office.

## **5.3 RECOMMENDATIONS**

There are currently seven versions of Wagner's law and further studies can be done to test the other models apart from this one used here. In addition, several other methods can be used in analyzing the relationship between economic growth and government spending. Furthermore, other researchers may look at incorporating other control variables in these models to see how significant this relationship is in terms of Zambia.

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## APPENDIX 1 Stata output for two versions

Table.11 Peacock-Wiseman with GDP (regressor) only

```
. tsset obs, yearly
      time variable:  obs, 1980 to 2013
              delta:  1 year

. regress dlqus dlyus
```

Source	SS	df	MS			
Model	.066094798	1	.066094798	Number of obs =	33	
Residual	.046558003	31	.001501871	F( 1, 31) =	44.01	
Total	.112652801	32	.0035204	Prob > F =	0.0000	
				R-squared =	0.5867	
				Adj R-squared =	0.5734	
				Root MSE =	.03875	

dlqus	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dlyus	1.156131	.1742769	6.63	0.000	.8006909	1.511571
_cons	.00232	.0082962	0.28	0.782	-.0146001	.0192402

Table.12 Peacock-Wiseman with only GDP and Population (regressor)

```
. regress dlqus dlyus dLp
```

Source	SS	df	MS			
Model	.071774649	2	.035887325	Number of obs =	33	
Residual	.040878152	30	.001362605	F( 2, 30) =	26.34	
Total	.112652801	32	.0035204	Prob > F =	0.0000	
				R-squared =	0.6371	
				Adj R-squared =	0.6129	
				Root MSE =	.03691	

dlqus	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dlyus	1.16496	.1660564	7.02	0.000	.8258277	1.504093
dLp	-.5184345	.2539279	-2.04	0.050	-1.037024	.0001554
_cons	.0170031	.0106848	1.59	0.122	-.0048182	.0388243

### 13. Goffman version with GDP (regressor) only

```
. regress dlgs dlypus
```

Source	SS	df	MS			
Model	.064983865	1	.064983865	Number of obs =	33	
Residual	.047668937	31	.001537708	F( 1, 31) =	42.26	
Total	.112652801	32	.0035204	Prob > F =	0.0000	
				R-squared =	0.5769	
				Adj R-squared =	0.5632	
				Root MSE =	.03921	

dlgs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dlypus	1.161229	.178629	6.50	0.000	.7969126	1.525545
_cons	.0342302	.0068262	5.01	0.000	.020308	.0481525

Table.14 Goffman version with GDP and Population (regressors)

```
. regress dlgs dlypus dLp
```

Source	SS	df	MS			
Model	.070176348	2	.035088174	Number of obs =	33	
Residual	.042476454	30	.001415882	F( 2, 30) =	24.78	
Total	.112652801	32	.0035204	Prob > F =	0.0000	
				R-squared =	0.6229	
				Adj R-squared =	0.5978	
				Root MSE =	.03763	

dlgs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dlypus	1.165618	.1714223	6.80	0.000	.8155271	1.515709
dLp	-.4955693	.2587798	-1.92	0.065	-1.024068	.0329295
_cons	.0484991	.0099208	4.89	0.000	.028238	.0687602