The Dynamic Causal Relationship between Government Revenue and Government Expenditure Nexus in Ghana

Takumah, Wisdom

University of Cape Coast

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Wisdom Takumah
Department of Economics
University of Cape Coast
Cape Coast. Ghana.
wtakumah@yahoo.com/wtakumah@gmail.com

Abstract

The relationship between government revenue and government expenditure has been an important topic in public economics, given its relevance for policy especially with respect to the budget deficit. The purpose of this paper is to investigate the relationship between government revenue and government expenditure in Ghana for the period of 1986 - 2012. We include GDP as a control variable into the model. Data properties were analyzed to determine their stationarity using the DF-GLS and PP unit root tests which indicated that the series are I(1). We find a cointegration relationship between government revenue and government expenditure. The causality tests indicate that there is a bidirectional causal relationship between government expenditure and revenues in both the long and the short run hence confirming the *Fiscal synchronization* hypothesis. The policy implication of the results suggests that there is interdependence between government expenditure and revenues. The government makes its expenditure and revenues decision simultaneously. Under this scenario the fiscal authorities of these countries with budget deficits should raise revenues and decrease spending simultaneously in order to control their budget deficits.

Keywords: Government revenue, Government expenditure; Cointegration; Causality, Budget Deficit, Fiscal synchronization, Fiscal policy.

JEL classification: C32; E62;H20; H50;H62

1. Introduction

The relationship between government expenditure and government revenue has attracted significant interest because sound fiscal policy is important to promote price stability and sustain growth in output and employment (Narayan & Narayan, 2006). Since independence, fiscal policy plays a big role to attain various development goals such as growth, equity and employment in Ghana. These goals have been achieved by various state led investment policy and various redistribution policy using different tax and expenditure policies and activities of state and central government.

Fiscal policy is regarded as an instrument that can be used to lessen short-run fluctuations in output and employment in many debates of macroeconomic policy. It can also be used to bring the economy to its potential level. If policymakers understand the relationship between government expenditure and government revenue, without a pause government deficits can be prevented. This is due to the fact that the relationship between government revenue and expenditure has an impact on the budget deficit. The causal relationship between government revenue and expenditure has remained an empirically debatable issue in the field of public finance, (Eita & Mbazima, 2008).

Over the last four decades, different studies have focused on different countries, time periods, proxy variables and different econometric methodologies to explore the relationship between government revenues and expenditures. The empirical outcomes of these studies have been varied and sometimes found to be conflicting results. The results seem to be different on the direction of causality. The policy implications of these relationships can be significant depending upon what kind of causal relationship exists between these variables.

The focus of this paper is to examine the causal relationship between government revenues and government expenditures in the case of Ghana and test whether government revenue causes government expenditure or whether the causality runs from government expenditure to government revenue, and if there is bidirectional causality. This study is very vital since it verifies the size of government, budget deficit and the structure of taxation and expenditure. The rest of the paper is organized as follows. In the next section, we explain the overview of the theoretical literature for analyzing the government revenue and government expenditure relationship, and review of the empirical literature. Section three (3) discuss methodology adopted explained in section 5. Empirical results will be discussed in section four (4) and section five (5) will provide summary, conclusions and some policy implications.

2. Literature Review

2.1 Theoretical Literature Review

In this section, theoretical literature is reviewed; thereafter some selected empirical studies in developed and developing countries have been presented. Essentially there are four (4) theoretical studies or schools of thought on the direction of causation between government expenditure and revenue or variables in the budgetary process.

The first school known as *tax -and- spend* school, proposed by Friedman (1978) and Buchanan and Wagner (1978). Friedman (1978) argues that there is a positive causal relationship between government revenue and expenditure. While Buchanan and Wagner (1978) stated that the causal relationship is negative. According to Friedman, increasing taxes will simply lead to more spending. Therefore, decreasing taxes is the appropriate remedy to budget deficits (Keho, 2010, Moalusi, 2004). On the contrary, Buchanan and Wagner (1978) propose an increase in taxes

revenue as remedy for deficit budgets. Their point of view is that with a decline in taxes the public will perceive that the cost of government programs has fallen.

The second school known as *spend-and-tax* school has been proposed by Peacock and Wiseman (1961). This school advocated that expenditure cause revenue, suggesting that first governments spend and then increase tax revenues as necessary to finance expenditures. The spend-and-tax hypothesis is valid when spending hikes created by some special events such as critical situations, that governments necessitate increasing taxes. As higher spending now will, lead to higher tax later, this hypothesis suggests that spending decreases are the desired solution to reducing budget deficits.

The third school, *fiscal synchronization* hypothesis argues that governments may concurrently change expenditure and taxes, (Meltzer & Richard, 1981; Musgrave, 1966). Typically, government, as a rational agent, equates the marginal cost of taxation with the marginal benefit of government spending. This implies bidirectional causality between government expenditure and revenue (governments take decisions about revenues and expenditures simultaneously).

A fourth hypothesis introduced by Baghestani and McNown (1994) relates to the institutional separation of the expenditure and taxation decisions of government. This perspective suggests that revenues and expenditures are independent of one another. . Here, expenditure would be defined on the basis of the requirements expressed by the citizenry and revenue would depend on the maximum tax burden tolerated by the population. As a result, the achievement of fiscal equilibrium would merely a matter of coincidence. This school is known *fiscal neutrality* school or institutional separation hypothesis.

2.2 Empirical Review

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

In the case of the United States of America, Blackley (1986), Ram (1988a), Bohn (1991), and Hoover and Shefrin (1992) provide evidence to support the tax-spend hypothesis while Anderson et al. (1986), Von Furstenberg et al. (1986), Jones and Joulfain (1991) and Ross and Payne (1998) find support for the spend-tax hypothesis. The rest of the empirical studies are summarized in Table 1 and Table 2 below.

Table 1: Summary of empirical studies for country-specific studies			
Authors	**Countries studied and period**	**Methods adopted**	**Empirical Results**
Anderson *et al.* (1986)	USA (1946-1983)	VAR Methodology	GE → GR
Baghestani and McNown (1994)	USA (Quarterly Data 1955-1989)	ECM	GR --- GE
Darrat (1998)	Turkey (1967-1994)	Johansen (1988) Cointegration test and ECM	GR → GE
Li (2001)	China (1950-1997)	ECM	GR ↔ GE
Carneiro *et al.* (2005)	Guinea-Bissau (1981-2002)	Granger causality test and ECM	GE → GR
Nyamongo *et al.* (2007)	South Africa (October 1994 - June 2004)	Johansen Cointegration and VECM Approach	GR ↔ GE in the long run GR --- GE in the short run
Eita & Mbazima (2008)	Namibia (1977 - 2007)	VAR , Johansen (1988; 1995) and Granger causality test	GR → GE
Aslan and Taşdemir (2009)	Turkey (1950-2007)	EG & GH test for Cointegration	GR ↔ GE

Table 2: Summary of empirical studies for multi-country studies

Authors	Countries studied	Method	Empirical Results
Payne (1998)	Forty-eight states USA (1942 to 1992)	EG for Cointegration, ECM	GR → GE: twenty-four states GE → GR: eight states, GR ↔ GE: eleven states five remain states failed the diagnostic tests for ECM
Cheng (1999)	8 Latin American Countries	Hsiao's Granger Causality Method	GR → GE: Columbia, the Dominican Republic, Honduras and Paraguay. GR ↔GE: Chile, Panama, Brazil and Peru
Fasano and Wang (2002)	6 Oil-Dependent GCC Countries	Johanson cointegration test, ECM	GR → GE
Chang *et al.*(2002)	10 Countries (1951-1996)	Johansen(1988), Johansen and Juselius (1990), Granger causality	GR → GE: Japan, South Korea, Taiwan, UK, USA. GE → GR: Australia and South Africa. GR ↔ GE: Canada, GR --- GE: New Zealand and Thailand
Narayan (2005)	9 Asian countries	ARDL bounds testing approach, VECM	GR → GE: Indonesia (1969–1999), Singapore, Sri Lanka (1960–2000) in the short-run and for Nepal (1960–1996) in both the short- and long-run. GE → GR: Indonesia and Sri Lanka GR --- GE: India (1960–2000), Malaysia (1960–1996), Pakistan (1960–2000), Philippines (1960–2000), Thailand (1960–2000), Singapore (1963–1995)
Wolde-Rufael (2008)	13 African countries	ECM and Granger Causality Test	GR → GE: Karnataka GR ↔ GE: Andhra Pradesh and Kerala GR--- GE: Tamil Nadu
Afonso and Rault (2009)	25 European countries (1960-2006)	Bootstrap Panel Analysis	GR → GE: Germany, Belgium, Austria, Finland, UK, and for several EU New Member. GE → GR: Italy, France, Spain, Greece, and Portugal
Chang and Chiang (2009)	15 OECD countries (1992-2006)	Panel Cointegration and Panel Granger Causality	GR ↔ GE

Source: Authors compilation

Notes:

1. GE → GR: means that the causality runs from government expenditure to government revenue (spend and tax hypothesis).
2. GR → GE: means that the causality runs from government revenue to government expenditure (tax and spend hypothesis).
3. GR ↔ GE: means that the bidirectional causality between government revenue and government expenditure (Fiscal synchronization hypothesis).
4. GR --- GE: means that no causality exists between government revenue and government expenditure (fiscal neutrality hypothesis).
5. Abbreviations are defined as follows: VAR=Vector Autoregressive Model, VEC=Vector Error Correction Model, ARDL=Auto Regressive Distributed. Lag, ECM=Error Correction Model, GDP=Real Gross Domestic Product, EG: Engle-Granger cointegration test & GH: Gregory-Hansen Cointegration test

3. Methodology

3.1. Data

The study uses annual time series data and covers the period 1986 to 2012. We select these period because time series data on government revenue and government expenditure is only available for these period. The data are obtained from World Development Indicators (WDI) 2013, compiled by the World Bank. Real GDP per capita (constant 2000 US$) was used to proxy economic growth. Total government revenue, total government expenditure and real GDP are the three variables used in the estimation. The logarithm of the real government expenditures, government revenues and real GDP were used in the empirical analysis. The transformation of the series to logarithms is intended to eliminate the problem of heteroskedasticity.

3.2 ARDL Bounds Testing Procedure for Cointegration

To examine the long-run relationship between government revenue, government expenditure and economic growth, we employ the ARDL bounds testing procedure to cointegration, proposed by proposed by Pesaran and Shin (1999), which was subsequently generalised by Pesaran et al. (2001). Following recent studies (see Odhiambo, 2009 and 2014), we formulated our empirical ARDL model as:

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta lnY_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta lnGE_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta lnGR_{t-i} + \alpha_4 lnY_{t-1} + \alpha_5 lnGE_{t-1} + \alpha_6 lnGR_{t-1} + \epsilon_t \quad (1)$$

$$\Delta lnGE_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta lnGE_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta lnGR_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta lnY_{t-i} + \rho_4 lnY_{t-1} + \rho_5 lnGE_{t-1} + \rho_6 lnGR_{t-1} + \epsilon_t \quad (2)$$

$$\Delta lnGR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta lnGR_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lnY_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta lnGE_{t-i} + \beta_4 lnY_{t-1} + \beta_5 lnGE_{t-1} + \beta_6 lnGR_{t-1} + \epsilon_t \quad (3)$$

Where lnY_t, $lnGE_t$, and GR_t are the logarithms of real GDP per capita, government expenditure consumption, and government revenue, respectively; α, β, and ρ are the parameters

of the model; Δ is the first difference operator; t is the time period; and ϵ_t is error term and assumed to be *iid*. The paper favors the ARDL bounds testing procedure for cointegration because: it has better finite sample properties and thus outperforms the Engle Two Step and the Johansen procedures in small samples (see Pesaran et al. 2001; Narayan and Smyth, 2005; Odhiambo, 2009); its estimates are robust even in the presence of endogeniety, whereas the Engle Two Step and Johansen procedures are biased under such circumstance; also the ARDL bounds testing procedure could be performed irrespective of whether the variable are I(0), I(1) or mixed, unlike the other tests (see Pesaran and Shin, 1999).

The ARDL bounds testing procedure for cointegrating relationships follows a non-standard asymptotic *F*-distribution under the null hypothesis that there exist a minimum of one cointegrating vector. Two sets of critical values are constructed by Pesaran et al. (2001) under this null hypothesis. The first set of critical values is constructed under the assumption that variables in the ARDL model are integrated of order zero, I(0). The second set of critical values is constructed under the assumption that variables in the model are integrated of order one, I(1). We fail to reject the null hypothesis of no cointegration relationship when the *F*-statistic falls below the lower bound. Similarly, we reject the null hypothesis of no cointegration when the calculated *F*-statistic is greater than the upper bound. However, the test is inconclusive when the *F*-statistic falls between the lower and upper bounds.

The bounds procedure has several advantages over alternatives such as the Engle and Granger (1987) two-step residual-based procedure because the bounds procedure can be applied to models consisting of variables with an order of integration less than or equal to one. This approach, hence, rules out the uncertainties present when pre-testing the order of integration. Also, the Conditional Error Correction Model (CECM) is likely to have better statistical properties than

the two-step Engle–Granger method because unlike the Engle–Granger method the CECM does not push the short-run dynamics into the residual terms (Banerjee *et al.*, 1993, 1998).

3.3 Specification for the Granger Causality Test

In order to examine the short- and long-run causal linkages between government revenue, government expenditure and economic growth, the study has specified in line with previous works (see Narayan and Smyth, 2005; Odhiambo, 2009), the model

$$\Delta lnY_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta lnY_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta lnGE_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta lnGR_{t-i} + ECM_{t-1} + \mu_t \quad (4)$$

$$\Delta lnGE_t = \theta_0 + \sum_{i=1}^{n} \theta_{1i} \Delta lnGE_{t-i} + \sum_{i=0}^{n} \theta_{2i} \Delta lnGR_{t-i} + \sum_{i=0}^{n} \theta_{3i} \Delta lnY_{t-i} + ECM_{t-1} + \mu_t \quad (5)$$

$$\Delta lnGR_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta lnGR_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta lnY_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta lnGE_{t-i} + ECM_{t-1} + \mu_t \quad (6)$$

Where all variables and parameters retain the definitions provided in the previous specification. ECM_{t-1} is the error-correction term of the immediate period before *t*; this term. The Granger-causality tests are examined by testing whether all the coefficients of lagged difference of the variables are statistically different from zero as a group based on a standard *F*-test and/or the coefficient of the error correction is also significant (denoting long-run causation). The *F*-tests on the differenced explanatory variables depict the short-term causal effects, whereas the significance or otherwise of the lagged error correction term denotes whether there is a long-run relationship, (Narayan, 2005; Odhiambo, 2009).

4. Analysis of Variables and Estimations

4.1 Stationarity Test

The first step towards investigating the causal relationship between electricity consumption and economic growth in the ARDL framework is to test for the stationary[1] properties of electricity consumption, inflation, and real GDP per capita. Standard inferences can only be made when the variables in the model are not integrated (or are stationary). Besides, the ARDL bounds testing procedure only works when variables are integrated of order zero or one (see Pesaran et al., 2001). Unit root tests were design to investigate the stationary properties of time series observations. This study used Phillips-Perron (PP) test, and Dickey-Fuller Generalised Least Squares (DF-GLS) test to examine the unit root properties of the variables. These two tests were chosen because they are able to control for serial correlation when testing for unit roots. The test for unit roots of the variables in levels in Table 3, indicated that the null hypothesis of unit roots could not be rejected. However, the first difference of variables, presented in Table 4, were found to be stationary at 5% level of significance for both tests. The variables are said to be, therefore, integrated of order one.

Table 3: Test for Unit Roots in At Levels

Variable	Phillips-Perron		DF-GLS	
	No Trend	Trend	No Trend	Trend
lnY	-1.3492	-2.5104	-1.1891	-1.9632
lnGE	-1.8706	-2.3624	-1.5571	-2.4651
lnGR	-1.6868	-2.3624	-1.2127	-1.9225

[1]A variable is said to be stationary when it has no unit root and its moments do not depend on time (See Enders, 2004)

Table 4: Test for Unit Roots in First Difference

Variable	Phillips-Perron		DF-GLS	
	No Trend	Trend	No Trend	Trend
ΔlnY	-4.137**	-5.157**	-4.675**	-3.163**
$\Delta lnGE$	-9.720**	-9.672**	-4.280**	-4.475**
$\Delta lnGR$	-4.763**	-4.721**	-4.257**	-3.652**

Truncation lag for DF-GLS is based Schwert criterion
Truncation lag for Phillips-Perron is based on Newey-West bandwidth
** denotes significance at 5% level

4.2 Results of ARDL Bounds Test for Cointegration

The ARDL bounds testing procedure was used to examine the potential long-run relationships between these variables. To do this, we used the Schwarz Bayesian Criterion (SBC) to establish the optimal lags of our ARDL specifications above. From the SBC, the optimal lags deemed appropriate, not reported here, were found to be 2, 1, and 2 for equations (1), (2), and (3), respectively.

Pesaran et al. (2001) emphasized that an *F*-test on lagged level explanatory variables in equations (1) to (3) would suffice to examine whether or not there was cointegration relationships between the variables. Using the optimal lags, we performed an *F*-test on equations (1) to (3) and reported the results in Table 5.

The results show that the *F*-statistic, 4.71, calculated for equation (1) was more than the lower bound value at 1%, 5%, and 10% levels of significance. To verify this, we estimated the long-run error-correction model. The results, not reported, show that the error-correction term was negative and significant. So for equation (1), the conclusion was that *lnY* is a cointegrating vector. Thus, the null hypothesis of no level effects or cointegration was rejected, in that case. In equation (2), the government expenditure equation, the *F*-statistic, 4.18, was clearly greater than the upper bound value at 10% level of significance. This implied that the null hypothesis of no cointegration

was rejected. Therefore, government expenditure, government revenue, and economic growth were said to be cointegrated; the cointegrating vector was *lnGE*. Finally, the *F*-statistic, 4.59, estimated for equation (3), the government revenue equation, was greater than the upper bound value at 5% and 10% levels of significance. There was, therefore, evidence against the null hypothesis of no cointegration. So the null hypothesis is rejected; hence *lnGR* is a cointegrating vector.

Table 5: ARDL Bounds Test for Cointegration

Dependent Variable	Function	F-statistic
lnY	*lnY(lnGE, lnGR)*	4.71
lnGE	*lnGE(lnY, lnGR)*	4.18*
lnGR	*lnGR(lnY, lnGE)*	4.59**

Asymptotic critical values for unrestricted intercept and no trend reported from Table CI(iii) p. 300 of Pesaran et al., 2001	1% I(0)	1% I(1)	5% I(0)	5% I(1)	10% I(0)	10% I(1)
	4.29	5.61	3.23	4.35	2.72	3.77

* and ** imply significance at 10% and 5% levels, respectively

4.3 Results of the Granger Causality Test

After establishing cointegrating relationships between economic growth, government expenditure and government revenue, the natural step was to test the direction of causal relationships between these variables. This was done in two steps. In the first step, we test how the lagged differenced explanatory variables affect the dependent variable in order to established short-run causality using the Wald test (*F*-test). In the second step, we test for the significance of the lagged error-correction terms, ECM_{t-1}, in order to establish long-run causality between the explanatory variables and the dependent variable using the *t*-test. Our results for the causality test are reported in Table 6 below.

The results in Table 6 show that there exist a bidirectional short- and long-run causal flow from government revenue to government expenditure in Ghana. This can be seen from the *p-value* of 0.012 and 0.026 associated with the joint significance test of government revenue and government expenditure equation presented in Table 6. The long-run causal flow from government revenue to government spending was supported by the negativity and significance of the error-correction term in the government revenue equation, equation (6). This results supports the *fiscal synchronization* hypothesis implying that expenditure decisions are not made in isolation from revenue decisions.

This results are consistent with the findings of Shah and Baffes (1994) for Argentina and Mexico, Ewing and Payne (1998) for some Latin American countries, Li (2001) and and Chang and Chiang (2009). This outcome suggests that fiscal policymakers should set revenues and expenditures simultaneously. However, the one period lagged error correction term measures budgetary disequilibrium. The other results show that there was a distinct unidirectional short- and long-run causal flow from government expenditure to economic growth. This could be seen by the *p-value* of 0.0257 associated with the joint significance test of government expenditure equation in Table 6.

Table 6: Granger Causality between Government Expenditure and Revenue

	W-statistics [P-value]			Coefficient [P Values]
	ΔlnY	$\Delta lnGR$	$\Delta lnGE$	ECM_{t-1}
$\boldsymbol{\Delta lnY}$	-----	1.252[0.465]	0.0218[0.978]	-----
$\boldsymbol{\Delta lnGR}$	2.588[0.274]	-----	9.175[0.012]	-0.3261[0.0198]**
$\boldsymbol{\Delta lnGE}$	5.168[0.0257]	5.350[0.026]	-----	-0.2476[1.0363]**

* and ** imply significance at 10% and 5% levels, respectfully.

5. Conclusion

This study re-examined an important subject between government expenditure and revenue in the area of public economics, also the study attempts to answer one critical question. Is there a causal relationship between government expenditure and government revenue in Ghana? We investigated this issue by applying the bound testing approach to cointegration, ARDL and the causality test. Analyzing data properties using the ADF and PP unit root tests indicating that the series are I(1). We find a cointegration relationship between government revenue, expenditure and GDP; all variables in real per capita form. However, applying the ECM version of the ARDL model shows that the error correction coefficient, which determines the speed of adjustment, has an expected and highly significant negative sign. The results indicated that deviation from the long-term growth rate in government expenditure (revenue) is corrected by approximately 25(32.6) percent in the following year. We found the estimated model passes a battery of diagnostic tests and the graphical evidence (CUSUM and CUSUMQ figures) in appendix A and B suggest that the models are stable during the sample period.

The policy implication of the results suggests that there is interdependence relation between government expenditure and revenue. The government makes its expenditures and revenues decision simultaneously. Under this scenario, the fiscal authorities of Ghana should try to increase revenues and decrease expenditures simultaneously in order to control the budget deficits. In addition, the bidirectional causality between government expenditure and revenues might complicate the government's efforts to control the budget deficit.

The policy recommendation for Ghana can be summarized as follows. In order to achieve fiscal sustainability, government expenditures should be re-examined with the view to assess (i) their contribution to an efficient allocation of resources within the economy and (ii) their potential to finance growth enhancing spending categories (such as infrastructure, research and development, education, and health). Secondly, the government should seek ways to re-order the intertemporal relationship between expenditures and revenues in a way consistent with the country's revenue mobilization potential. This could pave the way for a sound medium-term budgeting framework and help the government to control its expenditures rather than increasing its fiscal revenues, thus reestablishing fiscal discipline without jeopardizing the accumulation of factors and affecting the country's long-term growth potential.

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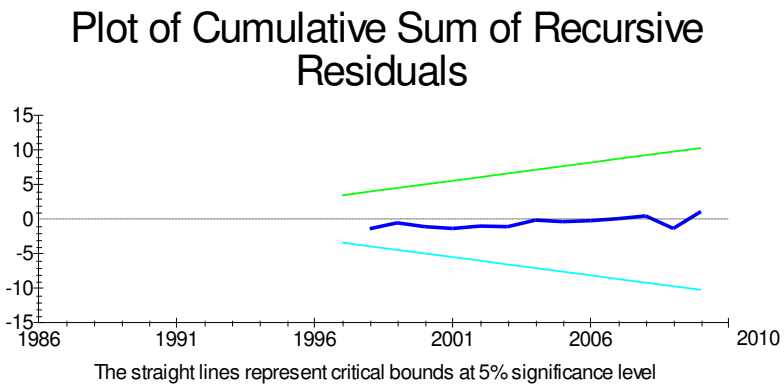
APPENDIX A



APPENDIX B