

Causal Relationship between Government Tax Revenue Growth and Economic Growth: A Case of Zimbabwe (1980-2012)

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Abstract

The main aim of the paper is to demystify the mystery surrounding the belief that, high tax revenue growth rates is a prima facie and a leading indicator for high standards of living as a result of high economic growth rates engineered through the government multiplier process. The effects of economic growth on government tax revenue growth were investigated for Zimbabwe during the period of 1980-2012. Short-run and long-run relationship between the tax revenue and economic growth in Zimbabwe were also investigated. Theoretically and empirically it has been found that taxes affect the allocation of resources and often distort the economic growth. The study applied the Granger Causality test, Johansen's cointegration test and vector error correction model to serve the purpose. However, findings of this study clearly showed that there is an independence relationship between economic growth and total government tax revenue with 30% speed of adjustment in the short run towards equilibrium level in the long run. This implies that there is fiscal independence between tax revenue and growth. The empirical analysis also provides the evidence of long-run equilibrium relationship. Based on the findings, we highlighted some of major issues that policymakers should consider for effective taxation policy formulation and implementation in line with the complexity nature of the Zimbabwe economy. Therefore, the outlook is that the economists and policy makers should suggest an ideal, efficient and buoyant tax system so that gross tax revenue of the government would increase substantially thereby leading to optimum mobilization of resources for higher economic growth of the country. This can only be achieved through efficient allocation of collected tax revenue to production sectors of the economy to try to achieve distributive principle through societal welfare maximization.

1. Introduction

Taxation is central to development and provides governments with the funding they require to finance economic development and growth. In any country, developed or less developed, mobilization of resources constitutes a paramount aspect of achieving a higher level of economic growth. And, as a source of resource mobilization, the role of tax revenue is very significant in developing countries such as Zimbabwe. Understanding the causal relationship between government tax revenue and economic growth is important from a policy point of view, especially for a country like Zimbabwe, which is suffering from persistent budget deficits, retarded economic growth, whilst tax revenues are rising. Theoretically, social infrastructure investment, however, must be financed, usually through taxation or budget deficits. In a closed economy with government, the resources come at the expense of crowding-out consumption or private savings, while an open economy allows the option of external borrowing. These costs, compounded by the dead-weight loss of distortionary taxation, can jeopardize the positive growth trajectory of the social infrastructure investment. An optimal policy balances the sustained positive growth and distributional effects of social infrastructure investment against the full economic costs imposed by taxation and/or increased indebtedness. The paper intent to demystify the mystery shrouding the fallacious belief that, high tax revenue growth rates is a prima facie and a leading indicator for high standards of living as a result of high economic growth rates engineered through the government multiplier process. The main objective was achieved by investigating the long-run and short run causal relationship between the tax revenue growth and economic growth in Zimbabwe and ascertaining the speed of short run adjustment towards the long run equilibrium.

During the 1950s and 1960s, many economists prescribed that greater government intervention was the best, if not the only way forward in achieving certain goals and objectives like poverty alleviation economic growth and development. However, in the 1980s and 90s there was growing skepticism concerning the achievements of governments' targets in terms of revenue collection and allocation. In recent years, an emphasis on government failure has replaced the previous concern for the market failure. The dramatic success of the East Asian Newly-Industrialised Countries (NIC), widely referred to as 'The Asian Tigers', in achieving sustained growth unraveled conflicting evidence on the role of state intervention. To some, it clearly showed that these economies illustrated the effectiveness of the market based policies in promoting economic development, with Hong Kong being viewed as the prime example, in the case of five Asian Tigers. However, more recently the reality of the importance of market friendly state activism has been recognised, especially in respect of Singapore, South Korea, Japan, China and Taiwan. Thus the World Bank (2010) has argued that these countries

have thrived on market-friendly government intervention. The clear implication of this experience is that the form of government intervention is crucial: some interventions may encourage economic growth and development, others may be a hindrance. This issue is explored in this paper, which adopts an empirical approach to examine this relationship, focusing on the role of various components of government finance in the economic development of less-developed countries (LDCs).

Since 2000 Zimbabwe has been experiencing a severe economic crisis which peaked in 2007 and 2008. During the period, severe foreign currency shortages were experienced, capacity utilisation in industry fell to below 10% by January 2009 and the economy became increasingly informalised. GDP was estimated to have contracted by a cumulative 50% and the official inflation rate was 231 million percent in July 2008 (Chugumira, 2010). The Zimbabwe economy has traditionally been agriculture based, but the sector declined from 2000 onwards with the collapse of commercial agriculture. Severe food shortages were experienced and poverty remained widespread. The infrastructure became dilapidated and the country failed to service its local and foreign debts. The Bretton Woods Institutions revoked Zimbabwe's borrowing powers and stopped funding the country which also sanctions Zimbabwe from some western countries (GoZ/UN, 2010).

According to Ministry of Finance (MoF) (2009), the inception of the inclusive government and adoption of a multicurrency regime in 2009 causes the economy to stabilise. GDP grew by 5.7% in 2009 (CZI, 2010), and the year-on-year inflation as at December 2009 was negative at -7.7%. Industrial capacity utilization had risen to between 35% and 60% by December 2009 (MoF, 2009). The inclusive government (IG) made macro-economic changes, including price liberalisation, removal of exchange restrictions, removal of surrender requirements on exports proceeds, imposition of budget constraints on parastatals, the cessation of quasi-fiscal expenditure by the reserve bank of Zimbabwe as well as some reforms to improve revenue collection through a more robust deregulation approach (GoZ/UN, 2010).

Zimbabwe, however, continued to suffer from suppressed economic growth due to low productivity and capacity utilization, liquidity constraints limiting access to local and foreign finance although tax revenue where rising. The financial sector remains grossly under-capitalised due to the inability to tap external resources. Low revenues and investment have resulted in savings of less than 5% of GDP (GoZ/UN, 2010). The low capacity utilization by companies has also been attributed to the high cost and unreliable infrastructure services including water and electricity (MoF, 2009). Legat (2010) asserts that, there have been calls from all sectors for simplification of the tax system including removing Exercise Duty exemptions. It has been argued that simplifying the tax system would reduce the cost of collection as ZIMRA would not need the blotted size of staff it has now.

The biggest source of revenue in Zimbabwe historically has been Pay as You Earn (PAYE) contributing nearly 40% of the tax revenue. Sales tax (replaced by VAT) was in the second position contributing an average 24% to the total tax revenue between 1996 and 2004. Since 2009, VAT has become the major contributor to total revenue collected as shown in Fig. 1. Of the total revenue collected from January to December 2009, amounting to US\$930 655 559.7, 96.5% was from taxation.

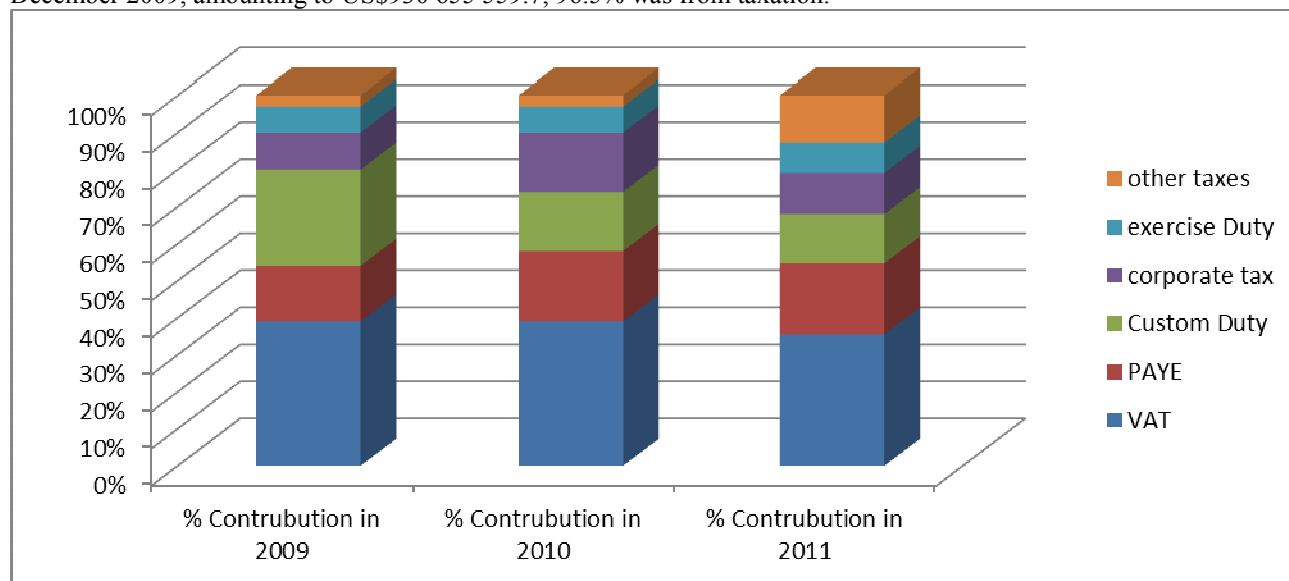


Fig. 1: Revenue contributions for the period 2009-2011

Source: Ministry of Finance (2010, 2011 and 2012)

In the second quarter of 2010, VAT contributed 35.5% of the \$519.1 million total revenues collected. Table 1 showed that PAYE was in the second position, contributing 19.2%. PAYE has remained lower than its

historical level. The situation where a redistributive tax contributes less than one which is not redistributive means that overall the tax system achievement of equity is limited. Value Added Tax (VAT) was adopted in January 2004 and replaced such taxes as sales tax, betting tax, gaming tax and import tax. VAT is levied on transactions rather than persons, therefore the liability to charge the tax arises every time a transaction is carried out by registered operators, and will not depend on the profitability of the business and it does not achieve equity principle, especially if all household allocate their expenditures proportionately to their incomes. The economic incidence is the same whether one is poor or rich. It is an indirect tax that is levied on the supply and importation of goods and services. VAT is payable on the value of goods imported into the country but some exemptions are allowed.

Tax bands are used on individual earnings in many countries including South Africa, Zambia and Botswana. According to World Bank's world report (2011), for the 2010 period, Sub-Saharan Africa's average tax revenue stood at 24.8 percent, whilst Zimbabwe registered highest average tax revenues as a percentage of GDP in the region at 30 percent for the period 1980-2010. The use of tax bands makes PAYE a progressive tax which is redistributive, hence the argument that the proportion of tax revenue from PAYE should be higher than that from the non progressive taxes such as VAT and customs duty. But for Zimbabwe it has been argued that a low flat rate may reduce the cost of collection and reduce evasion (Legat, 2010). Zimbabwe tax rates are generally not much comparable within the region.

Table 1: Comparison of Tax Rate for the Year 2010

country	Maximum PAYE rate (%)	VAT (%)	Corporate Rate (%)
Botswana	25	12	15-25
South Africa	40	14	28
Zambia	35	16	15-45
Zimbabwe	35	15	15-40

Source: Ministry of Finance (2011); World Bank world indicators.

It is generally agreed that the tax threshold should be related to poverty datum lines. The Zimbabwe Congress of Trade Unions (ZCTU) made presentations to the Minister of Finance for the 2011 and 2012 budget which proposed to correct the situation. ZCTU's proposals included the following; (i) Setting an income tax-free threshold which is at par with the Poverty Datum Line. As the PDL is approximately \$500, those who earn less than \$500 should not be taxed, (ii) the minimum tax rate should be 20% and the maximum should be 30%, (iii) the individual tax rate should be below corporate rate. The 2010 corporate rate is 25% while the maximum rate for individuals is 35% (Madzimore, 2011). In 2011 and 2012 it was raised 27% and 37.5 respectively (MoF, 2013).

However, in setting the tax threshold the Ministry of Finance had to balance between wanting to alleviate the plight of the poor and the need for government to raise revenue in order for sustainable growth and poverty eradication to be achieved especially by 2015, which are the crucial MDG goals.

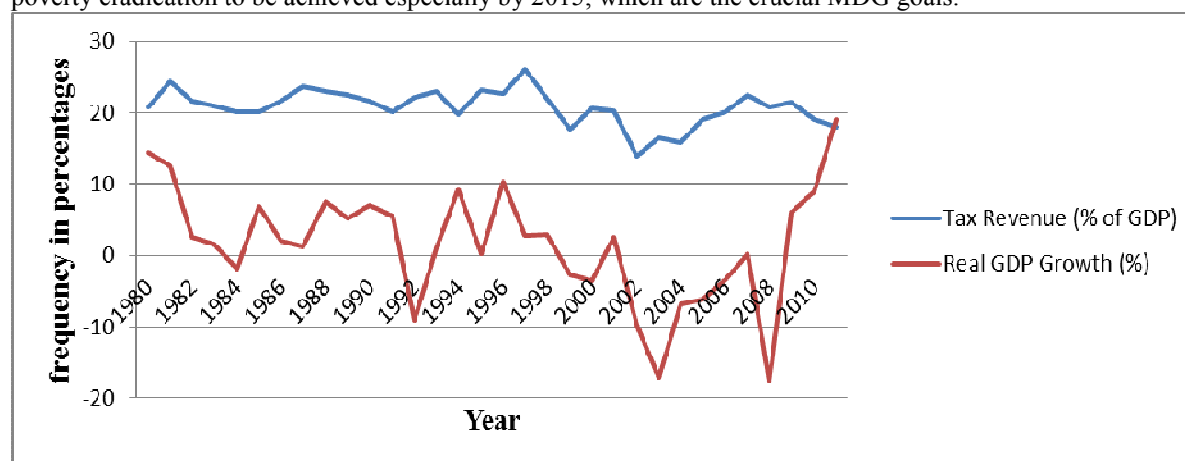


Fig. 2: Trends of tax revenue and real gross domestic product growth; 1980-2011 Source: World Bank; ZimStat, 1999 and Ministry of Finance, 2012

Introspection of Fig. 1.1, do not provide a conclusive and convincing solution on the direction of causation between tax revenue and growth rates, therefore making this research worthwhile and findings being of paramount importance.

The major problem is, based on official statistics from MoF, Zimbabwe's tax revenue as a percentage of Gross Domestic Product is currently topping regional averages, but the economy remained under-performing, following a sluggish recovery trend and poverty levels continued skyrocketing. For the 2010 period, Sub-Saharan Africa's average tax revenue stood at 24.8 percent, whilst Zimbabwe registered highest average tax

revenues as a percentage of GDP in the region at 40 percent for the period 1980-2010. As a result Zimbabwe is considered as one of the highly taxed countries in the world and also one of the countries that experienced a shocking drastic economic decline to the extent of it changing its status of being the bread basket of Africa to the begging basket case of Africa. Poverty prevalence rate is high and it's also highly impossible that Zimbabwe will achieve crucial millennium goal of poverty eradication through sustainable growth by 2015. Where is the tax revenue going? Given the behaviour of tax revenue and growth rates on Fig 2, policy mooted by the government must be directed towards which variable between tax revenue maximisation and economic growth to achieve the ultimate goal of poverty eradication by 2015, necessitated by equitable redistribution of income?

This research is of paramount importance, given that; an apposite fiscal policy is a vital ingredient for economic development. Despite being a short run policy measure, fiscal policy can have lasting macroeconomic consequences. In the debate about economic and social policy, fiscal policy is viewed as an instrument used to mitigate short run fluctuations in output and employment and bring the economy closer to potential output in the long run (Zagler & Durnecker, 2003). Fiscal policies are in large part contingent on government's expenditure vote allocations and revenue collections. Persistent budget deficits could be avoided if policy makers understand the nature of the nexus between growth and tax revenue relationship. On the policy side, the nature of the causal relationship between economic growth and government tax revenue is essential for three reasons. First, if government tax revenue causes growth through government multiplier, budget deficits can be eliminated by policies aimed at stimulating government tax revenues.

Second, if government tax multiplier driven growth causes government tax revenue growth, it implies government behavior as one where it induce growth through spending first which is an injection, and later, to pay for this spending, from rising tax revenue due to rising taxable incomes, accelerated consumption and widened tax base. Such a situation can induce capital outflow due to the fear of paying higher taxes in future. Third, if the "fiscal synchronization hypothesis" does not hold, it implies that growth decisions are made in isolation from tax revenue accumulation decisions, which can lead to serious budget deficits due to mis-allocation of tax revenue for recurrent expenditure such as supporting civil servant wage bill should government investment decision such as infrastructure development are not supported by funds from the collected tax revenues (Narayan, 2005). For these reasons, it is important to study the causal relationship between government tax revenue and economic growth emanating from the full government multiplier.

The research will shade more light on which policy instrument the government of Zimbabwe will target in order to achieve the ultimate goal of poverty eradication through sustainable growth provided those policies will be anchored on two policy core issues of credibility, consistent, coherency and conflict free policies. These policy core issues will reduce tax revenue loss true leakages such as tax evasion and avoidance since there will be trust of the government from the industry and general public.

2 Theoretical Frameworks

Theoretical framework allows us to unravel the different channels through which taxes might cause output growth. Basing on Harberger (1962, 1996), firstly, higher corporate taxes can depress investment rate, or the net growth in the capital stock, through high statutory tax rates on corporate and individual income, high effective capital gains tax rates and low depreciation allowances. Secondly, tax policy can also discourage productivity growth by reducing research and development (R&D) and economic development; if there would be any subsidy (negative tax) it will boost the research activities whose spillover effects can potentially enhance the productivity of existing labour and capital. Thirdly, taxes may reduce the work incentive which will reduce the labour force participation and hours of work, or it may also create biased occupational choice or the acquisition of education, skills and training. Fourth, heavy taxation on labour supply can distort the efficient use of human capital by discouraging worker from employment in sectors with high social productivity but a heavy tax burden and lastly tax policy can also affect the marginal productivity of capital by distorting investment from high taxed to low taxed sectors. This will hinder balance growth and economic development.

Tax structure varies around the globe with the prime motive of attaining maximum revenue with minimum distortion. Different countries have different philosophies about taxation and have different methods for collection; in the same manner countries have different uses of their revenue which affect the growth differently and as a result their growth rates are different. Atkinson (1995); Castles & Dawrick (1990) and Agell *et al.* (1997), all argued that the different uses of total government tax revenue expenditure affect growth differently and a similar argument applies to the way the tax revenue should be raised. Over the last few decades, most countries have increased taxation quite dramatically while others are following suit. Some have incorporated value added tax like Zimbabwe in 2004 and some are on the pipeline to do so.

Solow (1956), a pioneer theory in this regard, namely the neo-classical growth model concluded that taxes do not affect the steady-state growth rate. This implies that although tax policies are distortionary has no impact on long term economic growth rates and total factor productivity. On the other hand, endogenous growth theory by Romer (1986), emphasises factors such as 'spillover' effects and 'learning by doing' by which firm

specific decisions to invest in capital and R&D or individual investment in human capital, can yield positive external effects that benefits the rest of the economy. In this model government spending induced growth and tax revenue policies can have a long run sustainable and permanent growth. In an empirical context, this hypothesis postulates no causal relationship or independence between economic growth and government tax revenue.

The literature also has identified three main hypotheses to explain the nexus between government tax revenue growth and government spending induced growth. One is the “tax and grow” hypothesis, which perceives a unidirectional causal relationship running from tax revenue to economic growth. The advocate of this theory was Friedman (1978), who argued that raising tax revenue either through increasing tax rates or tax base would lead to more fiscal space which will drive growth.

The second is the “grow and tax” hypothesis, which argues that increased tax revenue arises because of accelerated economic growth achieved through government spending multiplier. Peacock & Wiseman (1979) postulates a case that government spending induced growth might increase due to crises and the increased levels of accelerated expenditure growth continue even after the crisis is over applying the Keynesian growth theory and the tax ratchet effect. They are of the view that severe crisis that initially force up government expenditure induce economic growth rate, more than tax revenue growth rate. This is capable of changing public attitudes about proper size of government. The main idea is that the original tax revenue increases due to the crisis becomes a permanent feature in the tax policies (Narayan, 2005). In an empirical sense, this hypothesis implies unidirectional causality running from economic growth to tax revenue growth. The third is the fiscal synchronization hypothesis owing to Barro’s (1979) tax smoothing model. This hypothesis explains that government tax spending induced growth and tax revenue maximisation decisions are taken simultaneously. This idea that tax revenue and real GDP change concurrently was explained by Meltzer and Richard (1981) in their quest to explain the size of government spending *visa-viz* tax revenue collections. In an empirical sense, this hypothesis postulates bidirectional causality between economic growth and government tax revenue.

Veritable empirical studies have been done to test the adequacy of the aforementioned theories. Most economists have always asserted that there is a strong connection between fiscal policies and economic growth, as compared to the connectedness between monetary policies and growth. This idea has been thought to originate from various channels such as the negative effect of distortive tax on the performance of the economy (Tanzi & Zee, 1997). Studies have revealed that any policy changes that led to an increase in economic incidence and deadweight loss distort economic growth (Karran, 1985, Easterly *et al.*, 1994, Kneller *et al.*, 1999). The supply side hypothesis has supported the inverse relationship between tax rates and economic growth. Firstly, increases in the tax rate causing a rise in tax revenue lead to a significant negative impact on economic growth. Second, the relationship between tax revenue and economic growth showed a positive association between the two, that is, any significant increase in tax income will have a positive impact on economic growth. A possible reason is that an increase in tax revenue will boost the economy and prospective economic development.

The tests on the relationship between the tax revenue growth and economic growth have been extensively performed especially in developed countries. The results show that economic development was the strongest determinant of tax growth. For instance Easterly *et al.* (1994) has shown how the distortion in tax structure affects the growth rate. Similarly Kneller *et al.* (1999) found evidence on how tax can negatively affect the growth rate. In contrast, it was found that a rise in income tax could lead to an increase in economic growth if the time preference is endogenously determined (Chang *et al.*, 1999). It was further assumed that the government collects income tax revenue and transforms it into a productive public expenditure that has an effect on the economic growth. Most studies have examined how tax may encourage or discourage the long term economic growth rate (Padovano & Galli, 2002, Koch *et al.*, 2005, Lee and Gordon, 2005).

Retarded growth is sometimes caused by the distortion tax where levels of tax policy change, whereas non-distortion tax will not affect the growth as the tax policy is stable. Padovano & Galli (2002) verified the robustness of the correlation between tax variables and growth by progressively including additional policy and control variables in the growth regression. Later, Lee & Gordon (2005) while exploring how tax policies affect a country’s growth rate, using cross-country data, found that any increment in tax rate leads to lower future economic growth. A similar finding was found by Koch *et al.* (2005) who, by using time series analysis for the period of 1960-2002, examined the implication of tax policy and economic growth by using a two-stage modeling technique. Findings reveal that the changes in economic growth are strongly associated with the changes in tax burden. In addition, they revealed that the impact of tax in developing economies is larger than in developed economies. Moreover taxes raise the cost or lower the return to the taxed activity. Results show that higher marginal tax rates have a negative impact on economic growth (Poulson & Kaplan, 2008).

Based on VAR methodology results show that net-tax increases often produce a positive although small and hardly significant output response (Castro & Cos, 2008). Most of the prior studies have found a positive relationship between tax and economic growth, but Reed (2008) has found a negative relationship between these two variables in US Compare to previous studies conducted in various part of the globe, this study have its own strength. Recently Gordon & Li (2009) and Kuismanen & Kamppi (2010) again emphasize on the

significant effect of fiscal policy on the economic activity. Therefore considering the significant impact of tax and economic growth we aim to identify the long run and short run relationship between tax revenue and economic performance for Zimbabwe using time series data for entire period of 43 decades employing the empirical approach. Though substantial amount of literatures has addresses this issues, the discussion in the developing context is scarce. Since these types of countries is progressing rapidly, the analysis of such analysis is important to help the government in policy formulation.

Tah, Nanthakumar & Colombage (2011), studied the causal effects of economic growth on government tax revenue were investigated for Malaysia during the period of 1970-2009 they applied co-integration, vector error correction model (VECM) and Granger causality methodology. Empirically they showed that taxes affect the allocation of resources and often distort the economic growth. However findings of their study further clearly showed that there was a unidirectional relationship between economic growth and total government tax revenue with 21% speed of adjustment in the short run to reach equilibrium level in the long-run. Based on the findings, they highlighted some of major issues that policymakers should consider for effective taxation policy formulation and implementation in line with the dynamic nature of the Malaysia economy.

The empirical literature on the tax-grow debate has yielded mixed results due in part to the various time periods analyzed, lag length specifications used, and methodology. Generally, the methodology used in these studies has been to test for Granger causality within a vector autoregressive model; however, some of the studies test for Granger causality within an error-correction framework.

In the case of the United States, Blackley (1986), Ram (1988a), Bohn (1991), and Hoover & Sheffrin (1992) provide evidence to support the tax-grow hypothesis while Anderson *et al.* (1986), Von Furstenberg *et al.* (1986), Jones & Joulfaian (1991) and Ross & Payne (1998) find support for the grow-tax hypothesis. Manage & Marlow (1986), Miller & Russek (1989), and Owoye (1995) suggest the fiscal synchronization hypothesis was valid for the United States while Baghestani & McNown (1994) support the institutional separation hypothesis.

In the case of Canada, the studies by Ahiakpor & Amirkhalkhali (1989) and Payne (1997) support the tax-spend hypothesis while the evidence of Owoye (1995) supports the fiscal synchronization hypothesis. Regarding the remaining G7 countries Owoye (1995) found that the tax-grow hypothesis was valid for Italy and Japan while the fiscal synchronization hypothesis was supported in France, Germany, and the United Kingdom. In the case of Greece, Provopoulos & Zambaras (1991) as well as Hondroyiannis & Papapetrou (1996) provide evidence of the grow-tax hypothesis while Katrakilidis (1997) found evidence in favor of fiscal synchronization. Ram (1988b) examines twenty-two countries comprising both developed and less developed economies. Using constant price measures of revenues and growth, Ram found support for the tax-grow hypothesis in El Salvador, Philippines, Thailand, and the United Kingdom; support for the grow-tax hypothesis in Honduras and New Zealand; and support for the fiscal synchronization hypothesis in Nicaragua. The remaining eighteen countries display an absence of causality in either direction thus lending support for the institutional separation hypothesis. In a study of OECD countries, Joulfaian & Mookerjee (1991) found support for the tax-grow hypothesis in Italy and Canada; support for the grow-tax hypothesis in the United States, Japan, Germany, France, United Kingdom, Austria, Finland, and Greece; and support for the fiscal synchronization hypothesis in Ireland. Baffes & Shah (1990, 1994) have extended this analysis for Argentina, Brazil, Chile, Mexico, and Pakistan. It was found that found that for Brazil, Mexico, and Pakistan strong bi-directional causal relationship existed between tax revenues and growths, while for Argentina and Chile growth appear to cause tax revenue growth.

3. Data and Model Specification

This study investigates the empirical causal relationship between government tax revenue and economic growth. Yearly data was collected for the period 1980 to 2012 providing 32 observations. Most of the studies conducted to study the relationship of economic growth with any variables (Colombage, 2009; Koch *et al.*, 2005; Soli *et al.*, 2008; Karran, 1985; Hahn, 2008; Butkiewicz & Yanikkaya, 2005) used Gross Domestic Product (GDP) changes as measure of economic growth. Similarly, this study utilised GDP growth rate (using 2000 as a base year) as a proxy of economic growth (EG). Government tax revenue (TR) measured as total tax revenue growth (% of GDP), which is composed of collections from direct and indirect tax revenues. That is, it was expressed as a percentage change of GDP. Tax revenue refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue, since they are regarded as transfer earnings. Both data was directly obtained or compiled from World Bank economic indicators, IMF, ZimStat and Economic Reports and national budgets from the Ministry of Finance Zimbabwe.

3.1 Unit Root Identification

Various time series techniques can be used in order to model the dynamic relationship between time series variables (Gujarati, 2004). However, it is important to determine the characteristics of the individual series before conducting further analysis. Therefore, unit root tests for stationary are examined on the levels and first differences for all variables using the most common unit root tests, which is the Augmented Dickey-Fuller (ADF)

and the Philip-Perron tests (PP). In some circumstance, lack of power in both the ADF and PP tests is widely acknowledged, then the NG-Perron (NP test must be done (Ng-Perron, 2001). Usually ADF yields superior results than PP test, if the data set has no missing observations and structural breaks whilst PP test also yields superior results than ADF test, if the dataset have some missing observations and have structural breaks (Green, 2003). In this research the ADF test was employed since there are no missing gaps and significant structural breaks in the dataset.

3.2 Long Run Co-Integration: Johansen Approach

Since the influential work of Granger & Newbold (1974) and Engle and Granger (1987) on the treatment of integrated time series data, many studies have been conducted using the co-integration methodology in order to yield consistent results and avoid the spurious regression problems, particularly in causality testing. The purpose of co-integration test in this study is to examine whether economic growth and tax revenue share a common stochastic trend, that is, whether they move on the same wave-length in the long-run thought there might be some disequilibrium in the short-run. The researcher employed Johansen's (1988) approach to determine whether any combinations of the variables are co-integrated. Johansen & Juselius (1990) recommend the trace test and the maximum eigen-value t-statistics in making the inference of the number of co-integrating vectors. For trace statistic, the null hypothesis is the number of co-integrating vectors is less than or equal to co-integrating vectors (r) against an unspecified alternative. In the case of maximum eigen-value co-integration test, the null hypothesis is the number of co-integrating vectors (r) against the alternative of $r + 1$ (Ng *et al.*, 2008). If the trace statistic is greater that the eigen-value (critical value), we conclude that the model contains at least one co-integrating equation. Where this condition is violated at a higher order, determines the maximum number of co-integrating equations.

3.3 Optimal Leg-length Determination

The key element in a model is to determine the correct lag length. Several studies in this area demonstrate the importance of selecting a correct lag length. Estimates of the model would be inefficient and inconsistency if the selected lag length is different from the true leg length (Brooks, 2004). Selecting a higher order lag length than the true one over estimates the parameter values and increases the forecasting errors and selecting a lower lag length usually underestimate the coefficients and generates autocorrelated errors. Therefore, accuracy of parameters and forecasts heavily depend on selecting the true lag length. There are several statistical methods used to select the correct lag length which includes Schwarz (SIC) and Akaike Information Criteria (AIC).

Akaike Information Criterion (AIC) developed by Hirotugu Akaike in 1971 (Greene, 2003) has been found to be nearly unbiased estimator of selecting lag order and also it's a large sample size measure of thirty and more items, while the Schwarz Information Criterion (SIC) is a small sample measure of less than thirty observations. Therefore the AIC has been chosen to determine the lag length. In this research the ordinary least Squares regression model was run starting with lag zero upwards, since according to Engle *et al.* (1995) it is the mostly used and recommended methodology used to determine the lag length The lag that provides the minimum Akaike value was chosen as the optimal lag length.

3.4 Causality Analysis

The deterministic components are selected using the Pantula principle suggested by Johansen (1992). The Pantula principle selected the co-integration equation with linear deterministic trend. Lag lengths in vector auto regression were selected using likelihood ratio test. Before testing the causality of the VECM, we will first examine the Granger causality test between tax revenue and economic growth to determine the short run causality. The Granger causality test or well known as 'joint F-test' between government tax revenue and economic growth can be written in the following forms:

$$\Delta TR_t = \sum_{i=1}^n \alpha_i \Delta TR_{t-i} + \sum_{j=1}^n \beta_j \Delta EG_{t-j} + \phi \gamma_{t-1} + \mu_t \dots \dots \dots (1)$$

$$\Delta EG_t = \sum_{i=1}^n \lambda_i \Delta TR_{t-i} + \sum_{j=1}^n \delta_j \Delta EG_{t-j} + \theta \gamma_{t-1} + \varepsilon_t \dots \dots \dots (2)$$

Equation (1) postulates that changes in tax revenue level is related to past values of itself as well as that of growth and a certain proportion of equilibrating error, and (2) postulates a similar behavior for growth. These regressions are expressed in growth forms, TR and EG changes, meaning that all variables are changes in growth rates. The above models can yield four distinct cases as follows:

- i) Unidirectional causality from ΔTR to ΔEG is indicated if the estimated coefficients on the lagged ΔTR in (1) are statistically different from zero as a group (i.e., $\alpha_i \neq 0$) and the set of estimated coefficients on the lagged ΔEG in (2) is not statistically different from zero (i.e., $\delta_j = 0$).

ii) Conversely, unidirectional causality from ΔEG to ΔTR exists if the set of lagged ΔTR coefficients in (1) is not statistically different from zero (i.e., $\alpha_i = 0$) and the set of the lagged ΔEG coefficients in (2) is statistically different from zero (i.e., $\delta_j \neq 0$).

iii) Feedback, or bilateral causality, is suggested when the sets of ΔTR and ΔEG coefficients are statistically significantly different from zero in both regressions.

iv) Finally, independence is suggested when the sets of ΔTR and ΔEG coefficients are not statistically significant in both the regressions.

More generally, according to Gujarati (2004), since the future cannot predict the past, if variable X (Granger) causes variable Y, then changes in X should precede changes in Y. Therefore, in a regression of Y on other variables (including its own past values) if we include past or lagged values of X and it significantly improves the prediction of Y, then we can say that X (Granger) causes Y. A similar definition applies if Y (Granger) causes X.

4. Estimation Results

Table 1 presents the results of the ADF unit root tests results. According to the results non-stationary of economic growth and tax revenue cannot be rejected in the levels. The results are consistent when an intercept and a linear trend are included as deterministic components in the test equation. Based on these statistics, the null hypothesis of unit root could not be rejected at the levels for both variables. However, stationary could be rejected at the first-difference, which implies that these series are integrated of order one, I(1). Once the variables are integrated with I(1), we proceed with the Johansen co-integration test to determine whether there exists a long term relationship between these two variables. The trace and maximum eigen-value statistics are used to test the null hypothesis of no co-integration for these time series:

Variable	ADF-statistic at level	Critical values		Order of integration
ΔTR	-7.249613***	-2.6423	-2.6423	I(1)
		-1.9526	-1.9526	
		-1.6216	-1.6216	
$\Delta RGDP$	-7.634378***	-2.6423	-2.6423	I(1)
		-1.9526	-1.9526	
		-1.6216	-1.6216	

Note: where (***) (** and *) imply stationarity at 1%, 5% and 10% respectively.

Table 4.1: Unit root test results for tax revenue and real GDP (For results see appendix A and B)

Table 4.1 shows the summary of Johansen co-integration test results where both trace and maximum eigen-value statistics find that at least one co-integrating vector exists between tax revenue and economic growth. Therefore, we conclude that there is co-integrating vector between both variables, where both tests reject the null hypothesis of no co-integration with one co-integrating vector.

H_0	$k=1, r=1$			$k=1, r=1$		
	$\lambda_{\max-eigen}$	C.V (5%)	C.V (1%)	λ_{Trace}	C.V (5%)	C.V (1%)
$r = 0$	40.54**	29.68	35.65	57.98**	34.03	40.56
$r \leq 1$	10.56	15.41	20.04	10.56	15.41	20.04

*Note: the 'k' value represents the lag length criteria and 'r' value indicates number of cointegrating vector. * and ** denotes rejection at 5% and 1% level respectively*

Table 4.2: Johansen Test Results for Long Run Cointegration

For further analysis, the VECM was used to investigate the causality between tax revenue and economic growth in the short-run. Since the series is co-integrated, the short run equation of the series can be determined using VECM, which represent symmetrical lag order. The results was as given in table 4.3

variable	Coefficient	Std-Error	t-statistic	P-value
ΔTR_{t-1}	0.253804**	0.109129	2.325714	0.0196
ΔEG_{t-1}	-0.305558**	0.115600	-2.643249	0.0112
ECT_{t-1}	-0.297448**	0.112708	-2.639110	0.0113
Intercept	0.210466**	0.08542	2.463903	0.0217

*Note: *, ** and *** denotes significance at 1%, 5% and 10% respectively*

$$\chi^2_{Hetero} = 0.45(0.84) \quad \chi^2_{Serial} = 0.63(0.50) \quad \chi^2_{Normality} = 1.88(0.24)$$

Table 4.3: Vector Error Correction Model Result for short-run causality

The VECM equation from Table 4.3 was as follows given the diagnostic test for stability results:

$$\Delta TR = 0.2104 + 0.2538\Delta TR_{t-1} - 0.3056\Delta EG_{t-1} - 0.2974ECT_{t-1}$$

All stability test conducted through VECM did not indicates any chronic indications, therefore the estimated VECM was statistically in a stable mode. The error correction term indicates that there was 30% speed of adjustment in short run to restore long run equilibrium level running from government tax revenue to economic growth in Zimbabwe. This was not a surprising indication because Zimbabwe is a developing nation mostly depends on tax revenue to reach sustainable economic growth and recurrent expenditure. Based on the chi-square test results for whites' hetroscedasticity, Breusch –Pagan autocorrelation/serial and jaque-Bera normality tests, indicated that heteteroscedastic , serial correlation and instability hypotheses where rejected. Therefore we conclude that the data have homoscedastic variance, serially uncorrelated and stable.

Table 4.4 shows the summary of the Akaike information Criterion value from lag 0-3. The optimum lag-length was found to be lag one which has a minimum AIC value.

Lag	0	1	2	3
Akaike information criterion value	4.774212	4.654743***	4.782431	4.904915

Note: (***) represent the minimum AIC value, which will be the optimal lag length.

Table 4.4: Optimal Lag-Length Determination Results

Table 4.5 indicates the short run causal relationship between economic growth and tax revenue using joint F-test approach with the error correction terms respectively. Based on the F-statistic values reported in table 3 shows that, economic growth does not Granger cause tax revenue and the null was no rejected. Again, on the other hand, the Granger cause hypothesis of tax revenue and economic growth was also not rejected with all level of significance, namely 1%, 5% and 10%. Therefore, the findings of this study imply that there was no causal relationship at all between government tax revenue and economic growth in Zimbabwe for the period 1980-2011.

Direction of Causation	F-Value	P-Value	Decision	ECT (t-statistic)
$\Delta TR \Rightarrow \Delta EG$	1.39871	0.24725	Do not reject	0.17474(1.4867)
$\Delta EG \Rightarrow \Delta TR$	0.17474	0.67924	Do not Reject	0.16720(1.7856)

5. Conclusions

This research attempts to determine the role of economic growth in fostering government tax revenue growth in Zimbabwe and the causal behaviour of movement of total tax revenue and economic growth both in the long and short run. In fact it was worthwhile to conduct an empirical test to observe the time related nature of the relationship between revenue collection and growth in order to see the direction of movement of these so called two potent components of government fiscal policy. The determination of the causal ordering between these two macroeconomic aggregates is crucial to ensure a sharpening of tax policy and the effectiveness of fund management for expenditure (Taha & Loganathan, 2008) and poverty eradication. Based on the analysis, unlike other studies (Karran, 1985, Poulson and Kaplan, 2008) the results showed that changes in taxation do not have any impact on economic growth and vice-versa. Therefore a result of this study does not support the supply-side hypothesis which emphasizes the effect of tax towards economic growth in favour of Baro's theoretical assertion that changes in tax revenue does not change the long term growth trajectory, that is, the economy will be in a steady-state. In addition, the strong or weak growth performance does not boost or hamper the tax revenue collection, since there was no causal relationship between tax revenue and growth in Zimbabwe for the period 1980-2012. The results have shown that government of Zimbabwe is not efficiently utilising the tax revenue to enhance societal welfare that is there is no redistribution of income to restore equity principle of a tax system. This implies that there is a large gap between the rich and poor (large Gini's Coefficient). Economic stability in the long run and short run cause on positive relationship between both variables. Both long run and short run relationship appeared in this study. There are several ways to extend the study. First we have focused on the total revenue and GDP. However, it is known that the composition of taxation changes with development. Therefore considering the decomposition of revenue such as direct tax, indirect tax and non tax revenue may provide meaningful results. Further by expand the analysis to cover other developing African countries will give a clear picture on the results for other countries for comparison purposes.

Stunted economic growth for Zimbabwe is possibly due to misuse of tax revenue which must be directed towards growth-driver sectors such as infrastructure towards recurrent expenditure such as supporting the blotted wage bill for civil servants. This lack of coordination is costly and stifles growth leading to independence between the two components of government fiscal policy found in this research. Policy makers to be pro-growth must direct tax revenue collection towards infrastructure development which will attract private investment both local and foreign, which through the multiplier process will drive growth with a large margin.

Efficient allocation of tax revenue and equitable redistribution of income must be the major concern of the government. We recommend a policy shift from the government's side to induce the responsiveness between tax revenue and growth, so that there will be tax buoyancy of some sort.

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