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Is the Ricardian Equivalence Hypothesis Valid?

An Empirical Study for Ethiopia

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There are two main dimensions of dealing with the topic of Ricardian Equivalence Hypothesis (REH) – the Keynesian proposition and the REH itself. According to the REH, today's borrowing to stimulate the economy or tax reduction – a substitution of debt for taxes -does not affect demand and consumption levels. However, the reverse is true for the Keynesian proposition. The objective of this paper is to test the validity of the REH in Ethiopia using annual data running from 1990 to 2011 by employing the bound testing – ARDL approach. The study included three main variables (the budget deficit, government consumption expenditure, and government debt) which contribute to the REH along with another variables. The result shows that government debt failed to fulfil REH. This implies that, in this study, we found limited evidence of the validity of the REH in Ethiopia.

Keywords: REH, ARDL, Ethiopia

1. Introduction

The Ricardian equivalence theorem was formulated, as the name suggests, by the British classical economist David Ricardo, who went on to immediately dismiss it as being irrelevant. However, the neoclassical economist Robert Barro forcefully argued that REH is worthy of professional attention and yields important policy prescription (Heijdra 2002).

There are two main points of view when dealing with the REH. These are the Keynesian proposition and the Ricardian equivalence hypothesis itself. According to Okpanachi and Abimiku (2007) cited in Daylop (2010), Keynesians argue that an increase in government spending by running budget deficits enhances domestic output and this stimulates the economy in the short run by making households feel wealthier, thus raising total private and public consumption expenditure. Besides, according to the Keynesian argument, consumers treat government debt as net wealth. Therefore, substitution of debt for taxes has a positive impact on private consumption and aggregate demand, even though it increases the real interest rate and leads to crowd out private investment and the economy slowing as well (Marinheiro 2001). However, in a sticky price model within a large economy, a fiscal expansion increases the real interest rate. This increase, in turn, leads to a fall in private consumption (Kim–Roubini 2008).

Nevertheless, the Ricardians argue that since a tax cut now is a tax increase in the future, the substitution of debt for taxes has no effect on aggregate demand or on the interest rate. Besides, potential consumers assume that today's borrowings are the postponed taxes of the future, the consumption level of consumers remaining unchanged due to their savings today. Further, under the REH, consumers respond to a reduction in tax by increasing their savings by buying securities, which helps to pay

the increased future taxes and to repay future debt. Hence, when private savings increase by the same amount as the budget deficit, both the national savings and the interest rate will be unchanged. Hence, for a given expenditure path, financing the public expenditure either by debt or taxation does not affect private consumption (Marinheiro 2001). In addition to taxation, issuing bonds is one of the ways of financing government expenditure. Since these bonds are considered loans, it will be paid back in increasing tax revenues. This is the choice between periods of "tax now or later.". If the government chooses the tax later principle to finance its deficit, according to REH, the taxpayers expect higher taxes in the future. Hence, fearing future taxes, economic agents will increase their savings by reducing their current consumption level. Similarly, if the government had chosen to tax now principle, the effect on aggregate demand would be the same.

Also, there has been contradictory empirical evidence on the existence of the REH. For example, studies that support the REH are (Tanner 1979, Kormendi 1983, Evans 1988, Leiderman–Razin 1988, Kormendi–Meguire 1990, Evans 1993, Issler–Lima 2000, Giorgioni–Holden 2003, Olasunkanmi–Akanni 2013, Mosikari–Eita 2017). In contrast, some studies (Yawitz–Meyer 1976, Buiter–Tobin 1979, Modigliani–Sterlling 1986, Bernheim 1987, Kazmi 1994, Graham–Himarios 1996, Drakos 2001, Marinheiro 2001, Onafowora–Owoye 2006, Vamvoukas–Gargalas 2008, Fang et al. 2010, Waqas–Awan 2011, Saeed–Khan 2012, Onyeiwu 2012, Odianye–Ebi 2013, Aderemi 2014) do not confirm the REH. Further, some studies found inconclusive results (Gupta 1992, Kaadu–Uuskula 2004). Further, the issues surrounding the effect of fiscal policies (the variables in the REH) are on today's global agenda, but there is a lack of country-relevant empirical studies in the case of Ethiopia (even Pickson–Ofori-Abebrese (2018) did not included Ethiopia to test the REH for SSA countries). This has resulted in a knowledge gap in the literature, thus necessitating the need for a systematic examination.

Hence, based on the above contradicting theories, inconclusive empirical findings, and lack of country-relevant empirical studies in the case of Ethiopia, we tested the REH to fill the literature gap by employing the ARDL cointegration approach. The main objective of our study is to provide an empirical test of the REH in the case of Ethiopia using time series data extending from 1990 to 2011.

2. Literature Review

This section presents the literature which is relevant to the topic. Specifically, it has theoretical literature about the theoretical precondition for the existence of REH and the theoretical framework of this study. Besides that, it has empirical literature, some of which supports the existence of REH and some that does not or provides inconclusive (mixed) results.

2.1.Theoretical Requirements for the Existence of the REH

The infinite time horizon of individuals is one of the requirements for the existence of the REH. That means, the time horizon of individuals should be at least the same as the lifetime of the government. This is because if the individual's lifespan is limited and shorter than that of the government, borrowing will increase the net wealth of the individual if that person dies. Here individuals are linked with future generation by altruistic gifts. Since individuals care about their children's well-being, they do not decide for a tax cut by increasing their consumption. Instead, they will buy securities and other fixed assets and transfer these assets to their families (Marinheiro 2001).

The existence of a perfect capital market (liquidity unconstraint) is an essential element to maintain REH. According to Hayashi (1987), if consumers face quantity constraint (due to the high-interest rate) on their borrowing, they face liquidity constraint. Therefore, they are not able to smooth out their consumption over an entire lifetime, and they will lack an opportunity to select the tax burden, and they will become indifferent to the issue.

The other prerequisite for the existence of REH is the presence of lump-sum taxes. Lump-sum taxation requires that a tax now be precisely equivalent to a tax next year, and by assumption raises the same present value of revenue. Debt and taxes must be equivalent. Moreover, failure to allow fully for the future by virtue either of finite horizons or fiscal targets are inconsistent with the lump-sum assumption. Any lump-sum tax must be intertemporally neutral, both in the sense that it does not distort between the present and future consumption when used in all periods at a constant rate, and in the sense that a tax differential between periods does not induce any taxpayer response (Brennan and Buchanan, 1980). However, in reality, taxes are not lump-sum. The reality is that tax liability is substantial if future income is high, and it is low if the income is small. Hence, with household lifetime resources becoming uncertain, this may lead to an increase in current consumption (Romer 1996, Marinheiro 2001). According to Romer (1996), if individuals do not optimise their consumption fully over the long term, the Ricardian equivalence will not hold. Further, the perfect foresight assumption is one of a basic assumptions for the occurrence of REH, even though it is difficult to achieve in an uncertain world (De Grauwe 1996, Marinheiro 2001).

2.2. The Theoretical Framework

The two main methods of testing the REH are the consumption function and the interest rate approaches. The consumption function approach tries to assess whether increases in government debtare considered net wealth by individuals and create increases in private consumption. However, the interest rate approach evaluates whether deficits lead to an increase in interest rates (Marinheiro 2001, Aderemi 2014). However, discriminating between the Ricardian equivalence and the perfect capital markets hypothesis for an open economy is the main problem of the interest rate approach. In an open economy, even when the consumers are not Ricardian, the interest rate may remain unchanged even though their consumption increases in

response to a budget deficit, and when it is assumed the interest rate across countries are equalised by international capital flows. Given the domestic interest rate, the budget deficit may be financed by an inflow of capital. However, in this case, it would create a deficit in the current account, which leads to the so-called twin-deficit phenomena when the Ricardian equivalence does not hold (Marinheiro 2001).

Further, the consumption function approach can be examined by the reduced-form (the structural consumption functions) and Euler equation approach. The approaches of Kormendi (1983), Modigliani and Sterlling (1986), Bernheim (1987), Perelman and Pestieau (1993), Cardia (1997), and Leachman (1996) are the popular approach from the reduced-form (the structural) consumption functions categories. Among these approaches, our study follows that of Bernheim (1987), which is the reduced (the structural consumption), approach to testing the existence of REH in the case of Ethiopia. The reason for using the structural consumption approach relative to Euler is: the Euler equation approach needs several restrictions in order to obtain an observable consumption function, such as the imposition of a constant real rate of return, the specification of a specific form of utility function, like the quadratic utility function in order to aggregate the Euler equation across individuals (Adji 2007). Besides that, the Euler approach requires incorporating rational expectations optimising framework (Aschauer 1985, Gupta 1992). However, the structural consumption function is less restrictive compared to the Euler approach (Kormendi 1983, Bernheim 1987). Further, we chose the Bernheim (1987) among other types of reduced-form (the structural) consumption functions due to different reasons (see data sources, model specification, and methodology of the study section). Hence, his standard model of private consumption is:

$$C_t = B_0 + \beta_1 Y_1 + \beta_2 DEF_t + \beta_3 G_t + \beta_4 D_t + \beta_5 W_t + \beta_t X + u_t \quad (1)$$

Where *C* is private consumption, *Y* is GDP, *DEF* is a budget deficit, *G* is government expenditure, *D* is government debt, *W* is wealth and *X* represents a vector of variables capturing the socio-economic conditions of the countries.

2.3. Empirical Literature

In this section, the empirical studies are presented on the REH. Here we clustered the studies based on their findings – those who support the REH, those who do not support the REH, and those who found mixed (inconclusive) results in the course of their research.

Table 1 Empirical Literature

Author and Year	Model type	The scope of the study	Results
Tanner (1979)	Yawitz-Meyer and the Life Cycle Model.	From 1947–1974, USA	Supports the REH
Buiter–Tobin (1979)	Kochin regression approach	From 1949–1976, USA	REH does not hold
Kormendi (1983)	OLS	From 1930–1976, USA	Supports the REH
Modigliani–Sterling (1986)	OLS	From 1952–1976, USA	REH does not hold
Evans (1988)	GMM	Quarterly data from 1947: II–1985: IV, USA	Supports the REH
Leiderman–Razin (1988)	non-linear least squares (from the TSP program)	Monthly data from1980:9–1985:12, Israel	Supports the REH
Kormendi–Meguire (1990)	Engle and Granger approach	From 1931–1985, USA	Supports the REH
Gupta (1992)	Aschauer (1985) model	From 1963–1986, developing countries	Inconclusive result. The study supports the REH only for the case of South Korea, Singapore, Pakistan, and Thailand.
Evans (1993)	Hansen (1982) approach	From 1960–1988, for 19 OECD countries	Supports the REH
Kazmi (1994)	OLS	From 1960–1988, Pakistan	REH does not hold
Himarios (1995)	based on the Euler condition	From 1953–1986,	Inconclusive
Issler–Lima (2000)	Johansen cointegration	From 1947–1992, Brazil	Supports the REH
Drakos (2001)	VECM	Quarterly data from Q1, 1981 to Q3, 1996, Greece	REH does not hold
Marinheiro (2001)	Both the Structural and Euler consumption functions approaches are adopted. Besides that, he used Kormendi (1983) consumption function, along with the Error Correction Method.	From 1954 to 1997, Portugal	REH does not hold
Giorgioni–Holden (2003)	OLS, Fixed Effect and Random Effect	From 1976–1998, for Ten developing economies	Supports the REH
Kaadu–Uuskula (2004)	Instrumental variable technique and full information maximum likelihood method	Quarterly data from 1997Q1–2002Q4, Estonia	Inconclusive
Onafowora–Owoye (2006)	Granger causality test and Vector Error Correction Method (VECM)	From 1970 to 2001, Nigeria	REH does not hold
Vamvoukas–Gargalas (2008)	Cointegration analysis, Granger causality tests and impulse response	From 1948 to 2001, Greece	REH does not hold
Fang *et al.* (2010)	Structural Vector Autoregressive (SVAR) estimation technique	Monthly data from January 1992 - June 2009, China	REH does not hold
Waqas–Awan (2011)	Johansen Cointegration	From 1973–2009, Pakistan	REH does not hold
Saeed–Khan (2012)	Johansen cointegration.	From 1972–2008, Pakistan	REH does not hold
Onyeiwu (2012)	Ordinary Least Squares (OLS) and Error Correction Method (ECM).	Quarterly time-series data from 1994–2008, Nigeria	REH does not hold
Odianye–Ebi (2013)	VECM	Quarterly time series data from Q1 1970– Q4 2010, Nigeria	REH does not hold
Olasunkanmi–Akanni (2013)	Johansen Cointegration and the Error Correction Mechanism	From 1981–2011, Nigeria	Supports the REH
Aderemi (2014)	Ordinary Least Squares (OLS)	From 1981 to 2012, Nigeria	REH does not hold
Mosikari–Eita (2017)	ARDL	Two sample periods, 1980–2014 and 1988–2014, Lesotho	Supports the REH
Pickson–Ofori-Abebrese (2018)	ARDL	From 1981–2014, for sub-Saharan countries (Botswana, Ghana, Gambia, Nigeria, and Kenya)	REH does not hold

Source: Authors' construction

From the above empirical literature, some of the studies support the REH and the others do not. Besides, there are few studies whose results are inconclusive. This is because of differences in the variables included in the model, the methodology, the time scope, and the case studies. Generally, relative to developed countries, REH does not exist in the case of developing countries. This implies in most developed nations that the main requirements of REH are mostly fulfilled relative to developing nations

3. Data Sources, Model Specification, and Methodology of the Study

In this section, the data type, sources, and data analysis of the study are presented. Furthermore, using Bernheim (1987) approach as a theoretical framework, it offers a way to specify the model. Finally, the ARDL estimation technique along with the estimation procedures are also presented.

3.1. Data Type, Source, Data Analysis, and Model Specification

This study used secondary time series data from 1990 to 2011. The sources of data were WDI, IMF, and countryeconomy.com (see Appendix 1). Further, in the study, we used only econometrics to test the REH for the case of Ethiopia.

This study used the reduced-form (the structural) consumption functions. In addition, it followed the Bernheim (1987) approach to test the existence of REH in the case of Ethiopia. Hence, his standard model of private consumption is:

$$CON_t = B_0 + \beta_1 GDP_t + \beta_2 DEF_t + \beta_3 GOVCE_t + \beta_4 GOVD_t + \beta_5 W_t + \beta_t X + \varepsilon_t \quad (2)$$

where CON is private consumption, GDP is the gross domestic product, DEF is a budget deficit, GOVCE is government consumption, GOVD is government debt, W is wealth, and *X* represents a vector of variables capturing the socio-economic conditions of the countries. However, estimating equation (2) for the case of Ethiopia will have various problems such as the unavailability of data on wealth. To solve the above problems, Bernheim (1987) suggested dropping the variable wealth because of its unavailability. Furthermore, Bernheim (1987) used growth in GDP and growth of population as the socio-economic factors. However, for our case, adding these variables leads to the regression result "singular matrix", so as a result, we dropped them. Finally, we modified the original model of Bernheim as follows:

$$CON_t = \beta_0 + \beta_1 GDP_t + \beta_2 DEF_t + \beta_3 GOVCE_t + \beta_4 GOVD_t + \varepsilon_t \quad (3)$$

We used the natural logarithm to measure the elasticity for all variables of the model. More specifically, the final model we used is:

$$lnCON_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnDEF_t + \beta_3 lnGOVCE_t + \beta_4 lnGOVD_t + \varepsilon_t \quad (4)$$

Where, β_0 is an intercept term, and β_1, β_2, β_3, and β_4 are the long run coefficients that will be estimated. Further, the REH holds when $\beta_2 = \beta_3 = \beta_4 = 0$. If government consumption substitutes private consumption, then $\beta_3 < 0$, while if it complements it, then $\beta_3 > 0$.

3.2. ARDL Model Specification

To empirically analyse the long run relationships and dynamic interactions among the variables of interest, the model has been estimated by using the bounds testing (or Autoregressive Distributed Lag (ARDL)) cointegration procedure, which was initially presented by Pesaran and Shin (1999) and further extended by Pesaran and Smith (2001). The procedure is adopted because of its several advantages over the conventional type of cointegration techniques. Firstly, relative to other multivariate cointegration techniques such as Johansen and Juselius, the bounds test procedure is simple since it allows the cointegration relationship to be estimated by Ordinary Least Squares once the lag order of the model is known. Secondly, the bounds testing procedure does not require the order of integrations of all the variables included in the model to be the same like other techniques such as the Johansen approach. It is appropriate irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually integrated (Fosu–Magnus 2006, Bakry–Almohamad 2018). The results of Augmented Dicky Fuller unit root test in Table 1 indicate that the time series variables under examination are integrated of different orders (mixed). Hence, the choice of the ARDL cointegration approach enables us to test the long-run relationships among these variables. Thirdly, the ARDL approach is considered to be a statistically significant approach and more valid than other cointegration techniques for small sample size (Fosu–Magnus 2006, Bakry–Almohamad 2018). This study uses yearly time series data from 1990 to 2011: which is considered a small sample (Narayan et al. 2004). The procedure will, however, fail in the presence of I(2) series (Fosu–Magnus 2006). Fourth, unalike Johansen and Juselius residual-based cointegration tests, this method is efficient and cannot lead to contradictory results, especially when there are more than two I (1) variables under consideration. When we see our variable, four out of five variables are I(1), so ARDL approach eliminates contradictory findings. Fifth, this method (ARDL) includes information on the structural break in time series data and does not suffer from low predicting power. In Ethiopia, there were three structural breaks from 1990 to 2011 (during 1992, 1993, and 2003). Therefore, the choice of the ARDL cointegration approach enables us to consider structural breaks in our study. The sixth advantage of this approach is that the model takes a sufficient number of lags to capture the data generating process in a general to specific modelling framework (Muhammad 2009). Seventh, it estimates the short and long-run components of the model simultaneously, removing the problems associated with omitted variables and autocorrelation. Eighth, this technique generally provides unbiased estimates of the long-run model and valid t-statistic even when some of the regressors are endogenous (Srinivasan et al. 2011). Having the above advantages and following the Bernheim (1987) approach as a framework, the ARDL general model we used in this study is:

$$\Delta lnCON_t = \alpha_0 + \sum_{i=1}^{p} \beta \Delta lnCON_{t-i} + \sum_{i=0}^{p} \delta \Delta lnGDP_{t-i} + \sum_{i=0}^{p} \gamma \Delta lnDEF_{t-i} + \sum_{i=0}^{p} \varphi \Delta lnGOVCE_{t-i} + \sum_{i=0}^{p} \sigma \Delta lnGOVD_{t-i} + b_0 lnCON_{t-1} + b_1 lnGDP_{t-1} + b_2 lnDEF_{t-1} + b_3 lnGOVCE_{t-1} + b_4 lnGOVD_{t-1} + v_t \quad (5)$$

Where, $b_1, b_2, b_3,$ and b_4 are long-run multipliers, α_0 is drift (constant term), and the coefficients of lagged values of difference of the variables show the short-run dynamic structure. Further, Δ is the first difference operator, and *p* is the optimal lag length.

3.3. ARDL Cointegration Procedures

Testing for the stationarity status of all variables to determine their order of integration is the initial step in ARDL, since unit root tests could be undertaken following the general formula of Augmented Dickey-Fuller (ADF) test. Accordingly, to verify the stationarity of variables, ADF is undertaken:

$$\Delta y_t = \delta + \beta t + \alpha y_{t-1} + \sum_{t+2}^{n} \gamma_i \Delta y_{t-i} + \varepsilon_t \quad (6)$$

The hypothesis to be tested $H_0: \alpha = 0$
$H_1: \alpha < 0$

Reject H_0 if $t_{\alpha=0}$ is less than critical values

Where, y_t represents variables subject to ADF test of stationary condition., in which all variables of the model are tested following the above formula of the unit root test. Here all variables should be either integrated order zero or one, or mixed. To avoid spurious results, it is necessary to confirm that none of the variables is integrated of order 2 or beyond (Fosu–Magnus 2006). Following the unit root test, the second step of ARDL approach is the selection of the maximum lag length for general and optimal lag length for the long run and short run equations using different information criteria before we estimate the model. The most common information criteria for the selection of lag length are Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC). However, Pesaran and Shin (1999) and Narayan (2004) suggested choosing two as the maximum order of lags if the observations are annual. Once the maximum lag length is determined, the third step is an estimation of the general equation (5) and then testing the existence of a long-run relationship among the variables by conducting F-test for the joint significance of the coefficients of the lagged levels of the variables. That means the null hypothesis (H_0) for no cointegration among variables in equation 7 against the alternative hypothesis (H_1) is

$$H_0: b_0 = b_1 = b_2 = b_3 = b_4 = 0$$
$$H_1: b_0 \neq b_1 \neq b_2 \neq b_3 \neq b_4 \neq 0 \quad (7)$$

The F test has a non-standard distribution which depends on (i) whether variables included in the model are I (0) or I (1), (ii) the number of regressors, and (iii) whether the model contains an intercept and/or a trend. The test involves asymptotic critical value bounds, depending on whether the variables are I (0), I (1) or a mixture of both. Two sets of critical values are generated which one set refers to I (1) series and the other for I (0) series. Critical values for I (1) series are referred to as upper bound critical value whilst the critical values for I (0) series are referred to as the lower bound critical values. If the F-test statistic exceeds their respective upper critical values, we can conclude that there is evidence of the long run relationship between the variables regardless of the order of integration of the variables. If the test statistics are below the upper critical value, we cannot reject the null hypothesis of no cointegration (Duasa, 2007). The fourth step is an estimation of the long-run and short-run relationship simultaneously. Once cointegration is established, the conditional ARDL long-run model is:

$$lnCON_t = \beta_0 + \sum_{i=1}^{p} \beta lnCON_{t-i} + \sum_{i=0}^{q} \beta_1 lnGDP_{t-i} + \sum_{i=0}^{r} \beta_2 lnDEF_{t-i} + \sum_{i=0}^{s} \beta_3 lnGOVCE_{t-i} + \sum_{i=0}^{t} \beta_4 lnGOVD_{t-i} + \varepsilon_t \quad (8)$$

This involves selecting the orders of the ARDL *(p, q, r, s, t)* for the model using AIC or SBC. The ARDL specification of the short-run dynamics derived by constructing an Error Correction Model (ECM) in the following form:

$$\Delta lnCON_t = \mu_{0+} \sum_{i=1}^{p} \mu \Delta lnCON_{t-i} + \sum_{i=0}^{q} \mu_1 \Delta lnGDP_{t-i} + \sum_{i=0}^{r} \mu_2 \Delta lnDEF_{t-i} + \sum_{i=0}^{s} \mu_3 \Delta lnGOVCE_{t-i} + \sum_{i=0}^{t} \mu_4 \Delta lnGOVD_{t-i} + \lambda ecm_{t-1} + \varepsilon_t \quad (9)$$

Where all coefficients of the short run equation are coefficients relating to the short-run dynamics of the model convergence to equilibrium, λ is the speed of adjustment parameter, and ecmt-1 is the one period lagged error correction term. Finally, it is necessary to run diagnostic tests such as serial correlation using Breusch-Godfrey serial correlation LM test, heteroskedasticity test using Breusch-Pagan-Godfrey test, normality using Jarque-Bera test, and stability tests using CUSUM and CUSUM of squares.

4. Econometric Estimation Results and Discussion

This section contains the empirical results and their interpretations along with the theoretical and empirical support. More specifically, the unit root test using Augmented Dickey-Fuller with intercept and trend, cointegration test, long-run and short-run dynamics, and diagnostic (normality, heteroscedasticity, autocorrelation, and stability) tests of the model are presented.

4.1. Unit Root & Cointegration Tests

The result of the unit root test shows that all variables, except government consumption expenditure (it is I(0)), included in the model are I (1) at one percent level of significance (see Table 2). Hence, having this mixed order of integration, we can proceed with the ARDL cointegration technique.

Table 2 Unit root test

Variables	ADF test statistics (with intercept and trend)		Order of integration
	Level	First difference	
LNCON	–0.966575	–5.370663***	I(1)
LNGDP	–2.261874	–5.019909***	I(1)
LNDEF	–3.134442	–5.595000***	I(1)
LNGOVCE	–4.901242***	–2.648994	I(0)
LNGOVD	–0.972786	–4.653030***	I(1)

Note *** Significant at 1% level, All the values in the table are t-statistics,

Source: Authors construction from using EViews 9 result, 2019.

Comparing the calculated F statistics with the upper bound critical values at one percent critical level of significance is the way to check the existence of cointegration among the variables. Our result implies that the null hypothesis of no cointegration rejected at one percent level. As a result, in the model, there is cointegration relationship between the variables (see Table 3).

Table 3 Cointegration test

Test statistics	Value	No. of independent variables	Significance level	Bound critical values	
	REH model				
F-statistics	8.06	4		I(0)	I(1)
			10%	2.45	3.52
			5%	2.86	4.01
			2.5%	3.25	4.49
			1%	3.75	5.06

Source: Authors construction from using EViews 9 result, 2019

4.2. The Long-run & Short-run Estimations

In the model, the explanatory variables included together explain around 99 percent of the systematic variation in consumption during the period being studied. The F-statistics are highly significant at the one percent level. Since the range of Durbin-Watson is between 0 to 4 and near to 2, the D-W result (1.71) of our model shows the

absence of serial correlation of the residuals in the system. However, the long run equilibrium coefficients and their asymptotic standard error, t-values, and p-values are presented in Table 4.

Table 4 Estimated Long run Coefficients ARDL (1, 0, 2, 0, 0) selected based on AIC
The dependent variable is LNCON

Variables	Coefficients	Std. Error	T-statistics [Prob]
LNGDP	1.346	0.106	12.68 [0.000]***
LNDEF	–0.025	0.054	–0.475[0.643]
LNGOVCE	0.016	0.085	0.194 [0.848]
LNGOVD	–0.102	0.055	–1.829[0.092]*
Constant	–4.480	1.486	–3.013[0.010]**
NB: The following values are from the estimation of the general model			
R-squared	0.994	F-statistic	317.08
Durbin-Watson stat	1.714	Prob(F-statistic)	0.0000

*** Significant at 1% level ** Significant at 5% level * Significant at 10% level

Source: Authors construction from using EViews 9 result, 2019

As we discussed earlier, the REH holds when $\beta_2 = \beta_3 = \beta_4 = 0$. Hence, the result shows that only government debt affects private consumption negatively and significantly. The coefficient of government debt is –0.1, which indicates that, while other things were constant, a one percent increment was responsible for a 0.1 percent reduction in private consumption during the period under study. Since $\beta_4 \neq 0$, our result does not support the REH in Ethiopia. In our result the government debt is a negative and significant effect on private consumption, and it is in line with the Keynesian crowding-out effect. Generally, these findings are largely in line with conventional Keynesian economics; hence we can conclude that Ethiopia is a non-Ricardian economy.

The result of the Error Correction Model (ECM) is presented in Table 5. In the short-run, private consumption expenditure is positively and significantly affected by the level difference of GDP. However, it is negatively and significantly affected by the level difference of government debt and lag difference of deficit. In the short run, the rise in the level difference of GDP by one percent results in a rise in the private consumption level of Ethiopia by 1.53%. However, a one percent increment in the level difference of government debt and lag difference of deficit reduces the private consumption by 0.11 and 0.05%, respectively. In both the long-run and short-run $\beta_2 = \beta_3 = \beta_4 = 0$ did not hold. Hence, Ethiopia is a non-Ricardian economy.

The error correction term indicates the speed of adjustment to restore equilibrium in the dynamic model. The ECM coefficient shows how slowly variables converge to equilibrium and theoretically, it should have a statistically significant coefficient with a negative sign. This condition occurs in our model. Besides that, the highly significant error correction term confirms the existence of a stable long-run

relationship between variables. The coefficient of ECM (–1) = –1.139, implying that about 113% of the deviation of the actual private consumption from its equilibrium value is eliminated every year; hence, in this study, full adjustment to reach equilibrium would require less than a year.

Table 5 Error Correction Representation ARDL (1, 0, 2, 0, 0) selected based on AIC
The dependent variable is D(LNCON)

Variables	Coefficients	Std. Error	T-statistics [Prob]
D(LNGDP)	1.535	0.239	6.413 [0.0000]***
D(LNDEF)	–0.055	0.039	–1.407 [0.184]
D(LNDEF(–1))	–0.052	0.027	–1.876 [0.085]*
D(GOVCE)	0.018	0.097	0.194 [0.849]
D(GOVD)	–0.116	0.064	–1.814 [0.094]*
CointEq(–1)	–1.139	0.164	–6.909 [0.0000]***

*** Significant at 1% level * Significant at 10% level

Source: Authors construction from using EViews 9 result, 2019

Finally, the diagnostic tests of the model such as normality test of Jarque-Bera, serial-correlation of Breusch-Godfrey LM, heteroskedasticity test of Breusch-Pagan-Godfrey, stability test of recursive residual (CUSUM) and CUSUM of square (CUSUMSQ) tests have been conducted. Hence, the estimated residuals did not provide any significant evidence of non-normality, serial-correlation, non-stability, or heteroskedasticity effect in the error term (see Appendix 2).

5. Conclusion and Future Studies

The Keynesian proposition and the REH are the two main competing views when dealing with the REH. According to the REH, today's borrowing to stimulate the economy or tax reduction – a substitution of debt for taxes -does not affect demand or consumption level. However, Keynesians argue that an increase in government spending by running budget deficit and substitution of debt for taxes can stimulate the economy (aggregate demand), thus raise total private and public consumption expenditure.

The primary objective of this study is to test the existence of REH empirically in the case of Ethiopia using annual time series data from 1990 to 2011 by employing the ARDL estimation approach. To do so, we conducted the unit root test using ADF and hence all variables except natural logarithm of government consumption expenditure are I(1). Further, we conducted the cointegration test to confirm whether there is longrun relationship among the variables in the model. Following the unit root and cointegration tests, we estimated both the long-run and short-run equilibirium relationships and the results provide substantial evidence against the prevalence of

REH in Ethiopia and support for Keynesian debt non-neutrality. This is because the REH holds when all budget deficit, government consumption expenditure, and government debt does not affect the private consumption level. Even though our result passed the first two requirements (deficit and government consumption expenditure), it did not fulfil the third requirement (government debt). Theoretically, the REH will be valid if there is the same discount rate for both public and private sectors, perfect capital market, no liquidity constraint, consumers are rational, certainty in the future incomes and taxes, and non-distortionary tax. However, all of the above assumptions are not found in Ethiopia. Therefore, it is an expected result for a developing country like Ethiopia.

Finally, this study has its own limitations even though it tried to fill the literature gap. We dropped some variables due to unavailability of data (wealth) and singularity of the regressed variable because of the short time series data relative to the variables included in the model. Hence, in future researches could extend similar investigations by taking these factors into account.

References

Aderemi, T. (2014): An Empirical Application of Debt Neutrality to the Nigerian Economy: Further Evidence. *International Journal of Economic Practices and Theories*, 4, 4, 493–503.

Adji, A. (2007): Essays on Ricardian Equivalence: Economic dissertations. Department of Economics Georgia State University.

Aschauer, D. (1985): Fiscal policy and aggregate demand. American Economic Review, 75, 117–127.

Bakry, W. – Almohamad, S. (2018): Further evidence on Middle East and North Africa financial markets integration, *International Journal of Economics and Business Research*, 15, 1, 1–22.

Bernheim, B. D. (1987): Ricardian Equivalence: an evaluation of theory and evidence with three 'Comments', in Stanley Fisher (ed.). NBER Macroeconomics Annual, 263–315.

Brennan, G. – Buchanan, J. M. (1980): The Logic of the Ricardian Equivalence Theorem, FinanzArchiv / Public Finance Analysis, New Series, 4–16.

Buiter, W. – Tobin, J. (1979): Debt Neutrality: A Brief Review of Doctrine and Evidence, in von Furstenberg, G. (ed.). *Social Security versus Private Saving*, Cambridge, Mass., Ballinger, 39–63.

Cardia, E. (1997): Replicating Ricardian Equivalence Tests with Simulated Series, *The American Economic Review*, 87,1, 65–79.

Daylop, G. T. (2010): Fiscal Deficits and the Growth of Domestic Output in Nigeria. *Jos Journal of Economics*, 4, 1, 153–173.

De Grauwe, P. (1996): International Money, 2nd ed., Oxford, Oxford University Press.

Drakos, K. (2001) Testing the Ricardian Equivalence Theorem: Time Series Evidence from Greece. *Journal of Economic Development*, 26, 1, 149–160.

Duasa, J. (2007): Determinants of Trade Balance: A case of Malaysia, *Journal of Economic Cooperation*, 28, 3, 21–40.

Evans, P. (1988): Are Consumers Ricardian? Evidence for the United States. *Journal of Political Economy*, 96, 5, 983–1004.

Evans, P. (1993): Consumers are not Ricardian: evidence from nineteen countries. *Economic Inquiry*, XXXI, 534–548.

Fang, W. – Ma, J. – Sheng, Y. (2010): An Empirical Test on the validity of China's Fiscal Policy based on the Ricardian Equivalence Proposition. *International Journal of Business and Management*, 5, 8, 209–214.

Fosu, O. – Magnus, F. (2006): An Examination of Foreign Direct Investment, Trade and Growth Relationships: A Case of Ghana. *American Journal of Applied Science*. 3, 11, 2079–2085.

Giorgioni, G. – Holden, K. (2003): Does the Ricardian Equivalence hold in Developing Countries? *International Review of Applied Economics*, 17, 2, 209–221.

Graham, F. – Himarios, D. (1996): Consumption, Wealth, and Finite Horizons: Tests of Ricardian Equivalence. *Economic Inquiry*, XXXIV, 527–544.

Gupta, K. (1992): Ricardian Equivalence and Crowding out in Asia. *Applied Economics*, 24, 19–25.

Hayashi, F. (1987): Tests for Liquidity Constraints: a critical survey and some new observations, in Truman F. Bewley (ed.), Advances in Econometrics Fifth World Congress, vol. 2, Cambridge University Press.

Heijdra, B. J. (2002): The foundation of modern macroeconomics: Oxford university press Inc., New York.

Himarios, D. (1995): Euler Equation Tests of Ricardian Equivalence. *Economics Letters*, 48, 165–171.

Issler, J. V. – Lima, L. R.(2000): Public Debt Sustainability and Endogenous Seigniorage in Brazil. *Journal of development Economics*, 62, 1, 131–147.

Kaadu, H. – Uuskula, L. (2004): Liquidity Constraints and Ricardian Equivalence in Estonia, *Working Papers* of Eesti Bank No. 7.

Kazmi, A. (1994): Private Consumption, Government Spending, Debt Neutrality: Resolving Kormendi-Feldstein-Modigliani Controversy. *The Pakistan Development Review*, 33, 4, 1055–1071.

Kim, S. – Roubini, N. (2008): Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S. *Journal of international economics*, 74, 362–383.

Kormendi, R. (1983): Government Debt, Government Spending, and Private Sector Behavior. *American Economic Review*, LXXIII, 5, 994–1010.

Kormendi, R. – Meguire, P. (1990): Government Debt, Government Spending, and Private Sector Behavior: Reply and Update, *American Economic Review*, 80, 3, 604–617.

Leachman, L. L. (1996): New Evidence on the Ricardian Equivalence Theorem: A Multico-integration Approach. *Applied Economics*, 28, 6, 695–704.

Leiderman, L. – Razin, A. (1988): Testing Ricardian Neutrality with an Intertemporal Stochastic Model. *Journal of Money, Credit and Banking*, 20, 1, 1–21.

Marinheiro, C. F. (2001): Ricardian Equivalence: An Empirical Application to the Portuguese Economy. Faculty of Economics of the University of Coimbra and Katholieke Universiteit Leuven, Discussions Paper Series 01.12, 1–41.

Modigliani, F. – Sterling, A. G. (1986): Government debt, government spending and private sector behaviour: a further comment. *The American Economic Review*, 80, 3, 600–603.

Mosikari, T. J. – Eita, J. H. (2017): Empirical test of the Ricardian Equivalence in the Kingdom of Lesotho, Cogent Economics & Finance, 5, 1–11.

Muhammad, S. (2009): Nominal and Real Devaluations Relations: A Case of Pakistan, *International Journal of applied Econometrics and Quantitative Studies Cooperation*, 9, 1, 85–108.

Narayan, P. – Smith, R. – Nandha, M. (2004): Interdependence and dynamic linkages between the emerging stock markets of South Asia, Accounting and Finance, 44, 3, 419–439.

Odianye, J. C. – Ebi U. K. (2013): The Relationship between Budget Deficit and Interest Rate: Evidence from Nigeria. *European Journal of Business and Social Sciences*, 2, 1, 158–167.

Okpanachi, U.M. – Abimiku, C.A. (2007): Fiscal Deficit and Macroeconomic Performance: Survey of theory and Empirical Evidence, In Ogiji P. (ed.) *The Nigerian Economy: Challenge and Directors for Growth in the Next 25 Years*, Makurdi, Aboki Publisher.

Olasunkanmi, O. I. – Akanni, O.P. (2013): Testing the Validity of Ricardian Equivalence in Nigeria. *International Centre of Science Education and Academic Research for Scholars*, 1, 1, 164–174.

Onafowora, A. O. – Owoye, O. (2006): An Empirical Investigation of Budget Deficit and Trade Deficit: The Case of Nigeria. *Journal of Developing Areas*, 39, 2, 153–174.

Onyeiwu, C. (2012): Domestic Debt and the Growth of Nigerian Economy. *Research Journal of Finance and Accounting*, 3,5, 45–56.

Perelman, S. – Pestieau, P. (1993): The Determinants of the Ricardian Equivalence in the OCDE Countries. in Verbon and Winden (eds.), 181–194.

Pesaran, M. H.. – Shin, Y. (1999): An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis, S. (Ed), The Ragnar Frish Centennial Symposium, Cambridge University Press.

Pesaran, M. H. – Smith, R. J. (2001): Bound Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16, 3, 289–326.

Pickson, R. B. – Ofori-Abebrese, G. (2018): Ricardian Equivalence Hypothesis in the Sub-Sahara African Countries. *Journal of Economic Integration*, 33, 3, 466–487.

Romer, D. (1996): Advanced Macro-Economics: McGraw Hill, Library of Congress Cataloging-in-Publication Data.

Saeed, S. – Khan A. M. (2012): Ricardian Equivalence Hypothesis and Budgetary Deficits: The Case of Pakistan. International Islamic University, Islamabad Pakistan.

Srinivasan, P. – Kumar, S. – Ganesh, L (2012), "Tourism and Economic Growth: A case of Sri Lanka," *The Romania Economic Journal*, XV, 45, 211–225.

Tanner, J. (1979): An Empirical Investigation of the Tax Discounting – A Comment. *Journal of Monetary Economics*, 31, 207–227.

Vamvoukas, A. G. – Gargalas, N. V. (2008): Testing Keynesian Proposition and Ricardian Equivalence: More Evidence on the Debate. *Journal of Business and Economics Research*, 6, 67–76.

Waqas, M. – Awan, M.S. (2011): Are Pakistan Consumers Ricardian?" *Economics and Business Review* 13, 3, 161–177.

Yawitz, J. – Meyer, L . (1976): An Empirical Test of the Extent of tax Discounting. *Journal of Money, Credit and Banking*, 8, 247–254.

Appendix

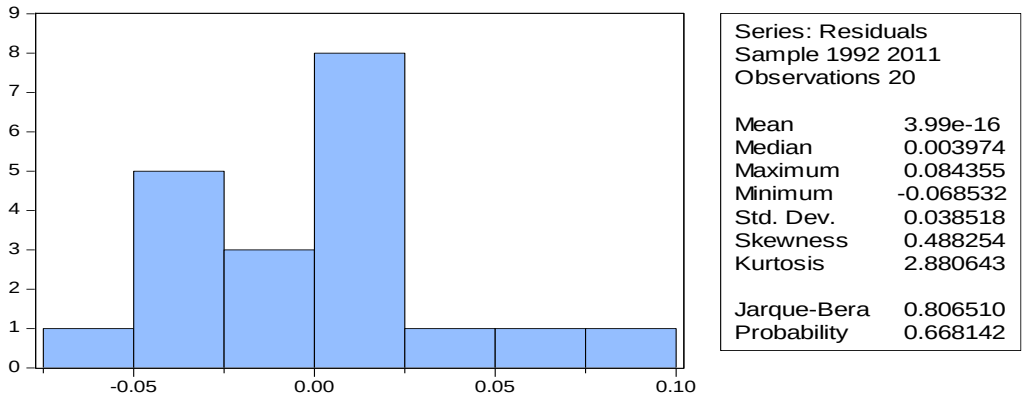
Appendix 1 Definitions, Measurement and Data Sources

Variables	Definition and Measurement	Source
LNCON	Natural logarithm of private consumption expenditure measured as US$	WDI
LNGDP	Natural logarithm of Gross Domestic Product measured as US$	WDI
LNDEF	Natural logarithm of government fiscal deficit measured as US$	Countryeconomy.com
LNGOVCE	Natural logarithm General government final consumption expenditure measured as US$	WDI
LNGOVD	Natural logarithm government debt measured as US$	IMF

Source: Authors construction

Appendix 2 Diagnostic tests

A. Normality test



B. Autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.522148	Prob. F(2,10)	0.6086
Obs*R-squared	1.891106	Prob. Chi-Square(2)	0.3885

C. Test of Heteroskedastisity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.933448	Prob. F(7,12)	0.1507
Obs*R-squared	10.60082	Prob. Chi-Square(7)	0.1570
Scaled explained SS	3.588544	Prob. Chi-Square(7)	0.8258

D. Stability Test