

ANALYZING THE RELATIONSHIP BETWEEN BUDGET DEFICIT, CURRENT ACCOUNT DEFICIT, AND GOVERNMENT DEBT SUSTAINABILITY

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Highlights

- Among macroeconomic variables, budget deficit and current account deficits have a significant impact on the credibility of countries in paying off their debts.
- Since the budget and current account deficits have been present in the Iranian economy for more than a few decades, there are potentials for a debt crisis in the economy.
- We found that a vicious circle can take place through the interaction between the budget deficit, the current account deficit, and the debt crisis.
- Based on the results there exists a dynamic relationship between budget deficits, current account deficit and government debt sustainability in the Iranian economy.
- The results also show that there is a stable and long-term relationship among budget deficit, current account deficit and government debt sustainability that can serve as a guide for policymakers.

Abstract

The main purpose of this study is to determine the dynamic relationships between budget deficit, current account deficit, and government debt sustainability during 1974-2015 in the Iranian economy. We used a VAR model with Impulse Functions and Variance Decomposition in our dynamic analysis. The results show that there is a long-term stable relationship among the variables of the model suggesting that to improve the government debt sustainability it has to reduce the budget deficit and current account deficit. Since Iran's dependence on oil revenues is the underlying cause of the dependence of the variables on each other, the government needs to reduce the dependence of the current account and the state budget on oil revenues to reduce both types of deficits and government debt sustainability.

Keywords: Budget Deficit, Current Account Deficit, Government Debt Sustainability, Iranian Economy, Vector Auto Regression Model (VAR)

JEL classification: E69, F32, F41, H62, H63

1. Introduction

The large size of the government's role in the Iranian economy and the ever-increasing current costs have caused the government to face budget deficits every year. The deficit, in turn, has brought

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about acute problems such as high inflation rates, current account deficits, and debt crisis. On the other hand, the data on non-oil exports and imports of goods and services in recent years indicate that the country's non-oil balance of trade has always been negative. The main reason for this economic problem is the single product economy; the country's high dependence on oil exports. This current account deficit can lead to a budget deficit and debt creation for the government. Another significant phenomenon in recent years is the problem of government debt and the inability to repay it. Due to the dependence of the country's budget on oil revenues, the unsustainability of debt can have significant effects, including revenues from the sale of oil to repay debts and expenditures by the government. This can be a source of negative effects on the Iranian economy such as budget deficits, current account deficit, decrease of production, spread of possible corruption, and the growing vulnerability of the economy to oil price fluctuations and external shocks in the economy (Davoodi, 1993; Negahbani, 2004 and Fatahi et al, 2014).

The term “Debt Sustainability” has many connotations to it, though it almost always refers to the fiscal policies of a government or the public sector. One meaning of sustainability relates to solvency; the ability of the government to repay its debt obligations in perpetuity without any defaults (Burnside, 2004: 1). Research indicates that many political and economic factors determine the credibility of countries in fulfilling their obligations to repay debt. These factors include public debt, economic growth, inflation, budget deficit, current account deficit and sovereignty quality (political stability). Among macroeconomic variables, budget deficit and current account deficits have a significant impact on the credibility of countries in paying off their debts (Mellios and Blanc, 2006: 4). Since the budget and current account deficits have been present in the Iranian economy for more than a few decades, there are potentials for a debt crisis in the economy. As a result, a vicious circle can take place through the interaction between the budget deficit, the current account deficit, and the debt crisis. The lack of attention and meaningful recognition of the interactions among these variables has led to actions and policies (sometimes even contradictory) not geared for eliminating the imbalance in the country's budget, the foreign trade sector, and the government debt sustainability. Therefore, the purpose of this present study is to investigate the interaction between budget deficit current account deficit and government debt sustainability during 1974-2015 in the Iranian economy. The results can serve as a guide for policymakers.

The outline of the paper is as follow. Section 2 presents the related literature review. Section 3 presents the econometric methodology and Data. Section 4 presents the empirical results including variance decomposition impulse response functions and causality analyses. Concluding remarks are given in section 5.

2. Related Literature Review

The issue of the linkages between budget deficit and current account deficit started to draw attention in the 1980s, when, during Reagan's presidency, the US experienced significant external and fiscal budget deficits. As a result of this co-movement, much theoretical and empirical literature has examined the relationship between the current account and budget deficits. It is possible to identify four streams of literature that explain the nexus between budget deficit and current account deficit: the twin deficit hypothesis, the current account targeting hypothesis, the feedback linkage, and the inter-temporal Ricardian view (Algiri 2013: 234).

The twin deficit hypothesis postulates that a budget deficit tends to cause a current account deficit. For example studies by Mundell (1963), and Haug (1996) have argued that government deficits cause trade deficits through the interest and exchange rate channels. In a small open economy IS-LM framework, an increase in the budget deficit would induce upward pressure on interest rates, thus, causing capital inflows. This will lead to an appreciation of the exchange rate through high demands

on domestic financial assets, leading to an increase in the trade deficit (Neaime, 2015: 128). Several studies (Salvatore, 2006; Rault and Afonso, 2009; Mohammadzadeh and Asgharpur 2008; Algiri 2013; Mohammadi and Tohidi 2013; Noferesti and Azimi 2015) have empirically shown that the two deficits are strongly related and generally the causality relation runs from budget deficits to current account deficits. Conversely, “current account targeting” has been labeled by Summers (1988) that current account deficits have a statistically significant impact on budget deficits (See for instance Safdari et al. 2014; Komijani and Varahrami 2012; Kalou, and Paleologou 2012; Merza et al. 2012).

Other studies found a bilateral relationship between the two deficits. For instance, Feldstein and Horioka (1980) found that savings and investments are highly correlated, and this linkage causes a bidirectional causality between budget and current account. The existence of important feedback generates causality between the two variables to run in both directions (Kalyoncu, 2007). Finally, the Ricardian Equivalence Hypothesis (Barro, 1989) argues that there is no relationship between the two deficits. It shows that changes in government revenues or expenditures have no real effects on real interest rates, investment, or the current account balance. (See for instance Papadogonas and Stournaras, 2006; Qaderi and Samadi 2016).

The empirical literature has studied the relationship between twin deficits and debt sustainability in developing countries because the issues of the government debt and deficits in EU member states in recent years have become important and seriously discussed after the financial crisis in 2008 (Dinca et al. 2011: 36). For instance, Khalid and Guan (1999) investigated the causal relationship between the current account and budget deficits. Their results for Indonesia and Pakistan show that a current account deficit tends to cause a budget deficit because much of the current account deficit was financed by borrowings from the banking system. Interest payments on these debts over the years have made these countries to have bigger budget deficits. In order to get an understanding of the factors affecting government debt sustainability Petrovic (2013) analyzed the factors affecting long-term interest rates for 27 EU member states during 1995-2011. Based on their findings since government debt and long-term interest rates have a positive relationship with each other, government debt, budget deficit, inflation, and the political system variables have a positive relationship with the long-term interest rates and, as a result, have a positive relationship with the government debt variable. Also, growth rate variables and current account balance are negatively related to long-term interest rates, while it has a negative effect on government debt variable. Mellios and Blanc (2006) studied the factors affecting credit ratings of countries by three important organizations: Fitch, S & P and MOODY'S, and used 13 political and economic factors affecting the credibility of countries in repaying their debts. These variables include public debt, economic growth, inflation, the size of the economy, the balance of payments and the quality of governance / political stability and so on. The impact of the variables correlated with these factors on ratings is then assessed through linear regression modeling and ordered logistic modeling. Their results show that per capita income, government revenue, real exchange rate changes, and inflation rates are considered as significant variables in affecting the credit rating of countries in paying off their debts. Empirical studies on debt sustainability in the Iranian economy are scarce. However, the literature is growing fast. For instance, Mousavi Mohseni and Taheri (2009), using cointegration tests, for the period 1955-2001, found that debt is not sustainable in the Iranian economy. They also pointed to the fiscal unsustainability of the post-revolutionary period. Khiabani et al. (2013), tested Iran's fiscal sustainability for the period 1971-2008 using a Multi-Co-Integration method. In their study, they show that the government is not in a sustainable-state of public finance. However, if one adds seigniorage to government revenues, the fiscal sustainability conditions will be met. Fatahi et al. (2014), using 1982-2011 data and autocorrelator estimator technique, show that the past budget deficits have had a positive effect on the current budget deficit. Also, debt sustainability was tested

through the Fiscal Reaction Function, which shows that in the short run debt sustainability is weak in the Iranian economy, but in the long run, debt is not sustainable.

With the above in mind, this paper can be perceived as addressing gaps in government debt sustainability literature and the relationships between budget deficit, current account deficit, and government debt sustainability in the Iranian economy.

3. Data and Methodology

3-1. Data

In this paper, we studied the relationship between three economic variables namely Budget Deficit, Current Account Deficit, and Government Debt Sustainability. The seasonal data has been collected for a period of 42 years from 1974 to 2015. Debt to GDP ratio was taken as an indicator for Government Debt Sustainability. The data has been taken from the Central Bank of Iran database, and the estimation is implemented using Eviews. The variables and their definitions are shown in Table 1.

Table 1. Variables and their definitions

Variables	Definitions
Budget Deficit (BD)	The logarithm of government expenditures to its income ratio
Current Account Deficit (CAD)	the logarithm of Import to the export of goods and services ratio
Government Debt Sustainability (DS)	the logarithm of the debt-to-GDP ratio
D1	A dummy variable during the war years 1980-1988
D2	A dummy variable for the Exchange rate unification in the year 1993
D3	A dummy variable for the Exchange rate unification in the year 2002

3-2. Methodology

VAR models are among the most successful, flexible and easy to use models for the analysis of multivariate time series. A VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and forecasting. It often provides superior forecasts to those from univariate time series models and expands theory-based simultaneous equations models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model. In VAR models, the variables are explained by the lag of the other variables in the system and the lag of itself⁴. The model and its respective ordering are as follows: (j = Time lags)

$$\begin{aligned}
 BD_t &= \alpha_1 + \sum_{j=1}^p \alpha_{11j} BD_{t-j} + \sum_{j=1}^p \alpha_{12j} CAD_{t-j} + \sum_{j=1}^p \alpha_{13j} DS_{t-j} + e_{1t} \\
 CAD_t &= \alpha_2 + \sum_{j=1}^p \alpha_{21j} BD_{t-j} + \sum_{j=1}^p \alpha_{22j} CAD_{t-j} + \sum_{j=1}^p \alpha_{23j} DS_{t-j} + e_{2t} \\
 DS_t &= \alpha_3 + \sum_{j=1}^p \alpha_{31j} BD_{t-j} + \sum_{j=1}^p \alpha_{32j} CAD_{t-j} + \sum_{j=1}^p \alpha_{33j} DS_{t-j} + e_{3t}
 \end{aligned}$$

⁴ <http://faculty.washington.edu/ezivot/econ584/notes/varModels.pdf>

4. Empirical Results

4-1. Unit Root Test Results

We applied the Kpss and Hegy tests to determine the presence of unit roots for each variable. As shown in Table 2 and Table 3 none of the variables have annual, semi-annual or seasonal unit roots.

Table 2. Results of Kpss Test Statistics

variables	Critical value (%5)	Value of test statistic
BD	0.146	0.117862
CAD	0.146	0.139613
DS	0.146	0.332009

Table 3. Results of Hegy Test Statistics

variables	Null hypothesis	Significant level	Computational statistics
BD	semi-annual unit root	0.005643	-5.304793
	seasonal unit root	0.000000	38.83829
CAD	semi-annual unit root	0.005643	-11.87395
	seasonal unit root	0.000000	57.18882
DS	semi-annual unit root	0.007263	-4.028820
	seasonal unit root	0.000000	38.34778

4-2. Vector Autoregression (VAR) Estimation Results

Before estimating the VAR model, the first task is to choose the number of lags that should be included in the model. Based on Schwarts – Bayesian (SC) criterion, we found that six lags are the best to represent the dynamic structure of the VAR system that is shown in Table 4.

Table 4. Choice Criteria for Selecting the Order of the VAR Model

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-127.04	-	0.00114	1.738101	1.96873	1.831755
1	393.61	995.762	190e-06	-4.657649	-4.25403	-4.493755
2	547.99	289.458	3.10e-07	-6.474875	-5.89828	-6.240739
3	580.37	59.5098	2.31e-07	-6.767204	-6.01763	-6.46282
4	606.61	47.2210	1.87e-07	-6.982627	-6.06007	-6.60801
5	634.23	48.6969	1.48e-07	-7.215496	-6.11996	-6.770639
6	676.68	73.2227	9.76e-08	-7.633595	6.3650*	-7.1184*
7	678.87	18.7252	9.54e-08	-7.659800	-6.21831	-7.074462
8	703.83	26.477*	3.76e - 08*	-7.747886*	-6.13342	-7.092307

* indicates lag selection by different criterion

AIC: Akaike Information Criteria

HQ: Hanan – Queen Criteria

FPE: Forecast Error Criteria

LR: Likelihood Ratio Test

Estimation results of the VAR model with six lags are shown below.

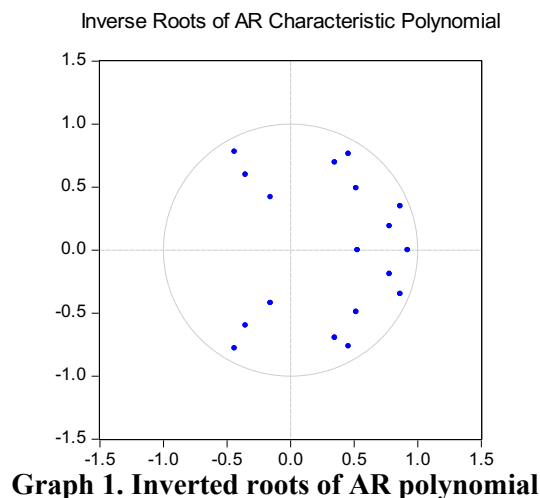
$$\begin{aligned} \text{BD} = & 1.918*\text{BD}(-1) - 1.789*\text{BD}(-2) + 1.220*\text{BD}(-3) - 0.861422036685*\text{BD}(-4) + 0.551*\text{BD}(-5) - 0.261*\text{BD}(-6) \\ & + 0.144*\text{CAD}(-1) - 0.225*\text{CAD}(-2) + 0.180*\text{CAD}(-3) - 0.043*\text{CAD}(-4) - 0.076*\text{CAD}(-5) + 0.066*\text{CAD}(-6) - \\ & 0.045*\text{DS}(-1) + 0.250*\text{DS}(-2) - 0.420*\text{DS}(-3) + 0.252*\text{DS}(-4) - 0.035*\text{DS}(-5) + 0.044*\text{DS}(-6) + 0.159*\text{D1} - \\ & 0.115*\text{D2} + 0.033*\text{D3} \end{aligned}$$

$$\begin{aligned} \text{CAD} = & -0.135*\text{BD}(-1) + 0.301*\text{BD}(-2) - 0.249*\text{BD}(-3) + 0.247*\text{BD}(-4) - 0.292*\text{BD}(-5) + 0.169*\text{BD}(-6) + \\ & 1.697*\text{CAD}(-1) - 1.393*\text{CAD}(-2) + 0.701*\text{CAD}(-3) - 0.292*\text{CAD}(-4) + 0.130*\text{CAD}(-5) - 0.094*\text{CAD}(-6) - \\ & 0.220*\text{DS}(-1) + 0.197*\text{DS}(-2) + 0.086*\text{DS}(-3) - 0.208*\text{DS}(-4) + 0.125*\text{DS}(-5) + 0.012*\text{DS}(-6) - 0.034 + \\ & 0.140*\text{D1} - 0.094*\text{D2} + 0.101*\text{D3} \end{aligned}$$

$$\begin{aligned} \text{DS} = & 0.198*\text{BD}(-1) - 0.222*\text{BD}(-2) + 0.167*\text{BD}(-3) - 0.062*\text{BD}(-4) - 0.099*\text{BD}(-5) + 0.119*\text{BD}(-6) + \\ & 0.014*\text{CAD}(-1) - 0.090*\text{CAD}(-2) + 0.208*\text{CAD}(-3) - 0.355*\text{CAD}(-4) + 0.167*\text{CAD}(-5) + 0.030*\text{CAD}(-6) + \\ & 1.866*\text{DS}(-1) - 1.557*\text{DS}(-2) + 1.207*\text{DS}(-3) - 1.121*\text{DS}(-4) + 1.004*\text{DS}(-5) - 0.448*\text{DS}(-6) - 0.092 + 0.067*\text{D1} \\ & + 0.053*\text{D2} - 0.023*\text{D3} \end{aligned}$$

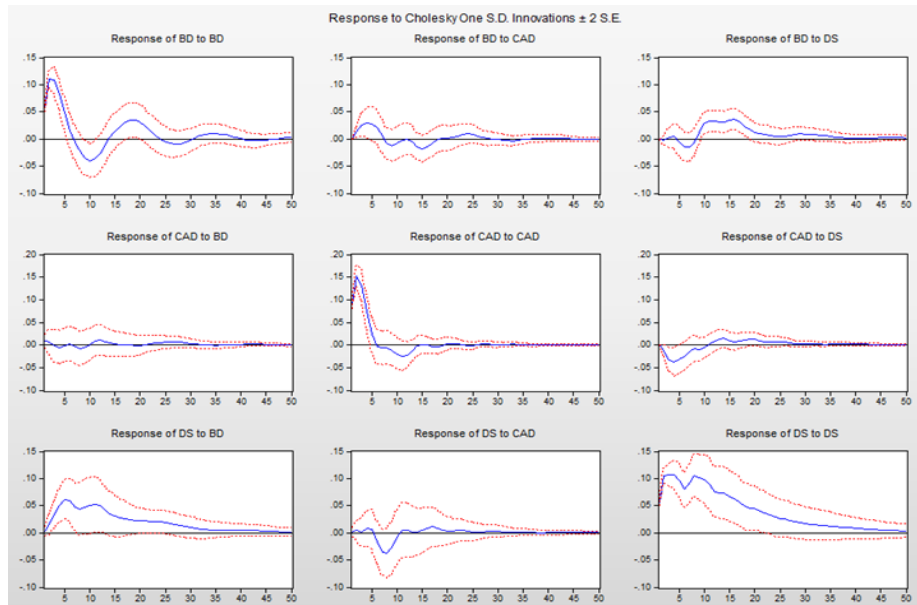
4-3. Checking VAR stationarity

The inverse of the four roots of the AR part belongs to the complex unity circle (Graph.1); hence, the VAR is stable (stationary).



4-4. Analysis of shocks and impulse response functions of the VAR

One of the advantages of VAR specifications is that it allows for the computation of Impulse Response Functions (IRF), i.e., functions of the response of any endogenous variables to one standard deviation shock in any other endogenous variable in the system (Rad, 2011: 4). Figure 2 shows the Impulse Response Function analysis, which is the responsibility of the three variables to each shock over a ten-year horizon.



Graph 2. The Results of Impulse Response Analysis

Generally, shocks are temporary, meaning the variables, in the long run, will retrieve their equilibrium. All the impulse functions converge to 0, which is a confirmation of the stability of the VAR model. The following results are obtained from the above functions:

(i) Impact of shocks on BD: If there is a positive shock on DS, this will have a positive impact on BD in the short run, but in the long run the impact is oscillating and eventually converges to 0. Also, the effect of CAD shocks on BD in the short term is positive, negative in the medium term and again positive in the long term. These results are consistent with the nature of the Iranian economy since a large junk of the government's budget is from oil revenues. If a shock on DS occurs, it has a negligible and generally negative effect on BD in the short run, but in the long run, it has a major and positive impact. It can be concluded that the consequences of debt in terms of the economic structure of Iran is of two types. In the short term it will lead to an increase in growth and a reduction in government deficit, but in the long run, it will lead to a decline in economic growth, government.

(ii) Impact of shocks on CAD: If there is a positive shock on BD, we see a positive effect on CAD in the first and second season, but from the third to the ninth season, the effect is negative. Also, in the tenth season, BD has a positive effect on CAD again which continues until the seventh season. From the eighteenth to the twentieth season, these effects are marginally negative and ultimately converge to 0. Besides, if there is a positive shock on CAD, from the first to the fifth season, we see a positive impact, but from the sixth to the fourteenth season the effect becomes negative causing CAD to fall and eventually reach zero. Also if there is a positive shock on DS, from the second to the tenth season, we see a negative impact on CAD, but from the eleventh season on the effect is positive leading to an increase till it converges to 0.

(iii) Impact of shocks on DS: The effect of BD shock on DS has always been positive which shows that as budget deficit increases the government's ability to repay its debts decreases. However, the effect of CAD shock on DS in the short-term is positive. From the sixth to the tenth season it is negative, and from the tenth season on (long run) it becomes positive again. This behavior shows

that if the current account deficit is due to oil revenue shocks, this deficit would lead to a reduction in oil revenues and consequently falling government revenues because oil plays a vital role in the Iranian economy. Iranian annual budget relies heavily on oil export revenue. The typical way of financing government debts is borrowing from the Central Bank. As a result, the current account deficit affects budget deficit through the debt variable. The debt created due to the current account deficit initially leads to higher economic growth and government revenues, and as a result, the debt-to-GDP ratio falls. Given the fact that current debt is generated by relying on expected future incomes, if expected incomes are not realized, problems arise in the ability to pay off debt. Therefore, the government has to repay the debt by creating new debt. Consequently, the government debt increases and the current account deficit has a positive effect on the debt-to-GDP ratio.

4-5. Analysis of the variance decomposition

Next, the variance decomposition analysis is presented in Table 6. Variance decomposition allows for a better understanding of the double causality between the variables. It shows the contribution of each source of innovation to the variance of k-year ahead forecast error for each of the variables included in the system. In other words, variance decompositions show how much of the forecast error variance for each endogenous variable can be explained by each disturbance (Aka and Dumont, 2008: 107).

Table 6. Forecast Error Variance Decompositions

variables	Period	Variance Decompositions		
		BD	CAD	DS
BD	1	100	0	0
	2	98.88	1.07	0.04
	4	94.99	4.88	0.11
	20	76.85	6.65	16.49
	25	76.53	6.92	16.54
CAD	1	0.97	99.02	0
	2	0.40	99.01	0.48
	4	0.28	95.05	4.65
	20	0.88	89.96	9.15
	25	1.03	89.38	9.57
DS	1	0.15	0.06	99.78
	2	1.70	0.12	98.17
	4	9.43	0.21	90.35
	20	18.85	2.47	78.67
	25	19.18	2.40	78.41

(i) The variation of BD: 94.99% of the budget deficit shocks are accounted for in the short run and in the long run 75.99%. The current account deficit and government debts both affect budget deficit by about 5% in the short run and 24% in the long run. Therefore, if we can create a situation of transparency and confidence in the economy, in the long run, we can manage to control 24% of the fluctuations of the government deficit. Also, we found that the effect of the current account deficit on the government deficit is higher in the short term whereas the impact of the debt-to-GDP ratio is higher in the long term. Moreover, since the government deficit is mostly of long term nature, it is incumbent on the government to know what kinds of remedies it has to cure its deficit in the long run.

(ii) The variation of CAD: Budget deficit shocks in the short run can explain about 28% and in the long run 1.28% of the fluctuations in the current account deficit. Also, debt shocks in the short run can explain 4.65% and in the long run about 9.74% the fluctuations of current account deficits. Finally, current account deficit shocks explain 95% in the short run and in the long run 88.97% of current account deficit fluctuations. Moreover, the share of debt variable in explaining current account deficit fluctuations is more than the budget deficit, but this share in the short run will have a more significant impact on current account deficit fluctuations.

(iii) The variation of DS: 90.35% of the impact of debt shocks occurs in the short run and 8.27% in the long run. The budget deficit and current account deficit affect the government debt sustainability about 10% in the short run and 21% in the long run. As a result, the government should be able to control 21% of debt fluctuations in the long-term and therefore improve debt sustainability. Also, the results show that the budget deficit variable has a more significant impact on government debt sustainability than the current account deficit.

4-6. Granger causality test

At this step, using Granger Causality Test, the relationship between variables is examined two at a time, and the results are presented in Tables 8 to 10. The outcomes show that there is a single causality running from CAD to BD and from CAD to DS. Also, a bidirectional causality is observed between BD and DS.

Table 8. Granger Causality Test *BD* and *CAD*

null hypothesis		Probability	$\chi^2 - \text{Statistic}$	df	conclusion
Table 9. Granger	CAD variable is not Granger cause of BD.	0.0209	7.739350	2	Reject null hypothesis
	BD variable is not Granger cause of CAD.	0.1604	3.66695	2	Accept the null hypothesis

Causality Test *BD* and *DS*

null hypothesis		Probability	$\chi^2 - \text{Statistic}$	df	conclusion
Table 10. Granger	DS variable is not Granger cause of BD.	0.0001	31.35334	8	Reject null hypothesis
	BD variable is not Granger cause of DS.	0.0332	16.71529	8	Reject null hypothesis

Causality Test *CAD* and *DS*

null hypothesis		Probability	$\chi^2 - \text{Statistic}$	df	conclusion
More over, the Granger	CAD variable is not Granger cause of DS.	0.0003	25.51680	6	Reject null hypothesis
	DS variable is not Granger cause of CAD.	0.7647	3.343373	6	Accept the null hypothesis

Granger Causality Test results show that the Keynesian approach which implies the existence of a direct relationship from the budget deficit towards the trade deficit does not apply to Iran's oil-based economy. Since the essential source of income in Iran is from oil exports, it is plausible to expect a different relationship between the deficits than their relationship in a non-oil economy. As such it is possible to expect a positive relationship between government budget and the trade deficit and the trade deficit could cause a budget deficit.

5. Concluding Remarks

In this study, the relationship between the budget deficits, current account deficit and government debt sustainability in Iran were investigated using a VAR model during 1974-2015., Using Granger Causality Test, we showed that there exists a relationship among the studied variables. We also conducted variance decomposition and impulse response functions to highlight the proportion of the effect of one variable on the other.

We found that there is a stable and long-term relationship between budget deficit, current account deficit, and government debt sustainability. So, policymakers should pay close attention to this fact in the implementation of policies. Also, our empirical evidence shows that, since the main reason of the relationship among the research variables is Iran's dependence on oil revenues, we need to reduce the dependence of the current account and government budget on oil export to reduce both deficits and government debt sustainability. To achieve this goal the government could gradually replace oil with non-oil exports and tax revenues. Moreover, it is necessary for the government to reduce its borrowing from the banking system to finance its budget deficit. The government could boost the stock market, issue corporate bonds, and establish financial and credit institutions under the supervision of the Central Bank.

AUTHORS

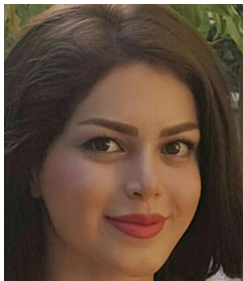


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