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Testing the Existence of the Ricardian Equivalence in Ghana in this 21st Century

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ABSTRACT

The Ricardian Equivalence Hypothesis formulated by a classical British economist David Ricardo argues that a reduced tax now is a tax increase in the future, the substitution of debt for current taxes has no effect on aggregate demand. The main objective of this paper is to examine empirically the existence of the Ricardian equivalency in Ghana by using time series data running from 1990 to 2017 and ARDL bound testing approach to cointegration and Error Correction Model framework developed by Pesaran and Shin (1995,1999). We examined the long run relationship between the dependent variable household final consumption expenditure and independent variables government expenditure, deficit, GDP per capita and gross debt. The long run results showed a positive and significant relationship between GDP per capita and household consumption expenditure. The result of analysis supports the Keynesian conventional theory and found strong evidence against the existence of the Ricardian Equivalency Hypothesis in Ghana.

1. Introduction

After the experience of the 2008 financial crisis, most countries witnessed an abnormal increase in fiscal deficit, since their public income expenditure have fail to increase at the same rate. This budgetary phenomenon was initially observed in many advance countries such as Spain, France, Portugal, Greece, Unite States etc. However, this effect was extended to many developing countries such as, Ghana. This phenomenon was accompanied by a huge rise in public debt of both the developed and developing economies.

Aside the slow improvement that considered, budget deficit in developed and developing economies is mostly associated with austerity measure. The challenges associated with public debt is probable to exist in the medium term due to the substantial financial needs and lack of additional public revenue. In this situation, what is necessary, is to think of what will be the economic behavior of households when they anticipate an upcoming increase of public debt.

The Richardian equivalence was formulated by a classical British economist David Ricardo as the name of the hypothesis imply. This hypothesis is forcefully argued by a neoclassical economist Robert Barro, the basis of his argument was that the Ricardian equivalency Hypothesis need professional attention and produces necessary policy prescriptions (Heijdra,2002). The Ricardian equivalency is of great importance when investigating the possible instruments linking fiscal policy to household consumption and its savings.

The Ricardian equivalency can be approach in two different ways. They are the Keynesian proposition and the Ricardian equivalence hypothesis. The Keynesians argument is that an increase in government spending through budget deficit improves domestic output and this inspires the economy in the short run by making household feel richer by increasing total

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private consumption and expenditure. The theory can further be explained as when household are in the known that the level of government debt in recent period will lead to higher taxes in the long run, they have the tendency to save towards the future increases. The present value of the long run saving due to the anticipated increase in future taxes would be completely compensated deficit, so that replacing the debt with takes will not have effect on the wealth of the private sector (Descamps, & Page, 1994). In this case consumption will not change which does not support the Keynesian theory, which states that an increase in public deficit will increase aggregate demand. In a whole, the effectiveness of a macroeconomic fiscal policy to a large extent, associated with as to whether households that are prevailing in the economy or the Ricardian ones.

2. Literature Review

This section provides both theoretical and empirical literature that are relevant for the study. Theoretical literature, is on theoretical requirement for the existence of the Ricardian equivalent hypothesis. The empirical literature is on studies that support or reject the Ricardian equivalence hypothesis.

2.1 Theoretical Requirement for the existence of the Ricardian equivalence hypothesis

It is very important to have in mind that for the Ricardian equivalence hypothesis to hold, mechanism based on intergeneration transfer must exist, in this sense, individual most always have it mind to leave a positive legacy for their offspring's. However, for household to become Ricardian, then they need to decide on their consumption on the basis of their fix income, which is associated with the present value of their wage after tax deduction. Household discounted expected present value of future taxes will be the same as current reduction in taxes or present rise in public spending. In other words, household must be anticipating and accept the rational expectation hypothesis.

The existence of a perfect capital market (liquidity unconstraint) is an essential element to support the REH. According to Hayashi (1987), if consumers face quantity constraint (due to high-interest rate) on their borrowing, they face the 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 be indifferent.

The other prerequisite for the existence of REH is the presence of lump-sum taxes. The lump-sum taxation requires that a tax now be precisely equivalent to a tax next year which raises the same present value of revenue by assumption. Debt and taxes must be equivalent. Moreover, failure to allow fully for the future by virtue either of finite horizons or fiscal illusion are inconsistent with the lump-sum assumption. Any lump-sum tax must temporally be neutral, such 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 the tax liability is substantial if future income is high and low if the income is low. Hence, household's lifetime resources became uncertain, which may lead to an increase in current consumption (Romer, 1996; Marinheiro, 2001).

According to Romer (1996), if individuals do not optimize their consumption fully over the long horizon, the Ricardian equivalence will not hold. Further, the perfect foresight assumption is one of a strong assumption for the occurrence of REH even though it is difficult to exist in an uncertain world (De Grauwe, 1996 Marinheiro, 2001).

Table 1.
Empirical literature on the Ricardian Equivalency Hypothesis

Author and Year	**Model type**	**The scope of the study**	**Results**
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, he used Kormendi (1983) consumption function, along with the Error Correction Method.	From 1954 to 1997, Portugal	REH does not hold
Giorgioni and Holden (2003)	OLS, Fixed Effect and Random Effect	From 1976-1998, for Ten developing economies	Supports the REH
Kaadu and Uuskula (2004)	Instrumental variable technique and full information maximum likelihood method	Quarterly data from 1997Q1-2002Q4, Estonia	Inconclusive
Onafowora and Owoye (2006)	Granger causality test and Vector Error Correction Method (VECM)	From 1970 to 2001, Nigeria	REH does not hold
Vamvoukas and 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 and Awan (2011)	Johansen Cointegration	From 1973-2009, Pakistan	REH does not hold
Saeed and 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 and Ebi (2013)	VECM	Quarterly time series data from Q1 1970- Q4 2010, Nigeria	REH does not hold
Olasunkanmi and 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 and Eita (2017)	ARDL	Two sample periods, 1980–2014 and 1988–2014, Lesotho	Supports the REH
Pickson and Ofori-Abebrese (2018)	ARDL	From 1981-2014, for sub-Saharan countries (Botswana, Ghana, Gambia, Nigeria, and Kenya)	REH does not hold

The empirical literature in table1 shows the results of studies conducted on the Ricardian equivalency. Some of the studies supported the Ricardian equivalency hypothesis, whiles other rejected the REH. The reason being the kind of variable used their studies, the model, methodology, period of study and country of case study. Generally, most of Studies conducted in developed and developing countries, the Ricardian equivalence hypothesis is rejected.

3. Methodology

The Ricardian Equivalence Hypothesis is empirically examined by analysing the effect of substitution of tax for debt on aggregate consumption and interest rate. Most of the studies on the Ricardian equivalency used the former variables which can be categorized into reduced form(structural) consumption functions and Euler equation specification. The reduce form(structural) consumption is faced with the problem of endogeneity. However, when instrumental variables and accurate income, interest rates and wealth variables are used in the estimation, the reduced(structural) form consumption functions provide perfect result compared with the Euler equation specification approach under rational expectation conditions

(Bernheim, 1987). This study will adopt the structural consumption function approach proposed by Bernheim, 1987. His standard model for private consumption is specified in (Eq. 1)

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

Where C is household final 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.
Because of data problem, we eliminated variables such as Wealth and retain the main REH and estimate the model in equation (2)

$$CONS_t = B_0 + \beta_1 GDP_t + \beta_2 DEBT_t + + \beta_3 DEF_t + \beta_4 GVEX_t + + u_t \qquad (2)$$

Where $CONS_t$ represent household final consumption expenditure as measured by the market value of all goods and services at time t, GDP_t is Gross Domestic Product at current market prices at time t , $GVEX_t$ is government expenditure at time t,$DEBT_t$ is total government debt at time t, and DEF_t is budget deficit at time t. The coefficient β_0 is the constant term of the equation, β_1, β_2, β_3 , β_4 and β_5 are the long run coefficients that will be estimated in the equation. The Ricardian Equivalency Hypothesis will exist in the case of Ghana if $\beta_2 = \beta_3 = \beta_4$.

3.1 Data Sources

The data for the study will be primarily secondary data drawn from International Monetary Fund (IMF) and World Bank (World Development Indicators) database. The data set were cross-checked with other international databases for consistency before being used for the analysis.

3.1.1 Estimation Procedure

To test for the existence of the Ricardian equivalency hypothesis in Ghana, the study will use Bound testing approach to Cointegration and error correction model within the ARDL framework developed by Pesaran and Shin (1999). We will first test the time series property of data. This will be done by using the Augmented Dickey-Fuller(ADF) and Philip-Perron (PP) to determine the stationarity of the variables used for the study. The will be achieved by carrying out a unit root test. The long run and short run relationships among the variables will be determined using ARDL bound testing approach to cointegration and the Error Correction Model. Finally, the stability and diagnostic test statistics of the ARDL model will be carried out to ensure reliability and goodness of fit of the model

3.1.2 ARDL Model Specification

The long run relationship and the dynamic relations among the variables of interest were empirically determined using ARDL bound test developed by Pesaran and Shin (1999) and modified by Pesaran, Shin, and Smith (2001). We used the Bernheim (1987) approach to developed a general ARDL model for the study. This is specified in equation (3)

$$\Delta CON_t = \alpha_{0+} \sum_{i=1}^{p} \beta \Delta CON_{t-i} + \sum_{i=0}^{p} \delta \Delta GDP_{t-i} + \sum_{i=0}^{p} \gamma \Delta DEF_{t-i} + \sum_{i=0}^{p} \varphi \Delta GOVCE_{t-i} + \sum_{i=0}^{p} \sigma \Delta GOVD_{t-i} + b_0 CON_{t-1} + b_1 GDP_{t-1} + b_2 DEF_{t-1} + b_3 GOVCE_{t-1} + b_4 GOVD_{t-1} + v_t \qquad (3)$$

The coefficients b_1, b_2, b_3, and b_4 in equation (3) represents the long-run multipliers and α_0 is the constant term. The short-run dynamic structure is represented by the coefficients of lagged values of difference. of the variables show the short-run dynamic structure. The symbol Δ represent the first difference operator, and p is the optimal lag length.

4. Results and Discussion

Table 2.
The Augmented Dickey-Fuller test results

Variables	ADF test (with intercept and trend)		Order of integration	Decision
	Level	First difference		
GOV.EXPT	-4.039948	-3.349261	I(0)	Stationary
GDP per Capita	-0.833717	--3.775961	I(1)	Stationary
GROSS_DEBT	0.542110	-4.386379	I(1)	Stationary
HFC	-1.913533	-5.250912	I(1)	Stationary
DEFICIT	-2.416794	--6.311436	I(1)	Stationary

*Note *** Significant at 1% level, All the values in the table are t-statistics,*
Source: Authors construction from using Eviews 10

Table 3.
The Phillips-Perron test results

Variables	Phillips-Perron test (with intercept and trend)		Order of integration	Decision
	Level	First difference		
GOV.EXPT	-1.800779	-3.258891	I(0)	Stationary
GDP per Capita	-0.942623	-3.787363	I(1)	Stationary
GROSS_DEBT	0.507976	-4.381359	I(1)	Stationary
HFC	-1.870647	-5.264178	I(1)	Stationary
DEFICIT	-2.416579	--6.280117	I(1)	Stationary

*Note *** Significant at 1% level, All the values in the table are t-statistics,*
Source: Authors construction from Eviews 10

The unit root test is conducted using the Augmented Dicks Fuller(ADF) and Phillips-Perron's test to determine the stationarity of the variables, the results showed that Government expenditure is stationary in levels with zero (0) order of integration. Households final consumption, GDP per capita, Gross Debt, and Deficit are also stationary and does not contain unit root. According to the Augmented Dicks Fuller (ADF) and Phillips-Perron's test the variables became stationary after the first difference and their order of integration is 1, I(1). The results of the analysis in table 2 and 3 called for testing of cointegration among the variables. In our case we used Bound test which is appropriate for ARDL estimation. ARDL estimation is appropriate if variables are purely I (0), I(1) or both (Duasa,2007). Since our regressors are mixed, we tested the cointegration using Bound test instead of Johansen Cointegration test.

Table 4.
ARDL Lag Selection

Lag	FPE	AIC	SC	HQ
0	54503384	32.00295	32.24672	32.07056
1	84050.38	25.48082	26.94347	25.88649
2	41711.72	24.50561	27.18714	25.24936
3	5521.150*	21.62399*	25.52439*	22.70580*

** indicates the chosen lag order under each criteria.*
Source: Authors construction from using Eviews 10

The optimum Lag selection for our ARDL is carried out using Final prediction error, Akaike information criterion SC: Schwarz information criterion and Hannan-Quinn information criterion to produce the output in table 4. A maximum lag of 3 is chosen by all the criteria.

Table 3 reports the results of the lag selection. The lag selection chosen by all the criteria is used in the Bound Testing and Error Correction estimation.

Table 5.
Bound Test for Cointegration

Test statistics	Value	No. of independent variables	Significance level	Bound critical values	
F- statistics				**I(0)**	**I(1)**
	7.353387	4	10 %	2.20	3.09
	7.353387	4	5%	2.56	3.49
	7.353387	4	2.5%	2.88	3.87
	7.353387	4	1%	3.29	4.37

Source: Authors construction from Eviews 10

We tested the presence of cointegration in our variables using the Wald F test statistics against Pesaran and Shin (1995) lower and upper bound critical values. The calculated Wald Test F Statistic is compared with the Pesaran and Shin (1995) lower bound [I(0)] and upper bound [I(1)] critical values at 1%, 2.5%, 5% and 10% level of significant. The F statistic value of 7.353387 is greater than the Pesaran and Shin (1995) upper bound [I(1)] values. The results show that the null hypothesis of no cointegration must be rejected at all levels (Table 5). This implies that there exist a long run equilibrium association running through the variables.

Table 6.
Error Correction Model Results
Dependent Variable: D(HFC)
Selected Model: ARDL(3, 2, 3, 0, 2)

Variable	Coefficient	Std. Error	t-Statistic	[Prob.]
D(HFC(-1))	0.2165	0.1106	1.9572	[0.0788]*
D(HFC(-2))	0.2600	0.1038	2.5044	[0.0312]**
D(GDP_CAPITA__PPP_)	0.0053	0.0031	1.6795	[0.1240]
D(GDP_CAPITA__PPP_(-1))	-0.0206	0.0035	-5.8973	[0.0002]***
D(GDP_CAPITA__PPP_(-2))	-0.0082	0.0035	-2.3220	[0.0426]**
D(GROSS_DEBT)	-0.1075	0.1715	-0.6270	[0.5447]*
D(GROSS_DEBT(-1))	0.8815	0.3312	2.6614	[0.0238]**
D(EXPENDITURE)	1.5798	0.6160	2.5644	[0.0235]**
D(EXPENDITURE(-1))	-3.2436	0.7291	-4.4490	[0.0007]***
D(DEFICIT)	-0.9236	0.1952	-4.7316	[0.0008]***
D(DEFICIT(-1))	-0.8986	0.1964	-4.5749	[0.0010]***
CointEq(-1)*	**-1.5970**	**0.1963**	**-8.1351**	**[0.0000]*****

*Note: ***, **, * represents Significant level at 1%,5% and10% respectively.*
Source: Authors construction from Eviews 10

The error correction model below, calculates the error correction term for the adjustment of the model to short run equilibrium when there is any disequilibrium in the system as a result of shock.

EC = HFC - (-0.8571*GROSS_DEBT + 0.0168*GDP_CAPITA__PPP_ +
1.3309*EXPENDITURE -0.5201*DEFICIT -42.7995)

Table 6 reports the results of the error correction. The error correction indicates the long run changes in the model. The error correction term ECT (-1) is a measure that indicate how the variables in the model to equilibrium. The error correction term for our model is statistically

significant with a negative sign (-1.5970). The t- statistic of -8.1351 and p- value of 0.000 confirms a long run causality running from the independent variables to the dependent variable. The ECM (-1) coefficient of (-1.5970) implies a very high level of convergence of the dependent variable and independent variables to equilibrium. If the dependent variable, Households final consumption is out of equilibrium, the scheme converges back to equilibrium at a rate of 159%. This shows that the actual household consumption deviates from its equilibrium value of 1.59 every year. In this study, to become equilibrium, we will need less than a year full adjustment.

Table 7
Long run estimated based on ARDL
Dependent Variable: HFC
Selected Model: ARDL (3, 2, 3, 0, 2)

Variable	Coefficient	Std. Error	t-Statistic	[Prob.]
GDP_CAPITA__PPP_	0.0168	0.0032	5.3096	[0.0003]***
GROSS_DEBT	-0.8571	0.2107	-4.0685	[0.0023]***
DEFICIT	-0.5201	0.2081	-2.4990	[0.0315]**
EXPENDITURE	1.3309	0.5126	2.5962	[0.0267]**
C	-42.7995	7.6025	-5.6297	[0.0002]***
R-squared	0.9188		Prob(F-statistic)	[0.0000]***
Adjusted R-squared	0.8931			
F-statistic	180.0333			
Durbin-Watson stat	2.159892			

*Note: ***, **, * represents Significant level at 1%,5% and10% respectively.*
Source: Authors construction from Eviews 10

The coefficient determination (R^2) measure the percentage of variations in Household consumption that is explained by the explanatory variables Deficit, GDP per capita, Gross Debt, and Government revenue. It also the fitness of the model, an R^2 value of 0.9188 means that 92% of the variations in Household consumption is explained by Government expenditure, Deficit, GDP per capita, Gross Debt, and the remaining 3% is been explained by unknown and observed factors ibn Ghana from 1990 to 2017. This also implies that the model fits the data and can predict household consumption in Ghana. The F statistics is a measure for the general significance of the explanatory the variables. The F-statistic value of 186.0333 and greater than 5 with an F-statistic probability of 0.0000 implies that the explanatory variables in the model jointly explains the trend in household consumption from 1990 to 2017. The results in table 7 shows that there is a significant positive relationship between government expenditure and household consumption. The positive coefficient for government expenditure (1.3309) implies that all other explanatory variable being constant, a 1% increase in government expenditure will increase household consumption by approximately 1.3309%. The long run results showed a positive and significant relationship between GDP per capita and household consumption. The coefficient of -0.8571 for Gross Debt implies that 1%increase in gross debt will reduce household consumption by approximately 0.8571% when all other variables in the model remains unchanged. The negative and statistically significant influence of gross debt on household final consumption is in support of the Keynesian conventional theory. Holding the effect of all the variables in the long run model constant, the negative and statistically significant constant term in the long run model means that household final consumption in Ghana will approximately reduce by 42.8% due to the effect of all other variables that are not considered in the model. The positive relationship between government expenditure and household consumption does not support both Keynesian conventional theory and the

Ricardian Equivalency Hypothesis. However, the results of our analysis shows that $\beta_2 \neq \beta_3 \neq \beta_4 \neq 0$. This shows that the Ricardian equivalency does not hold in the case of Ghana. The Ricardian equivalence theory will hold as discussed in the theoretical literature, if .$\beta_2 = \beta_3 = \beta_4$. In our analysis none of the coefficient is equal to zero (0). The coefficient for Gross debt (-0.8571), Deficit (-0.5201) and government expenditure (1.3309). The results of our analysis is in line with previous studies conducted in developing countries, specifically Africa, which found no evidence of the Ricardian equivalency. They are Pickson and Ofori-Abebrese (2018), Sub-Saharan Africa, Aderemi (2014), Nigeria; and Mosikari and Eita (2017), Lesotho.

4.1 Model Diagnostic and Stability Test

There is an empirical warning that parameters estimated from time series data might vary over time (Hansen,1992). Based on this evidence, it is important to conduct parameter test because there is a possibility of specifying the model incorrectly. This may result from unstable parameters which has a high probability of providing bias results. In order to check this misspecification in ARDL estimation, the significance of the variables included in the model are checked using diagnostic and structural stability test. These diagnostics test for the study can be seen in Appendix 2 The diagnostic test in Appendix I shows that there is no evidence of serial correlation based on Breusch-Godfrey Serial Correlation LM Test and the Jarque-Bera test for normality also proved that the error is normally distributed. Additionally, the model passed the Breusch-Pagan-Godfrey test for heteroscedasticity. The Durbin Watson test statistic value of 1.993 also showed that there is no evidence of serial correlation in the residuals. The stability to test of residual(CUSUM) and CUSUM square conducted indicates that all the coefficients in the model are stable and cannot be rejected.

5. Conclusion

The main of object of this study is test the existence of the Ricardian equivalence Hypothesis in Ghana in this 21st century using ARDL Bound testing approach to Cointegration and Error Correction Model framework developed by Pesaran and Shin (1995, 1999). We examined the existence of a long run relationship between Household final consumption and GDP per capita, Government expenditure and Gross Debt. We run an ARDL model developed by Pesaran and Shin (1995, 1999) using Bernheim (1987) approach for tesingt the existence of REH. The results of our analysis showed that there is long run relationship running from GDP per capita, Government expenditure and Gross Debt to Household final consumption. However, we found a strong evidence against the Ricardian Equivalence Hypothesis in Ghana and a support for the Keynesian debt non-neutrality for the period 1990 to 2017. The Ricardian equivalency will hold in the case of Ghana if government expenditure, and government debt does not affect household final consumption level; and all the theortical assumption of Ricardian equivalence Hypothesis met.

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Appendix 1

Table 7: Definition and measurement of variables

Variable	Description	Source
General government net lending/borrowing (Percent of GDP)	Net lending (+)/ borrowing (–) is calculated as revenue minus total expenditure. This is a core GFS balance that measures the extent to which general government is either putting financial resources at the disposal of other sectors in the economy and non-residents (net lending), or utilizing the financial resources generated by other sectors and non-residents (net borrowing). This balance may be viewed as an indicator of the financial impact of general government activity on the rest of the economy and non-residents.	IMF
GDP Per Capit(PPP)	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources	WDI
Household final consumption expenditure	is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses.	WDI
Government Expenditure	Total expenditure consists of total expense and the net acquisition of nonfinancial assets.	IMF
Gross Debt	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable.	IMF

Appendix 2

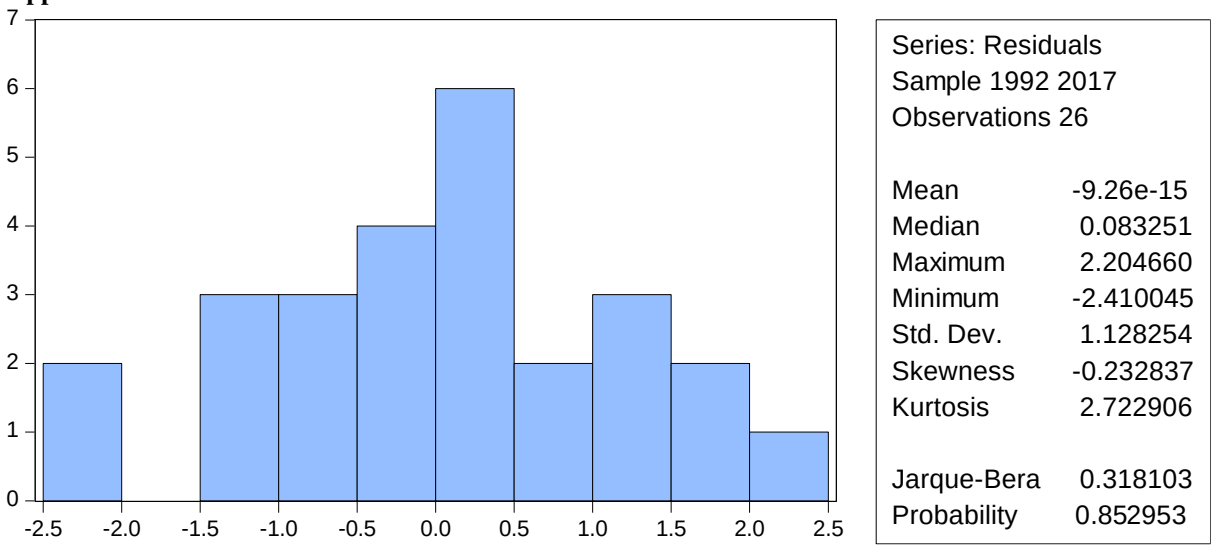

Table 8.

Breusch-Godfrey Serial Correlation LM Test

Test Statistic	Value	Probability	Decision
F-statistic	1.589427	0.2441	Do not reject Null

Table 9.
Heteroskedasticity Test: Breusch-Pagan-Godfrey

Test Statistic	Value	Probability	Decision
F-statistic	0.9667	0.5141	Do not reject Null