Detecting the Causality between Budget Deficit and Trade Deficit in Lebanon

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2013

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Abstract

This paper examines the link between government budget deficit and trade in Lebanon over the period 1975-2011. It uses cointegration and Granger causality tests to detect the short-run and the long-run relationships between the two deficits, and with other macroeconomic variables. The empirical results suggest that the budget deficit, the trade balance, the interest rate, and the exchange rate are cointegrated, suggesting the existence of an equilibrium relationship binding all these variables together. Besides, and most importantly, a bi-directional causality between budget deficit and trade deficit is detected, giving support to the "twin deficit" hypothesis.

Keywords: Trade Deficit; Budget Deficit; Cointegration; Causality.
JEL classification: F32; H62.

1. Introduction

The "twin deficit" phenomenon has obtained increasing attention from policy makers and researchers because, in most situations, it may harm economic growth. Until today, the twin deficit problem is one of the most controversial issues in economics. Different schools of thought have proposed different hypotheses about the relationship between government budget deficit and current account deficit. Sometimes, it is suggested that current account deficit could be the result of investment opportunities created by technical transformation, while in other times, it may be the result of a reduction in savings due to change in consumer expenditures, in tax rates, or in fiscal balance.

This study aims at reviewing the concept of twin deficit in the case of a small open economy, Lebanon. Our objective is to test the existing link between the internal (budget) deficit and the external (trade) deficit in Lebanon over the period 1975-2011. Note that both government budget deficit and trade balance in Lebanon witness persistent deficit, which may put pressures on economic growth. The study will try to detect the exact nature of the relationship between the two deficits in Lebanon: are they correlated or independent? Besides, determining the direction of causality between the two variables (if exists) allows help setting a macroeconomic policy of the country: which of the two deficits can be used as instrument and which is the objective? Finally, finding evidence of a long-term relationship between these two deficits may propose reconsidering the trading and the fiscal policies of the country.

The paper proceeds as follows. We present an overview of economic development in Lebanon in section 2. The review of literature is presented in section 3. We present and explain the exploited data in section 4. The empirical methodology is illustrated and the empirical results are presented in section 5. Finally, the conclusions of the paper and the policy recommendations are presented in section 6.

2. Overview of Economic Development in Lebanon between 1975 and 2011[1]

The Lebanese economy is a typical model of a small, open, and service-oriented economy with extensive links abroad. It is characterised by an unrestricted exchange and trade systems, free access to foreign investment and perfect capital and labour mobility. Before 1975, the Lebanese economy was the most advanced economy in the Middle East, with high level of financial stability, which was the result of good economic performance, low inflation rates, stable exchange rate, absence of budget deficit, absence of public debt, and a persistent surplus in the balance of payments. Regarding its external sector, Lebanon has consistently experienced a deficit in the balance of trade. Nevertheless, the export/import coverage rate recorded an improvement during early 1970s, reaching 66% in 1974.

The eruption of the civil war in 1975 interrupted the course of economic progress in Lebanon. The impact of the war on the overall financial conditions and on public finances was very deep. Gradually, the government became incapable of collecting and administering public revenues to finance spending, and the situation turned from a budget surplus in 1974 into a deficit in 1975, which persisted afterwards. Budget deficit increased from $97 million in 1975 to $171 million in 1976, and jumped from $347 million in 1981 to $1,391 million in 1982 (Appendix A).

To finance the increasing budget deficits, the government resorted to issuing treasury bills bearing high interest rates (Appendix B). This led to a sharp expansion in the money supply causing high inflation rates. Besides, during the 1980s, the central bank of Lebanon resorted to printing money to help the government financing its budget deficit, which led to hyperinflation: the inflation rate jumped from 3.8% in 1983, to 25.3% in 1984, to 60.1% in 1985, to 146.8% in 1986, and to 741.2% in 1987. The hyperinflation re-emerged again in 1992, with an inflation rate of 110% (Appendix C). This hyperinflation was coupled with a sharp depreciation of the Lebanese pound (LBP). The exchange rate jumped from LBP 38.4/$ in 1986 to LBP 224.6/$ in 1987, with a gradual increase to LBP 928.2/$ in 1991, and a sudden hike to LBP 1,712.8/$1 in 1992 (Appendix D).

Lebanon is essentially an importing country with a free trading system. The deficit on the balance of trade had always been a characteristic of the Lebanese economy, and was usually offset by a surplus on the services and capital accounts in the balance of payments. The war reduced the country's ability to produce and export and the balance of trade and the balance of payments as a whole came under increased pressure. For instance, the imports/exports coverage rate dropped from 66% in 1974 to 22% in 1990, and the balance of payments started to record a deficit starting 1983. Regarding the trade balance, it recorded a deficit of $777 million dollar in 1975, which was equal to 5.6% of the GDP (at constant prices), increased to $2,512 million in 1980 (21% of GDP), and stood at $2,082 million in 1990 (21.8% of GDP) (Appendix E).

After the war had ended in 1990, the government adopted a policy aimed at achieving economic stability by controlling the budget deficit and reducing it gradually. Nevertheless, it was obliged to work on rebuilding the drastically damaged infrastructure, which involved huge expenditures on roads, electricity and water facilities, airport and seaports, telecom, etc... This has put more pressure on government budget, whose deficit surpassed $2 billion for the first time in 1996. Additionally, after 1992 the government resorted to borrowing to finance its expenditures on infrastructure (mainly from local markets) which resulted in mounting of public debt and debt service burden, increasing subsequently budget deficit. This was also coupled with an increase in government securities yield.

[1] Sources: central bank of Lebanon, Lebanese ministry of finance, the IMF, the World Bank.

After the war, exports started to grow again but at lower rates than imports. This caused the trade deficit to widen further. Consequently, the export/import coverage rate decreased from 16% in 1991 to 10% in 1995. The trade deficit reached $6,462 million in 1995 (38.1% of GDP), $6,287 million in 2001 (33.2% of GDP), and $15,086 million in 2011 (49.2% of GDP).

Finally, the worsening of all these macroeconomic variables has affected the economic growth in Lebanon mainly between 1975 and 1990. For instance, the GDP at constant prices dropped from $13,835 million in 1975 to $5,950 million in 1976, from $12,033 million in 1981 to $7,606 million in 1982, and from $13,095 million in 1988 to $7,536 million in 1989. This GDP reached $30,678 million by the end of 2011 (Appendix F).

3. Literature Review

3.1 Foundation of the twin deficit theory

The literature proposes two main theoretical explanations for the link between budget deficit and current account deficit. The first approach is based on the Keynesian proposition and is in line with the early works of Mundell (1962) and Fleming (1963), which state that an increase in the budget deficit induces an upward pressure on interest rates, which attract foreign capital. Following this inflow of capital, exchange rate appreciates. Under a flexible exchange rate system, the appreciated exchange rate makes exports less attractive and increases the attractiveness of imports, worsening subsequently the current account. Whereas under a fixed exchange rate regime, the budget deficit generates higher real income or prices and this worsens the current account balance. In other words, budget deficit results in current account deficit under both fixed and flexible exchange rate regimes although the transmission mechanisms are different. The second approach assumes that the link between these two deficits is based on the Keynesian theory of absorption, where an increase in budget deficit allows an increase in domestic demand, which is partly met by imports of goods and services. These imports deteriorate the external balance.

A wide range of models has been developed to explain the link between the two deficits. In most cases, the results suggest that budget deficit is likely to lead to a deficit in current account. The national income identity provides a basis of the relationship between these two deficits. The national income identity model for an open economy is represented as follows:

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

where Y = gross domestic product, C = consumption, I = investment, G = government spending, X = exports and M = imports.

Defining current account (CA) as the difference between exports (X) and imports (M), Equation (1) becomes:

$$CA = Y - (C + I + G) \quad (2)$$

where (C + I + G) are the domestic residents' spending (also called domestic absorption).

In a closed economy, saving is equal to investment (S = I). This implies that external account should equal the difference between national savings and investment, and that current account is directly related to saving and investment decisions in an economy (Lau et al., 2010). On the other hand, in an open economy, total savings (S) equal domestic investment (I) plus the current account balance CA:

$$S = I + CA \quad (3)$$

Equation (3) states that an open economy can obtain domestically and internationally the necessary funds for investments to boost its national income because external borrowing allows investment at levels beyond those financed through domestic savings.

Furthermore, national savings can be decomposed into private savings (Sp) and government savings (Sg).

$$Sp = Y - T - C \quad (4)$$

and

$$Sg = T - G \quad (5)$$

where T is the government revenue. Using Equation 4 and substituting it into Equation 1 and rearranging, we obtain:

$$CA = Sp - I - (G - T) \quad (6)$$

For simplicity, assume savings-investment balance, Equation (6) shows that a rise in budget deficit will increase current account deficit. In other words, Equation (6) states that the external account and fiscal balance are interconnected, or "twinned".

The empirical literature has examined the phenomenon of twin deficit in both developed and developing countries. The majority of those studies remain questionable with respect to the nature of relationship between the two deficits. However, four hypotheses arise from the twin deficit phenomena. In the following, we present an overview of the findings of the empirical literature regarding these four hypotheses.

3.2 Hypothesis I: budget deficit worsens current account deficit

The first hypothesis states that budget deficit will cause a similar deficit in the current account. Many authors have found support for this hypothesis. For instance, Hutchison and Piggott (1984) found that an increase in budget deficit is likely to raise domestic real interest rates, which in turn, raise the value of dollar and subsequently increase the trade deficit in the U.S. Zietz and Pemperton (1990) analysed the influence of U.S. federal budget deficit on trade deficit. They found that budget deficit does affect trade deficit, mainly through its impact on domestic absorption and income rather than through higher interest and exchange rates. Abell (1990) estimated a Vector Autoregressive system and showed that the link between the two deficits is indirect rather than direct: the causality runs from budget deficit to higher interest rate, to foreign capital inflow, to an appreciation of the exchange rate and finally to trade deficit. Bachman (1992) also used the Vector Autoregressive methodology and found that fiscal deficit determines current account deficits in the U.S. Akhtar (1995) stated that the significant increase in the U.S. external deficits during the 1980's was largely driven by fiscal deficits.

Bernheim (1988) used annual data for the United States, Canada, Mexico, West Germany, and the United Kingdom over the period 1960-1984 to investigate if fiscal deficits lead to trade deficits. The estimation results suggest that fiscal deficit does significantly affect trade deficit in those countries. Piersanti (2000) used the standard portfolio models and general equilibrium models to examine the relationship between the two deficits. His empirical results found that current account deficits have been associated with large budget deficits for most industrial countries during the 1970-1997 period. Ahmed and Ansari (1994) demonstrate that budget deficit and the gap between savings and investment explain the current account deficit in Canada.

Akbostancı and Tunç (2002) employed the Error Correction Model to study the relationship between budget deficit and trade deficit for Turkey between 1987 and 2001. They found a long-run relationship between the two deficits, and worsening of budget balance worsens trade balance. Also Acaravcı and Ozturk (2008) found positive and unidirectional causality running from budget deficit to current account deficit in Turkey. Using annual data for Greece, Vamvoukas (1997, 1999) tested causality relationships and found a unidirectional relationship going from fiscal deficit to current account deficit. Hakro (2009) implemented on data from Pakistan, a Vector Autoregressive model and demonstrated a causality link flowing from budget deficit to prices, to interest rate, to capital flows, to exchange rates, and finally to trade deficits. Iram et al. (2011) examine the relationship between budget deficit and current account deficit in Pakistan over the period 1971-2008, using Autoregressive distributed lag approach and find a stable long run effect of budget deficit on trade deficit.

3.3 Hypothesis II: the Ricardian Equivalence Hypothesis

The second hypothesis refers to the Ricardian Equivalence Hypothesis which bases on the seminal work of Barro (1974). According to this view, an inter-temporal shift between taxes and budget deficits does not impact real interest rate, the quantity of investment, or the current account balance. Therefore, the absence of any causality between the two deficits would be in line with this hypothesis. According

to the Barro-Ricardo Equivalence Hypothesis, financing deficit through debt or tax has no economic impact, which means that increasing internal deficit does not have any effect on external deficit (Barro, 1989). Empirically, Evans (1989) examined the relationship between fiscal deficits and trade deficits using data from Canada, France, West Germany, Italy, Japan, the United Kingdom, and the United States. He did not find a significant effect of budget deficit on the current account. This result confirms the Ricardian Equivalence Hypothesis. Bhattacharya's (1997) employs a Vector Autoregressive model and examines the factors affecting the trade balance of the U.S. over the quarterly period 1976:1 to 1995:4. He finds neither direct nor indirect effect of federal budget deficit on trade deficit. Kulkarni and Erickson (2001) also found no evidence of twin deficits in India, Pakistan and Mexico during the period 1969-1997. Finally, Kaufmann et al. (2002) examined the relationship between the two deficits in Australia and didn't find any causal effect between them.

3.4 Hypothesis III: current account deficit worsens fiscal deficit

The third hypothesis states that a unidirectional causality exists and runs from current account deficit to budget deficit. This occurs when deterioration in current account leads to a slower economic growth and hence, results in budget deficit. This is especially true for a small open economy that highly depends on foreign capital inflows to boost economic developments. In other words, large capital inflows or debt accumulations make that country eventually run into budget deficit. This reverse causality running from current account to budget deficit was called 'current account targeting' by Summers (1988), who pointed out that external adjustment may be required via fiscal policy.

Kearney and Monadjemi (1990) estimate Vector Autoregressive models for seven OECD countries and find a feedback relationship from current account to government spending in most of the countries. Using data from Egypt, Marinheiro's (2008) found a reverse causality from current account to budget deficit. Anoruo and Ramchander (1998) used Indian data from 1957 to 1993 and found evidence of unidirectional causality from trade deficit to fiscal deficit. Bose and Jha (2011) also examine the causal links between government budget deficit and current account deficit in India. Their results suggest a strong reverse causation running from external deficit to internal deficit.

Alkswani (2000) examined the twin deficit hypothesis in the Saudi Arabia economy over the period 1970-1999, and concluded that it may not be applied to an oil-based economy. He stated that the increase in current account position (driven by the surplus of trade balance) encourages the government to spend more causing a budget deficit. Similarly, Merza et al. (2012) examined the twin deficits hypothesis for Kuwait for the quarterly period 1993:4-2010:4. Like Alkswani (2000), they found that causality runs from current account to budget balance. They also find a negative long-run relationship between current account and budget balance and an increase in current account causes a decrease in government budget surplus.

3.5 Hypothesis IV: budget deficit and current account deficit are mutually dependent.

This hypothesis suggests that a bi-directional causality between the two deficits exists. Darrat (1988) proves the existence of this bidirectional causality between government deficit and trade balance in the U.S. Islam (1995) examined the causal relationship between budget deficit and trade deficit in Brazil from 1973:Q1 to 1991:Q4. Using Granger causality test, his empirical results showed a bidirectional relationship between the two deficits. Lau and Baharumshah (2004) reveal the presence of a bi-directional causality between the two deficits in Malaysia for the period 1975-2000. Finally, Mukhtar et al., (2007) used the Error Correction model and Granger causality tests to examine the twin deficit in Pakistan using data over the period 1975-2005. The authors confirmed the existence of a long-run bi-directional relationship between the two deficits.

3.6 Mixed results

Khalid and Guan (1999) examine the causal relationship between budget and current account deficits for five developed countries (US, UK, France, Canada and Australia) from 1950 to 1994 and five

developing countries (India, Indonesia, Pakistan, Egypt and Mexico) from 1955 to 1993. Their results suggest a more significant long-run association between the two deficits in the developing countries than for developed countries. Furthermore, they found that the direction of causality for India is bi-directional, whereas for Indonesia and Pakistan the causality runs from current account deficits to budget deficits.

Baharumshah and Lau (2009) examine the twin deficits hypothesis for seven East Asian countries. Their empirical results show that twin deficits hypothesis exists only in four out of the seven investigated countries. Lau et al. (2010) studied the twin deficits in the 1997 Asian crisis countries. Their empirical results showed that causality runs from budget deficit to current account deficit for Malaysia, the Philippines (pre-crisis), and Thailand. Conversely, they found that the causality runs in the opposite direction for Indonesia and Korea. Finally, they revealed a bi-directional causality for the Philippines post-crisis. Using data for the U.S. from 1975 to 1998, Hatemi and Shukur (2002) show that during the period 1975-1989, the direction of Granger causality was from budget deficit to current account deficit, while from 1990 until 1998 it was in the opposite direction.

4. Data and descriptive statistics

This paper uses annual data for the period 1975-2011, extracted from three sources: (1) the World Bank database (World Development Indictors), (2) the International Financial Statistics database (IFS), and (3) the Lebanese Ministry of Finance reports.

To examine the causal relationship between trade deficit and budget deficit, we use the following variables. The budget deficit (BD) is the difference between government revenues and expenditures. This variable is extracted from the reports provided by the Lebanese Ministry of Finance. The trade deficit (TD) is the difference between exports and imports of goods. This variable is retrieved from the World Bank database (World Development Indictors). The gross domestic product (GDP) is extracted from the World Bank database. GDP which is initially expressed in U.S. dollars at current prices has been converted to constant prices using the GDP deflator (the base year is 2005). The proxy for interest rate is the discount rate (DR), which is the only interest rates variable available for the period 1975-2011. This variable is retrieved from the International Financial Statistics database. Finally, the nominal exchange rate (NER) between national currency (the Lebanese Pound) and the U.S. dollar is also extracted from the International Financial Statistics database. The following table shows the evolution of the variables in selected years.

Table 1: The evolution of variables in selected years

	1975	1990	2000	2011
Trade deficit ($ millions)	777	2,082	5,515	15,086
Budget deficit ($ millions)	97	1,028	3,940	2,342
Gross Domestic Product ($ millions)	13,835	9,536	18,203	30,678
Discount Rate (%)	7	22	20	10
Nominal Exchange Rate (LBP/$1)	2.30	695.09	1,507.50	1,507.50

5. Estimation methods and empirical results

The empirical analysis of the relationship between budget deficit and trade deficit will be done using the Vector Error Correction Models (VECM), a methodology which requires the estimation of many parameters. The employed methodology consists of trying to find out causal links among these variables using the VEC models and the methodology developed by Toda and Yamamoto (1995) on Vector Autoregressive (VAR) models. The utilisation of data to detect the existence of a long-term relationship through the cointegration test is subject to conditions regarding the characteristics of the variables: all variables must be integrated of the same order. To test this characteristic, we must determine whether the variables are stationary in levels or not.

5.1 Estimation methods

To detect the existence of a long-term relationship between the internal deficit and the external deficit, a preliminary test must examine the stationarity of the series under study. In fact, the non-stationarity of the series results in an invalidation of the classical inference procedures: the usual tests of significance of the coefficients (Fisher test or Student test) lying on the assumption of white noise residuals, are not verified. To test the stationarity of the different variables used in this study, we use the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests. They test the null hypothesis (H_0) of the existence of unit root against the alternative hypothesis of non-presence of unit root in the series. The estimation procedure involves estimating the following three models:
Model 1: a model with constant and deterministic trend

$$\Delta y_t = (\rho - 1) y_{t-1} + \beta t + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \alpha + \varepsilon_t \quad (6)$$

Model 2: a model with constant but without deterministic trend

$$\Delta y_t = (\rho - 1) y_{t-1} + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \alpha + \varepsilon_t \quad (7)$$

Model 3: a model without constant or deterministic trend

$$\Delta y_t = (\rho - 1) y_{t-1} + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \varepsilon_t \quad (8)$$

With $\Delta = 1 - L$ (L is the lag operator), y_t is the considered series at time t, t is a trend, and ε_t is a white noise.

We test the null hypothesis of existence of unit root (the series is integrated of order 1, i.e. non-stationary) against the hypothesis of absence of unit root (the series is integrated of order 0, i.e. stationary). If the unit root tests indicate that the series are *I(0)*, i.e. stationary in level, it is then necessary to perform the same tests but in first difference. If the tests reveal that the series are *I(1)*, the cointegration procedures and the Error Correction Model can be easily applied.

The cointegration test used in this paper is that of Johansen (1988, 1991). Johansen procedure focuses on the rank of the matrix P, which determines the number of cointegration vectors. Two statistics are proposed: the track test and the test of maximum eigenvalue. The track test is a test of relative maximum likelihood consists of calculating the following statistic:

$$TR = -T \sum_{i=q+1}^{N} \log\left(1 - \hat{\lambda}_t\right) \quad (9)$$

The tested null hypothesis is: $r \leq q$, i.e. there is at most r cointegration vectors. This is about testing the rank of the matrix P, since testing the existence of r cointegration vectors is about testing the null hypothesis: $Rank(P) = r$.

Regarding the test of maximum eigenvalue, the test statistic is given by:

$$VP_{\max} = -T \log\left(1 - \hat{\lambda}_{q+1}\right) \quad (10)$$

In the case where the hypothesis of cointegration is validated, the model can be written, as shown by Engel and Granger (1987) and Johansen (1988), under the form of a VECM representation:

$$\Delta y_t = \mu_1 + \sum_{i=1}^{k-1} \alpha_i \Delta y_{t-i} + \sum_{i=1}^{k-1} \beta_i \Delta x_{t-i} + \lambda EC_{t-1} + \varepsilon_t \quad (11)$$

$$\Delta x_t = \mu_2 + \sum_{i=1}^{k-1} \alpha_i' \Delta y_{t-i} + \sum_{i=1}^{k-1} \beta_i' \Delta x_{t-i} + \lambda' EC_{t-1} + \varepsilon_t' \quad (12)$$

where ε_t and ε_t' are two white noises, EC_{t-1} is the estimated residual of the cointegration relationship lagged one period, and the coefficients λ and λ' represent the respective adjustment speed. The cointegration relationship reflects the long-term equilibrium and the short-run dynamics of variables capture the fluctuations around this long-term relationship.

The VECM representation provides two channels through which causality can be detected (Granger, 1988). Thus, in Equation (12), x_t Granger-causes y_t either through the lagged dynamic terms Δx_{t-i} if the coefficients β_i are jointly significant (i.e. the hypothesis $H_0 : \beta_1 = \beta_2 = ... = \beta_{k-1} = 0$ is rejected), or through the error term EC_{t-1}, if the coefficient λ is statistically significant (i.e. reject $H_0 : \lambda = 0$). The joint significance of coefficients β_i indicates Granger causality in the short-term, while the significance of the coefficient λ suggests a long-term Granger causality among the variables. Furthermore, in Equation (13), if the hypothesis $H_0 : \alpha_1 = \alpha_2 = ... = \alpha_{k-1} = 0$ is rejected and/or the hypothesis $H_0 : \lambda' = 0$ is rejected, then y_t Granger-causes x_t.

5.2 Empirical results

The first step of the analysis is to determine the order of integration of the exploited variables. To do so, the unit root tests on each variable are performed. The results of stationarity tests in levels and first difference are presented in Tables (2) and (3).

Table 2: Results of Augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests in level

Variables	Model with constant and trend (1)		Model with constant but without trend (2)		Model without constant or trend (3)	
	ADF	PP	ADF	PP	ADF	PP
TD	-0.4920	-0.7252	1.4488	1.5738	2.9033	3.0860
BD	-3.4859	-3.2622	-1.9309	-1.7856	-0.4903	-0.2612
DR	-1.1581	-0.9986	-1.5947	-1.7361	-0.4213	-0.4678
NER	-0.8401	-1.3446	-0.9813	-1.0745	0.1060	0.2760
GDP	-2.1710	-3.2866	-0.2492	0.5155	0.9261	2.2516

Notes: Model (1): the critical value is equal to -3.45 at the 5% level. Model (2): the critical value is equal to -2.89 at the 5% level. Model (3): the critical value is equal to -1.95 at the 5% level. These critical values are taken for a maximum number of observations T=100.

The results of Augmented Dickey-Fuller test and Phillips-Perron test presented in Table (2) suggest the non-stationary of variables in level. The t-statistics are greater than the critical value at the 5% level. Therefore, we do not reject the null hypothesis of the presence of unit root. When we perform the same tests on the first-differenced variables (see Table 3), we reject the null hypothesis of the existence of unit root for all of the three models at the 5% level. We obtain generally better results for the Phillips-Perron test, which rejects the non-stationarity at the 1% level in most cases. We conclude that our variables are stationary in first difference and thus are integrated of order 1. The order of integration of the series is 1, thus the procedures for cointegration and for the Error Correction Model can be applied.

Table 3: Results of Augmented Dickey-Fuller (ADF) test and Philips Perron (PP) test in first difference

Variables	Model with constant and trend (1)		Model with constant but without trend (2)		Model without constant or trend (3)	
	ADF	PP	ADF	PP	ADF	PP

TD	-5.3390	-5.3424	-5.0474	-5.0782	-4.3391	-4.5944
BD	-7.2665	-7.5644	-7.3429	-7.6388	-7.3330	-7.5662
DR	-4.9547	-6.4864	-4.6725	-4.5713	-4.7367	-4.6448
NER	-3.9240	-3.9055	-3.9265	-3.9265	-3.7505	-3.7505
GDP	-5.7061	-8.8903	-7.2547	-8.6170	-6.7781	-6.6612

Notes: Model (1): the critical value is equal to -3.45 at the 5% level. Model (2): the critical value is equal to -2.89 at the 5% level. Model (3): the critical value is equal to -1.95 at the 5% level. These critical values are taken for a maximum number of observations T=100.

Given the results of unit root tests, cointegration tests were performed to detect the existence of a stable long-term relationship between trade deficit, budget deficit, interest rate, GDP, and exchange rate. The choice of the optimal number of lags is obtained from the AIC, FPE and maximum likelihood tests. All these tests conclude a differenced VAR with lag. Johansen tests are based on the estimations of maximum likelihood of a VAR of order 1. We therefore test the null hypothesis of absence of cointegration vector against the alternative hypothesis of existence of one cointegration vector. The results of the Johansen cointegration tests are reported in Table 4.

Table 4: Unrestricted Cointegration Rank Test (Trace)

Hypothesized N° of CE(s)	Eigenvalue	Trace Statistic	0.05 critical Value	Prob.**
None *	0.6068	94.2494	88.8038	0.0190
At most 1	0.5152	61.5762	63.8761	0.0769
At most 2	0.4470	36.2290	42.9152	0.1980
At most 3	0.2723	15.4933	25.8721	0.5337
At most 4	0.1173	4.3673	12.5179	0.6885

Notes: Trace test indicates 1 cointegrating equation at the 0.05 level. *denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

The results in Table 4 reveal the existence of a single cointegration relationship among the variables. This result does not precisely indicate which one of these variables is the dependent variable and which can be considered as exogenous. To ensure the stability of our results, we have repeated the cointegration test considering in each time one of the used variables as a dependent variable. Regardless of the chosen "dependent variable", the obtained results coincide to validate the existence of a single cointegration relationship among the variables included in the model. The existence of a cointegration relationship allows estimating a VEC model in order to describe the dynamic adjustment of variables towards their long-run equilibrium. The Error Correction Model allows then integrating the short-term fluctuations (the variables in first difference) around the long-run equilibrium given by the cointegration relationship.[2] To determine the direction of causality among the different variables, we apply a Granger causality test for a two-period lag. The estimation results are reported in Table (5).

Table 5: Results of causality test among the different variables

	ΔTD	ΔBD	ΔDR	ΔNER	ΔGDP
EC(-1)	-0.3509 [-5.8854]	0.0450 [0.8592]	0.0002 [0.6876]	-0.0271 [-2.1154]	0.0167 [0.0787]

[2] As demonstrated by Granger (1981), there is reciprocity between cointegration and Error Correction Model in the case of cointegrated series of order (1, 1), i.e. *I(1)* series whose residual of the linear regression is stationary.

$\Delta TD(-1)$	-0.0433 [-0.2896]	0.0039 [0.0311]	0.0011 [1.8036]	-0.0315 [-1.0157]	0.0708 [0.1381]
$\Delta TD(-2)$	-0.2821 [-1.9918]	0.2435 [2.0299]	-0.0007 [-1.1215]	0.0204 [0.6936]	-0.0880 [-0.1810]
$\Delta BD(-1)$	0.6061 [2.6303]	-0.5096 [-2.6112]	-0.0019 [-1.9811]	0.0027 [0.0573]	-0.5879 [-0.7433]
$\Delta BD(-2)$	0.4573 [1.8679]	-0.3900 [-1.8746]	-0.0019 [-1.8505]	0.0172 [0.3376]	-1.3195 [-1.5649]
$\Delta DR(-1)$	-10379.8969 [-2.2412]	13.7709 [0.3524]	0.3305 [1.7387]	-19.3253 [-2.0181]	-150.5639 [-0.9506]
$\Delta DR(-2)$	-12707.1974 [-2.3296]	41.4176 [0.9016]	-0.0031 [-0.0138]	-0.0640 [-0.0056]	26.8266 [0.1441]
$\Delta NER(-1)$	-2.5398 [-2.5959]	1.2035 [1.4442]	0.0034 [0.8368]	0.3340 [1.6356]	-1.9228 [-0.5693]
$\Delta NER(-2)$	-0.5517 [-0.5403]	-1.1904 [-1.3675]	-0.0017 [-0.4025]	0.0133 [0.0625]	2.4590 [0.6970]
$\Delta GDP(-1)$	0.1507 [2.3733]	0.0286 [0.5191]	0.0001 [0.4671]	0.0237 [1.7553]	0.1701 [0.7618]
$\Delta NER(-2)$	0.1247 [2.3347]	0.0307 [0.6661]	0.0002 [0.9713]	0.0099 [0.8756]	-0.0560 [-0.2997]
C	-448.6908 [-2.8934]	-91.7278 [-0.6951]	-0.2728 [-0.4250]	6.2882 [0.1944]	314.9659 [0.5889]
R^2	0.68	0.39	0.45	0.39	0.19
Jarque-Bera test	1.14 (0.56)	1.30 (0.52)	0.49 (0.00)	2.27 (0.32)	0.24 (0.88)
White homoscedasticity test		343.03 (0.29)			

Note: Student ratios for the estimated coefficients are between brackets. We present the test statistics of Jarque-Bera test and White homscedasticity test, and between parentheses are the probabilities of committing Type-I error.

The robustness of the model is evaluated by the Jarque-Bera test and the White homoscedasticity test, and we conclude that the model passes these tests. In addition, the explanatory power of the estimated equation – measured by the coefficient of determination – is high. The results reveal that the coefficient of the Error Correction term (the past residuals) or the restoring force coefficient is significantly different from zero at the 5% level with a negative sign. This result reinforces the existence of a long-term relationship among the variables. The economic interpretation of this result is that each time a deviation from the long-term relationship exists that unites the five variables, the trade balance consitutes the adjustment variable that allows restoring the equilibrium. The adjustment value indicates that approximately 35% of the disequilibrium of period *(t – 1)* is corrected in period *(t)*.

Looking at the trade balance equation ΔTD, we notice the existence of a causal link between the trade balance and the other variables. We observe that the trade balance is Granger-caused by itself and that the causality is negative and significantly different from zero at the 10% level. Conversely, the lagged budget balance positively causes the trade balance and this causality is statistically different from zero at the 10% level. This result seems to be in favour of the twin deficit conventional approach and reveals the existence of a close relationship between budget deficit and external deficit in Lebanon. We also observe that the lagged nominal exchange rate negatively causes the trade balance. The depreciation/devaluation of the national currency against foreign currencies results in a decline of domestic prices expressed in foreign currency and this in turn increases exports and reduces imports, thus reducing the trade balance deficit.

Conversely, we notice that GDP causes the trade balance with a positive sign and statistically significant at the 5% level. Thus, the additional wealth created in the economy in period *(t)* increases the trade deficit in period *(t + 1)*, widening further the gap between imports and exports. This phenomenon could be explained within the framework of a small open economy in two ways. On one hand, economic growth, even if it leads to an increase in exports, it increases more than proportionally the imports (since the overall effect on the trade deficit is positive). In fact, the increase in disposable income appears to cause a more than proportional increase in demand through its demand for imports component. On the other hand, given the importance of the proportion of imports of consumption goods in total imports of Lebanon, the additionally created wealth and allocated to imports is spent on consumption rather than to investment. Therefore, the increase of wealth widens the trade gap in Lebanon. Finally, the interest rate causes the trade balance with a negative sign and significant at the 5% level. This result, somehow confusing, can be explained by the fact that the increase in fiscal deficit – which is often accompanied by an increase in interest rates – is translated into an increase in savings of economic agents and therefore, a decrease in domestic demand, implying a reduction in the trade deficit.

When considering the ΔBD regression, the results show that the fiscal balance is Granger-caused by itself and this causality is negative and significant at the 5% level. Besides, we observe a causal link, with a positive sign and statistically significant at the 10% level, running from external deficit to budget deficit. This result validates the existence of an interaction between budget deficit and external deficit. We notice here that there is no causal link between interest rate, exchange rate, GDP, and budget deficit.

Regarding the ΔDR equation, we notice that interest rate is Granger-caused by itself. The results also reveal the existence of an instantaneous positive causality running from trade deficit to interest rates, but with an opposite sign to that found in the ΔTD regression. We observe that the budget deficit negatively Granger-cause the interest rate and this causality is statistically different from zero at the 10% level. The results of the model reject any causal relationship between exchange rate, GDP, and interest rate. Finally, ΔNER and ΔGDP regressions show no significant causal link among the different variables. Therefore, we do not find a clear impact of the internal or the external deficits on the economic development in Lebanon.

6. Conclusion

This paper has examined the twin deficit phenomenon in Lebanon over the period 1975-2011. Using several econometric tests (cointegration and Granger causality), we tried to detect the short-run and the long-run relationships between government budget deficit and trade deficit. The empirical results reveal that budget deficit, trade balance, interest rate, and exchange rate are cointegrated, suggesting the existence of an underlying equilibrium relationship binding all these variables together. Secondly, a two-way causality between budget deficit and trade deficit was detected, giving support to the twin deficit hypothesis. Thirdly, an increase in both interest rate and exchange rate lowers trade deficit.

From policy perspective, our results suggest the following: (1) a depreciation/devaluation of the local currency could help lowering trade deficit (this suggestion has a negative repercussion though), (2) economic growth must be accompanied with a trade policy that controls imports and direct the resulting increase in local demand towards local production, and (3) stimulating national savings could reduce domestic demand on imports, thus narrowing trade gap.

Acknowledgement

This work was supported by a grant from the National Council for Scientific Research (CNRS), Lebanon.

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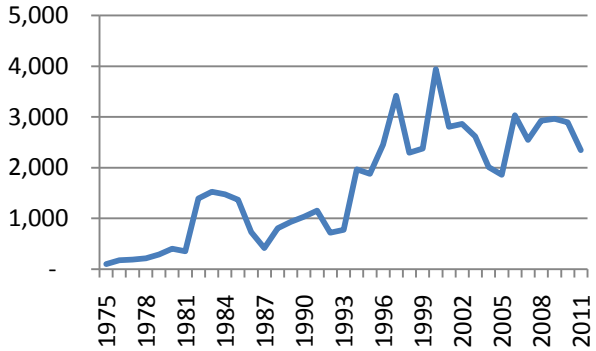
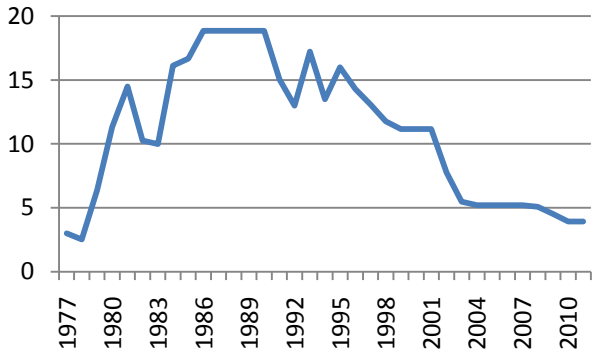
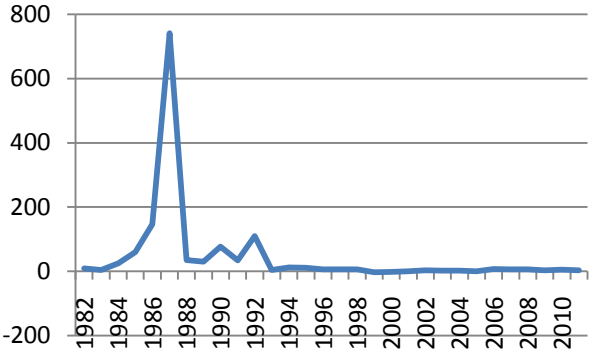
Appendix A: Budget deficit ($million)



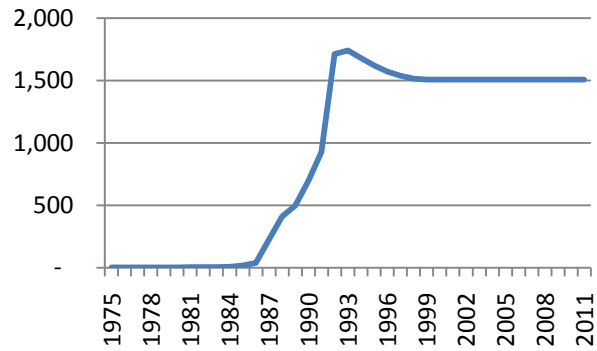
Appendix B: 3-month T-bill rate (%)



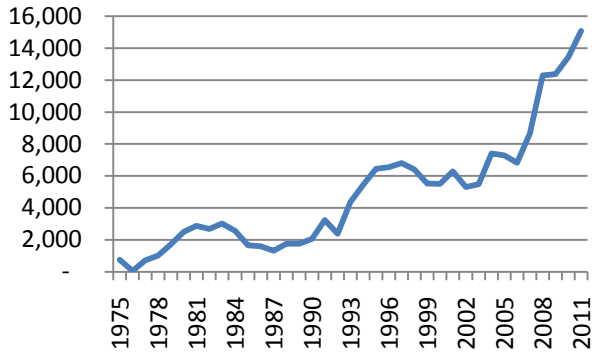
Appendix C: Inflation rate (%)



Appendix D: Exchange rate (LBP/$1)



Appendix E: Trade deficit ($million)



Appendix F: GDP at constant 2005 prices ($million)