Re-Examining Public Debt and Current Account Dynamics in Ethiopia: SVAR Evidence

Wondemhunegn Ezezew Melesse (bishangary@yahoo.com)
University of Gondar

Research

Keywords: public debt, fiscal deficit, current account balance, SVAR

Posted Date: September 24th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-78732/v1

Version of Record: A version of this preprint was published at Journal of Economic and Administrative Sciences on December 17th, 2020. See the published version at https://doi.org/10.1108/JEAS-08-2020-0148.

Re-examining public debt and current account dynamics in Ethiopia: SVAR evidence

Abstract

Public debt management is now an integral part of overall macroeconomic management in many developing and emerging market economies. Preventing unsustainable debt accumulation and maintaining healthy fiscal profile begins with understanding its key drivers both in the short- and in the long run. This study applies structural vector auto-regressive (SVAR) model on annual time series data to study general government debt and current account dynamics in Ethiopia for the period 1980-2018. Both the impulse response and forecast error variance decomposition results confirm that fiscal balance exerts the strongest influence on both government debt and current account balance in the short run. In addition, own shock as well as shocks stemming from gross fixed capital formation and growth have significant effects on general government debt. The findings were robust to alternative data transformation, differing Choleski ordering of the model variables, and inclusion of exogenous deterministic terms that capture changes in the political landscape.

Keywords: public debt, fiscal deficit, current account balance, SVAR

JEL classification: E60, E63, C32, H63

1. Introduction

Globally total private and public debt accounted for over 230 percent of world GDP in 2018. The distribution of debt burden varies substantially across income groupings. The corresponding figures for advanced economies are 265 percent of GDP ($130 trillion); for emerging market and developing economies 170 percent of GDP ($55 trillion); and for low-income countries 67 percent of GDP ($270 billion). Moreover, collectively speaking, public debt is consistently significantly higher than private debt in low-income countries while the converse is true in advanced economies (Kose et al., 2020)

Ethiopia's debt-to-GDP ratio stabilized below 50% for nearly a decade since the nation qualified for significant debt remission in 2004 and 2006[1]. However, debt has been rising[2] in recent years

[1] Since 1980, there were several occasions during which the country experienced sharp increase in public debt. For instance, Ethiopia's total government debt exceeded the 100% threshold (relative to GDP) during 1993-1996 and 2002-2004. Debt burden declined following significant debt relief benefits under the enhanced heavily indebted poor countries initiative (2004) and the multilateral debt relief initiative (2006) when debt-to-GDP ratios fell to 78% and 40%, respectively.

[2] The latest IMF country report on Ethiopia (IMF, 2020) assessed the country to be on high risk of debt distress.

Table 1.1: Total debt outstanding in billions of US dollar and percentage shares

	2015/16		2016/17[R]		2017/18[R]		2018/19[R]		31/03/2020[P]	
	USD	%	USD	%	USD	%	USD	%	USD	%
Total debt	39.4	100.0	45.8	100.0	49.3	100.0	53.8	100.0	54.7	100.0
External	21.3	53.9	23.3	50.9	25.8	52.3	27.0	50.2	27.7	50.5
Central	11.6	29.4	13.0	28.3	14.7	29.9	15.9	29.6	16.6	30.4
SOEs	9.7	24.6	10.4	22.6	11.1	22.4	11.1	20.6	11.0	20.1
Domestic	18.2	46.1	22.5	49.1	23.5	47.7	26.8	49.8	27.1	49.5
Central	7.7	19.5	10.3	22.5	11.0	22.4	12.5	23.3	12.4	22.7
SOEs	10.5	26.6	12.2	26.6	12.5	25.3	14.2	26.5	14.7	26.8

Source: adapted from statistical bulletin issued by Ministry of Finance (MoF, 2020)
Note: R-revised; P-provisional; Central-central government; SOEs-state owned enterprises. Domestic debt converted to US dollar at exchange rate end of each period

Figure 1.1 here

and the debt-to-GDP ratio reached over 60% in 2018. Table 1.1 summarizes the country's public debt dynamics in the last five fiscal years. Total debt increased steadily from 39.4 billion in 2015/16 to about 55 billion by end of March 2020. During the same period, the composition of external and domestic debt remained roughly equally distributed. In addition, the shares of central government and state owned enterprises (SOEs) in domestic and external loans also did not reveal significant change over time.

Against a backdrop of persistent current account and fiscal deficits, the government of Ethiopia has devoted considerable attention to the issue of debt sustainability in recent decades. For instance, Ethiopia's ministry of finance and economic cooperation (MoFEC) in its updated debt management and guarantee issuance directive (MoFEC, 2017) raises a number of points that include, among others, procedures of debt contracting; disbursement of proceeds of external loans; proper management and utilization of internal and external loans; proper execution of projects financed by external loan; and the establishment of an effective system that ensures external loans promote the development goals of the nation. The directive also adds several specific clauses that concern limits on non-concessional or commercial borrowing by the federal government or any of its enterprises.

The same document also emphasizes that the substantial part of funds obtained from external creditors shall be allocated to asset building. In fact, not more than 10% of external loans shall be

spent on secondary activities that include study, training, consultancy, and project administration. Government borrowing is also constrained by legislative screening. The house of people's representatives—one of the two legislative bodies in the country's bicameral parliamentary system—has to approve bonds before they are floated for sell to domestic and international investors. The directive also stipulates that additional government borrowing shall be made consistent with the debt sustainability analysis of the ministry of finance.

Preventing disastrous debt accumulation and maintaining healthy fiscal profile requires understanding its key drivers. A number of studies have been conducted on the determinants of public debt and current account balance in both developed and developing economies (e.g. Cherif and Hasanov, 2012; Bittencourt 2013; Anaya and Pienkowski, 2015; Sisay and Kotosz, 2020; Hashem and Fahmy, 2019; Brafu-Insaidoo et al., 2019; Calderon et al., 2007; Das, 2016; Teamrat, 2018; Sadiku et al., 2015). This paper highlights at least three important differences compared with those studies on low-income economies including Ethiopia. First, the few studies conducted on Ethiopia are dominated by single equation specifications and do not account for the possibility of endogenous feedback effects among the model variables. Even when multi-equation models are applied, the preliminary analyses on the stationarity of the time series variables disregard structural breaks. Failure to consider for potential structural dislocation in each series distorts the attendant conclusions on the order of integration and possible co-integration relationships. Still equally important is the role of rising gross fixed capital formation. In Ethiopia, capital formation jumped from a decade average of about 13% (relative to GDP) in the 1980s to about 35% in the most recent decade. Omitting this variable amounts to a major model misspecification when analyzing short-run macro dynamics in low-income economies with steadily increasing aggregate investment spending. In addition, the paper also makes contribution to the existing limited studies on Ethiopia by comparing the strength of shock propagation mechanisms using alternative data transformation techniques.

The rest of the paper is organized as follows: section 2 provides brief review of the existing literature on the determinants of public debt and current account balance. The model setup is described in section 3. Section 4 discusses the descriptive and econometric results while section 5 offers conclusions and policy recommendations.

2. Brief literature review

2.1 Determinants of government debt

Understanding the patterns and drivers of public debt is critical for several reasons. For one thing, rapidly increasing debt stock can accelerate a given economy's exposure to financial and economic disasters. Speedy and steady rise in debt to GDP ratios has the potential to undermine investor confidence thereby perpetuating hostile capital market environment where governments have to pay considerable risk premium on their debt stocks. These bumpy developments could ultimately descend into a terrible debt crisis if creditors worry that the rising public debt stock is unsustainable (Blanchard, 2019). Moreover, swift debt buildup can also trigger a currency crisis if fears about borrowers' ability to settle external debt obligations encourage speculative assault on fixed or pegged exchange rate arrangements (Krugman, 1979; Obstfeld and Rogoff, 1986). Huge debt level also limits a nation's ability to fight recessions and sustain growth through its adverse effects on interest rates, debt service burden, macroeconomic uncertainty and distortion of tax policy practices (Reinhart and Rogoff, 2010; Obstfeld, 2013; Debrun and Kinda, 2016; Huidrom et al., 2018; Romer and Romer ,2018).

Empirical studies abound for both developing and advanced-industrial nations. Sisay and Kotosz (2020) used ARDL model for Ethiopia to study macroeconomic determinants of external debt during the period 1981-2016. Their results confirmed, among others, the negative effects of inflation and growth on public debt in the short run. Hashem and Fahmy (2019) employed SVAR framework for Egypt and found positive effect of government expenditure, economic growth, and real effective exchange rate and negative effect of inflation and revenue on public debt. Bittencourt (2013) applying panel data estimators for a group of new democracies in Latin America as well as Cherif and Hasanov (2012) using a VAR model with debt feedback established unambiguous debt reduction effect of growth. However, Anaya and Pienkowski (2015) and Brafu-Insaidoo et al. (2019) found positive effects of growth on public debt movements in the short run.

2.2 Determinants of current account balance

The confluence between public finance and current account dynamics has been at the centre of academic and policy discourses since the advent of an inter-temporal framework for current account analysis due to Sachs (1982) and its refinement by Obstfeld and Rogoff (1995) in open

economy settings. The Mundell-Fleming (Fleming, 1967; Mundell, 1968) and Ricardian equivalence (Barro, 1974; 1989) constitute two major efforts that attempt to explain possible co-movement in the twin fiscal and current account deficits. The Mundell-Fleming model posits that deterioration in fiscal balance induces deterioration in current account balance via its effect on interest rate increase, capital inflow, exchange rate overvaluation and loss of international competitiveness (Abell 1990; Bachman, 1992; Bahmani-Oskooee, 1992). By contrast, in the Ricardian approach a government's decision to finance its deficits--either through tax reduction or increased borrowing--has no effect on the real interest rate, investment spending and external balance. Consequently, the intended increase in aggregate spending through tax cuts and/or bond issuance does not materialize as the government's intentions are neutralized by reduction in private spending to meet anticipated surge in tax liabilities in the future (Enders and Lee, 1990; Kim, 1995; Kaufmann et al., 2002).

On the empirical front, Calderon et al. (2002) relying on unbalanced panel of 44 developing countries found that output growth, appreciation of exchange rate, and lower-per-capita-income status are associated with higher level of current account deficits. Similarly, focusing on a sample of low-income economies and developing countries Calderon et al. (2007) found that the appreciation of the real exchange rate worsens the current account balance. Das (2016) exploited a panel of 106 countries representing advanced, emerging, and developing economies. The system GMM estimation results indicated that real effective exchange rate and growth are negatively related to movements in current account balance. Teamrat (2018) applied vector error correction model on Ethiopian data covering the period 1976-2015. The key finding revealed the presence of bi-directional causality between current account balance and fiscal deficit. Finally, Sadiku et al. (2015) found positive correlation between fiscal and current account balances employing ARDL model for Former Yugoslavia Republic of Macedonia (FYROM).

3 Methods and materials

3.1 Unit root tests

When working with time series data, it is always essential to make sure that all the variables included in the estimation process are covariance stationary. The use of non-stationary or explosive series in econometric analyses generates spurious correlation—coefficient estimates

without empirical support and inferential statistics with non-standard distribution. In normal circumstances, autoregressive based methods (Dickey and Fuller, 1979; 1981; Phillips and Perron, 1988) can be implemented to test the null hypothesis that each series contains unit root against the alternative of stationary process. Despite their widespread application, these tests have been shown to have low power to distinguish unit root processes from structural breaks. As a result, I use the method proposed by Zivot and Andrews (1992) that accounts for possible break in intercept, trend or both. The potential break points are determined endogenously[3] via recursive estimation of test regressions.

3.2 Equilibrium relationships

Engle and Granger (1987) demonstrated that if two or more non-stationary series co-move in the long run (i.e. they are co-integrated), there exists a corresponding error-correction mechanism where variation in the dependent variable is influenced by the lagged-level disequilibrium in the co-integrating representation as well as by changes in other predictor variables. Long-run equilibrium relationships exist if all variables are integrated of the same order and their linear combination is stationary. As single-equation co-integration tests have several weaknesses[4], the study will employ the multivariate maximum likelihood based approach developed by Johansen and Juselius (1990) to test for possible steady state relationships among the model variables.

3.3 Structural VAR identification

Standard reduced vector autoregressive model is a symmetric simultaneous equation setup which can be expressed in compact form:

$$y_t = \delta + \sum_{i=1}^{p} \Phi_i y_{t-i} + e_t \qquad (1)$$

[3] The potential break point can also be located exogenously by the researcher. Once the break point is identified, a modified Dickey-Fuller test can be executed using impulse or step dummy variable to account for the break. However, such treatments can be worse than the original problem to the extent that visual inspection fails to pin point the exact break date.

[4] For instance, in single-equation approaches, the choice of the dependent variable is arbitrary. Moreover, when the number of variables is greater than two, the possibility of more than one co-integration relationships cannot be accommodated.

where y_t is a vector of m dependent variables; y_{t-i} represents the lagged values of the dependent variables up to lag order of p which will be determined using information criteria; Φ_i is an m by m matrix of coefficient estimates corresponding to each lag; δ is an m by 1 vector of constant terms and e_t is a vector of m model residuals corresponding to each equation in the system. Eq.(1) is a reduced-form representation which allows only lagged effects on current values. For this reason, it is often criticized for being a-theoretical in the sense that contemporaneous feedback relationships cannot be entertained. In addition, the reduced-form setup assumes errors do not correlate strongly across equations. But if errors have non-zero cross-equation correlations, there must be a way to orthogonalize them through recursive identification. In general, a reduced form model can be considered a reformulation of a structural model with a new parameterization:

$$Ay_t = b + \sum_{i=1}^{p} \Theta_i y_{t-i} + B\varepsilon_t \qquad (2).$$

Eq. (2) shows the structural VAR model which measures the contemporaneous impact through matrix A. The reduced VAR model is obtained by setting $\delta = A^{-1}b$, $\Phi_i = A^{-1}\Theta_i$, and $e_t = A^{-1}B\varepsilon_t$. The structural disturbance terms ε_t --which are by definition uncorrelated with and independent of each other--can be used to produce the reduced-form residuals e_t by imposing some natural ordering among the model variables through theoretical rationalization. Thus, assuming that matrix B is identity, the relationship between reduced and structural errors is given by:

$$e_t = A^{-1}\varepsilon_t \qquad (3).$$

Mimicking Sims (1980), the VAR residual covariance matrix can be factored into LL′ employing Choleski decomposition where L is a lower triangular matrix. This requires imposing $m(m-1)/2$ zero restrictions on the relevant matrix. Impulse response functions (defined below) computed by applying Choleski factorization are known as orthogonalized impulse responses. A standard VAR model can be taken as the reduced form representation of a dynamic structural equation, and one can generate the lower triangular matrix L by re-arranging the system into a

recursive representation. The orders in which the endogenous variables appear in the VAR model establish the recursive structure which in turn bears our Choleski decomposition.

$$\begin{bmatrix} e_t^{dGFCF} \\ e_t^{dFB} \\ e_t^{dDebt} \\ e_t^{Growth} \\ e_t^{Infl} \end{bmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ na & 1 & 0 & 0 & 0 \\ na & na & 1 & 0 & 0 \\ na & na & na & 1 & 0 \\ na & na & na & na & 1 \end{pmatrix} \begin{bmatrix} \varepsilon_t^{dGFCF} \\ \varepsilon_t^{dFB} \\ \varepsilon_t^{dDebt} \\ \varepsilon_t^{Growth} \\ \varepsilon_t^{Infl} \end{bmatrix} \qquad (4)$$

Following[5] Favero and Giavazzi (2007), Cherif and Hasanov (2012), and Anaya and Pienkowski (2015) , we must place restrictions[6] on matrix A in order to make impulse response and forecast error variance decomposition analyses using SVAR framework. Theoretical guidance and empirical judgment could help formalize some kind of causal relationships among variables within the system which in turn facilitates the identification process. In the Choleski decomposition for the debt model shown in eq. (4), gross fixed capital formation (GFCF) is assumed to be most exogenous and is ordered first. This is because a developing country's investment needs are structural and should not respond readily to other macroeconomic developments contemporaneously. Fiscal balance (FB) is ordered second and suggests that fiscal adjustments respond to capital investment priorities but not to the remaining model variables. In a developing economy, debt cannot remain isolated and should react to fiscal balance and infrastructure investment backlogs. Growth reacts to gross fixed capital formation, fiscal balance and debt accumulation. Consistent with traditional identification scheme, nominal variables

[5] These studies allow for the possibility that government spending, taxation, and interest rates respond to the level of debt over time. Mishra et al. (2010) have shown that the interest rate channel is muted in developing economies where the necessary preconditions (like liquid asset markets and effective protection of property rights) do not exist. Moreover, domestic debt patterns in developing countries are mainly driven by the spending requirements of the political establishment while the external debt component is shaped by the goodwill of bilateral and multilateral creditor nations and institutions (which, for instance, supply roughly 75% of Ethiopia's external debt over the past five years) rather than by developments in capital markets.

[6] The na's in the lower triangular matrix are coefficients to be estimated and capture the contemporaneous effects among the model variables. For instance, the na in the second row measures the contemporaneous effect of the change in gross fixed capital formation on the change in government debt to GDP ratio.

should not affect real macro fundamentals concurrently and, as a result, inflation is considered to be the most endogenous process and is placed last.

A similar ordering is established for the current account (CA) model with five variables. Foreign direct investment (FDI) is the most exogenous and is placed first as a small open economy like Ethiopia has no direct influence over capital movements in and out of the country due to limited economic and institutional capabilities. Accordingly, while FDI contemporaneously affects other macro variables in the system it should not react to domestic financial or economic developments at the same time. This amounts to imposing four zero restrictions on the last four entries of the first row in matrix A. Fiscal balance (FB) responds to FDI influx as this would require sterilization measures through the central bank to prevent currency appreciation (via monetary expansion) and increased import spending by the government using the new bulk of foreign exchange reserves bought by the central bank. Current account is ordered third as it is assumed to respond to increased fiscal activism aimed at capital goods import requirements. The growth variable is placed fourth as growth should react to FDI, fiscal balance, and current account positions with the effective exchange rate ordered last.

3.4 Impulse response functions and forecast error variance decomposition

A stationary VAR process has moving average representation. Once the deterministic component is differenced out, the remaining stationary stochastic component can be cast into infinite moving average formulation. Applying lag operator and a little algebra, eq. (1) and eq. (3) can be combined to give:

$$y_t - \bar{y} = \sum_{s=0}^{\infty} \Phi_s B \varepsilon_{t-s} = \sum_{s=0}^{\infty} \Psi_s \varepsilon_{t-s} \qquad (5)$$

where $\bar{y}$ is the deterministic long-run mean values for all variables in the vector y_t and Ψ_i is coefficient matrix of the moving average representation.

Impulse response function (IRF) is the time path capturing the deviation of variable i from its long-run value in reaction to shocks stemming from variable j in the sth period following the realization of the shock. Algebraically, this can be summarized as:

$$\{\Psi_s\} i, j = \frac{\partial y_{it+s}}{\partial \varepsilon_{jt}} = \frac{\partial (y_{it+s} - \bar{y}_i)}{\partial \varepsilon_{jt}} . \qquad (6)$$

In addition, expanding eq. (5) and computing the multivariate forecast along the required horizon we get:

$$y_t - \bar{y} = \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + ... \qquad (7)$$

$$\text{var}(\tilde{y}_{t+s} - E(\tilde{y}_{t+s})) = \Omega + \Psi_1 \Omega \Psi_1^{'} + \Psi_2 \Omega \Psi_2^{'} + ... \qquad (8)$$

where Ω is the forecast error variance-covariance matrix for the m-dimensional stationary endogenous process and $\tilde{y}_{t+s}$ is the deviation of each endogenous variable from its corresponding long-run value. In each equation, the forecast error variance decomposition is computed by taking the ratio of the forecast error variance due to variable j to the total forecast variability of variable i in each specific period-horizon.

3.5 Data description

This paper relies on annual time series data for Ethiopia covering the time period 1980-2018. The major model variables are gross fixed capital formation measured relative to GDP, general government debt to GDP ratio, fiscal balance relative to GDP, per capita GDP growth, consumer price inflation, foreign direct investment in millions of dollars, reel effective exchange rate index (where increase indicates appreciation), and current account balance relative to GDP. The first five are used in the model for debt and the last five in the model for current account dynamics. Interest rates, interest payments, military expenditures, and monetary aggregates are normally included in the study of both debt and current account determinants; however, the potential sources consulted do not report the required complete set of information on these time series variables and, hence, could not be included in the analysis. In addition, even when those variables were available, it would be impractical to include them all in the proposed S/VAR estimation. VAR models generally suffer from the curse of dimensionality problem—with five variables and 4 lags, one has to estimate 105 parameters including intercepts. As a result, for the sake of parsimony, only five variables are considered in each SVAR model for debt and current account analyses. See appendix for sources of the data used in the present analysis.

4. Results and discussion

4.1 Descriptive results

Summary statistics of the target model variables are presented in table 4.1. General government debt was relatively high in the 1990s with debt to GDP ratio averaging around 107 percent while in the last decade the figure stabilized around 50 percent. Inflation has been increasing[7] consistently with a maximum value of 44.4 percent attained in 2008 and an average annual inflation rate of 13.5 percent for the most recent decade. The reel effective exchange rate revealed substantial depreciation up until 2000s followed by considerable appreciation in recent periods. Net government fiscal position does not appear to change significantly over time. For the period under scrutiny, the average fiscal balance relative to GDP remained below 5 percentage points. However, the latest decade shows marked fiscal improvement with the average net borrowing declining to 2 percentage points. There has been significant boost to the country's gross fixed capital formation since the 1980s with average capital formation relative to GDP jumping from 13 to around 35 percent in the 2010s. Though FDI has been expanding steadily in recent decades, the current account position has worsened over time.

Table 4.1: Summary statistics by decade and for entire sample period

				Mean values				
Period	Debt	Infl	REER	FB	GFCF	FDI	Growth	CA
1980-89	61.3	5.2	222.8	-4.0	13.0	0.4	-0.8	-2.2
1990-99	106.9	7.8	136.0	-4.8	14.7	69.4	-0.4	-1.1
2000-09	74.0	11.1	96.0	-4.2	25.3	311.2	5.6	-5.7
2010-18	50.2	13.5	133.1	-2.1	34.5	2037.2	8.0	-6.7
Total	73.7	9.3	147.3	-3.8	21.5	567.8	3.0	-3.8
Min	18.5	-9.1	81.5	-8.9	7.8	-2.6	-14.2	-12.7
Max	144.8	44.4	286.5	-0.9	39.2	4017	10	1.5
				Standard deviations				
1980-89	23.0	7.5	30.9	1.2	2.2	2.3	6.8	1.3
1990-99	25.3	8.8	51.5	2.0	5.2	110.1	7.5	2.5
2000-09	31.1	14.3	14.2	2.2	2.0	159.2	5.8	4.2
2010-18	7.5	9.1	21.4	0.7	3.7	1514.6	1.2	3.2
Total	31.3	10.4	57.2	1.9	9.3	1082.0	6.9	3.7

Source: own computation

[7] For comparison, between 2000 and 2018, Ethiopia's cumulative increase in inflation was about 233% while the corresponding change in the Euro zone teetered around 38% (2% per year for 19 years).

Table 4.2: Correlation matrix among model variables

	Debt	Infl	REER	FB	GFCF	FDI	Growth	CA
Debt	1.000							
Infl	-0.319	1.000						
REER	-0.220	-0.003	1.000					
FB	-0.468	0.152	-0.127	1.000				
GFCF	-0.322	0.193	-0.519	0.373	1.000			
FDI	-0.250	0.042	-0.099	0.292	0.727	1.000		
Growth	-0.193	-0.011	-0.490	0.322	0.545	0.309	1.000	
CA	0.491	-0.170	0.288	-0.345	-0.725	-0.558	-0.513	1.000

Source: own computation

Regarding volatility, foreign direct investment has exhibited the biggest fluctuation with average standard deviation of around 1082 for the sample period. Reel effective exchange rate, debt, and consumer price inflation have also shown substantial variability though they are relatively benign when compared with foreign direct investment.

Figure 4.1: here

Table 4.3:Zivot-Andrews unit root test results with structural break detected endogenously

	Levels			**Differences**		
Variables	**Intercept**	**Trend**	**Both**	**Intercept**	**Trend**	**Both**
Debt	-4.189	-2.621	-3.275	-5.555***	-5.314***	-5.471**
Inflation	-5.523***	-4.967***	-5.708***			
Exchange rate	-4.284	-3.908	-4.900	-6.419***	-5.802***	-6.318***
Fiscal balance	-4.789	-4.358	-4.737	-8.043***	-7.682***	-8.142***
Capital formation	*-3.730*	-3.499	-3.983	-8.216***	-7.938***	-8.503***
FDI	-5.109**	-4.868**	-4.187	-5.641***	-5.501***	-6.775***
PC GDP Growth	-5.874***	-5.382***	-5.802**			
Current account	-4.8009	-4.254	-4.724	-7.709***	-7.310***	-7.640***
95% critical value	-4.80	-4.42	-5.08	-4.80	-4.42	-5.08
95% critical value	-5.34	-4.93	-5.57	-5.34	-4.93	-5.57

Source: own computation

Table 4.3 presents the Zivot-Andrews unit root test results where the test accounts for potential structural breaks in each time series variable. Three scenarios are considered: break in intercept, trend or both. The inflation and per capita GDP variables are found decidedly level stationary under the three cases while FDI is found level stationary with break in either intercept or trend but not both. The remaining variables are difference stationary. As all variables do not have the

same degree of integration, the possibility of long-run[8] equilibrium relationship will not be considered here. Instead, I proceed with the VAR estimation procedure which will be the basis for the SVAR analysis later on.

4.2 Structural VAR analysis for the determinants of general government debt

As described in the methodology section, the debt model includes five variables: general government debt, inflation, gross fixed capital formation, fiscal balance, and per capita GDP growth. The inflation and per capita GDP variables are in level while the other three have been first differenced as they contain unit roots in levels. General-to-specific procedure was adopted to select the desirable lag lengths for the VAR specification. The experiment revealed that a lag order of 2 guarantees the necessary assumptions of normality as well as the absence of serious heteroskedasticity and serial correlation among model residual terms. As shown in table 4.4 below, the relevant diagnostic tests demonstrate the adequacy of the VAR specification for the debt model. In addition, the OLS cumulative sums of standardized residuals in figure 4.2 remain appreciably within the required confidence band confirming the stability of the system.

Table 4.4: Adequacy test results for the debt model of VAR (2)

Assumptions	Tests	Estimated p-values	P-critical
Serial correlation	Portmanteau test	0.995	0.05
Heteroskedasticity	ARCH test	0.999	0.05
Normality	Jarque Bera test	0.335	0.05
	Skewness test	0.442	0.05
	Kurtosis test	0.260	0.05

Source: own computation. Note the assumptions of normality, homoskedasticity, and absence of serial correlation cannot be rejected as the estimated probability values are all markedly larger than the standard probability critical value of 0.05.

Figure 4.2: here

[8] As all variables are either I (1) or I (0), an attempt was made to see if single equation co-integration relationship is present employing the ARDL method due to Pesaran et al. (2001). The results (not reported in this paper) showed that there are no long-run relationships for both the current account and government debt specifications.

Figure 4.3: here

The impulse response function plots for debt are shown in figure 4.3. Though not as much pronounced, inflation has negative effect on general government debt throughout the 8 year horizon. This negative effect is consistent with the debt monetization theory that politicians can render central government debt worthless by pursuing expansionary monetary and/or fiscal policy. Debt monetization is largely possible in economies where central bank independence cannot be taken for granted. Ethiopia is one such country where the executive branch of government has considerable influence[9] over the conduct of monetary policy decisions. The relevant debt impulse response functions also confirm that improvement in fiscal balance by one standard deviation has an immediate negative impact that reduces debt stock by about 2 units. Moreover, the negative reaction of debt to improvement in government balance sheet is sufficiently persistent that stays below zero up to 5 years. The effect of gross fixed capital formation on debt is not uniform. Specifically, on impact, one standard deviation increase in gross fixed capital formation results in an increase in debt stock by about 2 units. Overtime, however, expansion in gross capital formation reduces government debt stock and the reduction persists for considerable period of time. Intuitively, economic expansion as proxied by per capita GDP growth has significant negative effect on general government debt stock. This specific result could be linked to the productive effects of gross investment whose effect dilutes debt over time as noted above. These results are consistent with previous findings that documented significant negative effects of growth on public debt (Cherif and Hasanov, 2012; Bittencourt, 2013; Sisay and Kotosz, 2020)

Figure 4.4: here

The forecast error variance decomposition results are shown in figure 4.4. The bottom block displays that fiscal balance accounts for more than 50% of the forecast error variability of debt for the entire horizon under consideration. Gross fixed capital formation and economic growth also play significant roles though the contribution of inflation is negligible. These results indicate that fiscal balance and gross fixed capital formation together account for over 90% of the forecast error variability of general government debt while own shock and growth constitute the

[9] Until recently, commercial banks in Ethiopia were required to earmark 27% of their loans to buy government bonds with much of the proceeds to be spent on the grand Ethiopian renaissance dam hydropower project.

remaining 10%. In addition, it is also important to note that changes in fiscal balance and capital formation are the only two forces that make meaningful contributions in the forecast variance of all other variables at business cycle frequencies in the debt model.

4.3 Structural VAR analysis for the determinants of current account balance

Like the debt model, general-to-specific procedure was followed to choose the right lag length that satisfies the basic working assumptions of VAR model. As summarized in table 4.5, a lag order of two was found sufficient to fulfill the model adequacy requirements. The diagnostic test results show that we do not reject the necessary assumptions about normality, homoskedasticity, and absence of serious serial correlation relationships among the model residual terms.

Table 4.5: Adequacy test results for the current account model of VAR (2)

Assumptions	Tests	Estimated p-values	P-critical
Serial correlation	Portmanteau test	0.999	0.05
Heteroskedasticity	ARCH test	1.000	0.05
Normality	Jarque Bera test	0.544	0.05
	Skewness test	0.291	0.05
	Kurtosis test	0.744	0.05

Source: own computation.
Note the assumptions of normality, homoskedasticity, and absence of serial correlation cannot be rejected as the estimated probability values are all markedly larger than the standard probability critical value of 0.05.

Figure 4.5: here

Figure 4.5 presents the impulse response plots results for the current account model. The foreign direct investment and reel effective exchange rate changes do not seem to have any meaningful[10] effects on the current account balance as the magnitude of the responses is very small. However, the results confirm the significant effects of fiscal balance and economic growth on total debt stock dynamics in Ethiopia. Specifically, improving fiscal balance has positive effect on current account balance on impact in the first couple of years. But later on, improvement in fiscal balance affects current account negatively which may reflect the economic costs of fiscal

[10] This is also evident in the cumulative impulse response plots included in the appendix. The cumulative sum of the impulse responses for FDI and REER is not significantly different from zero (at maximum 0.05).

consolidation on growth and export performance which in turn influence current account movements adversely. Similarly, economic expansion improves current account positions in the first few years but the positive effects are reversed in the subsequent years which could be due to the increased investment spending on imported raw material and capital goods that support further growth but worsen the balance of payments position of the country.

Figure 4.6: here

The forecast error variance decomposition results are displayed in figure 4.6. The results reveal that fiscal balance explains about 75% of the forecast variability of current account balance for the entire horizon under examination. The remaining variability is explained by own shock and economic growth. In addition, fiscal balance and current account shocks play significant roles in shaping the forecast error variance of all other variables in the current account model. These findings are congruent with earlier studies that found strong correlation between fiscal and current account deficits (e.g. Sadiku et al., 2015; Teamrat, 2018) as well as between growth and current account movements (e.g. Calderon et al., 2002; Das, 2016).

4.4 Robustness checks

Several sensitivity[11] checking exercises were carried out to see whether the baseline results discussed so far hold out under changing assumptions and techniques. Figures 4.7 and 4.8 show results from alternative data transformation—where stationary processes are extracted from the cyclical components of the original series using Hodrick-Prescott filtering method (Hodrick and Prescott, 1997). We can see that in the current account model, both the quantitative and qualitative facets of the impulse responses are well preserved. Moreover, in the debt model, the qualitative and quantitative aspects remain unchanged for the effects of fiscal balance, gross fixed capital formation, and debt while growth has somewhat weaker influence. These specific results suggest that the choice of data transformation approach has no noticeable effect on the quality of the impulse response functions while it affects the magnitude of some of the responses in measurable ways. One major implication of this particular observation is that macroeconomic

[11] Another sensitivity check included changing orders of variables in the Choleski identification process. In addition, exogenous variables were also included using step dummies to account for effects of regime changes in 1991 (the collapse of the military government) and 2005 (bloody national elections). Overall, the baseline results remained intact. These robustness results not reported in this paper are available from the author upon request.

business cycle studies that rely on different data filtering techniques and econometric results that exploit differenced data could produce substantial variation in the strength of shock transmission on some of the endogenous variables.

Figure 4.7: here

Figure 4.8: here

5. Conclusions and recommendations

In this paper, structural vector auto-regressive model was applied to annual time series data to study the fiscal balance and current account dynamics in Ethiopia for the period 1980-2018. Both the impulse response and forecast error variance decomposition results confirm that fiscal balance exerts the strongest influence on both general government debt and current account balance in the short run. In addition, own shock as well as shocks stemming from gross fixed capital formation and growth have significant effects on general government debt. The findings were largely robust to alternative data transformation, differing Choleski ordering of the model variables, and inclusion of exogenous deterministic terms that capture changes in the political landscape. These findings suggest the importance of paying considerable attention to capital investment, economic growth, and the federal government's fiscal activities in order to maintain healthy debt trajectory consistent with the goals of national debt management strategies of Ethiopia. One practical approach would be to improve the efficiency of public sector investment spending. For example, in a recent study, Barhoumi et al. (2018) have found that the sub-Saharan region lags behind its peers in terms of public sector investment efficiency. Specifically, the region's inefficiency score was estimated to be 54% based on physical infrastructure indicators; 20% using survey-based (business leaders' perception) indicators; and 36% based on hybrid indicators. There is no doubt that filling[12] 20-54% inefficiency gap in public investment spending would reduce the country's debt burden substantially by improving the productivity of public capital and supporting sustained growth over time.

[12] Barhoumi et al. (2018) also show that quality of institutions is strongly correlated with estimated public efficiency levels. In particular, their results indicate that a 10 percent increase in the control of corruption index or the regulatory quality index could raise the efficiency of public investment in sub-Saharan African economies by about 12 percent.

Declarations:

Abbreviations

MoF: Ministry of Finance; MoFeC: Ministry of Finance and Economic Cooperation.

Acknowledgement

Not applicable.

Availability of data and material

The author is pleased to share the data upon reasonable request.

Conflict of interest

Not applicable.

Funding

No external funding was used for this study.

References

Abell JD (1990) Twin deficit during 1980s: an empirical investigation. Journal Macroeconomics, 12 (1): 81-96.

Anaya P, Pienkowski A (2015) What really drives public debt: a holistic approach. IMF working paper series No. WP/15/17, Washington, D.C., USA.

Bachman DD (1992) Why is the US current account deficit so large? Evidence from vector auto-regressions. Southern Economic Journal 59 (2): 232-240.

Bahmani-Oskooee M (1992) What are the long-run determinants of the US trade balance? Journal of Post Keynesian Economics 15 (1): 85-97.

Barhoumi K, Vu H, Towfighian SN, Maino R (2018) Public investment efficiency in sub-Saharan African countries: what lies ahead? International Monetary Fund African Department Working Paper No. 18/09, Washington, D.C., USA.

Barro RJ (1974) Are government bonds net wealth? Journal of Political Economy 82 (6): 1095-1117.

Barro RJ (1989) The Ricardian approach to budget deficits. Journal of Economic Perspectives 3(2): 37-54.

Bittencourt M (2013) Determinants of government and external debt: evidence from the young democracies of South America. ERSA working paper No.341.

Blanchard OJ (2019) Public debt and low interest rates. American Economic Review 109 (4): 1197–1229.

Brafu-Insaidoo WG, Ahiakpor F, Ogeh FV,William CG (2019) Macro-determinants of foreign debt in Ghana. Cogent Economics and Finance 7(1): 1-17. DOI: https://doi.org/10.1080/23322039.2019.1630161.

Calderon C, Chong A, Loayza N (2002) Determinants of current account deficits in developing countries. Contrib Macroecon 2 (1): 1–31.

Calderón C, Chong A, Zanforlin L (2007) Current account deficits in Africa: stylized facts and basic determinants. Economic Development and Cultural Change 56 (1): 191-221.

Cherif R, Hasanov F (2012) Public debt dynamics: the effects of austerity, inflation, and growth shocks. IMF working paper No. WP/12/230, IMF, Washington D.C., USA.

Das DK (2016). Determinants of current account imbalance in the global economy: a dynamic panel analysis. Journal of Economic Structures 5 (8): 1-24. DOI: 10.1186/s40008-016-0039-6.

Debrun X, Kinda T (2016) That squeezing feeling: the interest burden and public debt stabilization. International Finance 19 (2): 147–178.

Dickey DA, Fuller WA (1979) Distributions of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association 75 (366): 427–431.

Dickey DA, Fuller WA (1981) Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica 49 (4): 1057–1072.

Enders W, Lee B (1990) Current account and budget deficits: twins or distant cousins? Review of Economics and Statistics 72 (3): 373-381.

Engle RF, Granger CWJ (1987) Co-integration and error correction: representation, estimation and testing. Econometrica 55 (2): 251-276.

Favero C, Giavazzi F (2007) Debt and the effects of fiscal policy. National Bureau of Economic Research (NBER) working paper No. 12822.

Fleming MJ (1967) Domestic financial policies under fixed and floating exchange rates. IMF Working Paper No. 9, Washington, D.C., USA.

Hashem HYM, Fahmy HA (2019) Sensitivity of public debt to macroeconomic shocks: An application to the Egyptian economy. Business and Economic Horizons 15 (2): 219-241.

Hodrick RJ, Prescott, EC (1997) Postwar US business cycles: an empirical investigation. Journal of Money, Credit, and Banking 29 (1): 1-16.

Huidrom R, Kose MA, Ohnsorge F (2018) Challenges of fiscal policy in emerging and developing economies. Emerging Markets Finance and Trade 54 (9): 1927-1945.

International Monetary Fund (2020) Ethiopia country report No. 20/29, Washington, D.C., USA

Johansen S, Juselius K (1990) Maximum likelihood estimation and inference on cointegration-with applications to the demand for money. Oxford Bulletin of Economics and Statistics 52 (2): 169–210.

Kaufmann D, Kraay A, Zoido-Lobaton P (2002) Governance matters II. The World Bank. Washington, D.C., USA.

Kim KH (1995) On the long-run determinants of the US trade balance: a comment. Journal of Post Keynesian Economics 17 (3): 447-455.

Krugman P (1979) A model of balance of payments crises. Journal of Money, Credit, and Banking 11 (3): 311–325.

Ministry of Finance and Economic Cooperation of Ethiopia (2017) Public debt management and guarantee issuance directive No 46/2017. Available at: www.mofed.gov.et (Accessed on July 23, 2020).

Ministry of Finance of Ethiopia (2020) Public sector debt statistical bulletin No. 33. Available at: www.mofed.gov.et (Accessed on July 23, 2020).

Mishra P, Montiel PJ, Spilimbergo A (2010) Monetary transmission in low-income countries. IMF Working Paper Series No. 10/223, Washington, D.C, USA.

Mundell RA (1968) International Economics. Macmillan, New York.

Obstfeld M (2013) On keeping your powder dry: fiscal foundations of financial and price stability. Monetary and Economic Studies 31 (1): 25–37.

Obstfeld M, Rogoff K (1986) Ruling out divergent speculative bubbles. Journal of Monetary Economics 17 (3): 349-362.

Obstfeld M, Rogoff K (1995) Exchange rate dynamics redux. Journal of political economy 103 (3): 624-660.

Reinhart CM, Rogoff K (2010) Growth in a time of debt. American Economic Review 100(2): 573–578.

Pesaran MH, Shin H, Smith RC (2001) Bounds testing approaches to the analysis of level relationships. Journal of Applied Economics 16 (1): 289-326.

Phillips, PCB, Perron P (1988) Testing for a unit root in time series regression. Biometrika 75 (2): 335–346.

Romer CD, Romer DH (2018) Phillips lecture–why some times are different: macroeconomic policy and the aftermath of financial crises. Economica 85 (337): 1–40.

Sachs J (1982) The current account in the macroeconomic adjustment process. Scandinavian Journal of Economics 84 (2): 147-159.

Sadiku L, Fetahi-Vehapia M, Sadiku, M, Berisha N (2015) The persistence and determinants of current account deficit of FYROM: an empirical analysis. Procedia Economics and Finance 33 (1): 90-102.

Sims CA (1980) Macroeconomics and reality. Econometrica 48 (1):1-48.

Sisay DB, Kotosz B (2020) Macroeconomic determinants of external indebtedness of Ethiopia: ARDL approach to co-integration. Society and Economy 1-20. DOI: 10.1556/204.2020.00013.

Teamrat KG (2018) The effect of budget deficit on current account deficit in Ethiopia: investigating the twin deficits hypothesis. International Journal of Economic & Management Sciences 7(4): 1-6. DOI: 10.4172/2162-6359.1000530

Zivot E, Andrews D (1992) Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. Journal of Business & Economic Statistics 10(3): 251–270.

Appendix A

Table A1. Data sources and definitions

Variable	Measurement	Source
General government debt	Percentage of GDP	IMF public debt database
Consumer price inflation	Average yearly change	IMF
Reel effective exchange rate	Index	Bruegel database
Fiscal balance	Percentage of GDP	IMF
Gross fixed capital formation	Percentage of GDP	UNCTAD
Foreign direct investment	In millions of USD	UNCTAD
Per capita GDP growth (PPP)	Average yearly change	IMF
Current account balance	Percentage of GDP	IMF

Figure A1: here

Figure A2: here

Figure A3: here

Figures

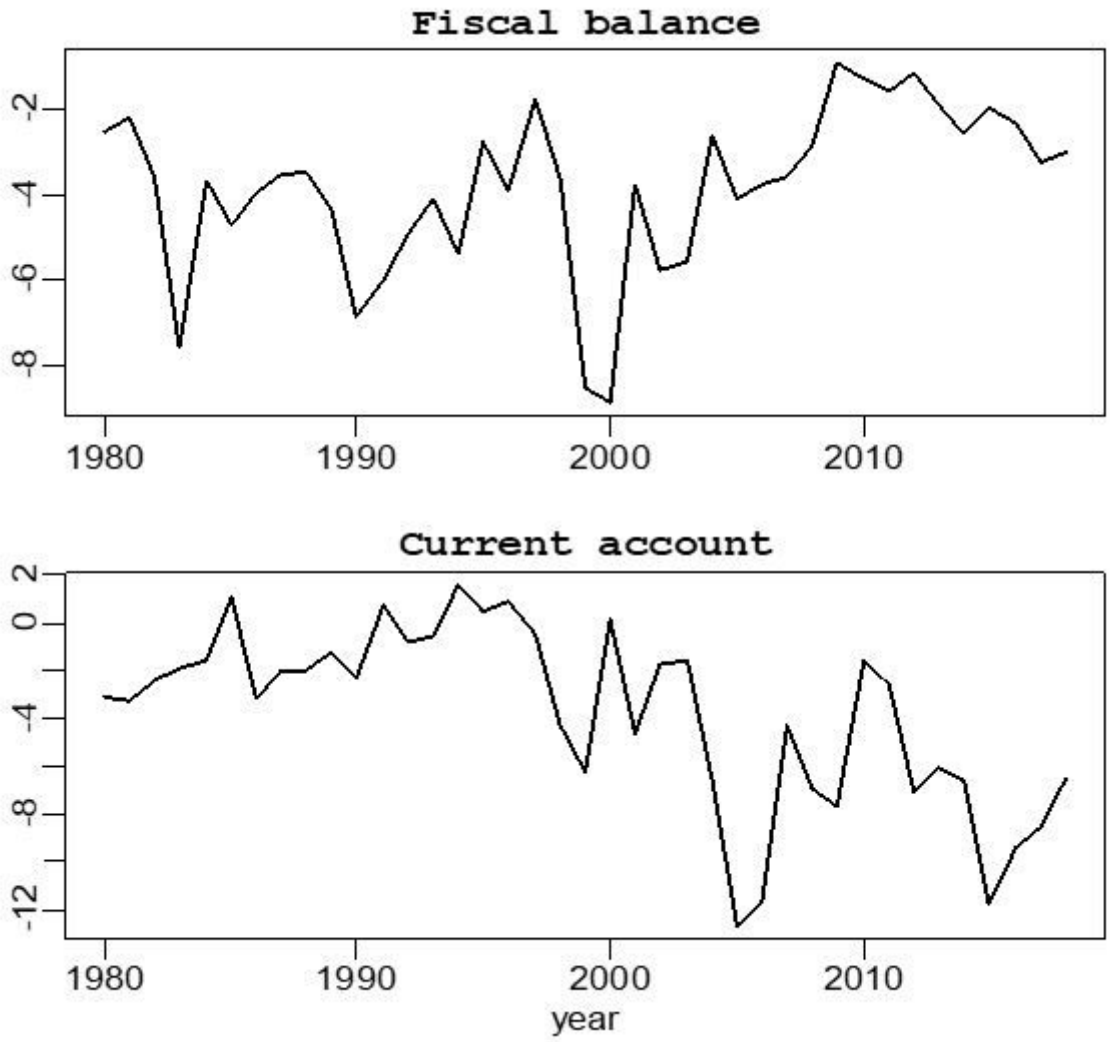

Figure 1

Current account and fiscal balance in Ethiopia 1980-2018

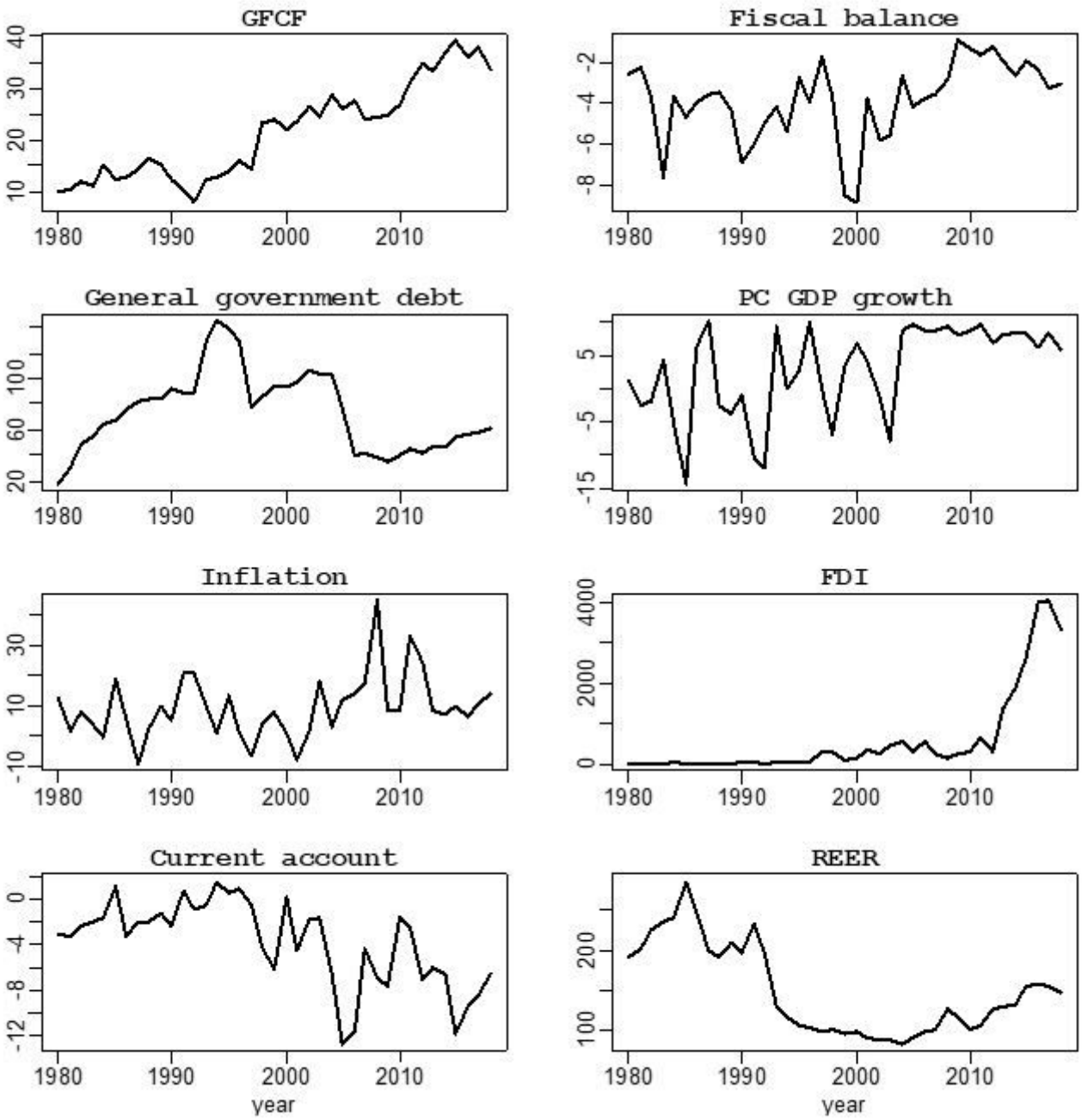

Figure 2

Level plot of model variables

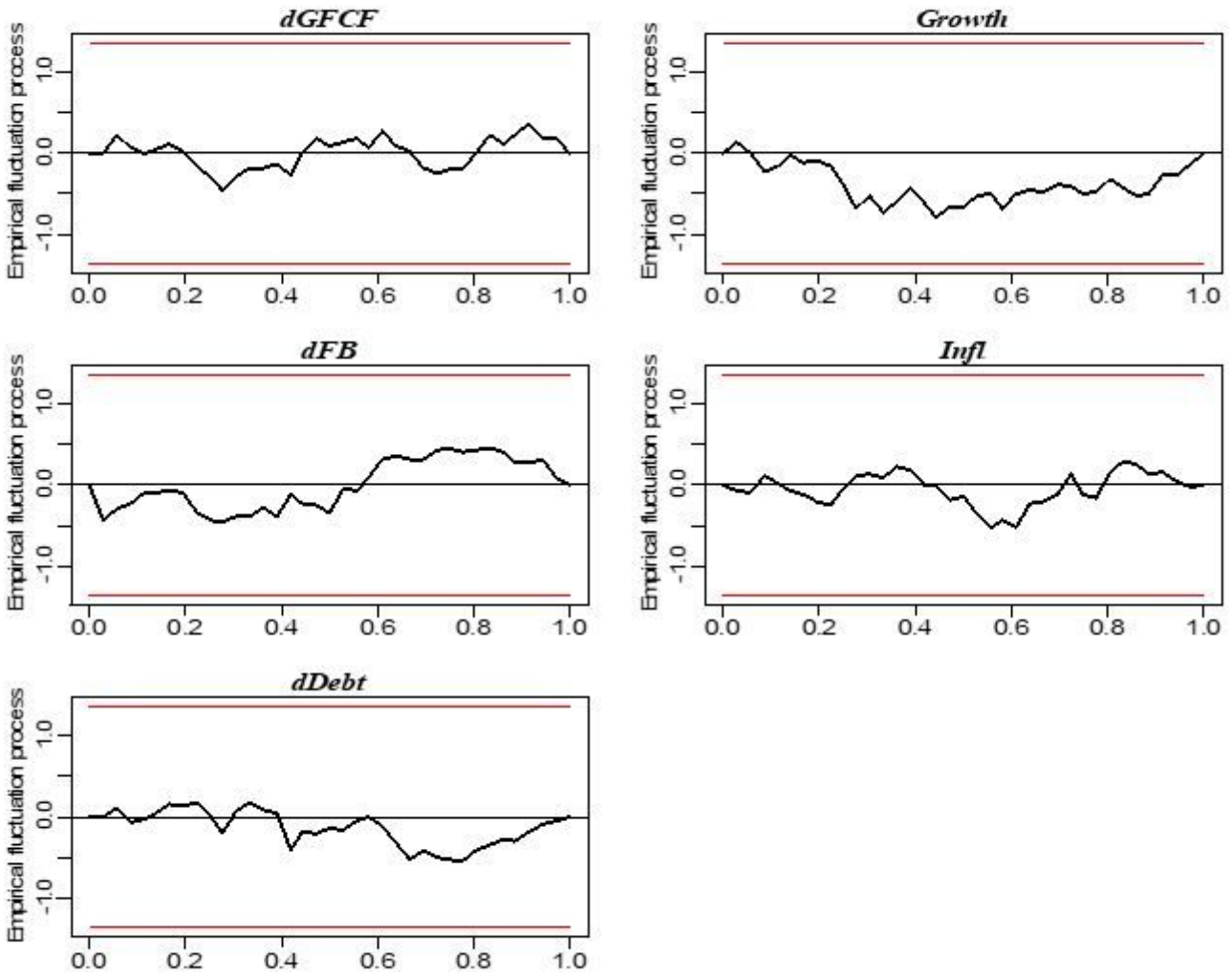

Figure 3

OLS-CUSUM plot of standardized residuals for the debt model

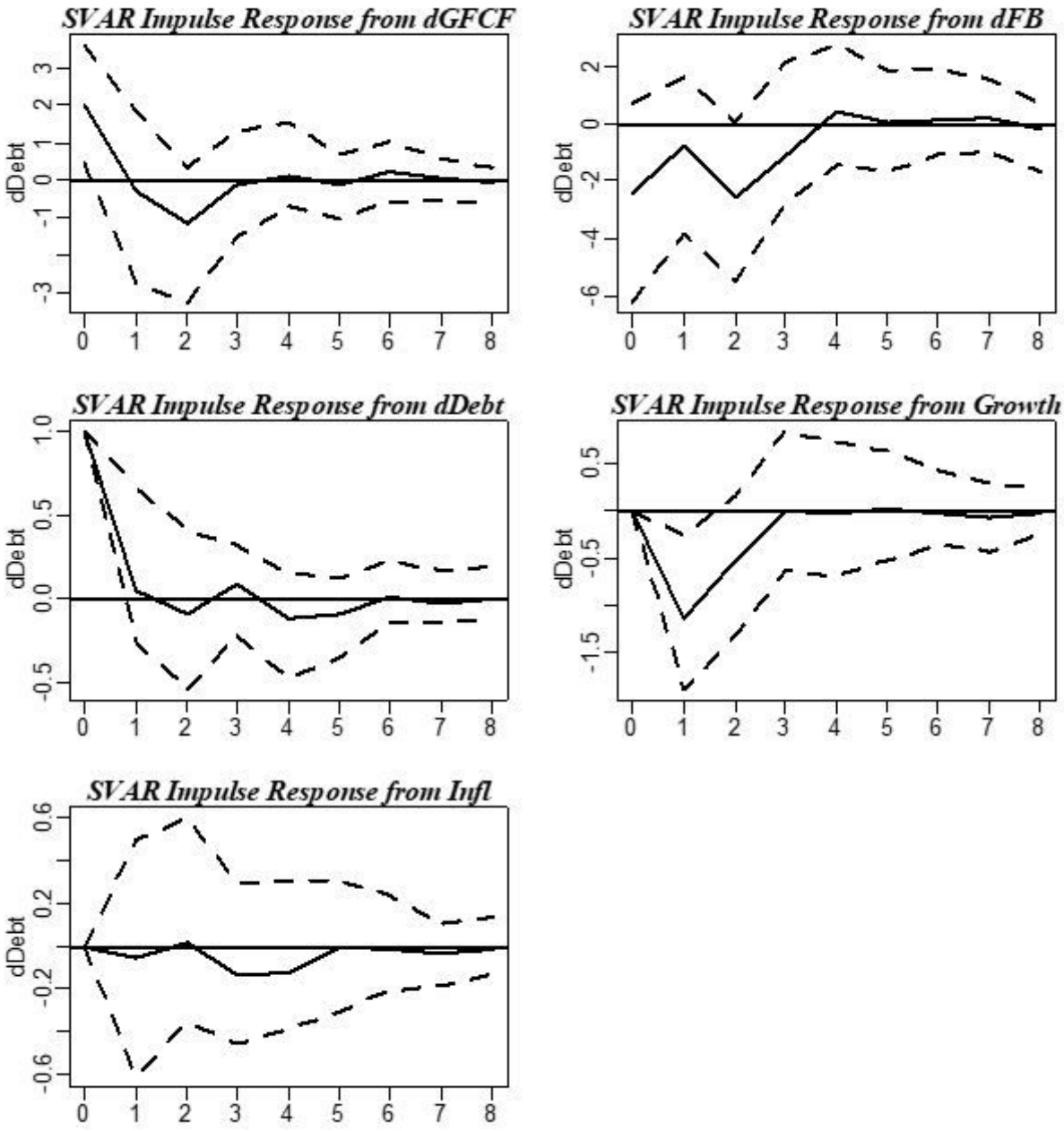

Figure 4

Impulse response functions of debt model

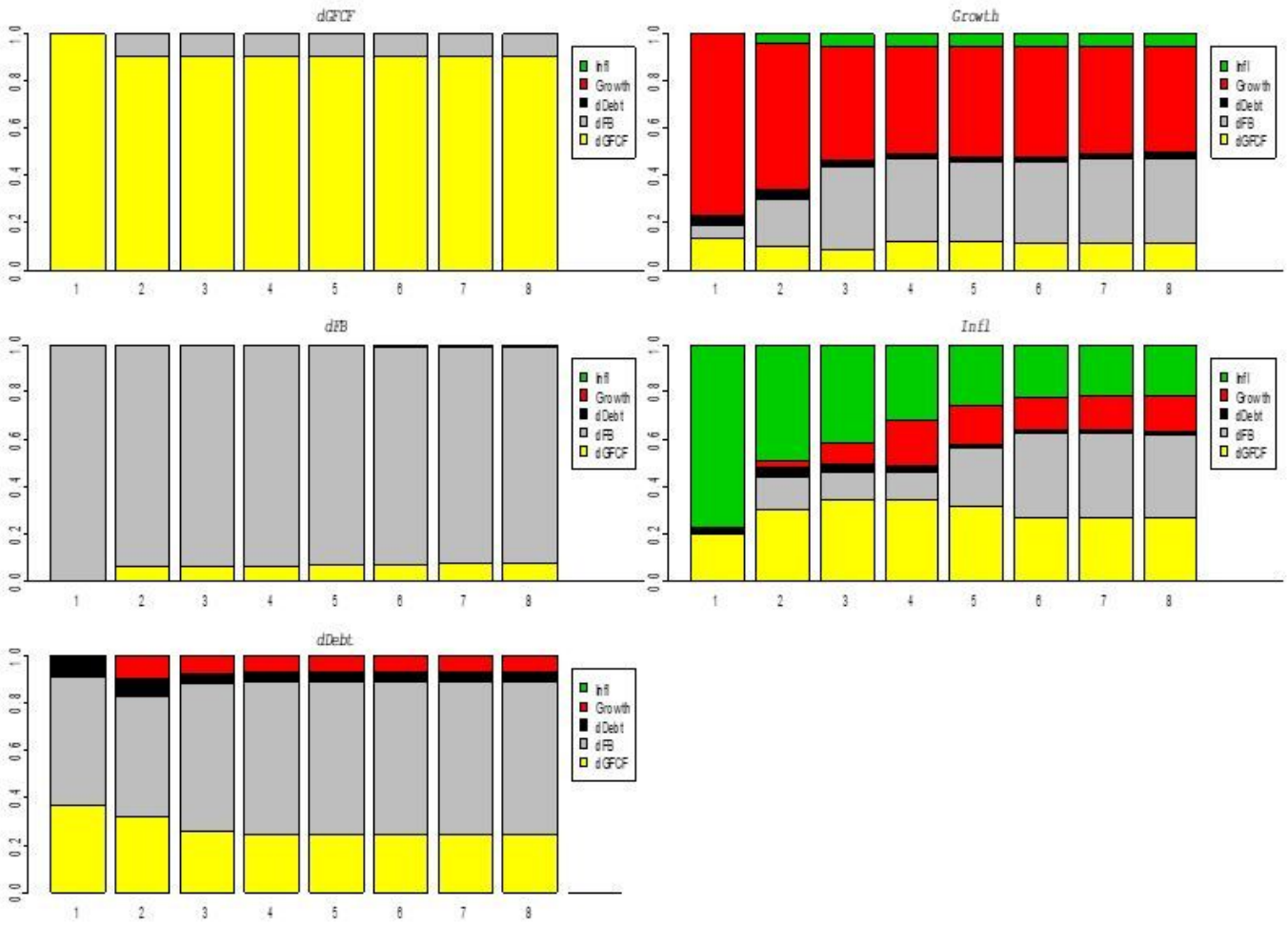

Figure 5

Forecast error variance decomposition for debt model

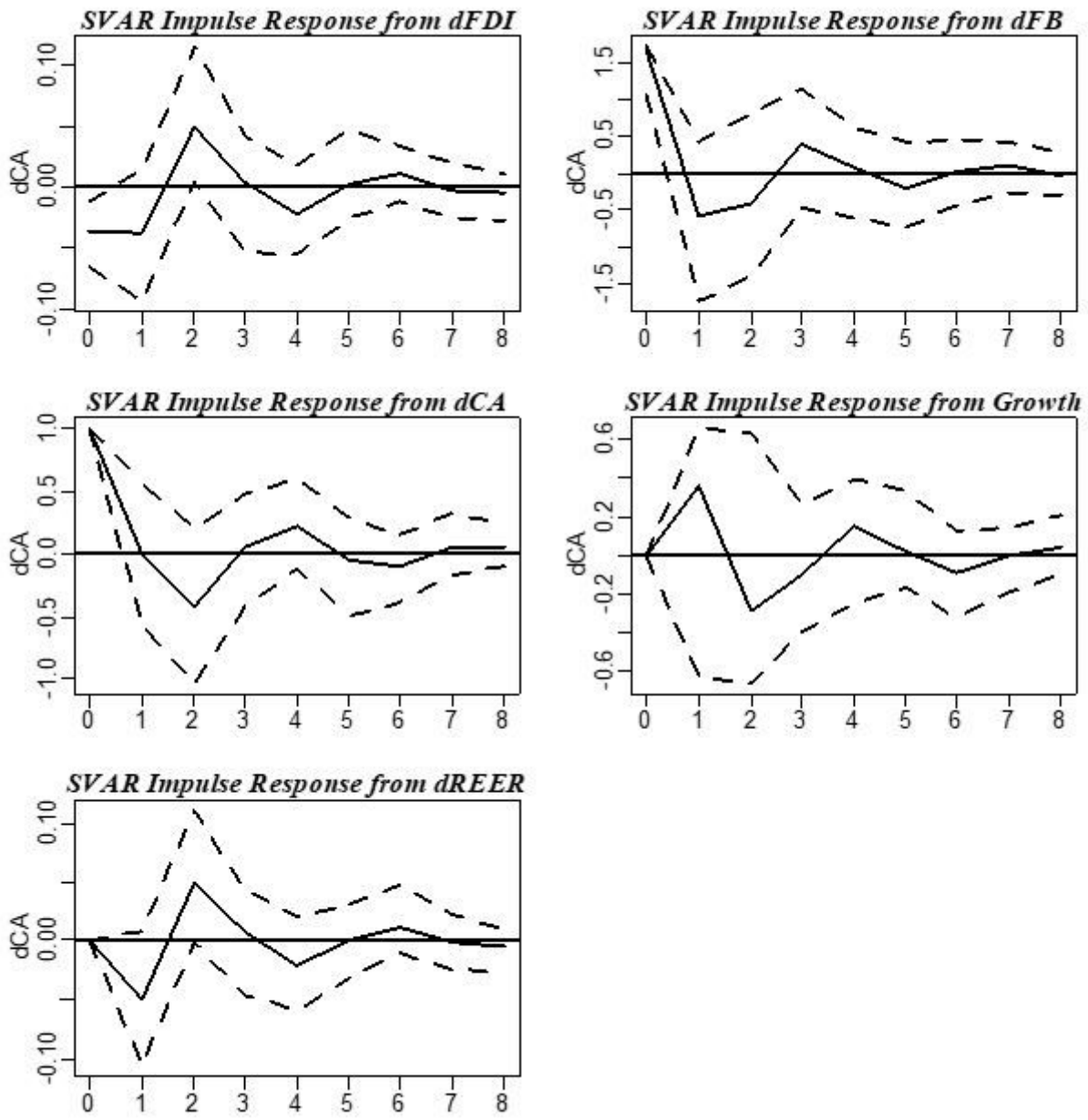

Figure 6

Impulse response functions of current account model

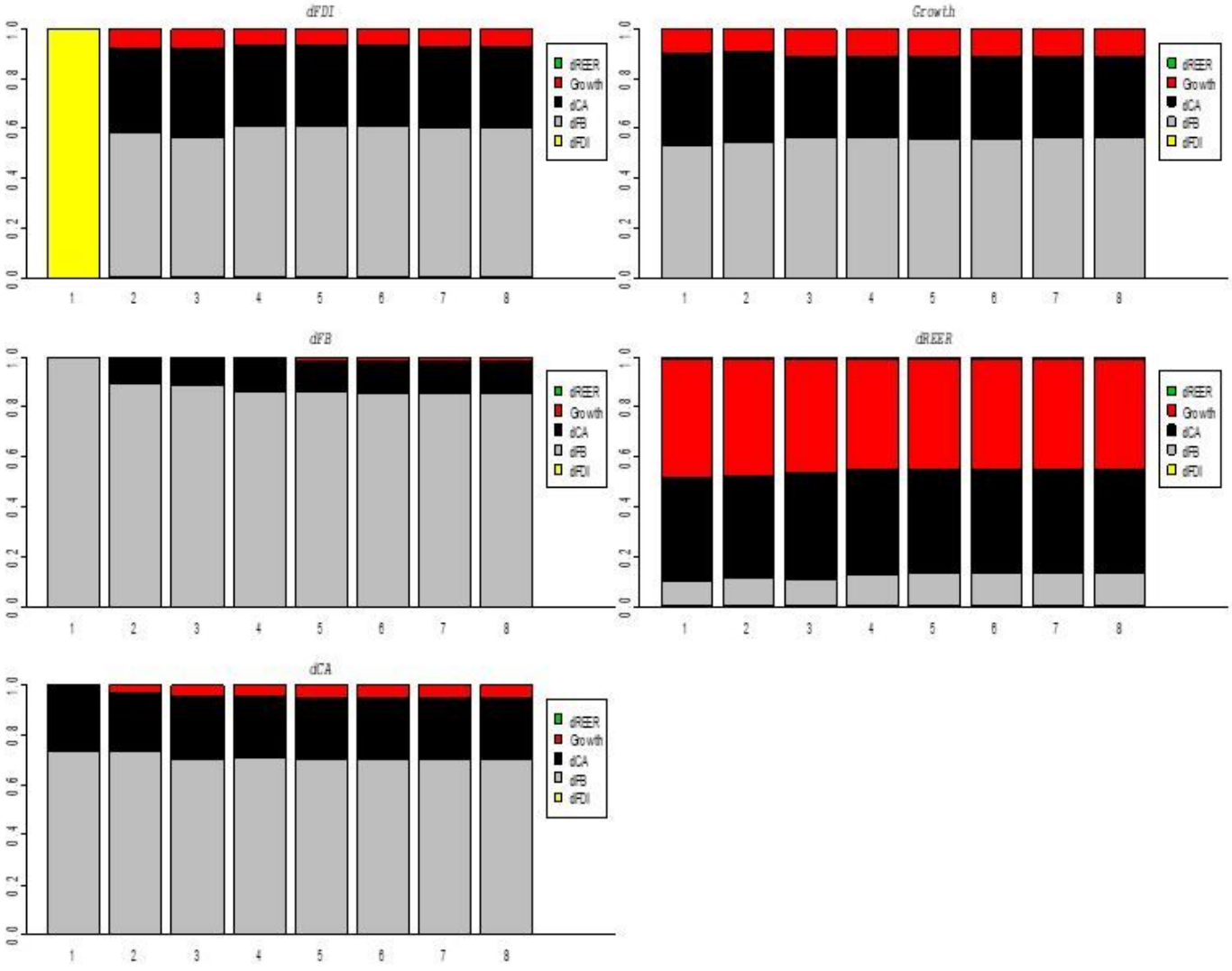

Figure 7

Forecast error variance decomposition for current account model

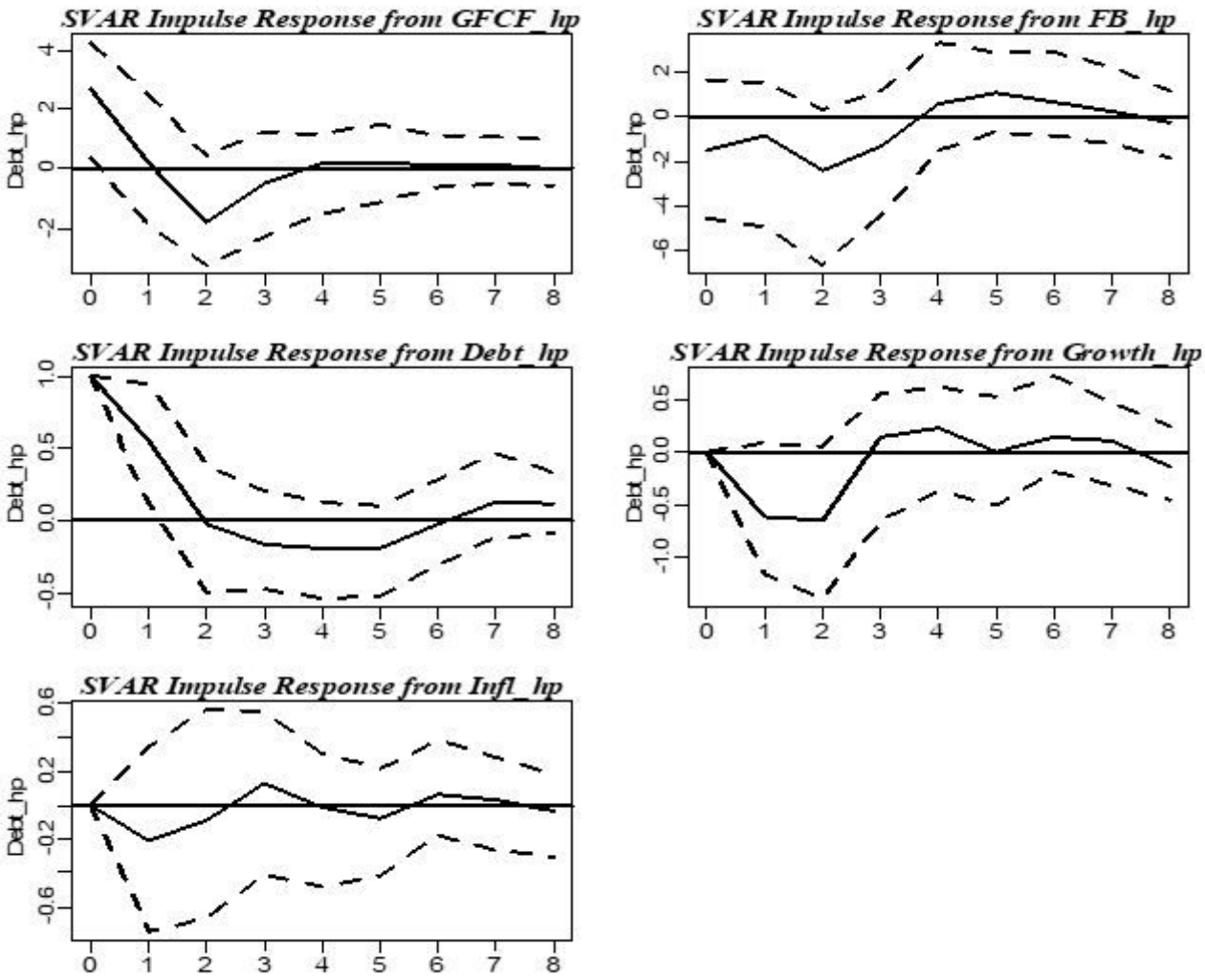

Figure 8

Impulse response functions of government debt with HP filtered data

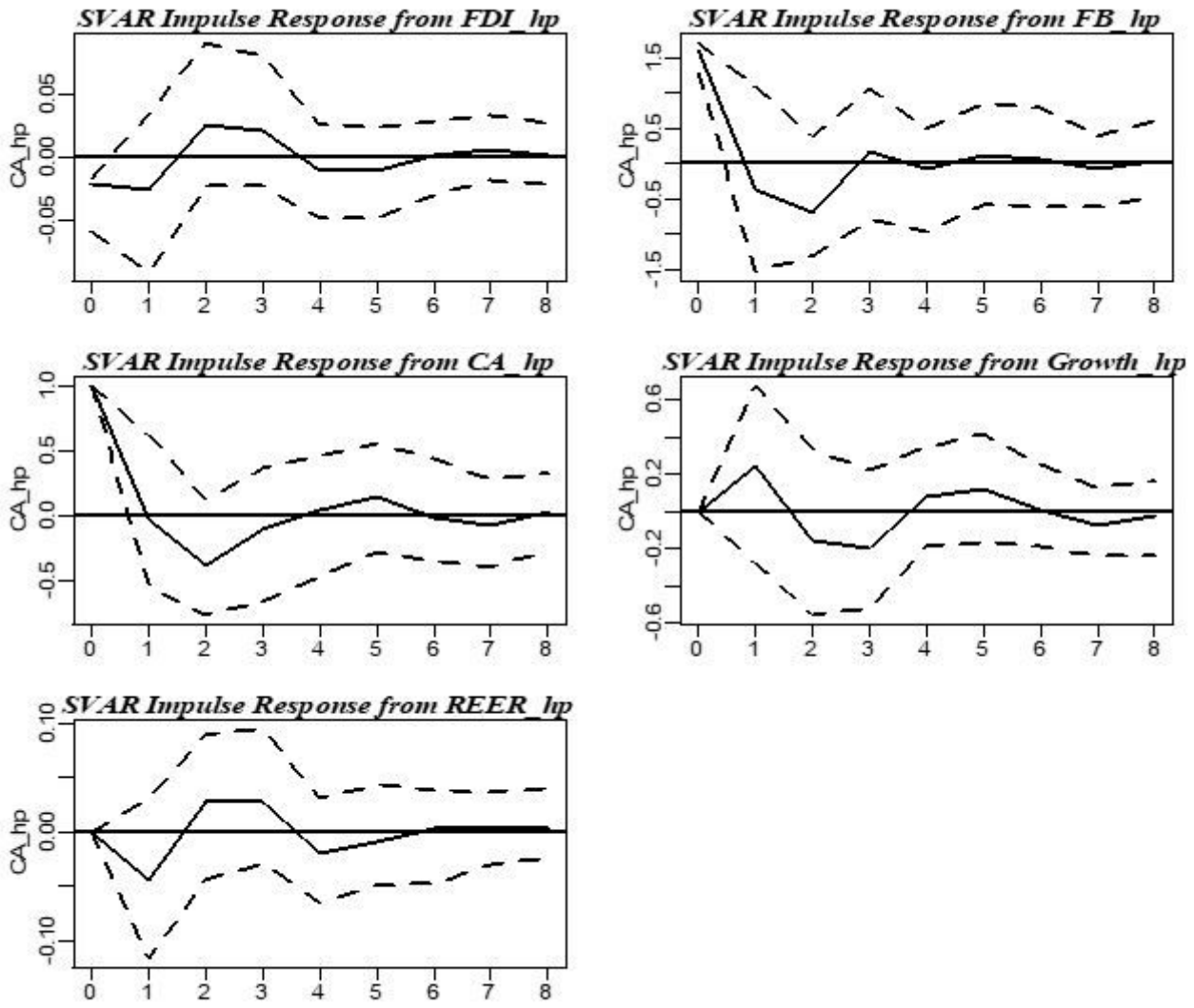

Figure 9

Impulse response functions of current account with HP filtered data

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.docx