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A Structural VAR analysis of Fiscal shocks on current accounts in Greece

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Abstract. *The present study is, in particular, an attempt to test the relationship between budget deficit and current account balance in Greece, from 1976 to 2009, using a structural autoregressive (SVAR) model. We focused on Greece because this country has presented in the last years seriously fiscal changes, and severely damage in the level of macroeconomic variables. We find that in case of Greece there is no long run relationship between budget deficit and current account deficit either in the presence or in absence of structural breaks in the data set. Further, Impulse Response Functions (IRFs) calculated in the framework of SVAR shows that increase in budget deficit increases the current account deficit, which is consistent with the twin deficit hypothesis.*

Keywords: Budget Deficit, Current Account Deficit, SVAR Analysis, Structural Breaks.

JEL Classification: H62, F32, C23.

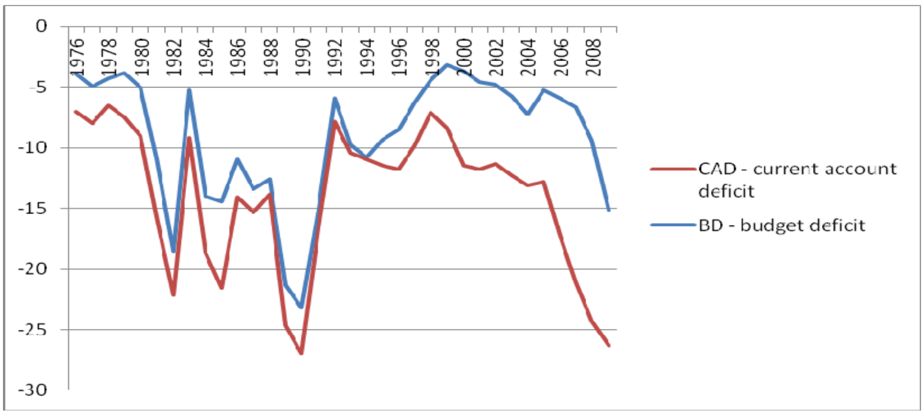
1. Introduction

The economy of Greece is going through a period of austerity to solve the debt crisis. The debt crisis shackled the economy in recent years and the European Union and other international bodies are helping the economy to recover from the crisis and to curb the spread of this crisis to other E.U countries. The Greek economy is experiencing high deficit in budget as well as in current account. The austerity plans and other measures are aimed at reducing the debt and to maintain fiscal prudence.

The budget and current account deficit is not a recent phenomenon in Greek economy. Kalou and Paleologou (2011) noted that the High level of military spending due to the military dictatorship in the 1960', the Greek-Turkish armed race and the welfare spending in the 1980's by the socialist government caused an increase in government expenditure in Greece. Governments resorted to the extensive borrowing or seignorage to meet these raising expenditures instead of raising the government revenue. In the Figure 1 we provided the trend path of current deficit and budget deficit as a percentage of GDP. Figure 1 shows that both deficits have a close relationship and moves in the same direction until 1994. However, thereafter, they start moving apart.

Whether the deficits in currents account and budget are related? The economic researches show that two different cases are possible: first one in which the fluctuations in budget deficits can be translated into current account (so called the twin deficits hypothesis), and second one in which the budget deficits do not affect current account deficits (known as Ricardian Equivalence Hypothesis - REH).

Figure 1. *Plot of current account and budget deficits (as percentage of GDP)*



In the case of twin deficits hypothesis, expansionary fiscal policy can increase the aggregate demand and the domestic interest rate. By consequence, this will generate capital inflow and appreciation of the currency. A strong currency can reduce the net exports, returning aggregate demand and output to their original levels.

In the case of Ricardian Equivalence Hypothesis, a reduction in the level of taxation, accompanied by an increase of budget deficit, will be followed by an increase in taxes on the long term. In this case the private households save the income obtained through the tax cut in order to support the increase of the tax payment in the future. Thus, a budget deficit would not determine a twin deficit.

As Greece presents in the last years seriously fiscal changes, and severely damage in the level of macroeconomic variables, our paper studies the connection between budget deficit and current account balance in this country, from 1976 to 2009, using a structural autoregressive (SVAR) model. This choice has made in order to see the sensitivity of the results of vector autoregressive (VAR) model. We have used two variables: the current account deficit (CAD) and budget deficit (BD). The variance decomposition analysis of SVAR approach indicates that, for current account deficit, around 94% of the forecast error is explained by changes in the same variable, and only 6% is explained by the budget deficit. Whereas, for budget deficit, near 5% of the forecasting error is explained by the changes in current account deficit, and 95% is by its own changes. Similar, results are reported by our traditional VAR model also. For this reason, the results are not sensitive in respect to approach chosen for analysis.

The rest of the paper is organized as follows: Section 2 contains the literature review. Section 3 presents data and methodology. Section 4 shows empirical results and interpretation. Section 5 concludes.

2. Literature review

A plethora of studies in the literature has examined the relationship between fiscal/budget deficit and current account/trade deficit in different country context by using different methodologies. Nevertheless, these studies provide mixed results, since some of the studies supported twin deficit hypothesis while others rejected the hypothesis.

Noteworthy studies that supports the twin deficit hypothesis and arguing that the budget deficit causes trade deficit significantly are: Abel (1990), Zietiz and Pemberton (1990), Endres and Lee (1990), Batchman (1992), Kasa (1994), Egwaikhide (1999), Vamvoukas (1999),Kasibhatla et al. (2001), Lau and Lee (2002), Akbostanci and Tunc (2002), Ata and Yucel (2003), Kouassi, Mougoue and Kymn (2004), Cavello (2005), Erceg, Guirrieri and Gust (2005), Salvatore (2006), Frankel (2006), Kim and Roubini (2008), Holmes (2011), and Kalou and Paleologou (2011).

Noteworthy studies which have rejected the twin deficit hypothesis are: Enders and Lee (1990), Boucher (1991), Bilgili and Bilgili (1998), Kustepeli (2001), Papadogonas and Stournaras (2006), Corsetti and Müller (2006), Marinheiro (2008), Rafiq (2010), and Baharumshah, Lau and Khalid (2005). While Khalid and Guan, (1999) found long term relationship between fiscal deficit and current account deficit for developing countries; for developed countries they didn’t find any long term relationship between fiscal deficit and current account deficit.

For the case of Greece, there are two recent main studies. In the first one, Papadogonas and Stournaras (2006) focused especially on the case of EU15 member-state and found that budget deficits have a small influence on the current account deficits. Contrary, for the case of Greece, the current account depends by many factors, one of them being the general government balance.

In the second one, Kalou and Paleologou (2011) treated the case of Greece using a multivariate Vector Error Correction (VEC) framework, for the period 1960-2007. The authors included the endogenous determination of structural breaks in order to identify the causal relation between the budget deficit and the current account deficit. The main finding demonstrates that the two deficits are positively linked.

In the study, we use a SVAR model to examine the twin deficit hypothesis, as no other study has used SVAR analysis to examine the twin deficit in Greek context to the best of our knowledge. In addition to that, most of the studies used VAR approach to analyze the dynamic impacts of different types of random disturbances on the variables in the model (Ferreira et al. 2005) as it takes into consideration those interactions and all variables are treated as endogenous as a function of all variables in lags. However, the reduced form VAR does not consider the structural relationships among the variables unless some identification restrictions are assumed. The SVAR analysis is an attempt to solve the traditional identification problem. Therefore, the SVAR can be used to predict the effects of specific policy actions or of important changes in the economy (Narayan et al. 2008).

3. Data and methodology

For analysis we used annual data of BD (measured by budget deficit as a percentage of GDP) and CAD (measured by net current account as percentage of GDP) for the period 1970-2009. Data was accessed from International Monetary Fund (IMF) CD-ROM (2010). To check the order of integration of the data we have used the ADF and PP test. However, these tests can be misleading results when data series exhibits structural breaks. Perron's (1989) unit root test in this regard is the first attempt however, his test assumes that the structural break date is uncorrelated with the data and known ex-ante by economic information: for example, the 1973 oil price shock. However, the Perron (1989)'s assumption of exogenous breaks has been criticized and considered inappropriate due to problems associated with "pre-testing". Therefore, Perron's (1989) methodology invalidates the distribution theory of conventional testing and will tend to over reject the null of unit root. Instead, Zivot and Andrews (1992, hereafter ZA) treat the selection of the break points as the outcome of an estimation procedure. They transform Perron (1989)'s test into an unconditional unit root test that allows endogenously determined break points in the intercept and/or the trend function.

Following Perron (1989)'s notation, ZA (1992) test the null of unit root against the alternative of a one-time structural break with three models: Model A allows a one-time change in the level of the series, Model B permits a one-time change in the slope of the trend function of the series and Model C admits both changes. The regression equations corresponding to these three models are as following.

Model A: $$\Delta y = \mu + \beta t + \alpha y_{t-1} + \theta DU_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

Model B: $\Delta y = \mu + \beta t + \alpha y_{t-1} + \gamma DT_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$ (2)

Model C: $\Delta y = \mu + \beta t + \alpha y_{t-1} + \theta DU_t + \gamma DT_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$ (3)

where DU_t and DT_t are break dummy variables for a mean shift and a trend shift, respectively. The shift occurs at each possible break point $T_B (1 < T_B < T)$. Formally:

$$DU_t = \begin{cases} 1, if, t > T_B \\ 0, otherwise \end{cases} and \quad DT_t = \begin{cases} t - T_B, if, t > T_B \\ 0, otherwise \end{cases} \quad (4)$$

where k is the number of lags determined for each possible break point by one of information criteria. The null hypothesis is $\alpha = 0$, which implies that the series exhibits a unit root with a drift and excludes any structural break points. The alternative hypothesis is $\alpha < 0$, which implies that the series is a trend-stationary with an unknown one-time break. So, equations (1), (2) and (3) are sequentially estimated and T_B is chosen so as to minimize the one sided t-statistics for testing $\hat{\alpha} = 0$.

After confirming, the same order of integration we proceeded to examine the long-term relationship between the variables using a battery of cointegration tests. Our battery of cointegration test is comprises of the Engle-Granger test (1987) test, Johansen (1988) test, Boswijk (1994) and Banerjee et al. (1998) and last but not least Lütkepohl et al. (2004).[(1)] Our choices to use a recent test developed by Lütkepohl et al. (2004) for coinegration analysis is based on to incorporate structural breaks in the data set. As if structural breaks are not analyzed we may lead to the biased results. There are a number of studies address testing for cointegration with structural shifts (see for details Lütkepohl et al. 2004) and these studies have considered single equation as well as systems cointegration tests but none of the proposed tests is appropriate for testing the cointegrating rank of a system when the break date is unknown. For such a situation Lütkepohl et al. (2004) proposed a cointegrating rank test for vector autoregressive (VAR) processes with a structural shift at unknown time in that the shift is assumed as a simple shift in the mean. The authors modelled a structural shift as a simple shift in the level of the process. The structural break date is estimated based on a full-unrestricted VAR model. In the next step, they applied Johansen type test for the cointegrating rank to the adjusted series. Their test is generalized version of the test proposed by Saikkonen and Lütkepohl (2000). It proceeds by estimating the break date in a first step based on a full VAR process in levels of the variables. Then the parameters of the deterministic part of the data generation process (DGP) are estimated by a suitable procedure and these estimators are used to adjust the original series for deterministic terms including the structural shift. Finally, to test for a cointegrating rank the Johansen likelihood ratio (LR) type test is performed to the adjusted series. This test has a great advantage: the asymptotic distribution of the test statistic under the null hypothesis is the same as in the case of a known break date and does not depend on the break date. [(2)]

Further, most of the studies until now have analysed the cointegration relationship between CAD and BD and no study has attempted to analyse the dynamics of the relationship between these variables. Therefore, the present study is the first one attempt in this direction and to do so, we used two competing approaches of analysing the dynamics of the relationship between CAD and BD namely, VAR and SVAR. SVAR is used to see the sensitivity of the results of our VAR model and also use of this approach do not exists, to the best of our knowledge, for the Greek context.

The SVAR is superior to the VAR in the sense; the reduced form VAR does not consider the structural relationships among the variables unless some identification restrictions are assumed. In this sense, SVAR analysis is an attempt to solve the traditional identification problem. Therefore, the SVAR can be used to predict the effects of specific policy actions or of important changes in the economy (Narayan et al. 2008). Hence, policy makers and economic forecasters the cause the results obtained from the model to predict how some variables, for example, current account deficit respond over time to changes in policies.

Our bivariate system for empirical analysis is given by,

$$x_t = [CAD_t, BD_t]' \tag{5}$$

Let us consider the following infinite-order vector moving average (VMA) representation:

$$\Delta x_t = B(L)\xi_t, \tag{6}$$

where L is a lag operator, Δ is a difference operator, and $\xi_t = [\xi_{a,t}, \xi_{b,t}]'$ is a (2 × 1) vector for the covariance matrix of structural shocks Ξ . The error term can be interpreted as the relative CAD shocks, and BD shocks. We assume that structural shocks have no contemporaneous correlation or autocorrelation i.e., we assume that Ξ is a diagonal matrix. Further, for estimation purpose we used the following finite-order VAR model:

$$[I - \Psi(L)]\Delta x_t = \upsilon_t, \tag{7}$$

where $\Psi(L)$ is a finite-order matrix polynomial in the lag operator and υ_t is a vector of white noise disturbances. Provided that the stationarity condition is fulfilled, equation (7) can be transformed in the VMA representation as follows:

$$\Delta x_t = A(L)\upsilon_t, \tag{8}$$

where $A(L)$ is a lag polynomial. From the equations (6) and (8) one can formulate a linear relationship between ξ_t and υ_t as follows:

$$\upsilon_t = B_0\xi_t, \tag{9}$$

where B_0 is a 2 ×2 matrix of the contemporaneous structural relationship between the two variables. Additionally, identification of the vector of structural shocks is necessary so that it can be recovered from the estimated disturbance vector. Hence, four parameters are required in the present case to convert the residuals from the estimated VAR into the original shocks, which drive the behaviour of the endogenous variables. However, we have three of the required four, which are given by the elements of $\Xi = B_0 B_0'$, . Therefore, only one identifying restriction is needed to be added. So, in order to impose one additional restriction we followed model of Blanchard and Quah (1989) and used economic theory to impose restrictions. Thus, we impose one additional restriction on the long-run multipliers while freely determining the short-run dynamics. Here we first imposed restriction on CAD shocks have no long-run impact on the levels of BD and next we imposed restriction on BD shocks have no long run impact on the level of CAD.

We have ordered the variable as CAD and BD. Firstly, we set restriction on CAD and assumed that CAD is affecting the BD and CAD is not getting response from BD. Secondly, we set restriction on BD and assumed that BD is affecting CAD and no response from BD to CAD. Hence, the long-run representation of equation (8) can be written as follows

$$\begin{bmatrix} \Delta CAD_t \\ \Delta BD_t \end{bmatrix} = \begin{bmatrix} B_{11}(1) & B_{12}(1) \\ B_{21}(1) & B_{22}(1) \end{bmatrix} \begin{bmatrix} \xi_{a,t} \\ \xi_{b,t} \end{bmatrix} \tag{10}$$

where $B(1) = B_0 + B_1 + B_2 + \ldots 0$ are long-run multipliers in our SVAR model (long-run effect of Δx_t). Firstly, we specify the long-run multiplier B_{12} equal to zero (i.e., $B_{12} = 0$), thus making the matrix a lower triangular matrix in the equation (10) and then we specify the long run multiplier B_{21} is equal to zero (i.e., $B_{21} = 0$), thus making the matrix an upper triangular matrix.

In the next step, we construct a SVAR and plot the impulse response functions (IRFs) of CAD, when a positive shock to BD occurs and in the final step, we study the forecasts error variance decomposition of SVAR model. Lag-length to be incorporated in our analysis of VAR and SVAR models is determined based on Akaike Information Criteria (AIC) because of its better performance in small sample (Liew, 2004).

4. Result and interpretations

The summary statistics is given in Table 1 given below.

Table 1. *Summary statistics for the data*

Full sample analysis					
Variables	**Mean**	**Std. Dev.**	**Skewness**	**Kurtosis**	**Jarque-Bera**
CAD	-3.677654	3.586706	-1.316189	4.260591	12.06788 (0.002396)
BD	-6.949267	5.274816	-1.041087	3.293657	6.264054 (0.043629)

As a first step to analyze the cointegration between the variables, we employed Zivot-Andrews (1992) unit root test, which considers one endogenously determined structural break. The ZA test result along with the results of ADF and PP are given in Table 2. The three models of ZA test provide the same result, both the study variables are intergraded at order 1 i.e., at level form both CAD and BD contains a unit root and in first difference from both become stationary.

Table 2. *ZA Unit Root Estimation with one structural break*

Variable	ADF	PP	ZA unit root test					
			Model A		Model B		Model C	
			t-statistic	Decision	t-statistic	Decision	t-statistic	Decision
BD	-2.67	-2.66	-3.848 [1992]	Contains unit root	-3.164 [1983]	Contains unit root	-4.409 [1992]	Contains unit root
D(BD)	-5.20	-6.74	-7.724 [1991]	Does not contain unit root	-6.694 [1999]	Does not contain unit root	-7.648 [1991]	Does not contain unit root
CAD	-1.79	-1.68	-3.718 [1986]	Contains unit root	-3.697 [1995]	Contains unit root	-3.819 [1991]	Contains unit root
D(CAD)	-4.34	-4.33	-6.300 [1986]	Does not contain unit root	-5.510 [1987]	Does not contain unit root	-6.042 [1986]	Does not contain unit root
ZA test-Critical values: 1%: -5.57 5%: -5.08 for model when breaks occur in intercept and trend both; Critical values: 1%: -5.43 5%: -4.80 for model when breaks occur in intercept only; Critical values: 1%: -4.93 5%: -4.42 for model when breaks occur in trend only.								

The first order integration of the study variables allows us to proceed with cointegration analysis, since first order integration is the necessary condition for cointegration analysis. We applied the Johansen's cointegration test, which does not consider the possibility of structural breaks in cointegration analysis and the structural cointegration procedure of LST (2004). As shown in Table 3, both the Johansen's cointegration test and the LST (2004) test show the same results i.e., the study variables are not cointegrated; there is no long term relationship between BD and CAD. (3)

Table 3. *Cointegration tests*(4)

Panel 1: Cointegration test- JJ [Trend assumption: Linear deterministic trend (restricted) Lags interval (in first differences): 1 to 2]					
Unrestricted Cointegration Rank Test (Trace)					
H_0	H_a	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None	At most 1	0.248121	12.03213	20.26184	0.4459
At most 1	At most 2	0.086822	2.906369	9.164546	0.5983
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
H_o	H_a	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
None	At most 1	0.248121	9.125766	15.89210	0.4204
At most 1	At most 2	0.086822	2.906369	9.164546	0.5983
Panel 2: Cointegrating rank Tests- LST (2004): Endogenously determined break date (1991) and constant assumption is linear deterministic trend (restricted) lags interval (in first differences): 1 to 2]					
H_o	H_a	Eigenvalue	Trace Statistic	5% Critical Value	1%Critical Value
None	At most 1	0.3785513	14.41	15.83	19.85
At most 1	At most 2	0.1380373	4.14	6.79	10.04

Note: (1)* denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values; (2) Critical values of Lütkepohl et al. (2004) test are from Trenkler (2003).
Source: Author's calculation.

Further, for analyzing the non-stationary series in a VAR system Ramaswamy and Sloek (1997) mentions three possible ways to specify. First, either to specify the series in differenced form, second, to specify them in levels, and third to consider the cointegration relationships among the test variables by applying a vector error correction model (VECM) and this is considered when the cointegration relationship is known. In addition, if the cointegration relationship is unknown, VECM can be biased and it could be more appropriate to consider the VAR in levels. Therefore, in this paper, we apply a VAR and a structural VAR model in first differenced series, as we do not have cointegrating relationship among the test variables but variables are nonstationary.(5)

To examine the dynamic relationships between the variables, we applied the VAR methodology. The result of VAR analysis is given in Table 2.1 of Appendix 2, which shows that in the first model i.e., in case of D(CAD), the lagged values of CAD or BD are not significantly affecting CAD. Similarly, for D(BD) model, lagged values of both CAD and BD are not significantly affecting BD.

The diagnostics tests of VAR model is illustrated in Figure 3.1 in Appendix 3. The IRFs in Figure 3.2 of the same Appendix 3 shows that the response of CAD to one SD innovations in CAD is positive in the initial years and it becomes zero from 3 year onwards. Similarly, we estimated the response of CAD to one SD shocks in BD, which is negative in the initial years and then turns out to be zero. In the case of BD, one SD shocks in CAD has initial impact positive however, later its impact becomes zero. However, for BD, shocks in BD itself has a large positive effect on BD in first two years and then it becomes negative, later the responses becomes zero.

We also analysed the variance decomposition analysis and presented results in Table 4, which shows that for CAD more than 99% of the variance is explained by the shocks in CAD itself. However, for BD 4.5% of the variances is explained by the shocks in CAD, rest is by its own shocks.

Finally, we analysed the relationship between the variables in SVAR framework, by putting restrictions on the VAR model. Since we have a sample size which is not large enough therefore, we have followed Benkwitz et al. (2001) which suggest that for small sample, properties of bootstrap confidence intervals are better in comparison to other asymptotic methodologies. Therefore, we have computed bootstrap percentile 95% confidence intervals (by following Hall 1992; Efron and Tibshirani 1993) with 1000 bootstrap replications to illustrate parameter uncertainty. The horizon of all responses is 20 years. In the following Figures 2 and 3, the Impulse response function of both models in SVAR is given.

As shown in Figure 2, one SD shocks in D(CAD) has a positive effect on D(BD) throughout the 20 year period. This implies that an increase in BD increases the CAD. This is expected as par the Twin deficit hypothesis. On the other hand, the effect of one SD shocks on D(CAD) to D(BD) is also positive, but the effect is less compared to the previous model.

Figure 2. *IRFs of CAD to BD in SVAR*

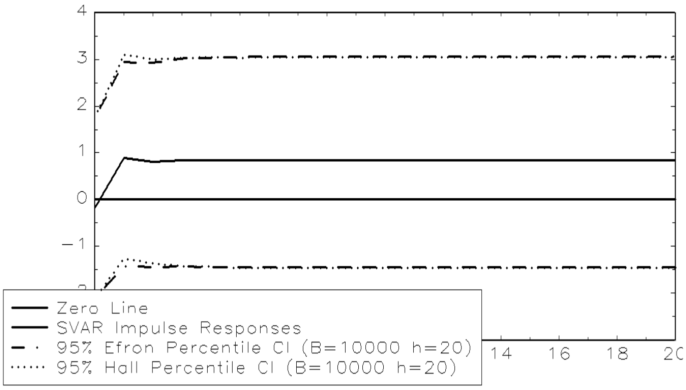
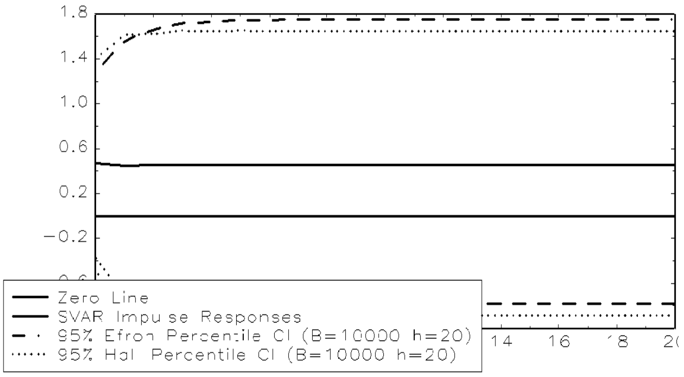


Figure 3. *IRF of BD to CAD in SVAR*



Further we analyzed the Variance decomposition analysis in SVAR framework, which explains how much of the forecasting error variance of each variable can be explained by its own innovations and changes in other variable. The VD analysis of BD indicates that around 95% of the forecasting error is explained by changes in the same variable and around 5% by the changes in CAD.

Table 4. *Variance decomposition analysis of BD and CAD*

	Variance Decomposition of BD		Variance Decomposition of CAD	
	CAD	BD	BD	CAD
1	0.00	0.1	0.07	0.93
2	0.05	0.95	0.06	0.94
3	0.05	0.95	0.06	0.94
4	0.05	0.95	0.06	0.94
5	0.05	0.95	0.06	0.94
10	0.05	0.95	0.06	0.94
15	0.05	0.95	0.06	0.94
20	0.05	0.95	0.06	0.94

5. Conclusions

Twin deficit hypothesis is an extensively tested hypothesis in economics. Nevertheless, the literature in this area is not conclusive, since various studies provide results in favour of or against twin deficit hypothesis. The effect of BD on CAD is attracting the attention of policy makers in recent years, since the fiscal stimulus packages implemented to fight the recent economic crisis increased the BD of many countries. In this study, we analysed the effect of BD on the CAD of a Greece, which is facing a debt crisis in recent years.

We find that in case of Greece there is no long run relationship between BD and CAD either in the presence or in absence of structural breaks in the data set. Further, the dynamic analysis of the variables analysed through VAR show that the lagged values of CAD or BD are not affecting each other significantly. However, IRF analysis shows that BD is negatively affecting the CAD in the initial years, whereas the effect of CAD on BD is positive in the initial years. The variance decomposition analysis of VAR model shows that the forecasting error variance of BD and CAD is explained by its own changes. Further, IRFs calculated in the framework of SVAR shows that increase in BD increases the CAD, which is consistent with the Twin deficit hypothesis. However, the VD analysis shows that the major proportion of forecasting errors of the study variables is explained by own changes.

Notes

(1) The Engle-Granger test (1987) test is based on two step procedure. First we extract residuals from a regression of one variable on the second and in the second step we apply DF/ADF type test on extracted residuals. In this test one could also control for serial correlation by the semiparametric approach of Phillips and Ouliaris (1990). This test is useful in two variables case only. The Johansen (1988) test is a system based test, which is applicable for more than two variables also. The Boswijk (1994) and Banerjee et al. (1998) test is based on error correction. A detailed procedure on these tests is available in Bayer and Hanck (2009). They combined these test and developed more powerful tests, which can be implemented through single STATA command.

(2) For the purpose of brevity we have avoided to present the detailed literature on this test which an interested reader can refer from the original paper.

(3) Steps for cointegration analysis are nicely presented in Tiwari (2011) and results of all analysis are presented in the Appendix 1 in various tables. The lag selection test in presented in Table 1.1, model selection test in Table 1.2, while the diagnostic check analysis is showed in Table 1.3.

(4) Further, we applied Engle and Granger (1987), Banerjee et al. (1998), Boswijk (1994) and two tests of Bayer and Hanck (2009) test for Cointergration (namely EG-J: and EG-J-Ba-Bo). Test statistics of Engle-Granger (1987), Banerjee et al. (1998), Boswijk (1994) tests with p-value in parenthesis are 1.7235 (0.6635), 8.7487(0.3688), -2.0133(0.4107), 6.7757 (0.2529) respectively. Test statistics of EG-J: and EG-J-Ba-Bo with 5% critical values in parenthesis are 2.8154544 (11.229) and 7.3447612 (21.931).

(5) Structural VAR Estimation Results of contemporaneous impact and long run impact are shown in Appendix 3.

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Appendix 1

Table 1.1. *Lag length selection test*

VAR Lag Order Selection Criteria
Endogenous variables: CAD BD
Exogenous variables: C
Sample: 1976 2009
Included observations: 31

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-178.5936	NA	393.6604	11.65120	11.74371	11.68136
1	-147.4746	56.21486*	68.51483*	9.901589*	10.17913*	9.992062*
2	-145.8117	2.789412	80.02170	10.05237	10.51495	10.20316
3	-144.2242	2.458056	94.45266	10.20801	10.85562	10.41912

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 1.2. *Model selection test*

Sample: 1976 2009
Included observations: 32
Series: BP BD
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	0	0	0	0	0
Max-Eig	0	0	0	0	0

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Log Likelihood by Rank (rows) and Model (columns)					
0	-156.5778	-156.5778	-156.3645	-156.3645	-156.1702
1	-154.9184	-152.0149	-151.9902	-151.4990	-151.4071
2	-154.8854	-150.5617	-150.5617	-148.3284	-148.3284
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	10.03611*	10.03611*	10.14778	10.14778	10.26064
1	10.18240	10.06343	10.12439	10.15618	10.21294
2	10.43034	10.28511	10.28511	10.27053	10.27053
Schwarz Criteria by Rank (rows) and Model (columns)					
0	10.21933*	10.21933*	10.42261	10.42261	10.62707
1	10.54883	10.47567	10.58243	10.66003	10.76259
2	10.97999	10.92637	10.92637	11.00339	11.00339

Table 1.3. *Diagnostic checks analysis*

VEC Residual Serial Correlation LM Tests		
1lag	3.592163	0.4640
VAR Lag Exclusion Wald Tests :Chi-squared test statistics for lag exclusion:		
1lag	2.716297	0.606366
VEC Residual Normality Tests-Joint J-B test (Orthogonalization: Residual Covariance (Urzua)		
4.025691		0.9097
VEC Residual Heteroskedasticity Tests: Includes Cross Terms (Joint test of Chi- square)		
10.40376		0.7936
Source: Author's calculation		

Appendix 2

Table 2.1. *VAR estimates*

Vector Autoregression Estimates		
Sample (adjusted): 1978 2009		
Included observations: 32 after adjustments		
Standard errors in ( ) & t-statistics in [ ]		
	D(CAD)	D(BD)
D(CAD(-1))	0.147415	0.559309
	(0.20326)	(0.51417)
	[0.72525]	[1.08778]
D(BD(-1))	-0.021755	-0.209175
	(0.07313)	(0.18499)
	[-0.29748]	[-1.13076]
C	-0.199695	-0.150604
	(0.33349)	(0.84360)
	[-0.59880]	[-0.17852]
R-squared	0.019130	0.069400
Adj. R-squared	-0.048517	0.005221
Sum sq. resids	98.12105	627.8727
S.E. equation	1.839425	4.653040
F-statistic	0.282788	1.081348
Log likelihood	-63.33349	-93.03166
Akaike AIC	4.145843	6.001979
Schwarz SC	4.283256	6.139391
Mean dependent	-0.250152	-0.320283
S.D. dependent	1.796364	4.665234
Determinant resid covariance (dof adj.)		73.25234
Determinant resid covariance		60.16134
Log likelihood		-156.3645
Akaike information criterion		10.14778
Schwarz criterion		10.42261

Appendix 3

Figure 3.1. *Diagnostics tests of VAR model*

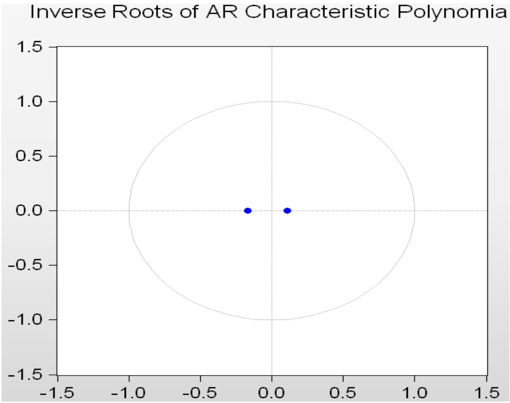
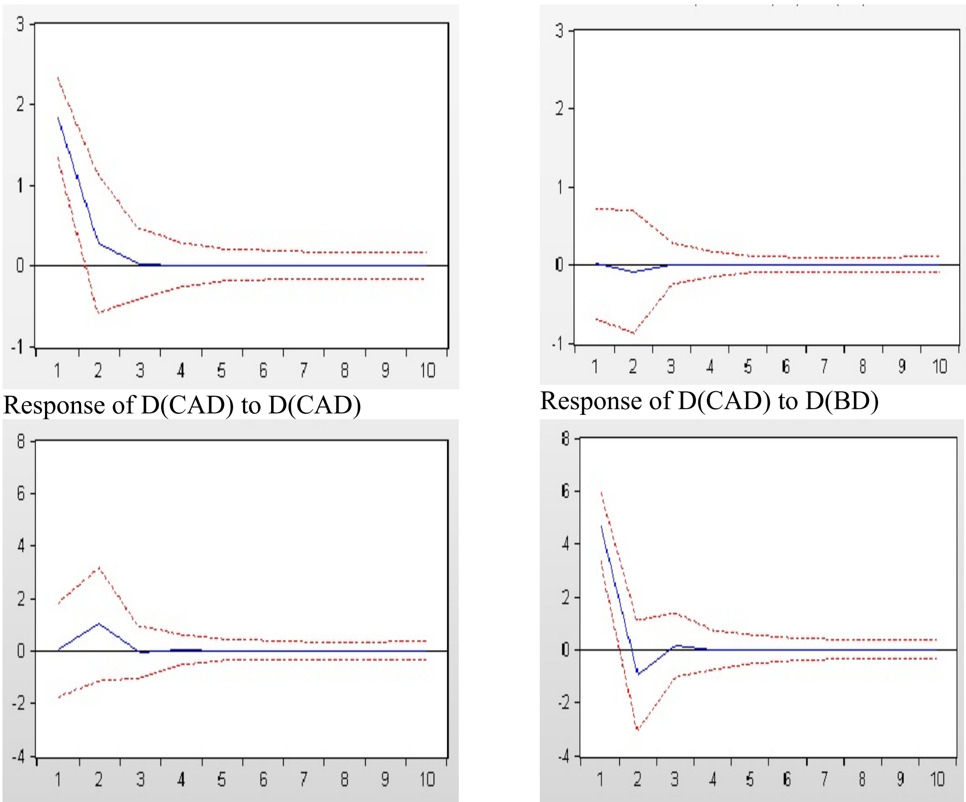


Figure 3.2. *IRFs of VAR analysis*



Response of D(BD) to D(BD) Response of D(BD) to D(CAD)