Twin deficits in Morocco: An empirical investigation

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ABSTRACT

This paper investigates the hypothesis of twin deficits in Morocco. According to this theoretical concept, the budget deficit is the main cause of the current account deficit. The Empirical results obtained from the impulse responses analysis of the VAR model and the Granger-causality test indicate the existence of an unidirectional causality going from the current account deficit to the fiscal deficit. This implies the existence of reverse causality i.e. the current account deterioration is the main cause of the fiscal deficit in Morocco.

1. Introduction

The issue of twin deficits has emerged during the 80s which were characterized by the simultaneous occurrence of current account deficit and fiscal deficit especially in developed economies such as the United States. The twin deficits hypothesis can be regarded as the determination of whether there is a causality relationship going from public sector deficit to current account deficit.

According to the traditional Mundell-fleming model (Fleming, 1962; Mundell, 1963), an expansionary fiscal policy financed by debt causes an increase in interest rates. High interest rates attract foreign investment looking for important yield. Thus, the demand for local currency increases causing the appreciation of exchange rate which causes an increase in imports (becoming cheaper), a decrease in exports (becoming more expensive) and finally lead to a widening of the current account deficit. Another theoretical explanation that leads to the same result is the Feldstein chain (Feldstein, 1992). Following this approach, an increase in government spending causes a decrease in the internal saving and consequently generates an increase in domestic interest rate. Like the Mundell-fleming model, the increase of capital inflow generates the appreciation of local currency causing a fall in exports and a rise of imports. This situation leads to a higher current account deficit.

In the opposite, the Ricardian equivalence hypothesis shows the absence of causal relationship between budget deficit and current account deficit (Barro, 1989). Following this approach, the different ways to finance a deficit have no impact on the interest rate and thus on investment and *in fine* on the current account balance. Indeed, the effect of the present tax cut or increase in government expenditures does not alter the level of consumption and investment because rational agents foresee that this tax cut as a tax burden in future**.** Therefore, they will increase savings in order to pay for future tax increases. Thus, the decrease of public saving will be compensated for by an equal increase of private saving, and hence the national saving will not be affected (Perera and liyanage, 2011). It follows that there is no causal relationship between fiscal and current account deficits.

The results of studies for different countries have led to different results. Moreover, changes in econometric approaches have led to conflicting results for the same country (Tahir, Muhammad Mahboob 2007). Empirical studies on the twin deficit hypothesis can be divided into four distinct groups according to their results. The first group indicates the existence of a causal link going from the budget deficit to current account deficit confirming the hypothesis of twin deficits. The main studies in this group are Abell (1990), Bachman (1992), Islam (1998), Piersanti (2000) and Erceg, Guerrieri, Gust (2005). The second group of studies involves a reverse causality running from the current account deficit to the budget deficit. Representative studies are Khalid and Guan (1999), Alkswani (2000) and Marinheiro (2008). Concerning the third group of studies, the authors found no causal relationship between the two deficits as in Enders and Lee (1990), Evans and Hasan (1994) and Kaufmann, Scharler and Winckler (2002). Finally, the fourth group of studies indicates the existence of bilateral causality between the current account and the budget deficit. This is particularly the case for the work of Laney, (1984), Evans (1993) and Baharumshah (2007).

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The present paper aims to analyse the validity of the twin deficits hypothesis in the Moroccan case. The next section presents the conceptual relationship between the current and the fiscal deficits. The Third section presents the empirical results. Section four shows some stylized facts from the Moroccan economy to strengthen our econometric results and finally the last section concludes.

2. The relationship between the current account deficit and budget deficit

The starting point to analyse the relationship between the current account deficit and the budget deficit is the national income equation, we have:

$$Y = C + I + G + (X-M) \quad (1)$$

With:
Y: national income
C: domestic consumption
I: national investment
G: government spending
X: exports of goods and services
M: imports of goods and services

Disregarding the income balance, we can write the current account (CA) as follows:

$$CA = X-M \quad (2)$$

A current account deficit occurs if a country imports more than it exports. The latter is financed either by reducing foreign reserves or by the external financing.

Based on equation (1), national saving (S) can be expressed as follows:

$$S = Y-C-G+CA \quad (3)$$

More succinctly, we can rewrite equation (3) as follows:

$$S = I + CA \quad (4)$$

Distinguishing between public and private saving we can write:

$$S = Sp + Sg \quad (5)$$

With Sp and Sg private and public saving respectively.

Private saving is the unused disposable income and can be written as:

$$Sp=Yd-C = (Y-T)-C \quad (6)$$

With Yd disposable income and T is the income tax.

Also, public saving is the difference between government resources and expenses, we have:

$$Sg = T-(G + R) = T-G-R \quad (7)$$

With T tax revenues, G government spending and R transfers.

We can rewrite equation (5) as follows:

$$S = Sp + Sg = Y-T-C-G+T-R = I + CA \quad (8)$$

Thus, the current account balance can be presented as follows:

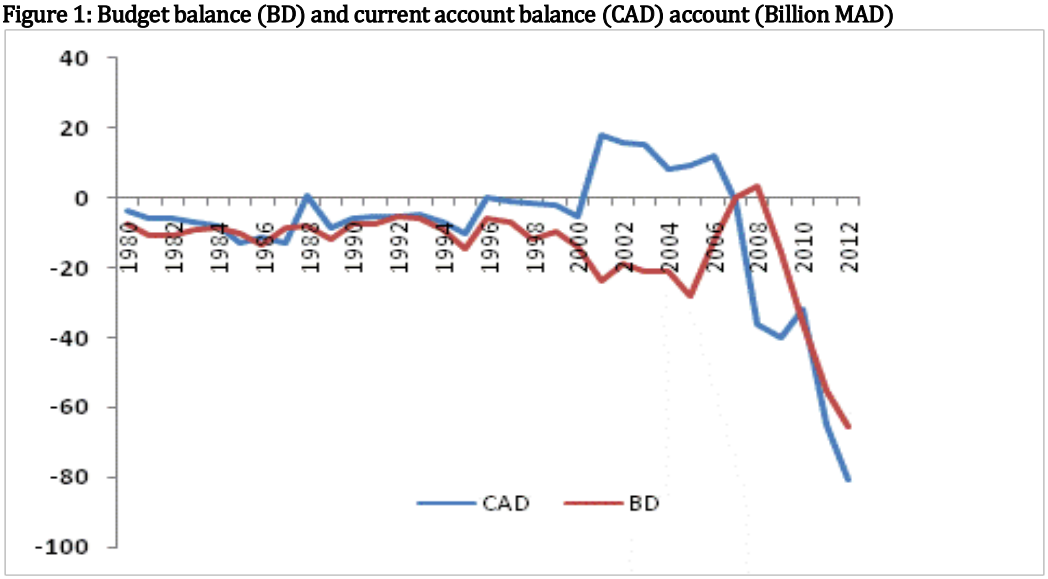
$$CA = Sp-I-(G + R-T) \quad (9)$$

Equation (9) indicates that if the difference between private saving and investment remains constant, the current account deficit is due to a change in the fiscal deficit and thus the existence of two deficits at the same time.

3. Empirical analysis

The data used to investigate the twin deficits hypothesis in morocco are the budget balance and the current account balance expressed in Billions of Moroccan Dirham (MAD). The data present an annual frequency and covers the period 1980-2012.

Figure 1: Budget balance (BD) and current account balance (CAD) account (Billion MAD)



Source: Ministry of finance, IMF WEO

The evolution of the budget balance and current account balance seems to have three distinct phases (Figure 1). The first phase runs from 1980 to 2000 and where the two variables show overall the same dynamic. The second phase covers the period from 2001 to 2007 and shown a contrasting trend of the variables, i.e. surplus was observed in trade balance in the same time as a deterioration of public finance. The final phase started in 2008 and shows a worrying development of both variables in line with the global financial and economic crisis.

3.1 Correlation analysis

The correlation coefficient measures the strength of the linear relationship between two variables. The result of this analysis shows the existence of a positive (0.60) and significant relationship between the current account and fiscal balances. Nevertheless, the existence of a significant correlation does not allow concluding on the existence of a causal link between these two variables. Therefore the use of more formal techniques, including causality tests or co-integration, is essential to ensure the accuracy of the analysis.

	DB/AD
Correlation	0.604203
t-Statistic	4.221802
Probability	0.0002
Observations	33

3.2 Unit root tests

The stationarity analysis is an essential step i.e. it is the stochastic nature of the series that dictates the appropriate modelling technique: if the series are stationary in level there will be a direct appeal to the VAR model and the study of Granger causality. Otherwise, if they are integrated of the same order than we should test for co-integration and eventually estimate an error correction model to study the long run dynamic of our variables.

Variables	ADF	PP
DB	I(1)	I(1)
CAD	I(1)	I(1)

Both tests i.e. augmented dickey Fuller (ADF) and Philips-Perron (PP) conclude that the series are stationary in first difference which suggests the possible existence of a co-integrating relationship (see appendices 1 for more detail about unit root tests). Using the Johansen test, we study the possible existence of a co-integrating relationship between our variables.

3.3 Co-integration test

The Johansen test tests for the presence of a long-term equilibrium relationship between the studied variables. Thus if a co-integration relationship is confirmed between the budget balance and the current account balance it is possible to argue that the two variables show the same long-term dynamics and that some form of relationship exists between them.

Included observations: 31
Series: CAD DB

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

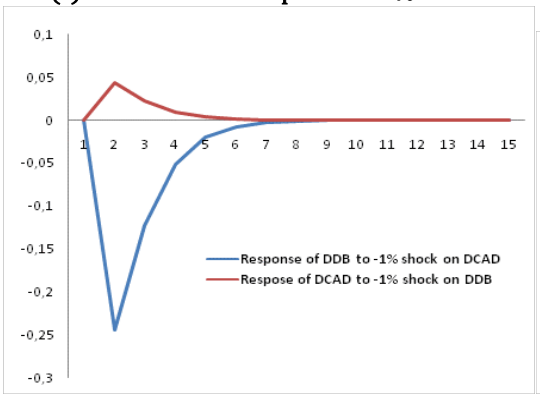
The trace and the Eigen-values tests (see appendices 6 for more detail) indicate the absence of co-integration relation between current account and budget balances. Based on these results, the only way is to estimate a bi-variate Vector Auto-regression (VAR) model and analyze the dynamic of each variable after a shock on the other.

3.4 VAR model estimation

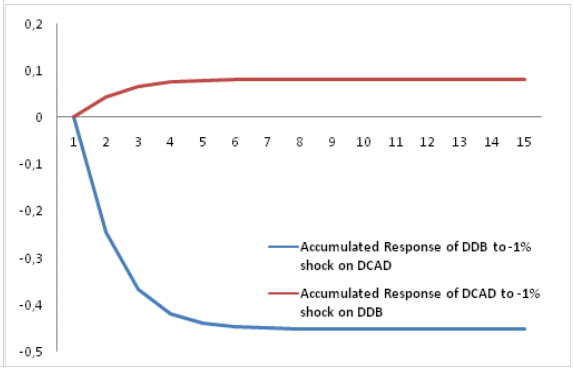
The VAR model is estimated using the first differences of the series as they are stationary in the first order. A lag of 1 is chosen as it satisfies most of the criteria for lag selection. For convenience, all the details about the model's estimation (lag choice, autocorrelation test, stability test) are presented in the appendices of the paper (2-5). In the following we perform the impulse response analysis and the granger causality test.

Figure 2: impulse responses

(a) Instantaneous Response to -1% Shock



(b) Accumulated Response to -1% Shock



Source: author's calculations

Figure 2 presents the results of the impulse response analysis. It appears that a negative choc to the current account balance generates an increase in the budget deficit and not the inverse because a negative shock to the budget balance has virtually no impact on the current account deficit (Figure 2 (a)). This result implies an inverse relationship going from the external account to the budget deficit. Concerning the shock effect quantification, the accumulated response (Figure 2 (b)) shows that an increase of the current account deficit of -1% implies an increase of fiscal deficit by 0.45%.

3.5 Causality test

The Granger causality test uses past information of a variable x to explain the current value of a variable y. If past information is useful to explain y, x is said to Granger causes y. Since the Granger test is conducted on stationary variables, we use the variables current account and fiscal balance in the first difference as in the VAR model below.

The test results are as follows:

Null Hypothesis:	Obs	F-Statistic	Prob.
DCAD does not Granger Cause DDB	**31**	**4.33066**	**0.0467**
DDB does not Granger Cause DCAD		0.02595	0.8732

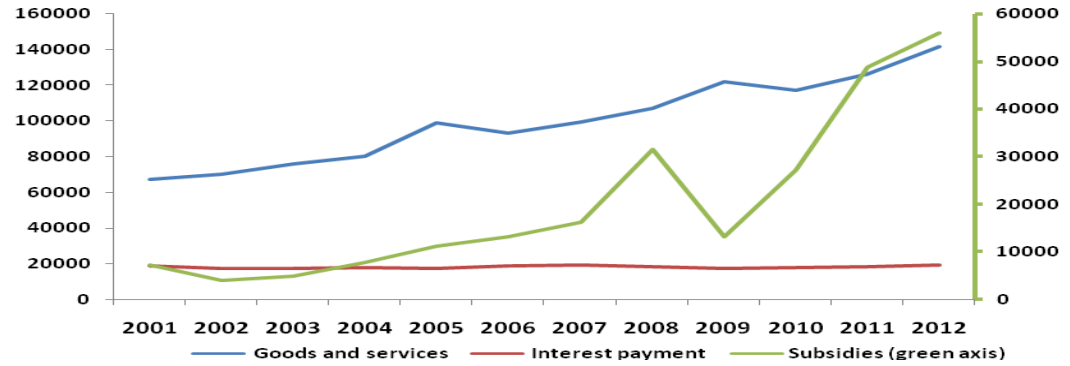
Thus, we reject the null hypothesis, i.e. the current account balance Granger causes the budget balance with at a significance level of 5%.

In summary, it appears from the impulse responses analysis and the Granger test that causality is unidirectional and runs from the current account balance to the budget balance. This result reflects the existence of reverse twin deficits hypothesis in Morocco. In the literature several studies have concluded to the same result (see in particular Anoruo and Ramchander 1998, Khalid and Teo, 1999 and Alkswani, 2000).

4. How can we explain the existence of reverse causality going from the current account deficit to fiscal deficit in Morocco?

The structure of the ordinary expenses of the Moroccan treasury (Figure 3) shows that energy and commodities subsidies have increased by 30% in average between 2000 and 2012, due to higher prices of raw material and energy on international markets, particularly since 2008. At the same time, spending on debt interest stagnated and spending on goods and services has appreciated only by 7% on average over the same period.

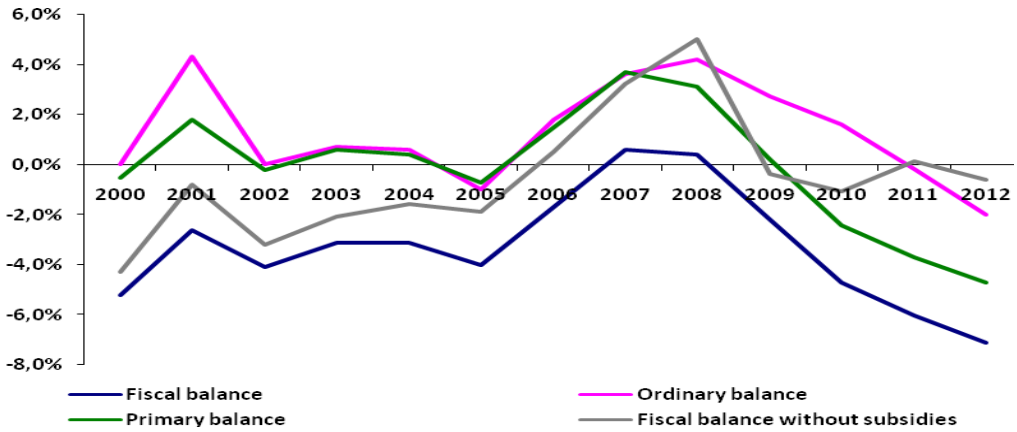
Figure 3: Evolution of various components of the ordinary Treasury expenses in Morocco (Millions of MAD)



Source: Ministry of finance

Thus, the increase in subsidies was reflected directly on the level of the fiscal deficit. The latter is about 3.3% in average over the period 2000-2012. However, if the subsidies are excluded, the deficit becomes only 0.6% (figure 4).

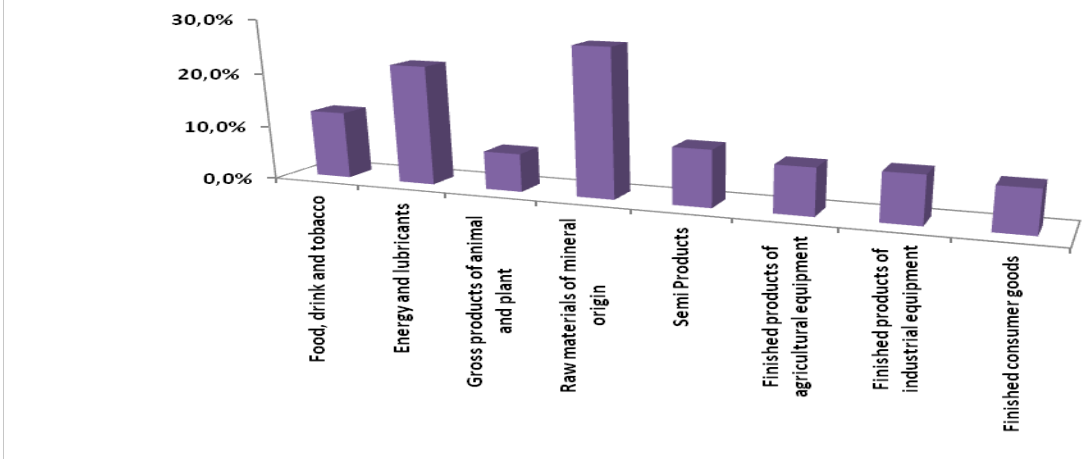
Figure 4: Evolution of different deficits



Source: Ministry of finance, author's calculation

By analyzing the evolution of imports, it appears that the imports of raw materials (27%) and energy (22%) have experienced the largest increases between 1999 and 2011. These represent the most important part of subsidies that the government provides to maintain the population purchase power (Figure 5).

Figure 5: average growth rate of imports for the main products (1999-2010)



Source: exchange office, author's calculation

Also, the analysis of the imports structure (Figure 6) shows that the share of energy products is very high (25.4%). This largely explains the widening of trade deficit (Figure 7) in line with the rising prices of raw materials on international markets.

Figure 6: the share of each product in total imports

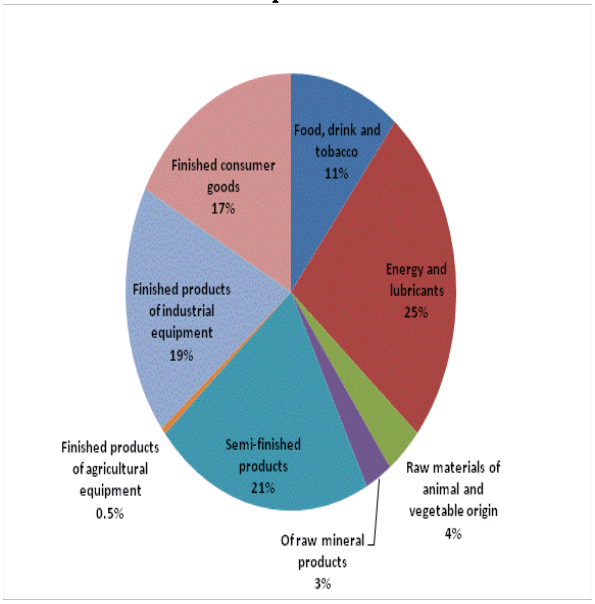
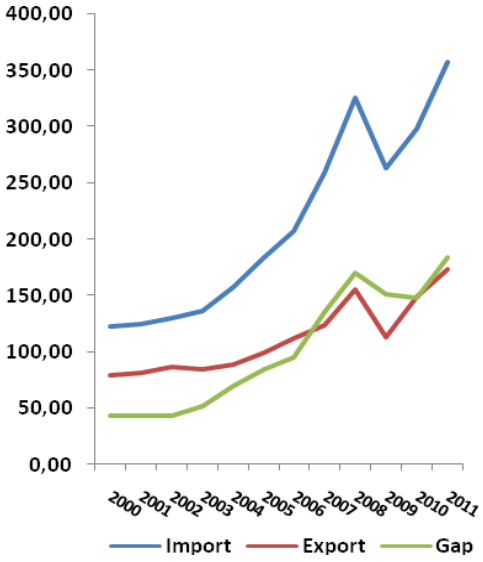


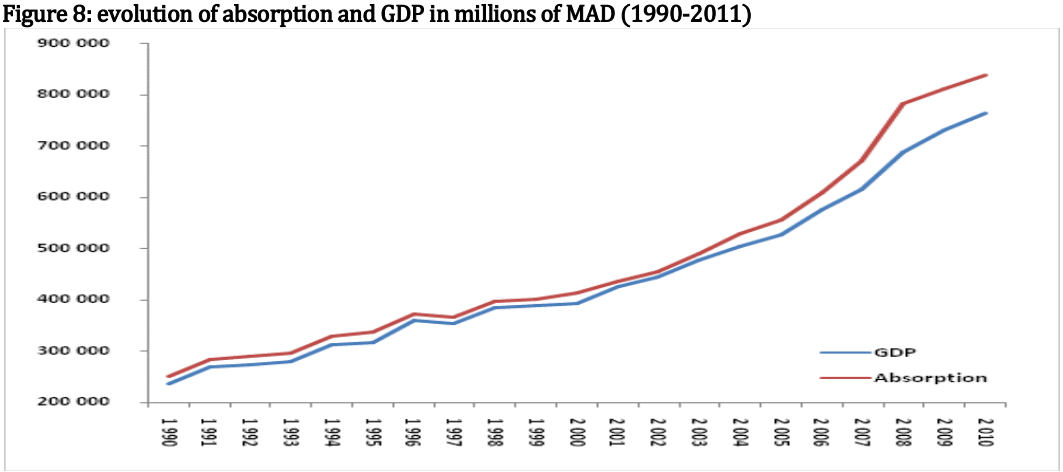
Figure 7: Evolution of imports and exports 2000 -2011 (Billions MAD)



Source: exchange office, author's calculation

Finally, the comparison between the absorption (consumption + investment) and value added (GDP) created by the Moroccan economy shows that there is a significant difference and the economy consumes more than it produces (Figure 8). This difference is necessarily filled by imports. And knowing that the government subsidizes the essential commodity, it is natural that the budget deficit is mainly due to the current account deficit.

Figure 8: evolution of absorption and GDP in millions of MAD (1990-2011)



Source: High Commission for Planning, author's calculation

5. Conclusion

The present study investigated the hypothesis of twin deficits in Morocco. The analysis was performed thought a bivariate VAR model and the examination of causality between the current account balance and the fiscal balance. The result implies the existence of an inverse relationship going from the external account to the public deficit. Indeed, the impulse response analysis showed that the current account deficit impacts negatively the budget deficit and a widening current account deficit of -1% generates a widening of -0.45% in the budget deficit.

This result was confirmed by the analysis of some stylised facts concerning the public finance and external sector. The subsidies have increased significantly over the last decade, in line with the increase in energy prices, which increased the current account deficit and by causal effect the fiscal deficit.

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Appendices

1-Unit root tests

a-Augmented Dickey Fuller test

Budget balance

Null Hypothesis: D(DB) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.257735	0.0260
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DB,2)
Method: Least Squares
Date: 07/01/13 Time: 11:34
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DB(-1))	-0.554324	0.170156	-3.257735	0.0029
C	-1.066033	1.350821	-0.789174	0.4364

R-squared	0.267914	Mean dependent var	-0.218111
Adjusted R-squared	0.242670	S.D. dependent var	8.480483
S.E. of regression	7.380118	Akaike info criterion	6.897797
Sum squared resid	1579.518	Schwarz criterion	6.990312
Log likelihood	-104.9159	Hannan-Quinn criter.	6.927955
F-statistic	10.61283	Durbin-Watson stat	1.876176
Prob(F-statistic)	0.002862		

Current account balance

Null Hypothesis: D(CAD) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.853586	0.0005
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CAD,2)
Method: Least Squares
Date: 07/01/13 Time: 09:55
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CAD(-1))	-0.920648	0.189684	-4.853586	0.0000
C	-2.254629	2.069825	-1.089285	0.2850

R-squared	0.448221	Mean dependent var	-0.423488
Adjusted R-squared	0.429194	S.D. dependent var	14.99800
S.E. of regression	11.33124	Akaike info criterion	7.755345
Sum squared resid	3723.512	Schwarz criterion	7.847860
Log likelihood	-118.2078	Hannan-Quinn criter.	7.785502
F-statistic	23.55729	Durbin-Watson stat	1.951548
Prob(F-statistic)	0.000038		

b-Phillips Perron test

Budget balance

Null Hypothesis: D(DB) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.079090	0.0387
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	50.95219
HAC corrected variance (Bartlett kernel)	41.15730

Phillips-Perron Test Equation
Dependent Variable: D(DB,2)
Method: Least Squares
Date: 07/01/13 Time: 23:13
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DB(-1))	-0.554324	0.170156	-3.257735	0.0029
C	-1.066033	1.350821	-0.789174	0.4364

R-squared	0.267914	Mean dependent var	-0.218111
Adjusted R-squared	0.242670	S.D. dependent var	8.480483
S.E. of regression	7.380118	Akaike info criterion	6.897797
Sum squared resid	1579.518	Schwarz criterion	6.990312
Log likelihood	-104.9159	Hannan-Quinn criter.	6.927955
F-statistic	10.61283	Durbin-Watson stat	1.876176
Prob(F-statistic)	0.002862		

Current account balance

Null Hypothesis: D(CAD) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.825979	0.0005
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	120.1133
HAC corrected variance (Bartlett kernel)	111.5211

Phillips-Perron Test Equation
Dependent Variable: D(CAD,2)
Method: Least Squares
Date: 07/01/13 Time: 23:06
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CAD(-1))	-0.920648	0.189684	-4.853586	0.0000
C	-2.254629	2.069825	-1.089285	0.2850

R-squared	0.448221	Mean dependent var	-0.423488
Adjusted R-squared	0.429194	S.D. dependent var	14.99800
S.E. of regression	11.33124	Akaike info criterion	7.755345
Sum squared resid	3723.512	Schwarz criterion	7.847860
Log likelihood	-118.2078	Hannan-Quinn criter.	7.785502
F-statistic	23.55729	Durbin-Watson stat	1.951548
Prob(F-statistic)	0.000038		

2-VAR Estimates

Vector Autoregression Estimates
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DDB	DCAD
DDB(-1)	0.422043	-0.042916
	(0.16155)	(0.26641)
	[2.61241]	[-0.16109]
DCAD(-1)	0.244096	0.081543
	(0.11730)	(0.19343)
	[2.08102]	[0.42156]
C	-0.616682	-2.315919
	(1.29744)	(2.13959)
	[-0.47531]	[-1.08241]
R-squared	0.299629	0.006919
Adj. R-squared	0.249603	-0.064015
Sum sq. resids	1367.943	3720.065
S.E. equation	6.989643	11.52647
F-statistic	5.989419	0.097540
Log likelihood	-102.6868	-118.1935
Akaike AIC	6.818502	7.818935
Schwarz SC	6.957275	7.957708
Mean dependent	-1.747761	-2.412458
S.D. dependent	8.068809	11.17435
Determinant resid covariance (dof adj.)		6407.017
Determinant resid covariance		5226.952
Log likelihood		-220.6787
Akaike information criterion		14.62443
Schwarz criterion		14.90198

3-Portmanteau Tests

VAR Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Sample: 1980 2012
Included observations: 31

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	0.103437	NA*	0.106885	NA*	NA*
2	1.880740	0.7577	2.006761	0.7345	4
3	6.566043	0.5841	7.194060	0.5158	8
4	10.62434	0.5614	11.85359	0.4575	12
5	14.74941	0.5431	16.77194	0.4005	16
6	16.44190	0.6889	18.87062	0.5302	20
7	18.38387	0.7840	21.37901	0.6163	24
8	18.69381	0.9073	21.79675	0.7906	28
9	19.84809	0.9538	23.42324	0.8645	32
10	22.38538	0.9630	27.16876	0.8555	36
11	25.24473	0.9667	31.60076	0.8259	40
12	29.24480	0.9573	38.12718	0.7205	44

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

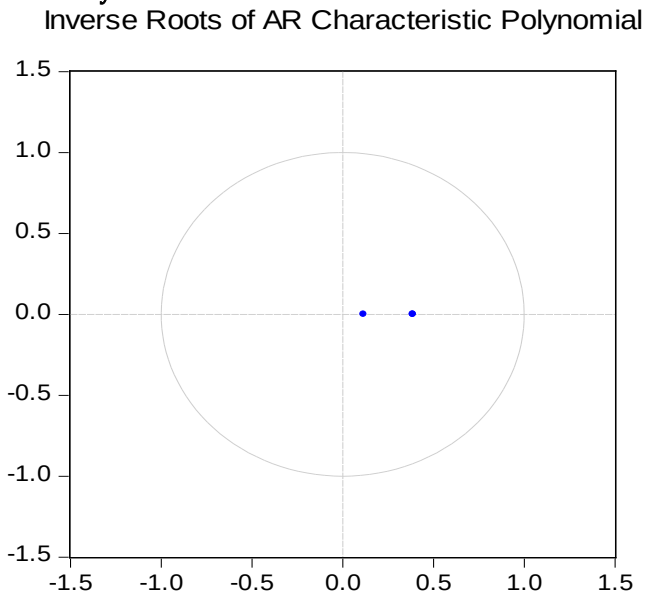
4-Lag lenght choice

VAR Lag Order Selection Criteria
Endogenous variables: DDB DCAD
Exogenous variables: C
Sample: 1980 2012
Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-200.6329	NA*	11318.09	15.00984	15.10583*	15.03839
1	**-**195.7294	8.717256	**10604.24***	**14.94292***	15.23088	**15.02855***
2	-194.0313	2.767362	12661.49	15.11343	15.59337	15.25614
3	-190.1759	5.711703	12998.70	15.12414	15.79605	15.32393
4	-187.5215	3.539111	14779.93	15.22382	16.08771	15.48070
5	-182.5489	5.893470	14420.18	15.15177	16.20764	15.46574

* 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

5-Stability test



6-Co-integration test

Sample: 1980 2012
Included observations: 31
Series: CAD DB
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	-221.3808	-221.3808	-220.6787	-220.6787	-218.0859
1	-217.9763	-216.6430	-215.9467	-212.9524	-211.1631
2	-215.6943	-213.6915	-213.6915	-209.0206	-209.0206
	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	14.54069	14.54069	14.62443	14.62443	14.58619
1	14.57912	14.55761	14.57721	14.44854	14.39762*
2	14.68995	14.68978	14.68978	14.51746	14.51746
	Schwarz Criteria by Rank (rows) and Model (columns)				
0	14.72573*	14.72573*	14.90198	14.90198	14.95625
1	14.94918	14.97393	15.03978	14.95738	14.95271
2	15.24505	15.33738	15.33738	15.25758	15.25758