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Is Tunisia's external debt sustainable? A cointegration-based analysis

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ABSTRACT: The contribution of borrowed capital could have dramatic consequences if the increase in foreign debt is not used to make profitable investments. Thus, monitoring the external debt of low-income countries and emerging economies is required. Monitoring tools based on different approaches in terms of empirical testing are therefore useful for studying the dynamics of debt and assessing its sustainability. We propose to study the dynamics of the Tunisian foreign debt during the period 1983-2010. Two theoretical approaches for assessing debt sustainability are used as they best suit the empirical quality of our study. The results obtained reveal a contrasted situation. We propose to apply two assessment approaches to the sustainability of Tunisia's external debt. Surprisingly, while the so-called accounting approach suggests that debt is not sustainable, the two versions of the actuarial approach confirm the opposite. We assume that Tunisia's foreign debt remains sustainable.

KEYWORDS: foreign debt, debt sustainability, budget deficit.

JEL Classification: H63, G18

Introduction

As regards recourse to foreign capital, we assume that there are two alternatives: either accepting or refusing external financing.

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- The first is the result of the widespread belief that foreign capital is essential for financing investments. In turn, investments are necessary for economic growth and cannot be funded by national savings only. It is therefore optimal for a country to borrow if it can carry out profitable investment projects ensuring the inter-temporal solvency of the country, and thus to repay the debt later on (Artus, 1993).

- The second is based on a national economy's deliberate choice to focus on the current account balance (Bayoumi, 1990). This can also be due to the impossibility to resort to external financing, thus forcing economic agents to rely solely on their internal funding sources.

Krugman (1988) and Cohen (1986) gave birth to the theory of debt overhang. This theory states that upon reaching a certain level, foreign debt discourages consumption and investment, thus curbing economic growth. The slow growth pattern causes debt to rise further, hence the focus will be on its sustainability.

Two categories are used to test the sustainability of external debt. The first category develops an analysis based on an accounting approach that involves a step-by-step simulation. A second category of time-series studies examines the respect of the rule of sustainability based on different econometric tests of stationarity, cointegration and a qualified actuarial approach.

The rest of this paper is organised as follows: Section 2 sheds light on the Tunisian economic background. Section 3 is devoted to the relevant theoretical considerations. Section 4 contains empirical approaches to sustainability and empirical results. The last section provides the concluding remarks.

An overview of the Tunisian economy

After decades of heavy state management and intervention in the economy, Tunisia is undergoing a process of economic reform and liberalisation. Prudent economic and fiscal planning has resulted in moderate but sustained growth for over a decade. Historically, Tunisia's economic growth has depended on oil, phosphates, agrifood products, car parts manufacturing, and tourism. In the World Economic Forum 2008/2009 Global Competitiveness Report, the country ranked No. 1 in Africa and No. 36 worldwide for economic competitiveness, well ahead of Portugal (43), Italy (49) and Greece (67).

Suffering from foreign debt and foreign exchange crises in the mid-1980s, the government launched a structural adjustment programme in 1986 to liberalise prices, reduce tariffs, and reorient Tunisia towards a market economy.

Tunisia's economic reform programme has been lauded as a model by international financial institutions. The government has liberalised prices, reduced tariffs, and

lowered debt-service-to-exports and debt-to-GDP ratios. It also extended the average maturity of its $10 billion foreign debt. Structural adjustment brought additional loans from the World Bank and other Western creditors. In 1990, Tunisia acceded to the General Agreement on Tariffs and Trade (GATT) and became a member of the World Trade Organisation (WTO). In 1998, Tunisia signed a free trade zone agreement with the European Union.

Current GDP per capita soared by more than 380% in the seventies (1970–1980: USD 280–1,369). However, this trend proved unsustainable and collapsed to a cumulative 10% rise in the turbulent eighties (1980–1990: USD 1,369–1,507), rising again to almost 50% cumulative growth in the nineties (1990–2000: USD 1,507–2,245), signifying the impact of successful diversification.

A progressive social policy combined with free market principles have sparked a rise in the standard of living. Real growth, which averaged 5% for much of the 2000s, declined to 4.4% in 2008 and 0.7% in 2009 due to the global recession and weakening demand in Europe.

Tunisia's population stood at 10.544 million in 2010 and is expected to grow to 11.108 million by 2015. In 2010, Tunisia's unemployment rate was 13.2%; however, it is expected to decline to 12.9% by 2015. 10.8% of the labour force is employed in agriculture, 28.3% in industry and 61% in services.

Theoretical approach to debt

Recourse to external borrowing to finance the development of low-income countries has been justified by various scientific studies that have dealt with the theoretical aspects of this phenomenon. Most economists have demonstrated the need to use external resources to boost the economies of developing countries (Cohen, 1985; Artus, 1998; and Bastidon, 2002).

The weight of the foreign debt is amplified by the coexistence of several endogenous and exogenous factors specific to these economies. The low level of savings, embryonic financial markets, a negative current account position, trade deterioration and the burden of foreign debt are all factors aggravating the debts of low-income countries.

Studies that have dealt with the issue of foreign debt are based essentially on the traditional theoretical frameworks. Classical economists base their analyses on the fact that debt is synonymous with future taxes and attributes a negative connotation to the country. In his study, Ricardo claims that the behaviour of economic actors is guided by an anticipation of future rising taxes. A policy of budgetary deficits financed by borrowing has no effect on economic activity since agents save an amount equivalent to the debt when they expect future higher taxes to reimburse

the loans (Barro, 1989). Any increase in indebtedness and debt service, insofar as it constitutes a tax on future production, discourages investment due to crowding (Sachs, 1989).

In contrast, for Keynesians, a budget deficit allows demand to be stimulated, promoting the development of real capacity for repayment and thereby contributing to the reduction of foreign debt.

Sustainability, solvency and liquidity

Debt is considered sustainable if it does not lead to an "excessive" accumulation of its stocks, i.e. to a level that could not be covered by future budgetary surpluses without major changes. It requires the debt ratio (i.e. the outstanding or net present value of future cash flows) relative to gross domestic product, export earnings or domestic revenue to remain at an acceptable level.

Accordingly, the financing of this debt excludes recourse to a "Ponzi scheme"[27] wherein the government would resort to new debt to make interest and principal payments at term.

The notion of solvency means that a country's debt must eventually be wiped out. On a practical level, it is important for the indebted country to continue to receive external funding and thus it must regularly pay interest on its outstanding debt. Hence solvency determines the ability of a government to service its debt in a timely fashion without further borrowing and accentuating the debt burden (Raffinot, 1998).

Liquidity is a short-term notion. A "debt crisis" refers to two situations: 1) situation of *illiquidity*, when the debtor is experiencing temporary difficulties yet can pay its debt in the future if given enough time; and conversely, 2) *insolvency*, when reimbursement is not possible in the present or in the future (Raffinot, 1993).

Within the framework of their access to global credit markets, a liquidity analysis is useful for developing countries.

[27] The term "Ponzi scheme" originates with Charles Ponzi, a Boston conman from the early 20th century. He proposed investments with a promised return of 40% in just 90 days. This case was based on a pyramid scheme: the investment of new entrants was used to pay former investors.

Empirical approaches to sustainability and choice of analytical methods

We propose to examine the models commonly used to test the sustainability of foreign debt. We have chosen studies that are best suited to empirical analysis. Thus, we focus on two types of studies to test the sustainability of foreign debt. The first develops a qualified accounting analysis that consists of step-by-step simulations. Based on time-series, the second category examines whether the sustainability rule is respected through various econometric tests of stationarity (the Feve and Henin approach, 1998) and a cointegration or actuarial approach (the Leachman and Francis approach, 2001).

The statistical data used are related to those published by the National Institute of Statistics (or INS). They cover the period from 1983 to 2010. The data related to the government budget are extracted from the publications of the Ministry of Finance.

The interest rate on debt is a weighted rate, representing the interest due to the reported amount of refunds for the period.

The accounting method

This approach uses the inter-temporal external constraint to examine external deficit sustainability apprehended by the current account or trade balance of a country. This approach is based on the hypothesis that a government cannot borrow indefinitely on international capital markets to finance a trade balance deficit.

Consider the following process of a country's debt accumulation, noted B_t:

$$B_{t+1} = (1 + r_t)B_t - NX_{t+1} \qquad \text{or} \qquad B_{t+1} = (1 + r_t)B_t + D_{t+1} \quad (1)$$

where:

NX_{t+1}: the trade balance or net export revenues

r_t: the nominal interest rate

B_t: debt at the beginning of the period

D_t: the primary fiscal deficit excluding interest or net external deficit

If the current account shows a negative balance NX_{t+1}, then the country's debt during the period increases by the (positive) amount, while a surplus will decrease

it. For a given process, NX_{t+1} and a nominal interest rate r_t, the relation (1) implies a cumulative dynamic and unstable debt (a snowball effect).[28]

When nx^{g}_{t+1} is the excess external net required (sustainable), which represents the trade surplus consistent with a stable debt ratio over time.

When dividing the equation (1) by Y_{t+1}, which presents GDP, we obtain:

$$\frac{B_{t+1}}{Y_{t+1}} = \frac{(1+r_t)B_t}{Y_{t+1}} - \frac{NX_{t+1}}{Y_{t+1}} \quad (2)$$

Therefore:

$$b_{t+1} = (1+r_t)\frac{B_t}{Y_{t+1}} - nx_{t+1} \quad (3)$$

This relationship can be rewritten taking into account the GDP growth rate n_t as:

$$b_{t+1} = \frac{(1+r_t)}{(1+n_t)} b_t - nx_{t+1} \quad (4)$$

Based on the accounting approach, the condition of foreign debt sustainability requires an assumption of debt ratio stability, i.e. $b_{t+1} = b_t$. We thus obtain:

$$nx^{g}_{t+1} = \frac{(r_t - n_t)}{(1+n_t)} b_{t+1} \quad \text{Or} \quad d^{g}_{t+1} = \frac{(n_t - r_t)}{(1+n_t)} b_{t+1} \quad (5)$$

where:

nx^{g}_{t+1} is the (sustainable) required external net surplus that represents the trade surplus consistent with a stable ratio of debt over time.

[28] The snowball effect is an evolving circle accumulating new facts already present yet in a growing pattern, such as a geometric series or even an exponential function. This term comes from the example of a snowball rolling down a snow-covered slope, hence we imagine that the ball will grow larger and larger, faster and faster.

The difference between the external deficit and the required net effective deficit represents a gap. This gap, if positive, indicates sustainability of external imbalances, whereas if it is negative, it indicates that the deficit is unsustainable.

We have applied the accounting method to the series published by the INS and the same data corrected for the effects of exchange rates.

In order to avoid an exchange rate effect on the statistical data used, we adjusted the foreign currency data relative to foreign transactions.

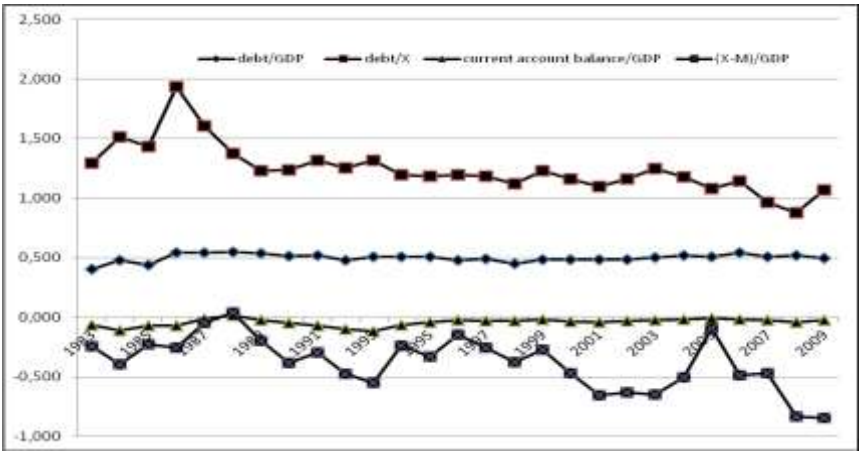
To simplify, let's assume a loan contract (in foreign currency) signed in year t for an amount m in one period. In terms of national currency, this amount corresponds to the sum of m × TC where TC denotes the value of the exchange rate. At the beginning of the period t +1 in local currency, the debt is equal to the depreciation A = m × TC, payable interest rises to r × m × TC. However, if the national currency depreciated and TC reached a certain value TC '> TC, the depreciation recorded and accounted for becomes m × TC'> m × TC. To strip out the variation in the exchange rate, its effect will be neutralised by a correction factor, while respecting employment resources.

Also, we have calculated the required surplus (deficit), while taking into consideration the trade ratio surplus and current account (see Appendices). For all four cases, the sustainability hypothesis has been verified for only one year, 1988. The study of the foreign debt sustainability in Tunisia based on the accounting method results in non-sustainability. In the long term, the Tunisian economy will not be able to accumulate the wealth needed to absorb its foreign debt.

The accounting method analysis is based on a static method that does not take into account the cumulative effects of debt dynamics. The long term is perceived as a juxtaposition of short periods. The assessment of debt sustainability is relevant when present and future explicative trends of debt variables are considered.

The observation of Tunisia's foreign debt data (Figure 1) shows a stable rate of debt, around 50% of GDP over the entire period of study. The same also holds true for current account balance as a percent of GDP. While this rate is not positive, it remains close to zero. Maintaining these ratios at a stable level suggests debt sustainability.

Figure 1: Trend in the main indicators of debt sustainability



The actuarial method

This method is based on the assumption that the government, as an economic agent, is subject to an inter-temporal budget constraint.

Putting forward the external conditions: $CA_t = NX_t - rB_{t-1}$ (6)

where:

B_t: the process of external debt accumulation

r: the nominal interest rate on foreign debt assumed constant for convenience

NX_t: the trade balance or net revenues of goods exportation and services

CA_t: the current account balance.

We can write: $B_t = B_{t-1} - CA_t$ (7)

The underlying assumption implies that the current account deficit generates a future debt, which increases because of the imbalance in the current account.

The dynamic of external debt is then written, taking into account the foregoing, as follows:

$$B_t = B_{t-1} - CA_t = (1+r)B_{t-1} - NX_t \quad (8)$$

Reasoning the initial date (t = 0) and with the necessary updates, we obtain:

$$B_0 = \frac{B_N}{(1+r)^N} - \sum_{t=0}^{N} \frac{NX_t}{(1+r)^{t+1}}$$

Let's consider:

$$B_N = B_0(1+r)^N + \sum_{t=0}^{N} \frac{NX_t}{(1+r)^{t-N+1}} \quad (9)$$

The convergence condition of the debt process is written as:

$$\lim_{N\to\infty} \frac{B_N}{(1+r)^N} = 0 \quad (10)$$

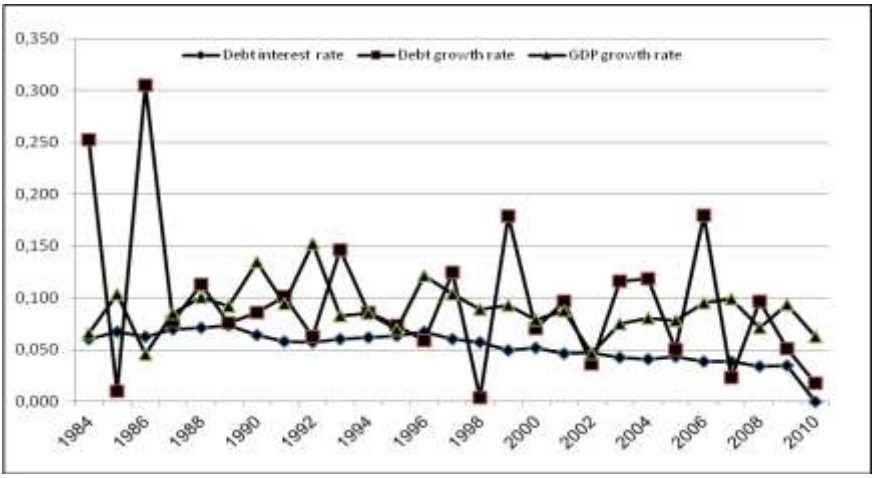
This actuarial transversality condition is behind two approaches that involve the use of unit root tests on the one hand, and cointegration on the other hand, to assess debt sustainability. The approaches of Feve and Henin (1998) as well as Leachman and Francis (2001) will be the framework for this evaluation.

1. The Feve and Henin approach (1998): From actuarial sustainability to effective sustainability

Assuming that the external debt is growing at a rate *g*, the condition of actuarial sustainability is only apparent in the long term, and debt must increase less rapidly than the interest rate ($g < r$). In practice, this condition may be insufficient when the interest rate exceeds the growth rate ($r > n$). In fact, if the debt, and therefore long-term interest expense, grows at a rate *g* such that $n < g < r$, then actuarial sustainability is satisfied, but the burden of debt is growing faster than total resources and will eventually exceed those resources. Hence we end up with a long-term dilemma. The debt is sustainable when it increases more slowly than the rate of interest and at the same time it seems unsustainable due to the excess of interest expense in relation to resources.

The examination of the Tunisian case reveals the following facts.

Figure 2: Trend in the debt interest rate, debt growth rate and GDP growth rate



Over the period studied, it is clear from the rate growth trend of the product (n), the interest rate (r) and the growth rate of debt (g) that for 14 out of 27 observations. The relationship $r < g < n$ is verified and in 13 cases, the relationship $r < n < g$ is confirmed. In all cases, r remains lower than g. This means that the sustainability condition is not verified. Furthermore, the comparative alternation between g and n gives further evidence that Tunisian debt is not sustainable.

To get out of this dilemma of incomplete sustainability, as in the case mentioned by Feve and Henin and $n < g < r$, when $n < r$ but $n < g$, the authors adopt the notion of *effective sustainability*. In the long term, when the debt ratio to the volume of resources tends to zero, debt service is assured.

In stochastic terms, this condition implies that the standard variable debt follows a stationary process, that is to say, it does not include trend or seasonality, and more generally no factor that changes over time. These characteristics (expectation, variance and covariance) are not modified over time. Debt sustainability must be based on unit root tests.

Testing in the Tunisian case gives the following results:

Table 1. Results of ADF tests

Variable	ADF value	Critical value; threshold accounting for 5%	Prob-critical	Integration degree
Debt / GNP	-3.91	-2.98	0.006	I(0)
Current balance / GNP	-3.68	-2.98	0.01	I(0)
Debts/Exports	-3.91	-3.58	0.02	I(1)
Current balance / Exports	-5.1	-3.61	0.002	I(0)

Based on the idea of Feve and Henin, the absence of a unit root for the explicative variables of the debt trend is sufficient to state that sustainability is accepted. Calculations for the Tunisian case (Table 1) show that the rate of debt and the current account balance relative to GDP are integrated of order zero. There is no unit root. Tunisia's foreign debt is sustainable. Despite the presence of a unit root for variable debt relative to exports, the Tunisian debt is considered sustainable because the rate of current account is integrated of order zero.

2. The Leachman and Francis approach

For Leachman and Francis (2001), unit root tests are not appropriate to analyse the sustainability of foreign debt. Debt can be sustainable even if the debt ratio has a unit root, i.e. it is not stationary. They propose integrating the inter-temporal dimension into the dynamics of debt accumulation.

The authors propose examining the existence of a long-run relationship between exports and imports, on the one hand, and between exports and foreign debt, on the other hand. Thus this means the study of cointegration between these variables taken two by two. These authors base their reasoning on the balance of payments, which they present as follows:

$$\left(X_t - M_t\right) - F_t^n + dB_t = 0$$

$X_t - Mt$: the trade balance, F_t^n: the net flow of foreign capital, dBt: the amount borrowed at date t (relative to GDP).

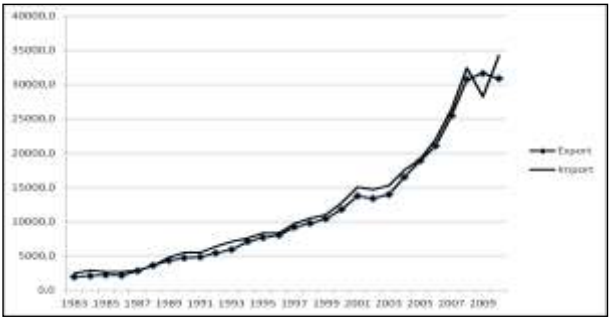
At date $t + 1$, the total cumulated debt $Bt + 1$ is equal to $Bt + (1 + r)\, dBt$. As the interest rate on the debt r is inferior to the debt growth rate g, the economy can import more than it exports, its debt will still be sustainable (it is the condition of actuarial effective sustainability).

3. Application of the approach Leachman and Francis to the sustainability of Tunisian foreign debt

The first step of their reasoning is to test the existence of a cointegrating vector between imports and exports, after identifying it as a process I (d).

The simple reading of Figure 3 reveals a clear correlation between the two foreign exchange variables. Tunisian exports and imports have similar long-term trends that seem to reflect the existence of an equilibrium relationship or cointegration between these series.

Figure 3. The trend in the value of exports and imports



Also, our empirical verifications of the possible presence of a cointegrating relation between imports and exports, on the one hand, and between exports and foreign debt, on the other, provide the following results.

Table 2. Results of ADF tests in second difference

Variable	ADF value	Critical value; threshold accounting for 5%	Prob-critical	Integration degree
Exports	-6.69	-1.95	0.00	I(2)
Imports	-4.89	-1.95	0.00	I(2)
Debts	-7.77	-1.95	0.00	I(2)

The three variables have the same order of integration, I(2). The existence of an integration vector can thus be verified. If the long-term equilibrium relationship exists, the sustainability of foreign debt would be verified.

The cointegrating relation reveals that the variables evolve together in the long run. The relation between exports and imports is written as a Least Ordinary Squares (LOS) regression: X = aMt + b (1) or M = aXt + b (2). Where X, M are the exports and imports, respectively, in year *t*. The Granger causality test informs us about the direction of the cointegrating relation that we will adopt, the relation (1) or the relation (2).

Variables showing strong trends feature strong correlations between one another without necessarily saying anything about causality. A model based on a cointegration test without a trend is less powerful than one with a trend. The results obtained are presented in Table 3.

Table 3. Causality tests between exports, imports and stationarity of the residuals

Granger causality test			
Hypothesis		**Critical probability**	
M does not cause X		**0.0182**	
X does not cause M		**0.0079**	
Static relationship between M and X:		M = 604.45 + 1.006 × X (1.9) (46.13)	
H_0: the residue of the cointegration relationship between M and X, which have a unit root			
Model	**Critical probability**	**Estimated value of the ADF statistic**	**MacKinnon critical value**
Without trend and constant term	**0.000**	-8.03	-1.95

The Tunisian trade pattern presents vertical specialisation features (importing – creation of value added – exporting). The cointegration test of these variables is intended to test trade pattern.

The estimated value of the ADF statistic (-8.40) is lower than the critical value (-1.95) at the 5% threshold, the hypothesis of residue stationarity is verified. The positive cointegration test on non-stationary variables should be completed by stationary residuals from a cointegrating relation.

The estimate of the static relationship provides significant coefficients at 5%, and unit root tests on the residue of this relationship point to the existence of a cointegration relationship between exports and imports. The estimation of the cointegrating relationship as it appears in E-views is:

X	M
1.000000	-0.892505
	(0.02034)

The values between parentheses are estimated standard deviations associated with the estimated coefficients. Here, we have normalised the coefficient of exports, i.e. we chose X (exports) as an endogenous variable. The coefficient of the cointegrating relationship is negative. There is a return to balance over time. The presence of this relationship may indicate the existence of permanent channels in the transmission of shocks between these variables. A rise of 89 monetary units is expressed in the long term by a positive impact on future exports of 100 monetary units. The coverage of actual imports by future exports is assured in the long term.

The second step consists of testing the existence of a cointegration relation between exports and foreign debt.

We use the same econometric verification approach as in the first step and apply it to the two variables foreign debt and exports.

Table 4. Causality tests between exports, debt and stationarity of the residues

Granger causality test			
Hypothesis		**Critical probability**	
X does not cause debt		**0.323**	
Debt does not cause X		**0.001**	
Static relationship between Debt and X:		X = -2300,406 + 1.097 × debt (-4.42) (31.51)	
H_0: the residue of the cointegration relationship between debt and X, which have a unit root			
Model	**Critical probability**	**Estimated value of the ADF statistic**	**MacKinnon critical value**
Without trend and with a constant	**0.023**	-2.29	-1.95

The estimated value of the ADF statistic (-2.29) is lower than the critical value (-1.95) at the 5% threshold, the hypothesis of stationarity of the residue is verified. The estimation of the static relationship provides significant coefficients at the 5% threshold, and unit root tests on the residue of this relationship conclude the existence of a cointegration relationship between debt and exports. The estimation of the cointegrating relationship as it appears in E-views is given by:

X	Debt
1.000000	-1.245291
	(0.04536)

The coefficient of debt is negative, indicating the existence of permanent channels of shock transmission between variables.

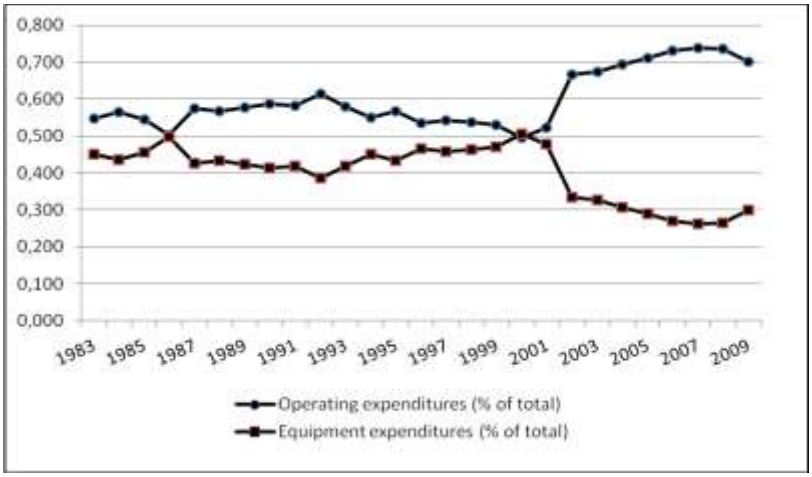
Definitely, the finding of cointegration relationships between exports and imports, and between exports and Tunisian debt reflects debt sustainability, according to the Leachman and Francis approach.

Conclusion

Recourse to foreign indebtedness is justified by two latent stylised facts of the Tunisian economy. The level of national saving is not sufficient to finance the investment required to achieve growth objectives during the next period.

It is worth noting that all methods of debt sustainability assessment take as a starting point the conditions of budgetary balance sought by the government, and which should be consistent with the constraints of repayment. In the case of the Tunisian economy, foreign debt would be sustainable if there is an adequate management of government accounts. Accordingly, in Figure 4, we represent the trend in the share of operating expenses and equipment in overall government expenditures.

Figure 4. Trend in operating expenses and equipment as a percentage of total budget expenditure



What is worth noticing here is the breaking point between the two major kinds of government expenditure beginning in 2001. The share of operating expenses in the government budget until 2000 trended down from 60% and 45%. From 2001, the reversal of the breakdown of government expenses as operating expenses suggests that debt is partly intended to be used permanently. A portion of the foreign debt will be used by the government to cover current expenses, such as salaries or administrative functions. Better debt management by the government is needed to avoid the risk of a debt burden that could rise in the medium term.

Foreign debt can be productive and compensate for the rationing of capital and savings in low-income or developing countries. The strategy proposed by this study has confirmed debt sustainability by joining debt dynamics and the current account balance. The results of the study have allowed us to conclude that the trend in foreign debt was not excessive in Tunisia in the period 1983-2010. Approaches to assessing debt sustainability are complementary; they are viewed as a necessary monitoring tool. Moreover, this optimistic conclusion should not hide the fact that foreign debt sustainability depends largely on how the debt is used. Priority must be given to modernising the state. Streamlining state intervention and modernising administrative structures should be the goal.

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Appendix

	Gap between net external deficit and deficit required net effective											
	Calculations on raw series						Calculations adjusted series					
Year	***CAB/ GDP**	**Overflow (deficit) required**	**Gap**	***TB/ GDP**	**Overflow (deficit) required**	**Gap**	**CAB/ GDP***	**Overflow (deficit) required**	**Gap**	**TB/GDP***	**Overflow (deficit) required**	**Gap**
1984	-0.111	0.000	-0.110	-0.118	0.000	-0.118	-0.136	0.000	-0.136	-0.136	0.000	-0.136
1985	-0.071	-0.002	-0.069	-0.062	-0.002	-0.060	-0.059	-0.002	-0.057	-0.059	-0.002	-0.057
1986	-0.073	0.000	-0.073	-0.067	0.000	-0.067	-0.054	0.000	-0.054	-0.054	0.000	-0.054
1987	-0.012	0.000	-0.012	-0.012	0.000	-0.012	-0.011	0.000	-0.011	-0.011	0.000	-0.011
1988	0.015	-0.001	0.015	**0.009**	-0.001	**0.010**	0.008	-0.001	0.009	**0.008**	-0.001	**0.009**
1989	-0.024	-0.001	-0.023	-0.040	-0.001	-0.039	-0.038	-0.001	-0.037	-0.038	-0.001	-0.037
1990	-0.047	-0.004	-0.042	-0.068	-0.003	-0.065	-0.063	-0.003	-0.060	-0.063	-0.003	-0.060
1991	-0.069	-0.003	-0.066	-0.048	-0.002	-0.046	-0.045	-0.002	-0.043	-0.045	-0.002	-0.043
1992	-0.098	-0.010	-0.088	-0.067	-0.006	-0.061	-0.064	-0.005	-0.058	-0.064	-0.005	-0.058
1993	-0.115	-0.001	-0.114	-0.072	-0.001	-0.071	-0.065	-0.001	-0.065	-0.065	-0.001	-0.065
1994	-0.063	-0.001	-0.062	-0.028	-0.001	-0.028	-0.028	-0.001	-0.027	-0.028	-0.001	-0.027
1995	-0.044	0.000	-0.043	-0.037	0.000	-0.037	-0.037	0.000	-0.037	-0.037	0.000	-0.037
1996	-0.025	-0.001	-0.023	-0.015	-0.001	-0.014	-0.015	-0.001	-0.014	-0.015	-0.001	-0.014

1997	-0.031	-0.001	-0.029	-0.023	-0.001	-0.022	-0.022	-0.001	-0.020	-0.022	-0.001	-0.020
1998	-0.033	-0.001	-0.033	-0.031	-0.001	-0.031	-0.031	-0.001	-0.030	-0.031	-0.001	-0.030
1999	-0.020	-0.002	-0.019	-0.021	-0.001	-0.019	-0.018	-0.001	-0.017	-0.018	-0.001	-0.017
2000	-0.039	-0.001	-0.038	-0.033	-0.001	-0.032	-0.032	-0.001	-0.031	-0.032	-0.001	-0.031
2001	-0.041	-0.001	-0.040	-0.043	-0.001	-0.041	-0.042	-0.001	-0.041	-0.042	-0.001	-0.041
2002	-0.033	0.000	-0.033	-0.039	0.000	-0.039	-0.039	0.000	-0.039	-0.039	0.000	-0.039
2003	-0.028	-0.001	-0.028	-0.038	-0.001	-0.037	-0.036	-0.001	-0.035	-0.036	-0.001	-0.035
2004	-0.018	0.000	-0.018	-0.027	0.000	-0.027	-0.026	0.000	-0.026	-0.026	0.000	-0.026
2005	-0.010	-0.001	-0.009	-0.005	-0.001	-0.004	-0.005	-0.001	-0.004	-0.005	-0.001	-0.004
2006	-0.020	-0.001	-0.018	-0.022	-0.001	-0.021	-0.018	-0.001	-0.017	-0.018	-0.001	-0.017
2007	-0.024	-0.002	-0.022	-0.020	-0.002	-0.018	-0.019	-0.002	-0.017	-0.019	-0.002	-0.017
2008	-0.041	-0.001	-0.040	-0.032	-0.001	-0.031	-0.029	-0.001	-0.028	-0.029	-0.001	-0.028
2009	-0.028	0.000	-0.028	-0.030	0.000	-0.030	-0.029	-0.003	-0.027	-0.029	-0.003	-0.027
2010	-0.050	0.000	-0.050	-0.056	0.000	-0.056	-0.054	0.000	-0.054	-0.054	0.000	-0.054

* CAB: current account balance; TB: trade balance

Tab3

Pairwise Granger Causality Tests
Sample: 1983 2010
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
M does not Granger Cause X	27	6.42137	0.0182
X does not Granger Cause M		8.39870	0.0079

Tab3

Dependent Variable: M
Method: Least Squares
Date: 10/23/13 Time: 17:59
Sample: 1983 2010
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	1.006154	0.021810	46.13270	0.0000
C	604.4566	317.7902	1.902062	0.0683

R-squared	0.987931	Mean dependent var	12104.13
Adjusted R-squared	0.987466	S.D. dependent var	9316.574
S.E. of regression	1043.020	Akaike info criterion	16.80638
Sum squared resid	28285142	Schwarz criterion	16.90153
Log likelihood	-233.2893	Hannan-Quinn criter.	16.83547
F-statistic	2128.226	Durbin-Watson stat	2.686186
Prob(F-statistic)	0.000000		

Tab3.Residual test

Null Hypothesis: RESID03 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.030722	0.0000
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID03)
Method: Least Squares
Sample (adjusted): 1984 2010
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID03(-1)	-1.605497	0.199919	-8.030722	0.0000
C	-90.56375	364.6225	-0.248377	0.8060
@TREND(1983)	2.907240	22.85519	0.127203	0.8998

R-squared	0.731340	Mean dependent var	100.4328
Adjusted R-squared	0.708952	S.D. dependent var	1706.379
S.E. of regression	920.5728	Akaike info criterion	16.59231
Sum squared resid	20338902	Schwarz criterion	16.73629
Log likelihood	-220.9962	Hannan-Quinn criter.	16.63512
F-statistic	32.66613	Durbin-Watson stat	1.943613
Prob(F-statistic)	0.000000		

Tab4

Dependent Variable: X
Method: Least Squares
Sample: 1983 2010
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBT	1.097088	0.034817	31.51056	0.0000
C	-2300.406	519.6292	-4.427014	0.0002

R-squared	0.974483	Mean dependent var	11429.33
Adjusted R-squared	0.973501	S.D. dependent var	9203.544
S.E. of regression	1498.194	Akaike info criterion	17.53066
Sum squared resid	58359191	Schwarz criterion	17.62581
Log likelihood	-243.4292	Hannan-Quinn criter.	17.55975
F-statistic	992.9152	Durbin-Watson stat	0.649888
Prob(F-statistic)	0.000000		