Sustainability of budget deficits and public debt in Lebanon: a stationarity and co-integration analysis

SIMON NEAIME
Department of Economics, Institute of Financial Economics, American University of Beirut, Beirut-Lebanon (e-mail: sn01@aub.edu.lb)

This paper presents a thorough empirical analysis of fiscal developments in Lebanon over the past three decades. After an evaluation of major fiscal and monetary developments, the paper uses the Present Value Constraint framework to analyze whether debt and deficits are sustainable. Unit root and co-integration tests reveal that public debt in Lebanon is not sustainable. It is also shown that Lebanon could be heading towards a debt and exchange rate crisis, which could degenerate into a banking crisis similar to the one observed in Argentina, unless timely fiscal adjustment measures are introduced in the near future.

Keywords: debt; budget deficits; sustainability

JEL Classification: E62; E69; F34; C32

1. Introduction
In the past two decades, an increasing number of exchange rate and debt crises have brought forward the potential damage on a given economy emanating from a weak public sector. Policy-makers and academics have, thus, devoted considerable efforts towards studying the weaknesses of the public sector, particularly in emerging economies that are exposed to various domestic fiscal and external imbalances. These efforts are primarily devoted to trying to forecast whether budget deficits and total public debt are sustainable. In the instance where debt is not sustainable, then reforming fiscal policies will be a must in avoiding a fiscal, monetary and exchange rate crisis.

After the accumulation of a sizeable debt in Lebanon, the financial distress of the public sector has become a major source of concern for the Lebanese economy. It is well known that Lebanon has been running a permanent budget deficit for the past two decades of about 30% of GDP, resulting in a debt that is currently above 180% of GDP. Some efforts have been undertaken recently in order to balance the primary deficit, by introducing Value Added Tax (VAT), reforming the archaic taxation system and improving government collection of tax revenues. Still, fiscal policy seems unable to generate a
structural change via privatization or the use of the proceeds of the Paris II Conference of International Donors’ countries, in order to change the growing trend of the Debt/GDP ratio. The fiscal problem is made even more urgent by the donors’ countries, which have put pressure on the Lebanese government to restructure its debt, privatize and improve tax collection. Failure of the Lebanese government to implement the necessary fiscal adjustments in a timely manner may lead to a debt and currency crisis and, subsequently, to a chain of bank failures, since a major portion of the public debt is held by the Lebanese banking system.

This paper will attempt to assess the sustainability of the Lebanese current fiscal policy and evaluate whether it is violating the inter-temporal budget constraint for the public sector. Broadly speaking, such a constraint stipulates that a fiscal policy is sustainable when it is expected to generate sufficient net revenues in the future to repay the accumulated debt and its service. However, a fiscal policy becomes unsustainable if the government intends to finance its future interest expenses by issuing further debt and is unable to generate adequate revenues even via seigniorage.

Studies analyzing public sector’s vulnerability have considered closely the issue of fiscal sustainability. Fiscal sustainability can be determined in various ways and the economic literature is rich in studies trying to assess the vulnerability of the public sector. Three theoretical approaches have been used frequently in the literature to assess the sustainability of public policies: (1) Debt Ratio analysis; (2) the Present Value Constraint (PVC); and (3) the Accounting Approach. This paper will make use of the PVC framework to look at the issue of fiscal sustainability in Lebanon.

A country’s external debt is sustainable if it can be serviced without either a restructuring of debt obligation, or a large correction in the balance of income and expenditure. Thus, the solvency of a country depends on both a willingness to pay, as well as an ability to pay.

When a country is facing a liquidity problem this does not necessarily mean that its debt is unsustainable, but insolvency of a given economy means that debt is unsustainable. An economy faces a liquidity problem when its due liabilities in a given period exceed its liquid foreign currency assets. In other words, a country may face a cash flow problem, even if it might be solvent in the long run. Consequently, the economy is unable to meet its immediate external obligations. However, a solvency problem arises when a given country will never be able to service its debt out of its own resources. Under these circumstances the external debt burden is said to be unsustainable.

The conduct of fiscal policy in the emerging economy of Lebanon has recently become critical in determining the country’s future economic and fiscal situation, due to the accumulation since the early 1990s of a sizeable level of debt. The Lebanese financial market is still under-developed and the government has been the only body that is currently borrowing domestically and from the international bond market, whether to finance its current expenditures or to repay its foreign debt. Since Lebanon has been financing its budget deficits via borrowing, this has had a direct bearing on interest rates, inflation and exchange rates and the rate of growth of GDP. Deficit financing
has also affected private sector’s growth directly by crowding out private investment. Thus, Lebanon’s ability to repay its external debt obligation can be viewed in the context of its ability to tax its residents and use the revenue to buy foreign exchange for debt service payments on the one hand, and on its ability to reduce government spending and control the debt and its service on the other.

The rest of the paper is divided as follows: the next section reviews the macroeconomic developments in Lebanon over the past three decades, with a close look at the development of fiscal and other macroeconomic variables. After a literature review, Section 3 explores empirically the issue of public debt sustainability in Lebanon using the PVC framework. Section 4 concludes the paper with some policy implications.

Subsequent to fifteen years of disturbances, which resulted in massive infrastructural damage, and economic difficulties, Lebanon has engaged since the early 1990s in a massive reconstruction plan. During the war period, the Lebanese government revenue base was eroded due to the inability of the government to collect taxes and the absence of adequate infrastructure. There was no external support available, given the high political instability and the shaky macroeconomic performance. The latter led to intense reliance on domestic currency financing for government spending and to increased resort to monetary financing during the years 1989–1991. The rate of inflation was at its highest historical levels of 400%, 100% and about 50% in 1989, 1990 and 1991, respectively. Total public debt stood at 40% of GDP by end-1992, even before any major reconstruction measure was undertaken. By late 1992, the exchange rate shot up from about Lebanese Lira (LL)3/$US prior to 1985, up by 110% over its 1991 level to reach as high as LL1838/$US. At that time, however, Lebanon’s GDP was taking on an upward drift, increasing from $US2.8 billion to $US4.45 billion and $US5.17 billion in 1991, 1992 and 1993, respectively (see figure 1).

Figure 1. (a) Inflation (%); (b) exchange (LL/$US) rates: 1960–2002. Source: Banque Du Liban (BDL), Lebanese Ministry of Finance and IMF.
To reinstate confidence in the country as a preparatory procedure for external assistance request, the newly established government that took office in 1992, opted for exchange rate-based stability policies. The Lebanese pound appreciated against the dollar by 7% and 3.7% in 1993 and 1994, respectively. The inflation rate declined to 30% in 1993 to reach the single digit level, 9%, by 1994, and down to about zero percent since 1997 (see also figure 1). A low inflation rate coupled with high real rates of interest encouraged the inflows of private capital and the initiation of the reconstruction program, which received its initial funds from foreign donors and was embarked on in 1993. The Lebanese pound was stabilized and was appreciating steadily against the US dollar since 1993. However, the three-month Treasury Bills (TBs) rate kept on increasing to reach its highest level, 30% in 1993, with a milder peak of 25% in 1995, at a time when all observers were expecting these rates to fall as a result of the steady appreciation of the LL. With a low rate of inflation of 2%, this constituted a real effective return on domestic short-term debt of 28%. There was, however, a reversal in the increasing trend of the TB rate since end of 1996, and the real return on Lebanese TBs with maturities between 3, 6 and 24 months ranged between 12% and 18%. This goes above the US dollar and the Euro LIBOR (or risk-free rate) by about 12–15% (see figure 2).

Figure 2. Nominal three-month Treasury Bills (TBs) rates and GDP: (a) yearly average TBs rates; (b) monthly TBs rates; (c) nominal GDP in ($US billion); (d) rate of growth of nominal GDP in (%). Source: Banque Du Liban (BDL), Lebanese Ministry of Finance and IMF.
On the other hand, the Lebanese monetary authority, the Banque Du Liban (BDL), was pursuing a conservative monetary policy with price and exchange rate stability as the goal. While these efforts were successful in stabilizing the exchange rate and bringing down the rate of inflation to about zero percent, the strict monetary policy was also exerting upward pressures on the domestic rate of interest. Instead of pursuing an accommodating monetary policy to ease the upward pressure on domestic interest rates, BDL was reluctant to take that venue due to several episodes of political instability and fears from a renewed devaluation of the local currency. The outcome of a restrictive monetary policy coupled with a heavy reliance on domestic credit was clear. A sizeable public debt started to emerge coupled with its heavy service burden, which subsequently translated into recurrent budget deficits.

All this helped in the acceleration and widening of subsequent budgetary deficits even at a time when government revenues were increasing four-fold in 1996, increasing from S$US619 million in 1992 to about S$US2.2 billion in 1996. To finance the fiscal imbalance, the Lebanese debt was soaring up rapidly. The debt and the need to finance it have contributed to the recession of the early 2000s (with an average growth in GDP of 1%) by the crowding out of private sector’s investments subsequent to the high interest rates peaking at 30% in 1993 (figure 2).

The fiscal and debt burden were carried on to the latter half of the 1990s and early 2000, with the rate of growth of GDP decreasing steadily since 1997. Tapping international capital markets was becoming more difficult or almost impossible for Lebanon, due both to the East Asian financial crisis that diverted away all kinds of external support to other emerging economies and the deteriorating fiscal position of the Lebanese government. As a consequence, Lebanon’s sole option was to turn to more domestic borrowing, but in foreign currency, tapping the financial savings of the Lebanese private sector and the pool of resident investors, while offering increasing spreads given the disturbingly increasing debt and deficit. The high debt cost could only deteriorate further the fiscal imbalance and called for immediate action. The previously mentioned crowding out effect of private sector investments materialized in the slow growth of GDP which came close to stagnating with a mere 1% increase recorded in 1999, 2000 and 2001. Moreover, the narrow debt holder base was concentrated in Lebanese private commercial banks, which retained more than 70% of total public debt at end of 1998. This fact urged the government to diversify its sources of financing, broaden the investors’ base and ensure better debt management.

After ten post-war years of the so-called reconstruction and economic revival, the Lebanese government reviewed its list of priorities with debt reduction now occupying the lead position. In September 2000, international credit agencies threatened to further downgrade Lebanon’s credit rating. Moody’s declared that it would review its B1 rating on Lebanon’s short-term domestic debt, essentially TBs. Standard and Poor lowered its rating on Lebanon’s long-term foreign-currency debt by one notch to B+ from BB, citing Lebanon’s onerous debt-service burden, the persistent high budget deficit and the stemming debt as the main reasons for such action. The new decade’s budgets
initiated a correction in the country’s fiscal imbalances, by relying on a dual track of decreasing expenditures and increasing public revenues.

Figure 3 indicates a steady increase in government revenues since the early 1990s, while at the same time government spending inclusive of servicing of

![Graphs](a)(b)(c)(d)(e)(f)

Figure 3. Fiscal developments: 1960–2002: (a) Revenues ($US billion); (b) government spending ($US billion); (c) deficit or surplus ($US billion); (d) primary deficit or surplus ($US billion); (e) government spending (GSP) and revenues (GREV) ($US billion); (f) budget deficit/GDP (%). Source: Banque Du Liban (BDL), Lebanese Ministry of Finance and the IMF.
the debt was also moving in the same direction. However, since the early 1990s
the gap between government expenditure and revenue seems to be widening
at an alarming rate (see figure 3e). Another key variable in analyzing debt
sustainability is the primary fiscal deficit. A permanent increase in the primary
deficit would increase the likelihood of debt becoming unsustainable and
contribute to the worsening of the management of public debt. Moreover, a
continuous increase in the primary deficit through insufficient tax revenues
or increased government expenditures would render debt unsustainable
by (1) increasing the real interest rate, (2) reducing GDP growth, and (3)
through increasing the level of debt. The Lebanese primary deficit seems to
be reverting to zero over the last two decades, indicating no real concerns in
the foreseeable future. However, the total deficit, which reflects the addition
of the debt service of the Lebanese public debt to government expenditures,
has become significant since the early 1990s, averaging between $US3 billion
and $US3.5 billion. The deficit to GDP ratio has also been hovering between
20% and 30% since the mid-1990s (see figure 3f).

A high burden of the debt service, coupled with high government spending
and modest increases in government revenues led to the accumulation of a
sizeable public debt. The debt to GDP ratio, which exceeded the 180% level
by the end of 2003 and which is the highest in the Mediterranean region, has
put Lebanon in the forefront of emerging economies with foreign debt prob-
lems. As noted before, the significant debt service in Lebanon is primarily
behind the continuous fiscal deficit and the increased debt stock. Total debt
service represented 18% of total GDP in 2002 and was described by the gov-
ernment’s official report in the Paris II meeting as ‘unusual’ and ‘unsustain-
able’. Banks and other private sector entities hold the larger part of total
domestic currency debt, with $US12.7 billion in 2002, which corresponds to
around 61% of total public debt (see table 1).

The accumulation of consecutive budget deficits, coupled with high interest
rates, high levels of government spending with no adequate revenues, led to the
accumulation of a huge public debt. Total debt stood at about $US32 billion
by the end of 2002 after an exponential increase since 1993, at a time when it
was hovering between $US0.5 billion and $US3 billion during the 1977–1993
period (see figure 4c). The fast accumulation of the huge public debt took
policy-makers and academics by surprise. The rate of growth of foreign debt

<table>
<thead>
<tr>
<th>Table 1. Domestic currency debt composition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$US billions</td>
</tr>
<tr>
<td>Banks and the private sector</td>
</tr>
<tr>
<td>Public sector</td>
</tr>
<tr>
<td>Banque du Liban (BDL)</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Public sector deposits</td>
</tr>
<tr>
<td>Domestic currency debt (gross)</td>
</tr>
<tr>
<td>Domestic currency debt (net)</td>
</tr>
</tbody>
</table>

has become even faster since 1995 and, by the end of 2002, foreign debt amounted to about $US13 billion when it had only been at about $US1 billion in 1996 (see figure 4b). This is partly due to the fact that the government has been converting a major portion of its domestic debt with high service costs and low maturity to foreign debt with relatively lower interest rate costs and higher maturity. Indeed, the accumulation of a huge debt entails a heavy debt service burden—after being below $US1 billion in 1994, it stood at about $US3 billion in 2002 (see figure 4d).

3. The sustainability of public debt
3.1. Literature review
After several emerging economies experienced recently increased debt levels and, in some instances, debt crisis, the issue of whether fiscal policies are sustainable has gained considerable attention among policy-makers and academics. Since the early 1990s, there has been an important emergence of empirical literature dealing with the issue of debt sustainability. The econometric literature testing the PVC focuses on the time series properties of government expenditures and tax revenues, budget deficits and the level
of public debt. These variables were never related in a structural model. Ideally, the stationarity and co-integration-based tests of debt sustainability should employ long time series (say 30–50 annual observations) on various macroeconomic variables. It should also take into consideration issues that are particularly relevant to less developed countries (LDCs).

Empirical studies on debt sustainability are numerous in the last decade and have gained extreme importance after the latest financial and debt crisis world-wide. Two empirical frameworks have been used in the literature. The first rests mainly on testing stationarity of the various fiscal variables, while the second employs co-integration techniques and explores the existence of a long-run equilibrium relationship between the fiscal variables of interest. Under the first framework, if the deficit series is non-stationary, then it means that it is growing without bound over time, which means that subsequent debt will also grow without bound, rendering fiscal policy unsustainable. This will also violate the PVC and the No-Ponzi-Game (NPG) constraints. A stationary deficit means that the series is reverting to a certain mean over-time being in general close zero. If that were the case, then obviously fiscal policy and debt would be sustainable, since deficits will be under control. In the second framework, co-integration tests were used to explore whether there is a long-run relationship between government revenues and expenses. If such a relationship exists, this means that the respective government is not spending without bound and is taking into account the amount of revenues it is generating. Subsequently, it will not have to borrow to cover its expenses and debt would be sustainable and will not grow without bound.

Empirical studies on developed economies are numerous and were initiated by the paper of Hamilton and Flavin (1986). Using yearly data for the USA, covering the period 1962–1984, they tested the validity of the PVC, or equivalently the NPG condition, or the budget constraint. In their study, if the government deficit and debt series are stationary then debt is sustainable, which was the case for the US sample used. Also using yearly data for the US economy over a larger sample, covering the periods 1890–1983 and 1960–1984, Trehan and Walsh (1988, 1991) looked at the stationarity of the public deficits and debt and concluded that since they were stationary for both sample periods, then debt is sustainable. Running the same empirical tests, Kremers (1988) used a different sample period—1920–1985—and found debt to be sustainable until 1981.

Within the same framework other researchers conducted stationarity tests on other countries to see whether debt is sustainable. For example, Smith and Zin (1991) used Canadian monthly data for the period 1946–1984 and looked at the stationarity of the public debt and deficits and found that debt was not sustainable. For India, using the same tests and the sample period 1970–1988 but with yearly data, Buiter and Patel (1992) found that public debt in India was not sustainable. Using monthly data for Italy and the period 1979–1991, Baglioni and Cherubini (1993) found that debt is not sustainable. Caporal (1995), using annual data on some EU countries over the period 1960–1991 found that the Italian, Greek, Danish and German debts were not sustainable.
Makrydakis (1999), using annual data for Greece over the period 1958–1995, also found that debt is not sustainable.

Other empirical studies have used co-integration techniques to test whether debt is sustainable. These co-integration techniques were used to test whether a long-run relationship exits between government revenues and expenditures. If such a relationship exits, then one can conclude that debt is sustainable. Using annual data covering the period 1953–1987, Elliot and Kennedy (1988) found that the Australian debt is sustainable. For the USA, Tanner and Liu (1993) and Haug (1995) found that the US debt is sustainable. Using Quarterly US Data for the period 1947–1992, Quintos (1995) found that US debt was sustainable until 1980. Using EU data from 1692–1992, Ahmed and Rogers (1995) found that debt is sustainable. Payne (1997) used annual data for some G7 countries and found that debt is sustainable for Germany. Crowder (1997) used Quarterly US data and found debt to be sustainable until 1982. Athanasios and Sidiropoulos (1999) also used EU data over the period 1961–1994 and found debt to be unsustainable for Spain, Belgium, Greek, Italy and Portugal.

The empirical literature focusing on developed economies has ignored, for example, the issue of money printing to finance fiscal deficits. Seigniorage has been used in many emerging economies to finance budget deficits, but its use varies from one country to another. Fiscal variables in some LDCs may exhibit structural breaks due to specific fiscal regime. One framework used to circumvent this shortcoming may be through the introduction of a level-shift dummy variable to the co-integration relationship involving tax revenues and government expenditures (see Hakkio and Rush, 1991; Tanner and Liu, 1994).

While in developed economies the issue is whether the fiscal regime has shifted from sustainable to unsustainable in recent years, in LDCs various emerging governments have been trying to move from unsustainable fiscal deficits to a situation where the debt is sustainable. Researchers often study whether the regime shifts reflect fundamental changes in the conduct of fiscal policy, or is the change in the time series properties of the data reflecting a change in the short-run dynamics of the fiscal variables and not due to a structural shift in the fiscal regime. It might be wise to focus on more recent fiscal conducts in the case of structural breaks and not study the whole sample period. Yet, Ahmed and Rogers (1995), in their analysis of whether fiscal policy is sustainable, studied the period 1692–1992 which included important data breaks, including World Wars I and II; they concluded that the US fiscal policy is sustainable. The use of a long time series for the USA made it possible to deal with the problem of data breaks. However, in most LDCs the unavailability of large data sets might surface and amplify the problem of structural breaks.

3.2. Theoretical framework

Insolvency of a given economy means that debt is unsustainable, i.e. that the respective government cannot pay back its debt. It also means that the present value of the sum of future revenues minus expenditures is larger than the initial level of indebtedness. In this context, empirical tests on the PVC should
not be interpreted as a test of government insolvency, but rather as tests of whether its conduct of fiscal policy is unsustainable. That is, could the past dynamic behavior of government revenues, expenditures and budget deficits, as captured by their time series properties, be continued indefinitely without leading to an insolvency situation where the government can no longer service its debt and subsequently default on it. Meeting the PVC is often seen as a ‘no-violation’ of the NPG constraint. Thus, the government cannot go on borrowing and spending without bound.

Empirical studies dealing with these issues start with the financing constraint of the public sector. This constraint relates the primary deficit plus nominal debt servicing to changes in outstanding debt. Specifically, the following dynamic equation relates the stock of debt in period \( t \), \( B_t \), to last period’s debt \( B_{t-1} \) plus debt service \( rB_{t-1} \), and the primary surplus \( Z_t \). \( Z \) will be negative when it represents a deficit and will constitute an addition to the stock of debt; it will be positive when it represents a surplus

\[
B_t = (1 + r)B_{t-1} - Z_t. \tag{1}
\]

\( B_t \) is the outstanding debt at the end of period \( t \), and \( r \) equals the \( ex \ post \) return on government debt during period \( t \). Given the time paths for \( r \), and \( Z_t \), the government financing constraint in equation (1) describes the time path of the stock of debt, i.e. the dynamics of debt accumulation or decumulation. Iterating equation (1) forward \( n \) periods and summing up, one gets

\[
B_{t-1} = \sum_{j=0}^{n} \frac{T_{t+j}}{(1 + r)^{j+1}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1 + r)^{j+1}} + \frac{B_{n+1}}{(1 + r)^{n+1}}, \tag{2}
\]

where \( G \) is defined to exclude interest payments. Seigniorage revenues are some time used in LDCs to finance budget deficits and, in poorer LDCs, grants and concessional lending might also constitute a source for the financing of budget deficits. Equation (2) can, thus, be modified to account for seigniorage revenues

\[
B_{t-1} \sum_{j=0}^{n} \frac{T_{t+j}}{(1 + r)^{j+1}} + \sum_{j=0}^{n} \frac{\Delta m_{t+j}}{P_{t+j}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1 + r)^{j+1}} + \frac{B_{n+1}}{(1 + r)^{n+1}}, \tag{3}
\]

where \( \Delta m_t \) is the change in the nominal stock of high powered money and \( P_t \) is the consumer price index.

If the last term in equations (2) or (3) approaches zero as the number of periods increases, then the No-Ponzi-Game constraint will be satisfied, i.e.

\[
\lim_{n \to \infty} \frac{B_{n+1}}{(1 + r)^{n+1}} = 0. \tag{4}
\]

The NPG constraint in equation (4), also known in the literature as the transversality condition, is stating that the present value of the government’s debt in the indefinite future converges to zero. For this to occur, debt \( B \) in the numerator must grow more slowly than the rate of interest \( r \). The government cannot finance interest payments on debt by continuously...
issuing new debt. This will happen when equation (4) is not violated and equation (2) reduces to

\[ B_{t-1} = \sum_{j=0}^{\infty} \frac{T_{t+j}}{(1+r)^{j+1}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1+r)^{j+1}}, \]  

(5)

while equation (3) becomes

\[ B_{t-1} = \sum_{j=1}^{n} \frac{T_{t+j}}{(1+r)^{j+1}} + \sum_{j=0}^{\infty} \frac{\Delta m_{t+j}}{P_{t+j}} - \sum_{j=0}^{n} \frac{G_{t+j}}{(1+r)^{j+1}}. \]  

(6)

Equivalently, empirically if the primary deficit and debt series are co-integrated, then again equation (4) will not be violated (see Haug 1991).

If we assume that public debt is growing over time at a constant rate \( \lambda \) to have \( B_{t+j} = (1+\lambda)B_{t+j-1}, \forall j \), one can rewrite equation (4) as follows

\[ \lim_{n \to \infty} \left( \frac{1+\lambda}{1+r} \right)^n B_0 = 0. \]  

(7)

For equation (7) to converge to zero, \( \lambda \) should be less than \( r \), i.e. the rate of growth of debt should be less than the real interest rate.

The literature relates the PVC to the accounting approach to assess fiscal sustainability by focusing on debt ratios to GDP. The accounting approach has, however, important impediments, due to the fact that all variables are taken in ratios to GDP. This approach will, therefore, not be considered in the present paper. Instead, the focus will shift to testing empirically the PVC constraint within the context of the Lebanese economy.

3.3. Econometric analysis and results

In this section, the fiscal data used are from the BDL, Quarterly and Yearly Bulletins, and from the Lebanese Ministry of Finance. Data are gathered on government revenues and expenditures, budget deficits and government total debt. Depending on data availability, government revenues and expenditures are tracked from 1960 to 2002. Data prior to 1990 are from BDL, while data after 1990 are from the Ministry of Finance. For macroeconomic data, the International Monetary Fund’s *International Financial Statistics* (various issues) are also used. The exchange and interest rates are tracked as early as 1960, while nominal GDP is since 1964 and the rate of inflation since 1965.

The econometric tests to be carried out rest on the two frameworks advanced in the literature—stationarity and co-integration tests. If the total budget deficit is stationary, i.e. integrated of order zero, I(0), then according to Trehan and Walsh (1988, 1991) this constitutes a sufficient condition to conclude that fiscal policy is sustainable. That is, the government deficit will not grow without bound, and the actual deficit will asymptotically converge to zero over time. The convergence to zero of the government deficit means that the PVC or the transversality condition in equation (4) is actually satisfied. In fact, an equivalent empirical test would be to test for the existence of unit roots in the government expenditures (inclusive of debt service: \( G_t + rB_{t-1} \)) and revenues series. If the two series do not contain a unit root,
then the budget deficit will be integrated of order zero and the transversality condition in equation (4) will be satisfied, pointing to the sustainability of fiscal policy. According to Hakio and Rush (1991), if the two series contain a unit root (i.e. are integrated of order 1) then one must search for a long-run equilibrium relationship between them. If such a relationship does not exist, debt would be unsustainable. However, if such a relationship exists with a co-integrating vector \((1, -b)\), where \(b = 1\), one obtains the condition of Trehan and Walsh according to which the total budget deficit is \(I(0)\) and debt would be sustainable. On the other hand, if \(0 < b < 1\), then the total budget deficit will be integrated of order \(I(1)\) and fiscal policy will be unsustainable. However, Quintos (1995) shows that the condition \(b = 1\) is only a sufficient, but not a necessary, condition for fiscal sustainability and that a sufficient and necessary condition is that \(0 < b < 1\). In this case when \(b = 1\), one will have a strong sustainability of fiscal policy and when \(0 < b < 1\), then fiscal policy will be weakly sustainable.

Thus, the non-stationarity of government total expenditures and revenues series is tested first. If the two series are stationary, i.e., \(I(0)\), then the total budget is also stationary and the transversality condition will be satisfied, pointing to the sustainability of fiscal policy.

Stationarity or non-stationarity of the individual fiscal series is established by applying both the Phillips–Perron (PP) and Augmented Dickey–Fuller (ADF) unit root tests. The following regressions are estimated

\[ \Delta X_t = \beta_1 + \beta_2 X_{t-1} + \sum_{i=1}^{k} \delta_i \Delta X_{t-i} + \varepsilon_i, \quad (8) \]

where \(\Delta\) is the first-difference operator; \((X_{i,t})\) represents respectively the following fiscal time series for Lebanon: \(G\) (government spending); \(R\) (government revenues), Total Deficit and Total Debt, as well as the ratio of these variables to GDP; \(\beta_i, \delta_i\) are constant parameters; and \(\varepsilon_i\) is a stationary stochastic process. The number of lags \((k)\) will be determined based on the Akaike Information Criterion (AIC).

To determine the order of integration of the series, model (8) is modified to include second differences on lagged first and \(k\) lags of second differences. That is,

\[ \Delta^2 X_t = \lambda_1 \Delta X_{t-1} + \sum_{i=1}^{k} \mu_i \Delta^2 X_{t-i} + \varepsilon_{1t}, \quad (9) \]

where, \(\Delta^2 X_t = \Delta X_t - \Delta X_{t-1}\), \(\lambda_1, \mu_i\) are constant parameters; and \(\varepsilon_{1t}\) is a stationary stochastic process. The \(k\) lagged difference terms are included so that the error terms \(\varepsilon_i\) and \(\varepsilon_{1t}\) in both equations are serially independent. Equations (8) and (9) are also estimated with a time trend. The unit root test results are reported in table 2. Based on the ADF and PP tests, the null hypothesis of non-stationarity \((H_0: \lambda_1 = \beta_2 = 0)\) of government spending \((G)\), government revenues \((R)\), and public debt and deficit could not be rejected. Specifically, the PP test on public debt indicates that it is non-stationary in the level and \(I(0)\) in its first difference at the 5% level of significance. In addition,
Table 2. Unit root tests for stationarity.

<table>
<thead>
<tr>
<th></th>
<th>G</th>
<th>G/GDP</th>
<th>R</th>
<th>R/GDP</th>
<th>Deficit</th>
<th>Deficit/GDP</th>
<th>Debt</th>
<th>Debt/GDP</th>
<th>Mackinnon’s Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Constant and time trend</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP(1)</td>
<td>-0.82</td>
<td>-2.60</td>
<td>0.50</td>
<td>-2.22</td>
<td>-2.36</td>
<td>-2.29</td>
<td>0.44</td>
<td>-1.72</td>
<td>-3.53</td>
</tr>
<tr>
<td>PP FD(1)</td>
<td>-6.61**</td>
<td>-5.39**</td>
<td>-4.90**</td>
<td>-6.25**</td>
<td>-7.68**</td>
<td>-6.34**</td>
<td>-3.8*</td>
<td>-4.88**</td>
<td>-3.52</td>
</tr>
<tr>
<td>Constants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP(1)</td>
<td>0.96</td>
<td>-1.95</td>
<td>2.37</td>
<td>-2.13</td>
<td>-0.72</td>
<td>-2.07</td>
<td>3.48*</td>
<td>-0.74</td>
<td>-2.93</td>
</tr>
<tr>
<td>Constant and time trend</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF(1)</td>
<td>-0.79</td>
<td>-2.85</td>
<td>0.38</td>
<td>-2.10</td>
<td>-2.05</td>
<td>-2.16</td>
<td>0.27</td>
<td>-1.71</td>
<td>-3.52</td>
</tr>
<tr>
<td>ADF FD(1)</td>
<td>-3.56*</td>
<td>-4.64**</td>
<td>-3.57*</td>
<td>-4.73**</td>
<td>-6.10**</td>
<td>-5.07**</td>
<td>-2.32</td>
<td>-3.55*</td>
<td>-3.52</td>
</tr>
<tr>
<td>Constants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF(1)</td>
<td>0.90</td>
<td>-2.09</td>
<td>1.94</td>
<td>-2.01</td>
<td>-0.50</td>
<td>-2.00</td>
<td>1.72</td>
<td>-1.08</td>
<td>-2.94</td>
</tr>
<tr>
<td>ADF FD(1)</td>
<td>-3.27*</td>
<td>-4.71**</td>
<td>-2.70</td>
<td>-4.71**</td>
<td>-5.87**</td>
<td>-5.08**</td>
<td>-1.27</td>
<td>-3.61**</td>
<td>-2.93</td>
</tr>
</tbody>
</table>

PP is the Phillips–Perron test; FD is the first difference; ADF is the Augmented Dickey–Fuller. The numbers in parentheses are the proper lag lengths based on the Akaike Information Criterion (AIC).

*Rejection of the null hypothesis of non-stationarity at the 5% level of significance; **stronger rejection at the 1% level.

For most variables the time trend variable is statistically insignificant. Based on ADF test, R is I(2) and the ADF test statistic is -6.77 without a time trend. Based on ADF test, Debt is I(2), where the ADF test statistic is -4.97 with a time trend and -5.09 without a time trend.
the ADF test\textsuperscript{10} is pointing towards stronger non-stationarity, indicating that the debt series is I(2). When one considers the series as ratios to GDP, the earlier results of non-stationarity are also confirmed, indicating that all the new series are non-stationary. Moreover, unit root tests on the budget deficit indicate that it is non-stationary, i.e. integrated of order zero, I(1), whether in level or as ratio to GDP Then, according to Trehan and Walsh (1988, 1991), this constitutes a sufficient condition to conclude that fiscal policy is unsustainable. That is, the government deficit will grow without bound and the actual deficit will not asymptotically converge to zero over time. The non-convergence to zero of the government deficit means that the PVC or the transversality condition in equation (4) is actually violated. Equivalently, table 2 also tests for the existence of unit roots in the government expenditure (inclusive of debt service: $G_t + r_t B_{t-1}$) and revenues series. It is also clear that the two series contain a unit root, which means again that the transversality condition in equation (4) will not be satisfied, reconfirming the earlier finding that fiscal policy in Lebanon is not sustainable. Thus, one can safely conclude that based on these unit root tests, the conduct of fiscal policy in Lebanon is unsustainable.

According to Hakio and Rush (1991), if the government expenditure and revenue series contain a unit root (i.e. are integrated of order 1) then one must search for a long-run equilibrium relationship between them. The Johansen (1991, 1995) efficient maximum likelihood test is next used to test for the existence of a long-run relationship between government revenue and expenditure. If such a relationship exists than one can conclude that fiscal policy in Lebanon is sustainable. More specifically, consider a vector auto-regression (VAR) of order $z$

$$X_t = A_1 X_{t-1} + \ldots + A_z X_{t-z} + \varepsilon_t,$$

(10)

where $X_t$ is our $y$-vector of the non-stationary I(1) government revenue and spending series and $\varepsilon_t$ is a vector of innovations. One can rewrite the VAR as

$$\Delta X_t = \theta X_{t-1} + \sum_{i=1}^{z-1} \lambda_i \Delta X_{t-i} + \varepsilon_t,$$

(11)

where, $\theta = \sum_{i=1}^y A_i - I_y$, and $\lambda_i = - \sum_{j=i+1}^y A_j$.

Granger’s representation theorem asserts that if the coefficient matrix $\theta$ has reduced rank $r < y$, then there exist $y \times r$ matrices $\omega$ and $\Omega$ each with rank $r$, such that $\theta = \omega \Omega'$ and $\Omega' X_t$ is stationary. $r$ is the number of co-integrating relations (the co-integrating rank) and each column of $\Omega$ is the co-integrating vector. The elements of $\omega$ are known as the adjustment parameters in the vector error correction model. Johansen’s method is to estimate the $\theta$ matrix in an unrestricted form, then test whether the restrictions implied by the reduced rank of $\theta$ can be rejected.

Tables 3 and 4 indicate no co-integrating vector at both levels of significance between government spending and revenues, and the null hypothesis of no co-integration cannot be rejected. Thus, according to these co-integration tests, fiscal policy in Lebanon appears to be on an unsustainable path, since
government spending and revenues are drifting too far apart and do not seem to converge to a long-run equilibrium relationship. The factor behind this is the servicing of a huge debt, which is making government expenditure exceed by far government revenue. This result is also confirmed when using the series as ratios to GDP. Tables 5 and 6 re-confirm the empirical results obtained above, indicating again no long-run relationship between the series as ratios to GDP.

Table 3. Co-integration tests between government revenue and expenditure as ratios to GDP.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Critical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>Alternative</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 0$</td>
<td>$r \geq 1$</td>
</tr>
<tr>
<td>$r \leq 1$</td>
<td>$r = 2$</td>
</tr>
</tbody>
</table>

Note that the Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix; the test allows for a linear deterministic trend in the data and no constant; $r$ represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes a linear deterministic trend in the data and no constant.

**significance at the 1% and *5% level.

Table 4. Co-integration tests between government revenue and expenditure.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Critical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>Alternative</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 0$</td>
<td>$r \geq 1$</td>
</tr>
<tr>
<td>$r \leq 1$</td>
<td>$r = 2$</td>
</tr>
</tbody>
</table>

Note that the Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix; the test does not allow for a linear deterministic trend in the data, but with a constant; $r$ represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes no linear deterministic trend in the data, but with a constant.

**significance at the 1% and *5% level.

Table 5. Co-integration tests between government revenue and expenditure as ratios to GDP.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Critical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>Alternative</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 0$</td>
<td>$r \geq 1$</td>
</tr>
<tr>
<td>$r \leq 1$</td>
<td>$r = 2$</td>
</tr>
</tbody>
</table>

Note that the Johansen co-integration likelihood ratio test is based on the trace of the stochastic matrix; the test allows for a restricted linear deterministic trend in the data, and no constant, normalized to government revenues; $r$ represents the number of co-integrating vectors, maximum lag 1 year in VAR; the asymptotic critical values are from Osterwald-Lenum (1992); the test assumes a restricted linear deterministic trend in the data, and no constant.

**significance at the 1% and *5% level.
4. Conclusion and policy recommendations

This paper has closely evaluated the fiscal developments in Lebanon since the end of the civil war in 1990. After highlighting the major monetary and fiscal developments, the paper used the PVC framework to study the issue of debt sustainability in Lebanon. The Lebanese debt to GDP ratio is among the highest in the Middle East region and has been growing fast in the last five years. The empirical section of the paper has tested the transversality condition by studying the time series properties of the fiscal variables. Unit root and co-integration tests on the PVC of the Lebanese government have shown that the current Lebanese fiscal policy is unsustainable.

Due to the current political situation it appears that the Lebanese government is not able or unwilling to undertake the necessary fiscal adjustment measures to address the rapidly deteriorating fiscal situation. The proceeds from the privatization of public enterprises have not yet materialized and the improvement in the primary balance did not result in a sustained debt service and debt stock reduction or economic growth.

Faced with an extremely difficult and unsustainable fiscal situation, Lebanon was provided through the Paris II conference a last resort before facing bankruptcy. Unless used in a timely manner, coupled with proceeds from privatization and an end to over-spending and government corruption, the proceeds of the Paris conference can cover at most one year’s worth of debt service. Less than a year after Paris II, Lebanese government officials started hoping for a Paris III Conference, at a time when none of the commitments to Paris II appear to have been fulfilled. The expected fiscal crisis could degenerate into a banking and currency crisis, since a major portion of the public debt is held by commercial banks. Some academics even believe that with the accumulation of a sizeable public debt, now standing at $US33 billion, the government is now targeting the savings of the Lebanese private sector, which are in the form of deposits with commercial banks, estimated at about $US40 billion. The crisis situation could prove to be similar to that in Argentina, where banks have refrained from paying private savings deposits.

In order to avert an imminent fiscal and exchange rate crisis, the Lebanese government will have to privatize in the next few months both the telecommunications and power sectors. It should also put an end to corruption and...
restructure the public sector. However, whether the government can deliver on its old promises in such a short period of time is highly unlikely, and all fiscal and monetary indicators are pointing to an imminent fiscal and exchange rate crisis.

Acknowledgments

Financial support from the University Research Board of the American University of Beirut is greatly acknowledged. The author is also grateful to the Editor of the Journal and an anonymous referee for very valuable comments and suggestions on an earlier draft.

Notes

1. Insolvency of a given economy means also that the present value of the sum of future income minus expenditure is larger than the initial level of indebtedness.
2. Physical assets ruin was estimated, by the United Nations, to be around SUS25 billion.
3. The 14 million wide Lebanese expatriate base contributed 20% of total capital inflows in 1998 (Lebanese Ministry of Finance, 1999).
4. Agenor and Montiel (1996, p. 123) argued that the government is solvent if the present value of the future resources available to it for debt service are at least equal to the face value of its initial debt stock. Thus, satisfying the present value budget constraint, implying that the government is solvent.
5. However, Wilcox (1989) found that debt was unsustainable over the 1960–1984 sample period.
6. Inflation has been contained in Lebanon since the early 1990s and the Lebanese government has rarely used seigniorage revenues to finance its budget deficit.
7. Equation (1) may be interpreted in nominal or real terms. However, the empirical literature on debt sustainability suggests that the use of macroeconomic variables in real terms may be more robust and empirical tests are more likely to be satisfied if one considers real debt (i.e. nominal debt divided by a price index such as the consumer price index). Hence, \( r_t \) and \( Z_t \) may be interpreted as the real interest rate and real primary surplus.
8. According to equation (1), if the government runs a primary surplus equal to zero (\( Z_t = 0 \)), the stock of debt will grow at a rate equal to the interest rate: \( \Delta B_t = rB_{t-1} \). If the government runs a primary deficit (\( Z_t < 0 \)), the stock of debt will grow at a rate exceeding the interest rate. If the government runs a primary surplus (\( Z_t > 0 \)), the stock of debt will grow more slowly than the interest rate. If the surplus more than offsets payments on existing debt (i.e. the conventional surplus, \( Z_t + rB_{t-1} \) is positive), then the debt will actually shrink over time.
9. While the PVC in levels or in ratios to GDP is unchanged, the conversion of fiscal variables from levels to ratios and implementing stationarity tests may constitute an important impediment. The series in levels may be integrated of order 1, I(1), when converted to ratios they may become stationary, or I(0) series. Equivalently, for co-integration-based tests, one requirement for two series to be co-integrated is that both be integrated of order 1, thus, using I(0) ratio series may lead to the conclusion that the series are not co-integrated when, in fact, they are.
10. It is now well known in the econometrics literature that the Dickey–Fuller type tests may have serious shortcomings in the presence of structural breaks in the data (see Perron, 1989, 1997). Perron shows that Dickey–Fuller tests may fail to reject the unit root hypothesis if the series present a break-in-the-trend. Since the data used in the above analysis span the periods 1960–2002, structural breaks may not be ruled out. The ADF tests are, therefore, supplemented with the PP unit root tests.
References
AUTHOR QUERIES
JOURNAL ID: RMEE-02_01_03

QUERY NUMBER

1. Caporal (1995) – this is spelt Caporale in the reference list?
2. Elliot and Kennedy (1988) – not in the reference list. Please supply full details or delete.
3. Tanner and Liu (1993) – this is 1994 in the reference list?
4. Ahmed and Rogers (1995) – this is spelt Ahmed and Roger in the reference list?
6. 'decumulation' – is this a real word? Doesn't appear in the OED?
7. Haug, 1991 – this is 1995 in the reference list?
9. 'y x r' please confirm that the 'x' is really a multiplication sign '×'.
11. Anand and Van Wijnbergen, 1989 – is this cited in the text? If not, please cite or delete.
12. Barnhill and Kopits, 2003 – is this cited in the text? If not, please cite or delete.
14. Jondeau, 1992 – is this cited in the text? If not, please cite or delete.
15. Wickens and Uctum, 1993 – is this cited in the text? If not, please cite or delete.
16. Table 1 source – The Ministry of Finance, 2002 – not in the reference list. Please supply full details or delete.
18. Table 3 footnotes. Repetition of '… the test allows for a linear deterministic trend in the data and no constant…' and '… the test assumes a linear deterministic trend in the data and no constant…'. OK?
19. Table 4 footnotes. Repetition of '… the test does not allow for a linear deterministic trend in the data, but with a constant…' and '… the test assumes no linear deterministic trend in the data, but with a constant…' OK?
20. Tables 5 and 6 footnotes – similar repetitions to Queries 18 and 19 respectively, OK?