

# Testing the Ricardian Equivalence Hypothesis in Zimbabwe: An ARDL Bound Testing Approach

Regret Sunge<sup>1\*</sup> Shylet Mufandaedza Simion Matsvai

Great Zimbabwe University, Faculty of Commerce, Department of Economics, Box 1235, Masvingo, Zimbabwe  
\*rsunge@gzu.ac.zw

## Abstract

Government deficit financing, particularly debt for tax swap, is increasingly dominating debate over the role of fiscal policy in macro-economic stabilisation. The Ricardian Equivalence Hypothesis (REH) suggesting fiscal policy impotence has sparked empirical tests in many countries. However, no empirical effort has been devoted to Zimbabwe. The major objective of this study was to econometrically test whether the REH holds in Zimbabwe. Using Bound Testing approach to Cointegration and Error Correction Model within the context of the Auto-Regressive-Distributed-Lag (ARDL) framework developed by Pesaran and Shin (1995, 1999), we investigated whether a long-run equilibrium relationship exists between Private Consumption and Gross Domestic Product, Government expenditure, Tax Revenue, Total Public Debt and Interest Payments. We analysed the strength of the long run association using Impulse Response Functions (IRFs). We then run the OLS regression on the reduced form consumption function, derived from Kormendi's Consolidated Consumption function to test the REH in Zimbabwe. The results show that there is long run association running from Gross Domestic Product (GDP), Government Expenditure, Tax Revenue, Total Public Debt and Interest Payments to Private Consumption. More importantly we found strong evidence against the REH in Zimbabwe and support for Keynesian debt non-neutrality. The findings therefore imply that fiscal policy has a role in macroeconomic stabilisation in Zimbabwe.

**Keywords:** Ricardian Equivalence, Debt for tax swap, Bound Test of Cointegration, ARDL Model, IRF.

## 1. Introduction

Fiscal Policy can be used with a stabilisation objective if government finance decisions are able to influence private consumption behaviour. Following the Great Depression of the 1930s, the Keynesian assertion that an expansionary fiscal stance (through budget deficit) is a suitable stabilisation policy has largely been accepted in macroeconomic stabilisation literature. So revolutionary was Keynesian macroeconomics; nevertheless it could not survive some scrutiny from rival theories which have sparked fierce debate, both theoretical and empirical, on how the deficit should be financed, particularly between debt and taxes. This is in respect of the significance of the debt controversy in macroeconomic policy formulation and implementation because it focuses largely on debt-financed-tax cut as a stabilisation measure in the short run and capital formation in the long run (Romer, 1996).

Of importance in this strife is the wealth effect of debt on consumption and capital accumulation. According to the conventional Keynesian theory, the substitution of tax for debt with regards to budget deficit financing increases disposable income, aggregate consumption and aggregate demand (Adji, 2009). In addition, the resultant higher desired consumption relative to saving and a shift in consumers' portfolio pushes up interest rates (Afzal, 2012) and therefore leads to the famous crowding out effect on private capital formation (Saeed and Khan, 2012). This view points to the fact that the source of finance for the budget deficit is actually a matter of concern. It therefore implies an active role for fiscal policy in macroeconomic stabilisation.

In contrast is the Ricardian Equivalence Hypothesis (REH) owing to Ricardo (1817, 1820) and Barro (1974). The Ricardian Equivalence is an economic proposition that whilst government spending has an effect on real economic activity, whether the spending is tax financed or debt financed does not matter (Romer, 1996). The gist of the REH is that households are farsighted and do not treat government bonds as net wealth (Barro 1974) and as such the debt for tax replacement won't induce more consumption since they would save the extra income to repay the government debt in future. Intergenerational altruism implies that Ricardian equivalence holds even if the recipients of a tax cut die before future taxes are increased to fully repay the bonds (Seater 1993). Hence to consumers whether the deficit is financed by debt or tax is merely a choice of tax now or tax later: the two options are therefore equivalent (Afzal, 2012). Thus the REH provides an argument for short run fiscal policy impotence and its irrelevancy in long run private capital formation.

Owing to this theoretical inconclusiveness, empirical tests of the Ricardian Equivalence Hypothesis became imperative. More importantly, given the restrictive assumptions upon which the REH is built on, relatively very little empirical effort has been devoted to developing countries at large and Zimbabwe in particular. In this paper our main objective was to provide an empirical test of the Ricardian Equivalence Hypothesis in Zimbabwe using time series data from 1980 to 2014. This study differs from the majority of previous studies on the REH in that we used the ARDL approach and Impulse Response Functions to

cointegration and analysis of convergence to equilibrium respectively. In addition, Zimbabwe provides an interesting case because no study has tested the hypothesis to date irrespective of its heavy borrowing to finance its growing government expenditure which has seen the country's total public debt accumulating to critically unsustainable levels. The rest of the paper is organised as follows; Section 2 looks at Debt Financing in Zimbabwe, Section 3 reviews the literature, both theoretical and empirical on REH, Section 4 details the methodology used for the study, Section 5 analyses the results and Section 6 concludes the study.

## 2. Debt Financing in Zimbabwe

Deficit finance means any public expenditure that is in excess of current revenues and is used to describe the financing of a deliberately created gap between expenditure and revenue (Jhingan, 2001). It is also necessary to point out that deficit financing can lead to high inflation, even if central bank pursue a sound monetary policy and can also be catastrophic in causing other interconnected macroeconomic problems in weak or fragile economies. Feldstein, (2004) described fiscal deficits as obesity in that the more severe the problem; the harder it becomes to correct the problem.

Zimbabwe has been enduring a persistent and growing government budget deficit since independence. With its revenue base shrinking due to a dwindling economy, borrowing, mostly external, became imperative and this plunged the Southern Africa country into its current debt overhang. Currently external debt constitutes about 86% of total public debt, of which 81% is the stock of accumulated arrears, (ZES, 2015). Thus much of Zimbabwe's debt is accumulated because of failure to service it. Zimbabwe's credit rating against world economies is bad. In 2012 the world's average public debt as a percentage of GDP was 63.3% whilst Zimbabwe's public debt, at 244% of GDP, was four times higher and topped the list of high public debt countries followed by Japan, Greece, Italy, Iceland and Portugal with ratios of 226%, 175%, 133%, 131% and 128% respectively, (World Fact book 2013). Its highest ever public debt to GDP was 277% recorded in 2009, (See Fig 1 in Appendix). The severe and unsustainable debt has been shooting down the growth trajectory that the economy deserved following dollarization in 2009. The country has not been accessing financial support from the Breton Wood Institutions due to default. The Zimbabwe Accelerated Arrears-Clearance, Debt and Development Strategy (ZAADDS) have cited the debt overhang as one of the major reasons for the subdued economic growth and the continuous downward revision of growth forecasts. The high debt levels have invited increased calls from various economic stakeholders for Zimbabwe to openly and officially follow the Highly Indebted Poor Country (HIPC) Initiative for possible debt relief programmes.

Evidence of debt for tax swap in Zimbabwe is clear. During the decade after independence (1980 to 1990) tax revenue as a percentage of GDP was averaging 21.57 % while public debt as a percentage of GDP averaged 58% (World Bank, 2014). With government expenditure increasing over the years, the proportion of expenditure financed by borrowing has been increasing significantly higher than the proportion of tax revenue. Public debt as a percentage of GDP averaged 137% between 2000 and 2013 representing a 136% increase from the 1980s average. On the other hand, tax revenue as a percentage of DGP averaged 18.61% showing a 13.47% decrease (World Bank, 2014). (See Fig 2 in Appendix).

## 3. Literature Review

The Ricardian Equivalence Hypothesis postulates that for a given magnitude of government expenditure, the substitution of debt for tax will have no effect on consumption, aggregate demand and interest rates (Saeed and Khan, 2012). We look at the theoretical framework by Romer (1996) in which households' optimisation is a function of government's budget constraint. The government's budget constraint is that the present value of its purchases of goods and services must be less than or equal to its initial wealth plus the present value of its tax receipts (net of transfer payments) as expressed below:

$$\int_{t=0}^{\infty} e^{-R(t)} G(t) dt \leq -D(0) + \int_{t=0}^{\infty} e^{-R(t)} T(t) dt \quad \dots\dots\dots(1)$$

- Where  $R(t)$  is the real interest rate at time  $t$  such that  $e^{-R(t)}$  discounts future values to present values,  $G(t)$  is government expenditure at time  $t$ ,  $T(t)$  is the tax revenue at time  $t$ .  $D(0)$  represents debt rather than wealth and therefore enters negatively into the budget constraint.

When there are taxes, the representative household's budget constraint is that the present value of its consumption cannot exceed its initial wealth plus the present value of its after-tax labour income written as:

$$\int_{t=0}^{\infty} e^{-R(t)} C(t) dt \leq K(0) + D(0) + \int_{t=0}^{\infty} e^{-R(t)} [W(t) - T(t)] dt \quad \dots\dots\dots(2)$$

- Where  $C(t)$  household consumption at time  $t$ ,  $W(t)$  is household income at time  $t$ ,  $T(t)$  is taxes,  $K(0)$  and  $D(0)$  are quantities of capital and government bonds at time 0.

Romer (1996) assumes that the government satisfies its budget constraint (1) with equality implying that the government never pays its debt. If not so, then its wealth would be growing forever, which is rather unrealistic.

Thus (1) can be written as:

$$\int_{t=0}^{\infty} e^{-R(t)} T(t) dt = D(0) + \int_{t=0}^{\infty} e^{-R(t)} G(t) dt \dots\dots\dots(3)$$

Substituting (3) into (2) gives an important representative household's budget constraint:

$$\int_{t=0}^{\infty} e^{-R(t)} C(t) dt \leq K(0) + \int_{t=0}^{\infty} e^{-R(t)} W(t) dt - \int_{t=0}^{\infty} e^{-R(t)} G(t) dt, \dots\dots\dots(4)$$

Equation (4) expresses the household's budget constraint in terms of the present value of government purchases without reference to the division of the financing of those purchases at any time between bonds and taxes. The implication of this constraint is that government expenditure influences private consumption negatively however, whether the government budget deficit is financed by taxes or by bonds does not make the household's lifetime consumption pattern differ, hence the Ricardian Equivalence.

The gist of the REH, according to Barro (1974) is that households are farsighted and do not take government bonds as net wealth. If the government substitutes debt for tax, such individuals will simply save the additional income instead of increasing their consumption. The increase in savings will be used to buy the government bonds which they will use the pay for future tax increases necessitated by the government's retiring of its accumulated debt (Saeed and Khan 2012). Therefore, if private savings increase by the same proportion as does the budget deficit, the net national savings remain unaffected and this in turn leaves the interest rate unchanged. It implies that to consumers, debt is not net wealth and thus neutral.

The REH have invited some fierce theoretical criticisms suggesting Ricardian Non Equivalence. Firstly, according to the Diamond Overlapping Generations Model, the REH do not factor in population dynamics and assumes infinite horizons. If the economy is of the Samuelson (1958) and Diamond (1965) type in which individuals live in exactly successive periods of overlapping generations and derive utility from their own consumption, the REH will not hold (Seater, 1993). Issues of government debt in the current period lowers taxes of the current working generation to be paid with taxes levied on future generations since the present value of future tax obligations of the current generations will be less than the current value of tax reduction. In the end, the bonds represent net wealth to those who are currently living, thereby inducing their consumption (Romer, 1996) and thus failing the hypothesis.

The second argument for Ricardian no-equivalence as forwarded by Tobin and Buiter (1980) and Seater (1993) is that of childless families. According to his argument, regardless of forward looking families with children, the REH will collapse because other families do not have children and as such disregard higher future taxes on the next generation in their optimisation constraint. Such households will therefore treat government bonds as net wealth and therefore increase current consumption. It has been argued that families with children may anticipate a higher burden on their future generations and therefore leave higher bequests Barro (1989). However Seater (1993) posit that the higher bequests are most likely not to outdo the higher taxes.

According to Romer (1996), liquidity constraints have been fingered by Tobin (1980) and Hubbard and Judd (1986) as a candidate reason for the departure from the REH. The households may face borrowing limits because when the government issues a bond to be paid by taxes in future it will actually be borrowing on behalf of the household. If the household can borrow at the government interest rate, as assumed, debt for tax replacement would have no effect on its behavior. In the event that the household faces a higher interest rate and "if the household would borrow at the government interest rate and increase its current consumption if that were possible, it will respond to the government's borrowing on its behalf by increasing its consumption" (Romer, 1996: 69).

Another important factor leading to debt non-neutrality is the distortionary or non-distortionary effects of taxes and was strongly presented by Abel (1986). The REH assumes that taxes are lump sum and therefore non-distortionary. However Bernheim (1987) posited that taxes are a function of income and thus are non-lump sum. Thus tax liability is positively related with income and the debt for tax policy therefore reduces the household's uncertainty about lifetime resources which causes a rational household to respond by increasing its current consumption.

From the literature above, there is some reasonable basis for Ricardian Non-Equivalence. However we learnt a lesson from scientists. Newton physics is known to be false, nevertheless physicists and engineers often treat it as true because it is an excellent approximation in many circumstances- so is with the REH. Seater (1993) agrees that the Ricardian Equivalence is only an approximation and its real relevance in macroeconomics is actually an empirical question. Just like the theoretical strife, the existing body of empirical work has failed to bring the matter to rest as findings are mixed.

## Empirical Literature

Olasunkanmi and Akanni (2013) tested the empirical validity of Ricardian Equivalence Hypothesis (REH) using Nigerian data from 1981 to 2011. They followed the work of Irving Fisher (1907) and Ramsey (1928) and Park (1997) and their model was built basing on Permanent Income Hypothesis (PIH) to test the validity of Ricardian Equivalence Hypothesis. They employed the Johansen Cointegration and the Error Correction Mechanism to test the validity of REH in Nigeria and found a mixed result with the set of variables used. The empirical findings indicated that increases in government debt are associated with increase in private consumption and the coefficient of government spending as well as the relationship between the sign and magnitude of government debt and total wealth supported the existence of REH while the signs and magnitude of taxes and personal income rejected the existence of REH. They therefore concluded that the REH in Nigeria is dependent upon the variables used in analysing its validity.

Muhamm and Masood (2011) checked the Ricardian Equivalence Hypothesis in case of Pakistan by using annual data for the period of 1973-2009. They used Government expenditure, private consumption expenditure, tax revenue, government debt, disposable income, government budget deficit and wealth as variables which are used for analysis. They conducted Cointegration tests and results showed a long run relationship among the variables while results of structural form consumption function invalidated the Ricardian Equivalence Hypothesis in case of Pakistan. The results however manifested the controversy of fiscal policies in boosting private consumption and controlling budget deficits in Pakistan. In another study in Pakistan, Saeed and Khan (2012) tested the Ricardian equivalence hypothesis in Pakistan using the Johansen cointegration. It was established that the Ricardian Equivalence Hypothesis did not hold but the twin deficits hold for Pakistan for the period 1972 to 2008. The use of cointegration analysis invalidate the RE hypothesis and hence Pakistan was found to be a non Ricardian economy facing budget and current account deficits.

Testing the REH has not been restricted to reduced form consumption, but also extended to the interest rate. Vamvoukas and Gargalas (2008), used data of the Greek economy and applied cointegration analysis, Granger causality tests and impulse response functions (IRF) to test the REH in Greece. The empirical analysis confirmed the existence of dynamic relationships between the budget deficit and the interest rate, indicating a two-way causality between deficits and interest rates. The findings of Granger tests and IRFs contradicted the view of Ricardian equivalence that government deficits do not influence the behavior of interest rate. Experimenting with the four-variable system, IRF results show that in the case of Greece the budget deficit positively affects both the interest rate and the inflation rate and this confirms to the rationale of the Keynesian proposition.

Not all studies were pointing to the same direction. Some found evidence for the REH and others could either reject or support it. Issler and Lima (2000) examined the effects of public debt on consumption behavior in Brazil and concluded that the behavior of a “rational” consumer in Brazil may be consistent with Ricardian equivalence thereby contradicting the majority of the studies previously done on the emerging economies. Budget deficits are financed and balanced entirely through changes in taxation. Kaadu and Uuskula (2004) examined the relevance of the Ricardian equivalence in Estonia. They used Instrumental Variable Technique and Full Information Maximum Likelihood Method to estimate consumption equation and system of equation respectively. Their results could neither reject nor confirm the existence of Ricardian equivalence.

Scant research has been done to test the REH in Zimbabwe. Haque (1988) and Gupta (1992) have found empirical support for the Ricardian Equivalence behavior for the case of developing countries with the exception of Zimbabwe. More recently, Giorgioni and Holden (2003) using panel data estimation assessed whether the Ricardian equivalence held for ten developing economies (Burundi, El Salvador, Ethiopia, Honduras, India, Morocco, Nigeria, Pakistan, Sri Lanka and Zimbabwe). Their results indicated that for these countries the Ricardian equivalence was valid, due to the negative relationship between consumption and budget deficits. However, the REH still has to be tested in the Zimbabwean economy and this motivated this study.

## 4. Research Methodology

Empirical examination of the REH has been carried out by analyzing the effect of tax for debt swap either on aggregate consumption and interest rates. The majority of studies used the former variable which can be divided into reduced form consumption-functions and Euler equation-specification. Despite endogeneity problems raised against the reduced form consumption functions, the use of instrumental variables and the fact that given the correct income, interest rates and wealth variables, structural consumption functions are perfectly in tandem with Euler-equation approach under rational expectations (Bernheim 1987), this study uses the former approach. Econometric tests of the REH under the reduced form consumption are largely based on the Lifecycle Hypothesis (Feldstein (1982), Permanent Income Hypothesis (Seater and Mariano 1985) and the Consolidated Approach (Kormendi 1983). Following an argument by Seater and Mariano (1985) that Feldstein’s Lifecycle Hypothesis specification of the consumption function was guilty of specification bias and Kormendi’s synthesis of the Permanent Income and Lifecycle Hypothesis, we use the Consolidated Approach to test the REH in

Zimbabwe.

**Consolidated Approach to Aggregate Consumption:**

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{t-1} + \alpha_3 GS_t + \alpha_4 W_t + \alpha_5 TR_t + \alpha_6 TX_t + \alpha_7 RE_t + \alpha_8 GINT_t + \alpha_9 GD_t + \varepsilon_t \dots\dots\dots 1$$

Where  $C_t$  is household final consumption expenditure as measured by the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by household at time  $t$ ,  $Y_t$  is Gross Domestic Product at current market prices at time  $t$ ,  $GS_t$  is general government final consumption expenditure including all government current expenditures for purchases of goods and services at time  $t$ ,  $W_t$  is privately owned wealth at time  $t$ ,  $TR_t$  is government transfer payments at time  $t$ ,  $RE_t$  is Corporate retained income at time  $t$ ,  $GINT_t$  is Government interest payment on outstanding debt at time  $t$ ,  $GD_t$  is Government Debt at time  $t$   $\alpha_1$  to  $\alpha_2$  are estimation parameters  $\varepsilon_t$  is the error term.

In this specification, the REH holds under the following conditions;  $\alpha_3 < 0$ ,  $\alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = 0$ . It holds when  $\alpha_3 < 0$  because government consumption has a negative effect on current consumption, but the choice of debt/tax financing leaves private consumption unchanged such that  $\alpha_6 = 0$ . Individuals' ownership in firms is rewarded as retained earnings which are saved for future tax payments implying that  $\alpha_7 = 0$ . Debt neutrality implies that  $\alpha_9 = 0$  and because the government interest payments on its stock of outstanding debt are anticipated  $\alpha_8 = 0$ . Finally, since the value of private wealth includes government debt, the Ricardian view implies that a separate debt variable should have a negative coefficient that is equal in magnitude to the one of the total wealth variable, i.e  $\alpha_4 = -\alpha_8$  (Ricciuti, 2001). Due to data constraints, we were forced to drop the variables transfer payments (TR), retained earnings (RE) and wealth (W) but managed to retain the key REH variables and estimated the following model:

$$\log CONS_t = \alpha_0 + \alpha_1 \log GDP_t + \alpha_2 \log GVEX_t + \alpha_3 \log TXR_t + \alpha_4 \log DEBT_t + \alpha_5 \log INT_t + \varepsilon_t \dots\dots\dots 2$$

Where  $CONS_t$  is household final consumption expenditure as measured by the market value of all goods and services,  $GDP_t$  is Gross Domestic Product at current market prices at time  $t$ ,  $GVEX_t$  is government expenditure at time  $t$ ,  $TXR_t$  is government tax revenue at time  $t$ ,  $DEBT_t$  is total government debt at time  $t$ ,  $INT_t$  are government interest payments on outstanding debt at time  $t$ . Following the consolidated consumption function estimation by Kormendi (1983), in our model the REH holds when  $\alpha_2 < 0$ ,  $\alpha_3 = \alpha_4 = \alpha_5 = 0$ .

**5. Model Estimation and Results Analysis**

Unit root tests were conducted on all the variables to ascertain their stationarity using the Augmented Dick Fuller (ADF) test after which the ARDL Bound Testing was conducted to determine the existence of cointegration among the variables. We then estimated the Error Correction Model on the consolidated consumption function to analyse the long run association between the explanatory variables and the dependent variable. In addition we used Impulse Response Functions to analyse the strength of the long run association. Finally, we ran an OLS on equation 2 to test the REH. Unit Root Tests results are shown in table 1 below.

**Table 1 Unit Root Tests**

Variables	T Statistic	5% Critical Value	Probability	Order of Integration	Decision
dlogCONS	-5.485	-3.572	0.0000*	I(1)	Stationary
dlogGDP	-4.263	-3.572	0.0036**	I(1)	Stationary
dlogGVEX	-3.667	-3.572	0.0246**	I(1)	Stationary
dlogTXR	-4.286	-3.572	0.0033**	I(1)	Stationary
logTDEBT	-4.522	-3.568	0.0014*	I(0)	Stationary
dlogINT	-4.062	-3.572	0.0072**	I(1)	Stationary

\*, \*\*, \*\*\* implies that the variable is stationary at 1%, 5% and 10% significance level respectively.

Total Public Debt was found to be stationary in levels thus it is integrated of order zero, I(0). Consumption, GDP, Government Expenditure, Tax Revenue and Interest Payments became stationary after first difference and are therefore integrated of order 1, I(1). These results necessitated testing for cointegration among the variables. Instead of using the conventional Johansen Cointegration method, we used Bound Testing for cointegration under the framework of the ARDL Model. Arguments for using ARDL in this study are well documented. According to Pesaran and Shin (1995), unlike the conventional method which uses multiple equations system, ARDL uses reduced form equation and is therefore parsimonious. More importantly, Duasa (2007), points that ARDL is applicable irrespective of whether the regressors are purely I(0), purely I(1) or a mixture of both and this makes Johansen Cointegration unsuitable for our case in which the order of integration of our variables is

mixed. The existence or absence of cointegration is tested using the Wald F Statistic against Pesaran and Shin (1995) lower and upper bound critical values. Prior to the test, Optimum Lag Selection for the ARDL Model was carried out using the Akai and Schwaz Criteria and produced the following output.

**Table 2 ARDL Lag Selection**

Lag	Akaike	Schwaz
0	44.61411	44.84086
1	43.88587	44.38972
2	43.76870	44.55508
3	42.33145*	43.45241*

\* indicates the chosen lag order under each criteria. All the criteria unanimously choose a maximum lag of 3.

Table 2 shows results of the lag selection. Both criteria chose lag 3 and this was used in Bound Testing and Error Correction estimation.

**Table 3 Bound Test for Cointegration**

Test Statistic	Value	K	Level of Significance	Bound Critical Values	
				I(0)	I(1)
F Statistic	10.16823	5	1%	1.81	2.93
	10.16823	5	5%	2.14	3.34
	10.16823	5	10%	2.82	4.21

The Wald Test calculated F Statistic is compared against the Pesaran and Shin (1995) lower bound [I(0)] and upper bound [I(1)] critical values at 1%, 5% and 10% level of significance. At all levels of significance, the F Statistic of 10.16823 is greater than the corresponding upper bounds critical values. This implies that the null hypothesis of no cointegration cannot be accepted at all levels therefore signifying that there exists a long run equilibrium association running from Gross Domestic Product, Government Expenditure, Tax Revenue, Total Public Debt and Interest Payments to Private Consumption. The nature of the long run association was established by estimating the error correction of the ARDL model. Specifically we did this to determine the speed of convergence of the system back to equilibrium.

**Table 4 Error Correction Model Results**

Dependant Variable: D CONS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CONS(-1))	2.513917	1.08771	2.311201	0.0434
D(CONS(-2))	1.219062	0.586666	2.077949	0.0644
D(CONS(-3))	-1.26921	0.550924	-2.303785	0.044
D(GDP(-1))	-0.788137	0.606756	-1.298936	0.2231
D(GDP(-2))	-1.230532	0.525094	-2.343453	0.0411
D(GDP(-3))	1.342622	0.567522	2.365764	0.0396
D(GVEX(-1))	3.141087	1.244344	2.524292	0.0302
D(GVEX(-2))	1.733532	0.681245	2.544655	0.0291
D(GVEX(-3))	0.058471	0.537316	0.10882	0.9155
D(TXR(-1))	-3.316316	1.349327	-2.457755	0.0338
D(TXR(-2))	-1.386416	0.714106	-1.941472	0.0809
D(TXR(-3))	-2.045538	0.802685	-2.548371	0.0289
D(DEBT(-1))	-0.032003	0.080353	-0.398282	0.6988
D(DEBT(-2))	0.022786	0.117191	0.194439	0.8497
D(DEBT(-3))	-0.366146	0.179085	-2.044534	0.0681
D(INT(-1))	0.649311	1.725742	0.37625	0.7146
D(INT(-2))	8.636396	3.140901	2.749655	0.0205
D(INT(-3))	6.572101	2.684448	2.448213	0.0344
<b>ECT(-1)</b>	<b>-2.081196</b>	<b>0.890344</b>	<b>-2.337518</b>	<b>0.0415</b>

<b>R<sup>2</sup></b>	0.867231
<b>Adjusted R<sup>2</sup></b>	0.6284245
<b>D.W Test</b>	1.42124

The table above shows the error correction model results. The long run dynamics in the model is shown by the

error correction term ECT (-1), which measures the convergence of the model to equilibrium. The error correction term is negative (-2.081196) and statistically significant, t statistic (-2.337518) and p value (0.0415), and this shows evidence of long run causality from the explanatory variables to the dependent variable. The coefficient of -2.081196 shows very high levels of convergence to equilibrium. If consumption is in disequilibrium, the system converges back to equilibrium at a speed of 208%. We also run Impulse Response Functions on the error correction model to extract further insights into the long run adjustment process of the system. Short run dynamics are shown by first differences of lag 1, lag 2 and lag 3 of the variables. Negative and statistically significant lags of variables show short run causality running from the independent variable to consumption.

#### Impulse Response Functions

An impulse/innovation is a shock to a VAR system which is analysed by an Impulse Response Function (IRF). IRF measures the responsiveness of the dependent variable over a given time period to a shock in the error term, (Duasa, 2007). IRFs are sensitive to the ordering of the variables and we used the Cholesky dof adjusted criteria for this over a 10 year response period. The IRFs for the Error Correction Model are shown on Fig 4 (*see Fig 4 Appendix*). Shocks in the independent variables caused disturbances in consumption but it converges to equilibrium after an average of 7 years. An impulse in GDP, for instance, had a fairly stable positive impact on the level of consumption for the first 7 and half years after which consumption goes back to equilibrium and then disequilibrium. This is in concurrence with the positive coefficient of GDP in the long run relationship obtained from the OLS reported below. The same trend is observed for TXR and INT. A shock in GVEX had a small and largely negative impact on private consumption for the first 8 years after which it converges to equilibrium. The negative impact is in agreement with both Keynesian and Ricardian view on government expenditure and was also confirmed in this study. Overallly the IRFs provides evidence against the Ricardian Equivalence Hypothesis. We then carried out further diagnostic tests on the error correction model to detect serial correlation and stability problems and these we did using the Breusch-Godfrey Serial Correlation Test and the Recursive (CUSUM) Estimates respectively.

**Table 5 Breusch-Godfrey Serial Correlation Test**

**Dependant Variable: Residuals**

Breusch-Godfrey Serial Correlation Test			
Test Statistic	Value	Probability	Decision
F Statistic	0.296866	0.8268	Do not reject H <sub>0</sub>

The probability value of 0.8268 is greater than 0.05 hence we cannot reject H<sub>0</sub> that there is no serial correlation on the error correction model. Therefore the model is free of serial correlation. Stability test results are shown on Fig 3 in Appendix. The CUSUM Estimates line is between the 5% Significance Level implying that the error correction model is stable. After establishing that long run association do exists among the variables in the model and determining the speed of adjustment to equilibrium, we then proceeded to run the OLS of the model to inquire on the REH and obtained the following results.

**Table 5 OLS Long Run Model Results**

**Dependent Variable: dlogCONS**

Variable	Coefficient	St Error	t statistic	p>t
<b>DlogGDP</b>	1.312617	0.144744	9.068525	0.000
<b>DlogGVEX</b>	-0.196375	0.050842	-3.862443	0.001
<b>DlogTXR</b>	0.039055	0.043688	0.893952	0.508
<b>LogDEBT</b>	-0.081821	0.030679	-2.666993	0.014
<b>DlogINT</b>	-0.006320	0.030679	-0.208380	0.823
<b>Constant</b>	0.8000709	0.299177	2.676372	0.013
<b>R<sup>2</sup></b>	0.801382			
<b>Adjusted R<sup>2</sup></b>	0.764601			
<b>F(6, 26)</b>	21.78788			
<b>Prob &gt; F</b>	0.000000			

#### Estimated Equation

$$dlogCONS = 0.8000709 + 1.312617dlogGDP - 0.196375 dlogGVEX + 0.039055dlogTXR - 0.081821logDEBT - 0.006320dlogINT + 0.18678$$

#### Results Interpretation

$R^2$  measures the model's goodness of fit and at 0.8013820 implies that all the explanatory variables combined account for approximately 80% variations in private consumption in Zimbabwe from 1980 to 2013. The F statistic is the yardstick for overall significance of the explanatory variables. The F Statistic (21.78788) is greater than 5 and the F probability of 0.000000 means that collectively, the explanatory variables have been statistically significant in explaining the trend in private consumption over the period of study.

The results show that GDP had a statistically significant positive impact on private consumption. A coefficient of 1.312617 implies that other explanatory variables constant, a 1% increase in GDP led to a 1.3% increase in private consumption. This is in line with the conventional link in which an increase in GDP increases disposal income and therefore consumption. The negative coefficient of government expenditure (-0.196375) implies that, ceteris paribus, a 1% increase in government expenditure was responsible for approximately 0.2% fall in consumption. This is in line with both the Keynesian conventional theory and the REH. However, the

results on other REH variables show that  $\alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$ . The results therefore find strong evidence against the Ricardian Equivalence Hypothesis in Zimbabwe and are in tandem with those of the Impulse Response Functions. The findings concurs with the majority of previous studies which found no evidence of the REH in developing and transitional countries, Muhammm and Masood (2011) and Saeed and Khan (2012) for Pakistan, Vamvoukas and Gargalas (2008) in Greece. However it contradicted findings by Olanunmi and Akanni (2013) in Nigeria and Issler and Lima (2000) in Brazil.

Debt was found to have a statistically significant negative impact on private consumption thereby refuting the REH. The coefficient of -0.081821 means that a 1% increase in public debt, ceteris paribus, accounted for about 0.08% decrease in private consumption during the period under study. This is in line with the Keynesian crowding out effect. The REH rejection is cemented by the positive impact of tax revenue on consumption. Interest payments were found to be statistically insignificant but negligibly and negatively affecting private consumption. A coefficient of -0.006320 implies that for every dollar used to pay for outstanding debts, household consumption fell by \$0.006. Though statistically insignificant, a coefficient of 0.039055 shows that a 1% rise in tax revenue caused a 0.039055% increase in consumption. These findings are largely in line with the conventional Keynesian economics; hence we conclude that Zimbabwe is a non-Ricardian economy.

## 6. Conclusion.

The major objective of this study was to econometrically test whether Zimbabwe is a Ricardian economy. Using Bound Testing approach to Cointegration and Error Correction Model developed within the context of the Auto-Regressive-Distributed-Lag (ARDL) framework developed by Pesaran and Shin (1995, 1999), we investigated whether a long-run equilibrium relationship exists between Private Consumption and Gross Domestic Product, Government expenditure, Tax Revenue, Total Public Debt and Interest Payments. In addition, we examined the strength of the long run association and convergence to equilibrium of the model using Impulse Response Functions (IRFs). We then run the OLS regression on the reduced form consumption function, derived from Kormendi's Consolidated Consumption function to test the REH in Zimbabwe. The results show that there is long run association running from Gross Domestic Product (GDP), Government Expenditure, Tax Revenue, Total Public Debt and Interest Payments to Private Consumption. More importantly we found strong evidence against the REH in Zimbabwe and support for Keynesian debt non-neutrality. The findings therefore imply that fiscal policy has a role in macroeconomic stabilisation in Zimbabwe.

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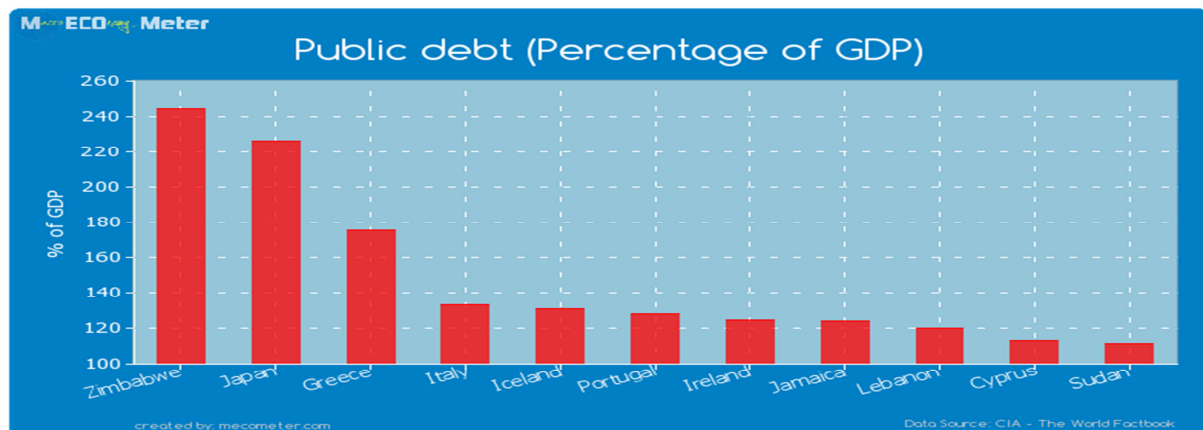
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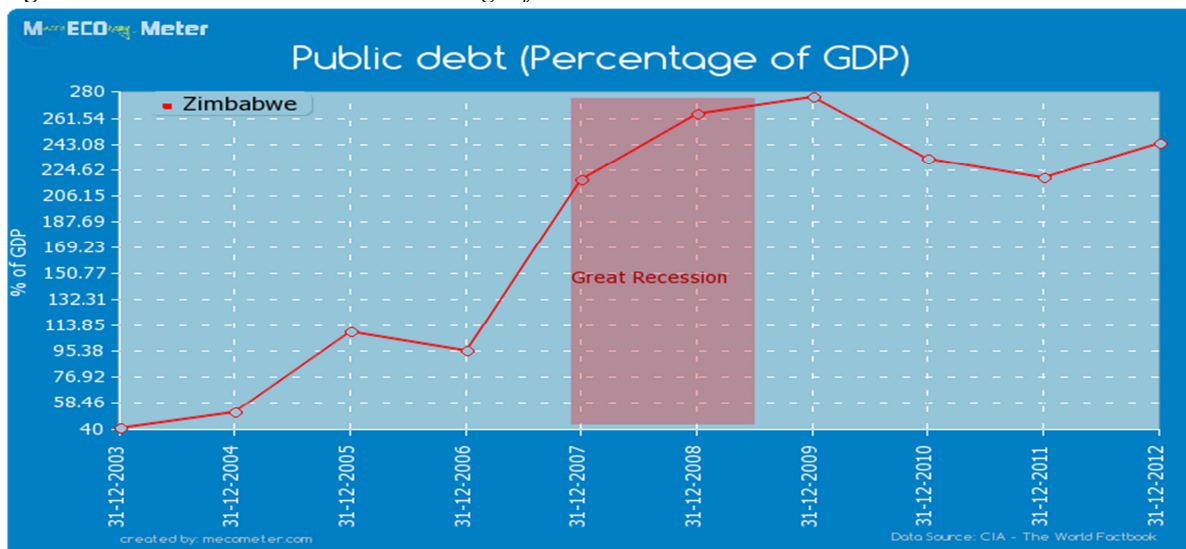
**Appendix**

**Fig 1 Zimbabwe's (2012) Public Debt Rating**



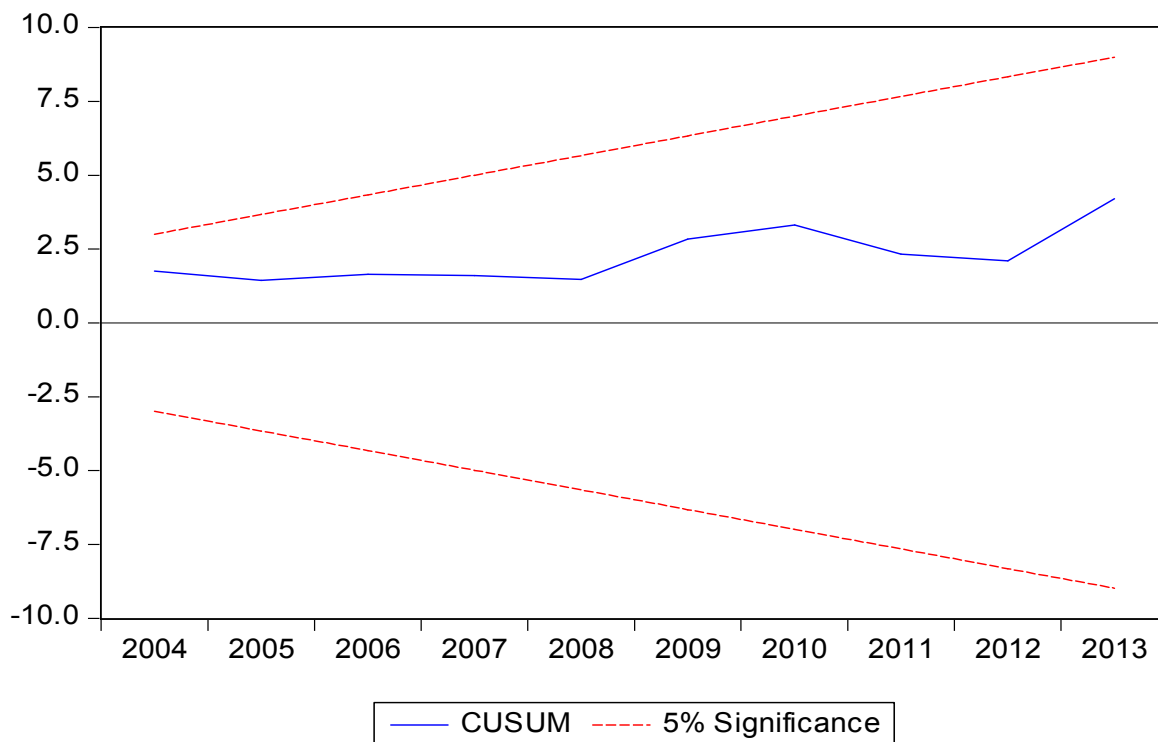
Source: World Fact Book (2013)

**Fig 2 Zimbabwe's Public Debt as a Percentage of GDP**



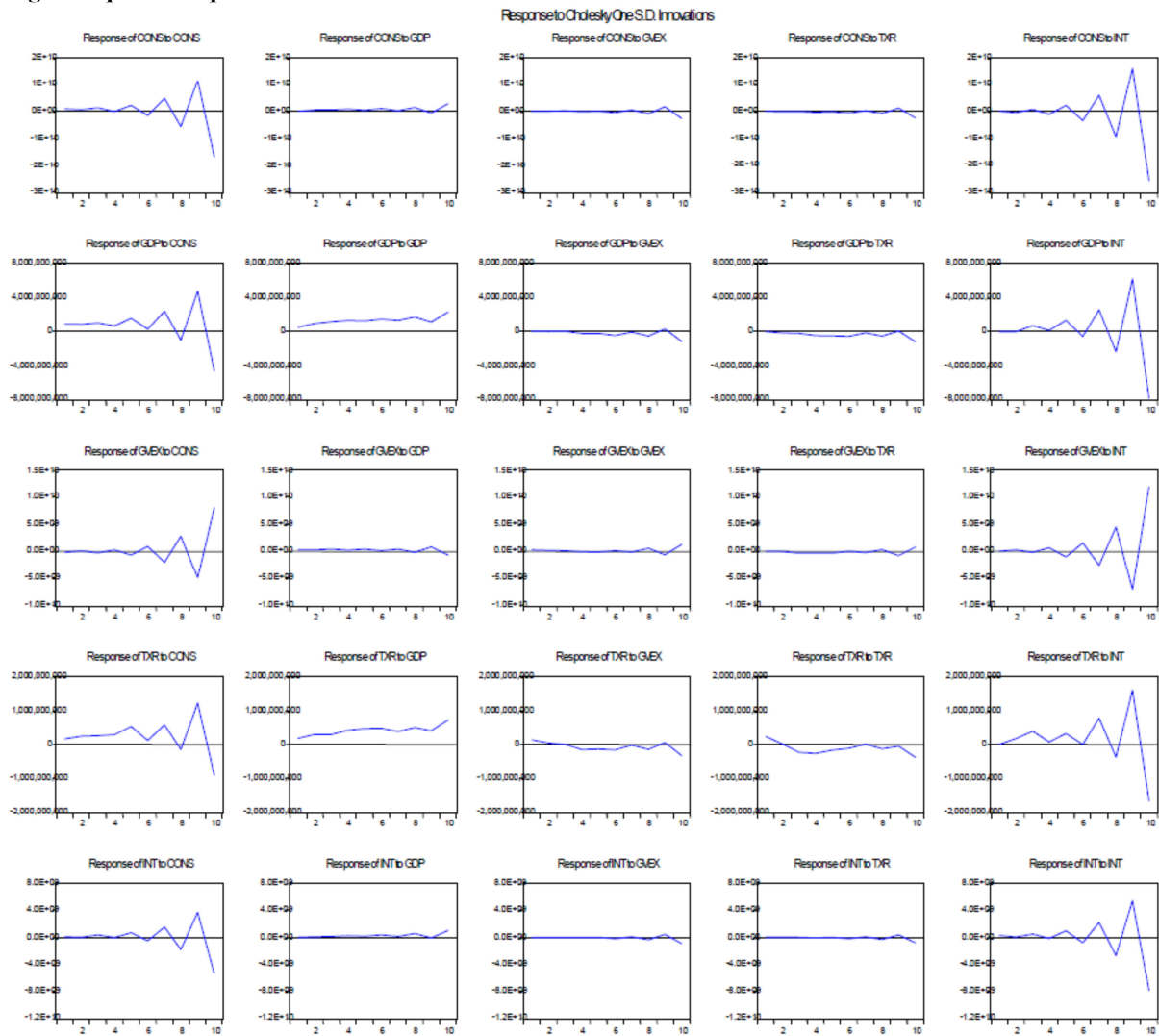
Source: World Fact Book (2013)

**Fig 3. Stability Tests**



The CUSUM Estimates line is between the 5% Significance Level implying that the error correction model is stable.

**Fig 4: Impulse Response Functions**



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