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Determinants of domestic saving in Ethiopia: An autoregressive distributed lag (ARDL) bounds testing approach

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The objective of this paper was to investigate the determinants of domestic saving in Ethiopia using time series annual data form 1970/71-2010/11. In this study, effort has been made to identify the long run and short run determinants of domestic saving in Ethiopia using an ARDL bounds testing Approach and Error correction model (ECM) to capture both short run and long run relationships. The Estimated results revealed that growth rate of income (gPCI), budget deficit ratio (BDR) and inflation rate (INF) were statistically significant short run and long run determinants of domestic saving in Ethiopia. But, depositing interest rate (IR), current account deficit ratio (CADR) and financial depth (DFD) were found to be statistically insignificant determinants in the long run. However, in the short run, DFD and IR found to have statistically significant meaning in explaining domestic savings in Ethiopia. The speed of adjustment has value 0.63768 with negative sign, which showed the convergence of saving model towards long run equilibrium. The overall findings of the study underlined the importance of raising the level of income in a sustainable manner, minimizing the adverse impacts of budget deficit and inflation rate and creating competitive environment in the financial sector.

Key words: Domestic saving, autoregressive distributed lag, Error correction model, Ethiopia.

INTRODUCTION

Domestic saving is believed to be the main sources of finance to domestic investment. Of course, there have been two main views regarding the means of financing domestic investment. The first view is that, in the world of perfect capital mobility, domestic investments are determined by the international flow of capital. According to this view, domestic investments are highly correlated with foreign capital inflow and less correlated with domestic savings. The other view is that due to the existence of substantial impediments to capital mobility across international borders, domestic investments are highly dependent on domestic savings. That means, since foreign capital is something exogenous, countries that try to depend on foreign capital can be highly affected by external shocks. This is because countries, especially developing countries, will face a serious domestic capital shortage whenever a decline in foreign capital inflow happens. As a result, most economists argue that domestic saving is the major determinant of domestic investment growth which in turn is also basic for fast and sustainable economic growth (Feldstein, 1983; Khan, 2006 and Culpeper, 2008).

Ethiopia is among the developing countries that needs fast and sustainable investment growth. However, her domestic saving rate was on the lowest for the past several decades. The average domestic saving rate was only 7.9% of the GDP during the past four decades (1970/71 to 2010/11). Splitting the available data among

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the three regimes of Ethiopia during the study period also shows that the average saving rate was 13.8% of GDP during the period from 1970/71 to 1973/74, 7% from 1974/75 to 1990/91 and 7.3% from 1991/92 to 2010/11. This classification implies that, though saving rate was relatively good during the Imperial period, it declined to lower per cents during the Derg and the current regimes of Ethiopia (that is, EPRDF).

Moreover, available data from World Bank report (2011) shows that the average saving rate of Ethiopia was very low by any standard. For instance, when compared with the average saving rates of Sub-Saharan Africa countries between the period 1980/81 and 2010/11, average domestic saving rate in Ethiopia was only 8.6% of the GDP. However, during the same period, the average for Sub-Saharan Africa countries was 17.2% of GDP. This implies how much the domestic saving rates of Ethiopia were too much low even by Sub-Saharan Africa standards.

On the other hand, since 2003/04, Ethiopia has registered fastest economic growth for eight consecutive years. The average real growth rate of GDP has increased from 4% during the period from 1995/96 to 2002/03 to 11.3% during the period between 2003/04 and 2010/11. As a result, the average real per capita income has also increased from around 1.6% between 1995/96 to 2002/03 to 7.9% from 2003/04 to 2010/11 (MOFED, 2010/11).

According to the life-cycle and permanent income hypothesis, income growth is one of the primary determinants of domestic saving through its effect on the lifetime income of working population. This is because, higher rate of income growth raises the aggregate income of active workers relative to those not earning labor incomes and this will raise the lifetime resources of workers on which consumption and saving depends (Modigliani,1986).

However, similar to previous years, the trend of saving rate in Ethiopia has never changed since 2003/04.Rather declined compared with the previous equivalent eight years saving rate. That means, even though the average saving rate from 1995/96 to 2002/03 was 8.4% of GDP, it pushed down to 7.2% from 2003/04 to 2010/11, which is inconsistent with the conclusion reached by life-cycle and permanent income hypothesis. Therefore, it is these facts that make the question what determines domestic saving in Ethiopia critical at this time.

To the best of the researcher's knowledge, Abu (2004), Kidane (2009), and Worku (2010) have analyzed the determinants of domestic saving in Ethiopia using time series data. In these studies the growth rate of income, depositing interest rate, current account deficit, and inflation, degree of financial depth, foreign saving and dependency ratio were included to identify the major determinants of domestic saving. However, results found were inconsistent. Hence, this study can complement the previous studies at least in the following three ways. I) unlike the previous studies, this study applied an ARDL bounds testing approach and ECM which is a recent advance in econometric modeling (II) since studies in the area of saving are very scanty and have showed inconsistent results, the study helps to further identify the determining capacity of the variables tested before (III) the study also added recent data not used in previous studies.

The main objective of this study was to identify the major determinants of domestic saving in Ethiopia. To achieve this objective, the study tried to answer the following three basic research questions:

1. What are the determinants of domestic saving in Ethiopia?
2. How these factors affect the long run and short run saving behavior of the economy?
3. If there is long run relationship between saving and its determinants how the deviation will adjust towards the long run equilibrium or to find out the speed of adjustment?

Finally, this article is organized as follows. The second and third section presented the review of literature and methodology parts of the study respectively. Econometric results and their discussions are presented in the fourth section. The fifth section of this article contained both conclusions and policy implications of the study.

THEORETICAL AND EMPIRICAL LITERATURE

Theoretical literature

Theoretically, there are many factors that determine the saving performance of a country. The most important factors as shown in many studies are those related to income, fiscal policy, depositing interest rate, macroeconomic stability, the extent of financial sector development, and external variables.

Life-cycle hypothesis (LCH) proposed by Modigliani (1986) advocated that saving is a positive function of income growth. Higher rate of income growth means the aggregate income of active workers will rise which in turn rises the lifetime resources of individual's on which consumption and saving depends. As a result, income growth will result an increase of aggregate saving. However, Tobin (1967 cited in Ozcan et al., 2003) argued that the above conclusion works if future income is unanticipatable. If future income is anticipatable, forward looking individuals will expect higher income in the future which motivates them to consume more today. This reduces the saving rate of working individuals and may offset the greater effect of higher income growth.

Interest rate is considered as one of the financial variables that have an impact on saving. The relation between interest rates and savings is ambiguous theoretically because interest rate changes are subject to

potentially offsetting positive substitution and negative income effects (Ozcan et al., 2003). The substitution effect is that a higher interest rate raises the current price of consumption relative to future price. This reduces current consumption and increase saving. The income effect, on the other hand, is that if the households are net lenders, an increase in interest rate will increase lifetime income, and so increase present consumption by decreasing saving. In this case, if the substitution effects out way the income effect, aggregate saving will rise and vice versa.

The second relevant financial variable is financial depth measured by the degree of monetization of the economy captured by the ratio of broad money (M2) to national output (GDP) (Ozcan et al., 2003). Financial depth or financial market development shows the range and availability of financial assets, accessibility to banking facilities, and extent of credit opportunity. The range and availability of different financial assets that suit savers interest, expansion of bank branches and improvement in the accessibility to banking facilities motivates individuals to save. However, saving can be discouraged by the availability of more credit as availability of more credit relaxes domestic liquidity constraints, particularly credit given for consumption (Loayz et al., 2000).

In most saving studies inflation is also incorporated to capture the impact of macroeconomic uncertainty on saving behaviors. Buffer stock saving theory suggests that greater uncertainty would rise saving since risk averse consumers set resources aside as a precaution against possible adverse changes in income and other factors (Modigliani and Cao, 2004). Another effect of inflation is that since it increases nominal interest rate, it will lead to higher measured household income and saving. But, if interest rate is not adjustable to inflation rate changes, a rise in inflation rate will reduce real interest rate which causes a disincentive to save in financial assets (Loayza et al., 2000).

One of the external variables that might be relevant to savings is current account deficit. The current account deficit used as a proxy for external saving tends to have a negative impact on domestic savings, because it is used as a substitute for domestic savings (Ozcan et al., 2003).

Budget deficit is also another important fiscal policy variable that influences domestic saving. Decrease in the government saving decreases domestic saving. Moreover, a rise in government budget deficit tends to raise consumption and discourage saving by shifting the tax burden from present to future generation (Touny, 2008).

Empirical literature

Empirically, many studies have been examined both in developing and developed countries. Table 1 summarizes the results found for the most important determinants of domestic saving used in many empirical literatures and the researcher intends to use in this particular study.

MATERIALS AND METHODS

Types and sources of data

This study has applied secondary data collected from two sources for the period from 1970/71 to 2010/11. The reason for the use of 1970/71 as a cutoff point is because it is only starting from this year that consistent data could be found in the National Bank of Ethiopia (NBE) for most variables used in this particular study. Hence, while the data for GDSR, gPCI, BDR, CADR and DFD were obtained from National Bank of Ethiopia (NBE), the data for INF and depositing interest rate (IR) were collected from International Financial Statistics (IFS). Moreover, the reason for the use of IFS data for the two variables is because of the absence of well organized data from NBE.

Model specification

Many empirical literatures in the area of saving show a number of factors that can determine domestic saving behavior both in developed and developing countries. However, taking into account data constraints, this study has tried to examine the significance of the growth rate of income, interest rate, financial depth, government budget deficit, inflation, and current account deficit in determining domestic savings in Ethiopia. Accordingly, the researcher specifies the following saving function:

Where represents random white noise error term. GDSR, Gross domestic saving as a ratio of nominal GDP; gPCI, Growth rate of real per capita income; IR, Interest rate; INF, Inflation rate; BDR, Budget deficit as a ratio of nominal GDP; CADR, Current account as a ratio of nominal GDP; DFD, Degree of financial depth(M2) as a ratio of nominal GDP.

Methods of data analysis and estimation techniques

This study has applied cointegration test and Error correction mechanisms to examine both the long run and short run determinants of domestic saving in Ethiopia. In order to examine the existence of cointegration (long run relationship among variables), an ARDL bounds testing approach of cointegration proposed by Pesaran et al. (2001) is used.

The bounds test has been used in many empirical studies in macroeconomics (Narayan and AL Siyabi, 2005; Narayan and Narayan, 2005; Ang, 2007). The test involves estimating the following unrestricted error correction model by ordinary least square method:

The presence of cointegration between savings and its determinants is tested by restricting the lagged levels variables in the equation above equal to zero. Therefore, the null hypothesis for no cointegration is:

Against the alternative hypothesis of a cointegrating relation:

This hypothesis is tested using the F-statistic. That means, the calculated F-statistic is compared with the two asymptotic critical values tabulated by Narayan (2004). The lower bound critical value assumes that all the regressors are I(0), while the upper bound

Table 1. Summary the results found for the most important determinants of domestic saving used in many empirical literatures.

Author name and publication year	Data type	Methodology	Results of variables					
			Growth rate of income	Depositing interest rate	Inflation	Budget deficit ratio	Current account deficit ratio	Degree of financial depth
Masson et.al (1998)	Time series and cross sectional	OLS	Positive	Mixed			Negative	
Baharumshah et al (2002)	Time series	Johansen co-integartion test	Positive	Mixed				
Ozcan et al (2003)	time series	OLS	insignificant		positive			Positive
Abu (2004	time series	Unrestricted VAR model	Positive		Positive		Positive	Positive
Authukoral and Sen (2004)	Time series	General to specific modeling procedure	Positive	Positive	Positive	Negative		Positive
Agrawal et al (2007)	Time series	Dynamic OLS (DOLS) procedures of co integration test		Negative		Positive	Positive	Positive
Adewuyi et al (2007)	panel data	Fixed and random effect models	Insignificant	Negative	Negative	negative		Insignificant
Nwachukwu and Egwaikhide (2007)	Time series	Johansen co-integration test and Error correction	Negative	Negative	Positive			
Touny (2008)	Time series	Engle-Granger co-integration test and ECM	Positive	Positive	Positive	Negative	Negative	Positive
Kidane (2009)	Time series	cointegration and error correction modeling	Positive	Insignificant	Negative			Insignificant
Obwona and SSentamu (2010)	Time series	OLS	Positive	Insignificant			Negative	
Worku (2010)	time series	Engle-Granger co-integration test and Error-correction model	Positive	Insignificant	Negative			
Keho (2011)	Time series	ARDL bounds testing approach	Positive	Mixed	Mixed		Mixed	Mixed as well as insignificant

Note: Positive implies the variable is a significant positive determinant of domestic saving; Negative implies the variable is a significant negative determinant of domestic saving; Insignificant implies the variable is statistically insignificant to determine domestic saving and mixed implies the variable is negative determinant of domestic saving in some countries and positive in other countries.

critical value assumes that they are I(1). If the computed F-statistic exceeds the upper-bound critical value, then the variables are cointegrated. Otherwise, the variables are not cointegrated. Once cointegration is found, the long-run coefficients are estimated by using the following model.

The existence of long-run relationship also permits to estimate the error correction model (ECM), which indicates the speed of adjustment back to long-run equilibrium after a short-run disturbance. The standard ECM involves estimating the following equation.

ESTIMATION OF RESULTS AND DISCUSSION

Unit root test

Unlike other cointegration tests, an ARDL bounds testing approach to cointegration do not require same order of integration for all variables. However, since the bounds test is developed on basis that the variables are I(0) or I(1), prior to applying the bounds test procedure, the implementation of unit root tests might still be necessary in order to ensure that all the variables satisfy the underlying assumption. Moreover, ARDL cannot be used for I(2) variables. Hence, Augmented Dickey Fuller (ADF) and PP tests are applied to examine the order of integration.

The ADF and PP (Philips Perron Test) tests in Tables 2 and 3 imply that except gPCI and INF all variables are found to be non-stationary at level and stationary at first difference at the conventional 5% level of significance. That means, while gPCI and INF are found I(0),the other all variables are found to be I(1). Besides, the unit root tests make sure that there is no I(2) variable. Therefore, an ARDL procedure of cointegration test can be applied for this study.

ARDL cointegration analysis

Cointegration test is applied to examine the existence of some long run equilibrium relationship among variables included in the model. When variables are cointegrated, it means, they do not drift too much apart and are tied together by some long run equilibrium relationships.

Table 2. Results of unit root test (ADF).

Variables	Without constant and trend	With constant only	With constant and trend	Order of integration
GDSR	-1.232878	-3.705390	-3.717029	
Δ GDSR	-9.214399**	-9.116501**	-9.069272**	I(1)
gPCI	-3.062272**	-4.068537**	-6.547764**	I(0)
IR	-0.818186	-2.139678	-2.122860	
Δ IR	-5.887207**	-5.813417**	-5.729954**	I(1)
BDR	-1.256224	-2.734241	-2.864262	
Δ BDR	-9.131419**	-9.014409**	-9.037167**	I(1)
CADR	-0.512936	-1.159265	-2.298961	
Δ CADR	-4.404271**	-4.361338**	-4.125045**	I(1)
DFD	0.809659	-1.542420	-4.084704	
Δ DFD	-4.678331**	-4.858801**	-5.066083**	I(1)
INF	-3.5658978**	-5.159568**	-5.127229**	I(0)

Note: **represents significant at 5%.

Table 3. Results of unit root test (Philips Perron Test).

Variables	Without constant and trend	With constant only	With constant and trend	Order of integration
GDSR	-1.464103	-3.622163	-3.654345	
Δ GDSR	-9.214399**	-9.116501	-9.175514**	I(1)
gPCI	-3.640743**	-4.873422**	-5.846953**	I(0)
IR	-0.861542	-2.331331	-2.332603	
Δ IR	-5.887207**	-5.813417**	-5.729954**	I(1)
BDR	-1.256224	-2.626879	-2.854013	
Δ BDR	-9.161237**	-9.042978**	-9.157732**	I(1)
CADR	-0.562399	-1.192764	-1.734844	
Δ CADR	-4.630574**	-4.391025**	-4.384667**	I(1)
DFD	0.532885	-1.523793	-0.901584	
Δ DFD	-4.665819**	-4.852581**	-5.062408**	I(1)
INF	-3.672984**	-5.142610**	-5.109089**	I(0)

Note: **represents significant at 5%.

ARDL model is estimated from a recursive search of the optimal number of lags through either Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC).

However, Pesaran and Smith (1998) argue that the Schwartz-Bayesian Criteria (SBC) is preferable to other model specification criteria because it often has more parsimonious specifications. Since, the researcher has forty years annual observation, maximum lag order of one is used in order to obtain a more parsimonious model selected using the SBC criteria.

From the ARDL estimates as shown in Table 5, we first test the null of no cointegration (that is) against the alternative using the F-test with critical values tabulated by Narayan (2004). The null hypothesis of no cointegration will be rejected if the calculated F-statistic is greater than the upper bound critical value. If the computed F-statistics is less than the lower bound critical value, then we cannot reject the null of no cointegration. The result is inconclusive if the computed F-statistic falls within the lower and upper bound critical values.

As presented in Table 5, the calculated F-static (6.741) is greater than the upper bound critical value (3.881 and 4.211) at 5% level of significance using both restricted intercept and no trend and using restricted intercept & trend. This implies that the null hypothesis of no cointegration is rejected at 5% level of significance. Therefore, there is cointegartion among the variables used in this study. In other words, there is long run relationship among these variables. Moreover, the results of a few diagnostic tests in Tables 4 indicate that there is no error autocorrelation and conditional

Table 4. Autoregressive distributed lag estimates. ARDL (1,0,0,0,1,1,1) selected based on Schwarz Bayesian Criterion (Dependent variable is GDSR).

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
GDSR(-1)	.36232	.12720	2.8484[.008]
gPCI	.26235	.065237	4.0215[.000]
BDR	-.51923	.18916	-2.7449[.010]
CADR	-.14076	.091330	-1.5412[.134]
DFD	.56478	.21542	2.6217[.014]
DFD(-1)	-.64853	.21830	-2.9708[.006]
INF	-.023229	.038578	-.60212[.552]
INF(-1)	-.20641	.042396	-4.8685[.000]
IR	.49233	.24186	2.0355[.051]
IR(-1)	-.48620	.25150	-1.9332[.063]
C	9.6291	2.2427	4.2936[.000]
R-Squared	.69827	R-Bar-Squared	.59423
S.E. of regression	1.9569	F-stat. F(10, 29)	6.7113[.000]
Mean of dependent variable	7.7301	S.D. of Dependent Variable	3.0720
Residual sum of squares	111.0514	Equation Log-likelihood	-77.1798
Akaike Info. Criterion	-88.1798	Schwarz Bayesian Criterion	-97.4686
DW-statistic	2.0115	Durbin's h-statistic	-.061360[.951]

Diagnostic tests		
Test statistics	**LM Version**	**F Version**
A: Serial Correlation	CHSQ(1)= .70831[.400]	F(1, 28)= .50475[.483]
B: Functional Form	CHSQ(1)= .15243[.696]	F(1, 28)= .10711[.746]
C: Normality	CHSQ(2)= .30965[.857]	Not applicable
D: Heteroscedasticity	CHSQ(1)= 1.1526[.283]	F(1, 38)= 1.1275[.295]

Notes: Figures in [] are p-values. A: Lagrange multiplier test of residual serial correlation, B: Ramsey's RESET test using the square of the fitted values, C: Based on a test of skewness and kurtosis of residuals, D: Based on the regression of squared residuals on squared fitted values

Table 5. Estimated long run coefficients using the ARDL approach. ARDL(1,0,0,0,1,1,1) selected based on Schwarz Bayesian Criterion (Dependent variable is GDSR).

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
gPCI	.41141	.13391	3.0723[.005]**
BDR	-.81425	.35148	-2.3166[.028]**
CADR	-.22074	.14351	-1.5381[.135]
DFD	-.13133	.11623	-1.1299[.268]
INF	-.36011	.086629	-4.1569[.000]**
IR	.0096001	.21457	.044742[.965]
C	15.1002	2.3383	6.4577[.000]

Note: ** Significant at 5% level.

heteroskedasticity, the functional form is also acceptable and errors are normally distributed. The model(parameter)stability test using cumulative sum (CUSUM) and (CUSUMSQ) control chart also confirmed that the null hypothesis of parameter stability cannot be rejected at the 5% critical bound (see Appendix). Thus, the parameters of the estimated saving model do not suffer from any structural instability over the period of study.

Once the existence of cointegration is confirmed, the next step is estimating the long run coefficients of the ARDL model.

Table 6. F-static of cointegration relationship.

Test static	Value	Lag	Significance level (%)	Bound critical values* (Restricted intercept and no trend)		Bound critical values* (Restricted intercept and trend)	
				I(0)	I(1)	I(0)	I(1)
F-static	6.7113	1	1	3.505	5.121	3.800	5.643
			5	2.618	3.881	2.797	4.211
			10	2.218	3.314	2.353	3.599

Note:* Based on Narayan (2004).

The results presented in Table 6 shows that the growth rate of income (gPCI) is statistically significant positive determinants of domestic saving in long run. However, budget deficit ratio (BDR) and inflation rate (INF) are found to have adverse effects on the domestic saving rate in Ethiopia. The remaining three variables, namely, depositing interest rate (IR), degree of financial depth (DFD) and the current account deficit ratio (CADR) are found to be statistically insignificant determinates of domestic saving in Ethiopia.

The findings of this study confirmed that with income growth, saving rate also grows in Ethiopia. The result is consistent with the lifecycle hypothesis and previous studies conducted in Ethiopia.

The negative impact of budget deficit ratio imply that private saving is unable to offset the increasing budget deficit and hence, reduced domestic saving ratio for a long period of time. Moreover, the adverse effect of inflation rate also indicates that rising inflation rate in Ethiopia reduces domestic saving rate either by reducing the purchasing power of individual's income or through portfolio adjustment from depositing in the form of money in banks to another fixed asset.

Depositing interest rate (IR) and degree of financial depth (DFD) are also confirmed as statistically insignificant determinates of domestic saving ratio in Ethiopia. This result may show financial development does not contribute to increase savings in Ethiopia. This is because of the low financial sector development in country. In the country, even bank services were not well expanded and competitive to create conducive saving environment. Depositing interest rate is also not in position to encourage savings. Therefore, the outcome does not suggest that financial development is not crucial for the country. This result is consistent with the study conducted by Masson et al (1998) for developing countries and Kidane (2009) for the case of Ethiopia.

The short run dynamic modelling (ECM)

After cointegration test, Error correction model (ECM) is also estimated to capture the short run dynamics of the model. The results of the ECM for gross domestic saving ratio implied that most of the coefficients, except CADR and INF are statistically significant in the short run (Table 7). Moreover, the coefficient of the error correction term that captures the speed of adjustment towards the long run equilibrium is found with the correct sign and magnitude. The speed of adjustment is -0.63768, which implies that around 64% deviations from long-term equilibrium are adjusted every year. This also indicates once the disequilibria happened, it will take more than one year to adjust itself towards the long run equilibrium.

Conclusions and Policy Implications

This study tried to empirically investigate the significance of some macroeconomic variables in determining domestic saving in Ethiopia by using times series data from 1970/71 to 2010/11. The method used was a bounds testing approach to cointegration developed within an ARDL framework and ECM to examine the existence of long run equilibrium relationship between GDSR, gPCI, BDR, CADR, DFD, IR and INF. The results provide strong evidence that growth rate of income play a stronger positive role in determining both the short run and long run behavior of domestic saving in Ethiopia. Budget deficit ratio and inflation rate were also found to have adverse effects both in the short run and long run. However, the effect of CADR is found insignificant to determine domestic saving ratio both in the short run and long run. The first policy implication of this study is that, effort has to be made to raise the level of income in a sustainable manner. The second policy implication is that, since budget deficit ratio and inflation have adverse effects, they should be kept at the level that cannot cause adverse effects on saving behavior. The third policy implication is that there is a need to urgently develop the financial sector of the country by further expanding bank branches and services and by creating a very competitive environment in the financial sector.

Table 7. Error correction representation for the selected ARDL model. ARDL (1,0,0,0,1,1,1) selected based on Schwarz Bayesian Criterion (Dependent variable is ΔGDSR).

Regressor	Coefficient	Standard error	T-Ratio[Prob]
ΔgPCI	.26235	.065237	4.0215[.000]**
ΔBDR	-.51923	.18916	-2.7449[.010]**
ΔCADR	-.14076	.091330	-1.5412[.133]
ΔDFD	.56478	.21542	2.6217[.013]**
ΔINF	-.023229	.038578	-.60212[.551]
ΔIR	.49233	.24186	2.0355[.050]**
ΔC	9.6291	2.2427	4.2936[.000]
ECM(-1)	-.63768	.12720	-5.0131[.000]**

R-squared	.70332	R-Bar-squared	.60101
S.E. of regression	1.9569	F-stat. F(7, 32)	9.8211[.000]
Mean of dependent variable	-.093326	S.D. of dependent variable	3.0980
Residual sum of squares	111.0514	Equation Log-likelihood	-77.1798
Akaike Info. Criterion	-88.1798	Schwarz Bayesian criterion	-97.4686
DW-statistic	2.0115		

Note: **Significant at 5% level.

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Appendix

Model (Parameter) Stability Test
i) Cumulative sum control chart (CUSUM)

Appendix. Model (Parameter) Stability Test.

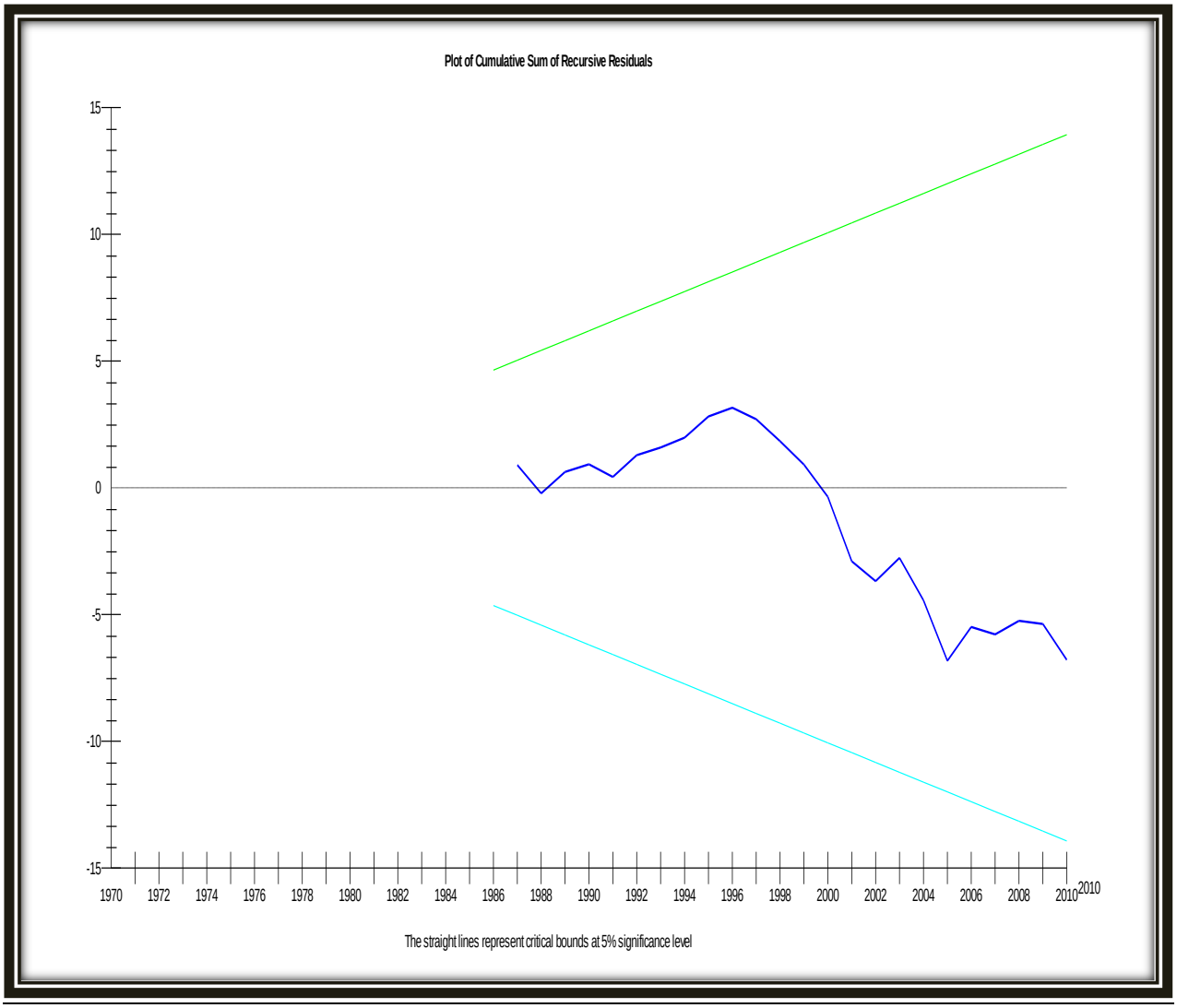

Figure A1. Cumulative sum control chart (CUSUM).

ii) Cumulative sum squared (CUSUMSQ) chart

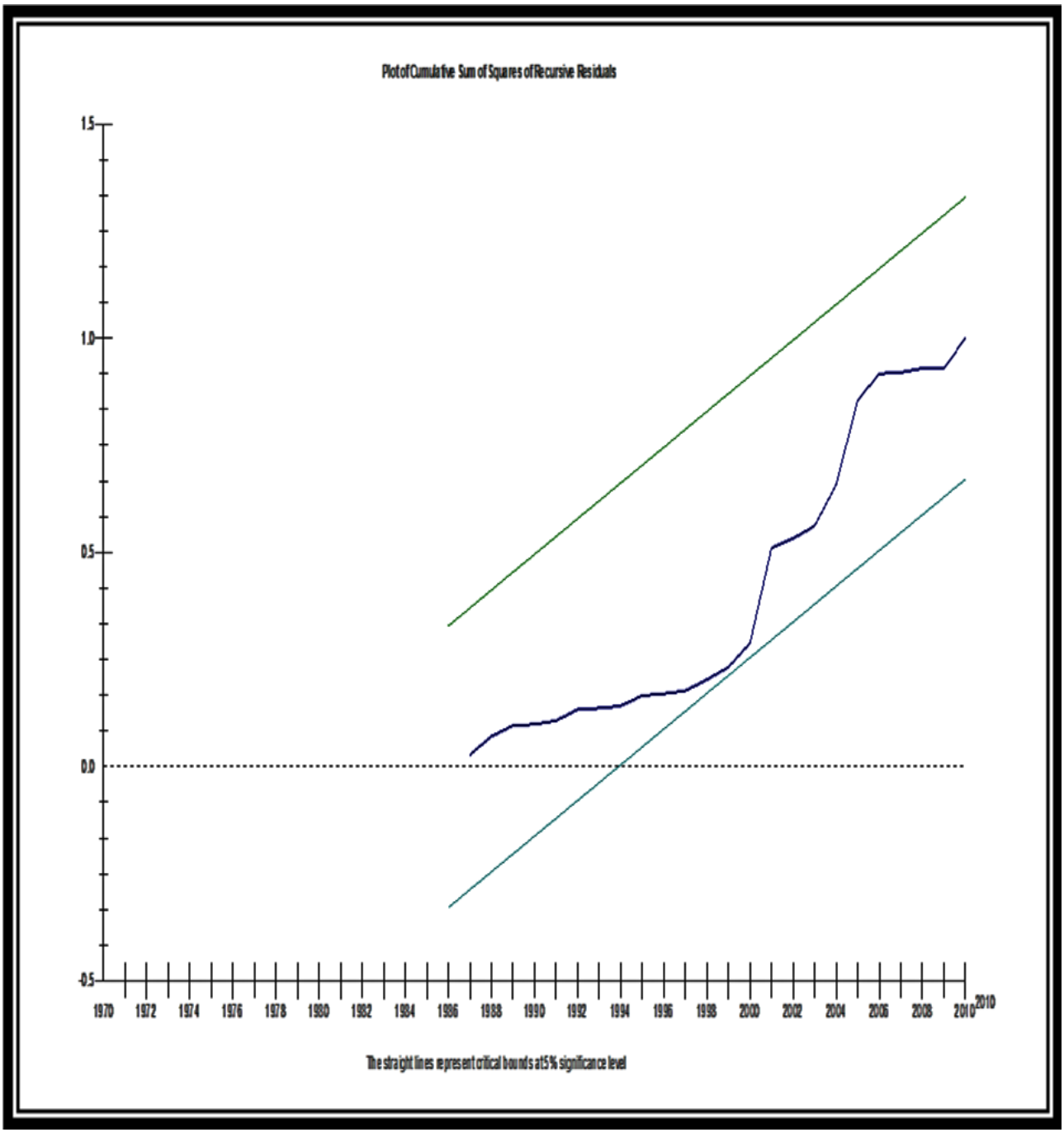

Figure A2. Cumulative sum squared (CUSUMSQ) chart.