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THE SUSTAINABILITY OF FISCAL ADJUSTMENT PROCESS : A QUANTITATIVE APPROACH WITH AN APPLICATION TO TUNISIA

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ABSTRACT

This study is a contribution to the literature concerning the sustainability of fiscal deficits in emerging economies. A novelty in this article is an attempt to check the sustainability of fiscal adjustment process monitored by fiscal authorities. Running accounting model for the fiscal disequilibrium in Tunisia over the period 1976-2010 shows sustainable thresholds of fiscal deficits and helps to quantify the related required fiscal adjustment for each year. Using bivariate cointegration test and a dynamic Error Correction Model to check the short and long run relationships between primary deficits and sustainable thresholds, this study found evidence to authorities' ability and willingness to adjust: if the primary fiscal deficit has increased above its long-run ratio, the primary fiscal deficit will decrease in the following period to restore the long run equilibrium with a high significant speed to adjust. As a guide to possible future policy actions, the realized fiscal buffers until 2010 help to withstand "Arab Spring" Revolution crisis which started in 2011 and may provide additional support for actual expansionary fiscal policy and allow more room for manoeuvre to ensure political transition to democracy. Nowadays, Tunisia is faced with diminished policy space and after the forthcoming elections, authorities' ability and willingness to adjust could be the strong link in the upturn in public finance disequilibrium.

Contribution/ Originality

This study is one of very few studies which have investigated the sustainability of the fiscal adjustment considered as a process. Our innovative contribution is to provide a quantitative approach, aims at analysing how do adjustment mechanisms work in a developing country, and checks authorities' ability and willingness to adjust.

1. INTRODUCTION

The Danish, Irish and Swedish experiences, concerning fiscal contractions having some positive effects on the economic activity, caused a lot of interests for the relevance of the fiscal adjustment and the return to the fiscal balance. The recent fiscal crisis observed in countries such as Greece, Italy, Ireland, Portugal, and Spain, turned on the red light for emerging economies (De Mendonça and Marcelo, 2013). Meanwhile, many "Arab spring" countries are faced with diminished policy space, having eaten into their foreign exchange and fiscal buffers during 2011 (International Monetary Fund, 2012).

Fiscal balance is essential for increasing private investment and sustaining economic growth (Blanchard, 2010). In this context, fiscal sustainability is widely retained as the central element within the analysis of public finance that unbalances not only for the developed countries but also for the emergent and the developing ones. The instability of the dynamics of the public and external public debt - considering the relationship between deficits, debt, inflation, economic growth, exchange and interest rates - involves an abundant theoretical and empirical literature dealing with the question of the sustainability of the fiscal and current account deficits. However, the persistent fiscal deficits and the inability to achieve budgetary equilibrium or a budget surplus in some developing countries (DCs) let believe about the unsustainability of the adjustment effort process itself which involves an exploding gap between the observed fiscal deficit and the corresponding sustainable threshold. Our innovative contribution is to provide a specific (for Tunisia) quantitative approach to estimate the sustainable thresholds of fiscal deficits and to quantify the related fiscal adjustment. Using an Error correction model helps to check the dynamic short and long run relationships between the observed fiscal deficits and the related sustainable thresholds, to analyse the quality of government fiscal efforts and to respond to the two key issues in this study: How do the governments manage their budget disequilibrium and how do adjustment forces work?

Tunisia, one of the "Arab spring" countries with leading role, has, since 2011, implemented an expansionary fiscal policy to address social demand such as youth unemployment, poverty, onerous public service wage bill, soaring transfers and subsidies designed to control the oil prices and basic food. This study is a contribution to highlight if the past policies had generated fiscal buffers to sustain actual government expansionary spending policy and to allow more room for manoeuvre to ensure political transition. Indeed, this paper surveys the recent literature analysing sustainability of fiscal deficits and the usefulness adjustment policies in the DCs, which is outlined in Section 2. An analytical quantitative framework for assessing the thresholds of fiscal and the related required adjustment is developed in Section 3. Data and econometric methodology are outlined in section 4 where a cointegration tests and a dynamic Error Correction Model is estimated to analyse the short and long run relationships among primary fiscal deficits and sustainable thresholds. This study will help to draw lessons from the past to the future fiscal policies in Tunisia which is presented in section 5.

2. PREVIOUS RESEARCH

Sustainability analysis for the DCs will, in many cases, involve issues that are not particularly important in the industrialized countries context (Cuddington, 1996). Reliance on Seigniorage to finance deficits is often quantitatively much more important, although its use varies widely across DCs. The central bank, the domestic and the external fiscal deficits financing were at the forefront of public finance in the DCs and still occupy the central stage in the fiscal sustainability design. There are two strands of an extensive and well-documented literature on fiscal deficits sustainability: the Intertemporal Budget constraint (IBC) approach and the financeable fiscal deficit approach.

The solvency approach developed by Hamilton and Flavin (1986) and Wilcox (1989) states that the initial stock of debt must be offset by the present value of future fiscal surplus. When this present value budget constraint is satisfied, the fiscal policy is considered to be sustainable. In practice, the empirical literature has suggested two main approaches to assess sustainability: econometric test and sustainability indicators.

On the one hand, the results of econometric tests have been mixed because the tests are very sensitive to the quality and quantity of data used and the statistical procedures applied. Stationarity and cointegration tests have been implemented to check the sustainability of fiscal policies using the univariate properties of debt and fiscal deficits (Hamilton and Flavin (1986) and Wilcox (1989)) or long-run linear cointegration relationships between government revenues and expenditures (Trehan and Carl (1988; 1991). Structural breaks have been introduced exogenously (Hakkio *et al.* (1991)) or endogenously (Haug (1995), Quintos (1995)) in the econometric frameworks.

Recently, studies of new approach to sustainability have been explored which take into account the possibility of non-linear fiscal adjustments. Using a threshold autoregressive (TAR) Arghyrou and Luintel (2007) check the sustainability of fiscal deficit and show how economic policymakers will intervene when deficit reaches a certain endogenous threshold. Finally, multicointegration methodologies between public spending and revenues were used for testing the sustainability of fiscal practices (Leachman et al. (2005) , Kia (2008)).

On the other hand, the often voiced concern of policymakers and international organizations is to define reliable indicators of sustainability to assess the current fiscal policy stance and to monitor future required fiscal decisions. All these indicators are based on the stability of Debt-to-GDP Ratios as a benchmark and allow gauging fiscal sustainability in a simple way. The primary gap indicators (PGI), the tax gap indicators (TGI) and the expenditure gap indicators (EGI) developed by Buiter (1985; 1997) and Blanchard (1993) are usually used to measure the sustainability of the current fiscal policy stance.

Another strand of research developed by Van Wijnbergen and Anand (1988; 1989), Van Wijnbergen *et al.* (1988), Van Wijnbergen (1990), Van Wijnbergen *et al.* (1992), Buiter (1997) and Van Wijnbergen and Budina (2000), focuses on the concept of the "financeable deficit" which is considered as the authorized deficit by the economic fundamentals such as real interest rates, real

growth rates, public debt management, real exchange rate and the eventually seigniorage from money creation. This literature is called consistency approach because it focuses on medium run consistency given a variety of macroeconomic policy objectives. The fiscal inconsistency (fiscal adjustment) is quantified as the difference between the observed primary deficit and the financeable one, given the debt management target summarized by the constant debt to GDP ratio for both foreign and external debt. A key feature design of this approach is parsimonious data requirements and it is consistent with particular features of many major developing economies considered as credit-based economies.

During the last two decades, the successes and failures of fiscal adjustment efforts have given rise to a significant large empirical literature on what factors drive the persistence of fiscal adjustment. Using a sample of 25 emerging market countries during 1980-2001, Gupta *et al.* (2003) show that the probability of ending a fiscal adjustment is affected by the legacy of previous fiscal failures, the size of the deficit, the composition of spending, and the level of total revenues.

3. THE FRAMEWORK

Regarding the sustainability of fiscal deficits, the framework should start with the government flow budget constraint consistent with public finance practices in many DCs which can be stated as follows:

$$PD_t + i_t B_{t-1} + i_t^* E_t B_{t-1}^* = \Delta B_t + E_t \Delta B_t^* + \Delta CN_t^{cb} \tag{1}$$

where: PD_t is the primary (noninterest) fiscal deficit; B_{t-1} is the government debt at the end of period (t-1) and i_t is the one-period rate of interest payable on domestic government debt; B_{t-1}^* is the external public debt at the end of period t-1, i_t^* its one-period nominal interest rate on the external public debt and E_t is the nominal exchange rate defined as domestic currency value of one unit of foreign currency; Δ lag operator and ΔCN_t^{cb} is the Central Bank net credit to the government, then ΔB_t is the adjusted[1] internal flow debt.

The existence of financial flows between financial institutions and the government such as refundable and non-refundable monetary advances provided each year by the Tunisian Central Bank and the Tunisian Treasury Bills held by the domestic banks, leads to believe that there is an implicit monetary financing of budget deficits, while this statistic is not available in the official publications of the Central Bank and the Ministry of Finance.

To generate seigniorage in the flow budget constraint, the accounts of the government and the Central Bank must be consolidated as shown in the Appendix 1. The presence of the quasi-fiscal activities, such as refinancing and credit guarantees to promote commercial bank, lending to particular sectors or to particular activities, accomplished by the Central Bank will justify this consolidation procedure.

$$PD_t + i_t(B_{t-1} - RF_{t-1}) + i_t^*(B_{t-1}^* - NFA_{t-1}^*)E_t = \Delta(B_t - RF_t) + E_t \Delta(B_t^* - NFA_t^*) + \Delta M_{0t} \tag{2}$$

Equation (2) represents the consolidated public sector deficit identity: on the left-hand side, it lists interest payments on the net internal and external debt where RF_t is the bank refinancing with the central Bank and NFA denotes the net foreign assets; on the right-hand side, it indicates the different sources of financing increases in net internal and external debt, and in the base money.

Therefore, expressing all stocks and flows as proportions of GDP as shown in the Appendix 2, equation 2 gives:

$$pd_t + \frac{r_t - n_t}{1 + n_t}\left(b_{t-1} - rf_{t-1}\right) + \frac{\left(1 + r_t^*\right)\left(1 + \hat{e}_t\right) - \left(1 + n_t\right)}{1 + n_t}\left(b_{t-1}^* - nfa_{t-1}^*\right)$$
$$=$$
$$\Delta\left(b_t - rf_t\right) + \Delta\left(b_t^* - nfa_t^*\right) + s_t \tag{3}$$

$s_t \equiv \Delta M_{0t}/P_t Y_t$ states the seigniorage or the monetary financing of fiscal deficit as a fraction GDP, π_t is the inflation at t, n_t is the real growth rate, r_t is the domestic real interest rate; π_t^* is the foreign inflation rate, r_t^* is the foreign real interest rate; $\hat{e}_t$ is the percentage depreciation of the real exchange rate.

Following Buiter (1997), seigniorage can be decomposed into three elements:

$$s_t = \left(\frac{(1 + \pi_t)(1 + n_t) - 1}{(1 + \pi_t)(1 + n_t)}\right)m_{t-1} + \Delta m_t = \left(\frac{\pi_t}{(1 + \pi_t)(1 + n_t)} + \frac{n_t}{1 + n_t}\right)m_{t-1} + \Delta m_t \tag{4}$$

Where $m_t = M_{0t}/P_t Y_t$ is the hard money as a percentage of GDP.

– The inflation tax (it) is defined as:

$$it = \pi_t \frac{M_{t-1}}{P_t Y_t} = \frac{\pi_t}{(1 + \pi_t)(1 + n_t)} m_{t-1} \tag{5}$$

– The revenue (R_t) authorised by the growth rate or the growth-induced increase in base money is expressed as:

$$Rt = \frac{n_t}{1 + n_t} m_{t-1} \tag{6}$$

– The variation of the base money as a percentage of GDP (μ_t) or the variation of the inverse of monetary base income velocity is given by:

$$\mu = \Delta m_t \tag{7}$$

In the short-run, seigniorage can exceed the inflation tax to the extent that there is positive real growth or to the extent that the income velocity of the monetary base of falls. In the steady-state[2], seigniorage can be expressed as:

$$s = (n + \pi)m \tag{8}$$

A typical benchmark for analysing the sustainability of fiscal deficits and fiscal adjustment is that the adjusted debt-GDP ratios should be constant, which leads to:

$$pdsd_t = \frac{n_t - r_t}{1 + n_t}\left(b_{t-1} - rf_{t-1}\right) + \frac{\left(1 + n_t\right) - \left(1 + r_t^*\right)\left(1 + \hat{e}_t\right)}{1 + n_t}\left(b_{t-1}^* - nfa_{t-1}^*\right) + s_t \tag{9}$$

Where *pdst* is the primary fiscal deficit sustainable threshold at the end of period t.

Equation 9 shows that the primary deficit of the consolidated public sector, as a share of GDP, is constrained not to exceed the sum of financing sources authorized by the current economic conditions: revenue from seigniorage (equations (5), (6) and (7)) and the excess of domestic growth over the relevant real interest cost of adjusted domestic and foreign debt.

A backward-looking analysis allows us to determine sustainable thresholds of budget deficits that can maintain constant debt-GDP ratios. The Required Fiscal Adjustment can be quantified as the difference between observed primary fiscal deficit and the sustainable budget deficit threshold:

$$RFA_t = pd_t - pdst_t \tag{10}$$

4. DATA AND METHODOLOGY

4.1. Data

The study uses annual data over the period 1976-2010. The availability of data on the source constitutes the basis for choosing data set. Variety of data sources have been used to collect and to generate the required primary statistics such as the reports of Tunisian Central Bank, the ministry of finance the World Bank Development Indicators and International Financial Statistics.

Equation 4 breaks down fiscal seigniorage into three source components: inflation tax (equation 5), growth-induced revenue (equation 6) and changes in the inverse of base money income velocity (equation 7). The statistical measures of these variables show a strong stability between 0 and 1% of the inflation tax revenues and those authorized by the growth during the whole period. This result shows that authorities are relatively sceptical about the monetary financing of the budget deficit even in period of public finance crisis; picks of the budget deficit recorded in 1986 and 1991 corresponded to a relatively weak inflation tax, respectively 0.42% and 0.66%. Furthermore the inflation tax and the growth-induced revenues have no significant effect on the changes in seigniorage as shown by Figures n°1 and n°2. However, Figure n°3 shows a significant correlation (0.95) between the seigniorage and the variation of the central money as percentage of the GDP.

The money market reforms initiated in 1988 (creation of the Transferable Treasury bonds[3] (BTC), Certificate of Deposit and Commercial paper) and the Tunisian Stock Exchange reforms introduced in 1995 with tax cuts on corporations and a change in taxes on capital gains and dividends, seem to have a significant effect on seigniorage revenue (Figure n°3), particularly on the variation of the central money as a percentage of GDP. The evolution of seigniorage over the period 1995-2003 allows rapid alternation between positive and negative peaks, reflecting the monetary authorities' ability to keep under control the objective of price stability.

The evolution of budget deficit sustainable thresholds, as shown by the Figure n°4, allows to provide a clear idea about the global evolution of the economic activity and particularly that of the

public finance during the period 1976-2010. In the first period 1976-1985, all sustainable thresholds are positive, reflecting authorities' preferences for growth-oriented public expenditures financed by an external borrowing. The deterioration of the economic activity in 1986 is characterized by the negative peaks, which had provided the implementation of the Structural Adjustment Programme[4] in August 1986 aimed at strengthening the public and external finance.

The period 1987-1992 was characterized by the implementation of strong fiscal adjustment measures which had brought the budget deficit sustainable threshold from -10.12 % in 1986 to 3.55% in 1992 and 4.52% in 1996. During the period stretching from 1992 to 2002, although the adjustment efforts achieved important public finance improvements reversing the declines of the sustainable thresholds as it is highlighted in Figure n°4, the size of principal debt repayment shows that these efforts are insufficient and unveils the unsustainable path of the fiscal policy. As depicted in Figure n°5, the gap between the net and the gross budget deficit sustainable threshold curves explains the danger of repayment burden. By using part of proceeds from privatization, which has been adopted since 1998 (see Figure n°6), for early repayment of external debt, Tunisia reduced the public debt/GDP ratio to 44% in 2010.

Figure n°5 illustrates the difference between the gross budgetary adjustment and the net budgetary adjustment: on the basis of the gross fiscal adjustment evolution, one might perceive it as successful efforts and that authorities could establish the public finance equilibrium and it would be possible to opt for a less restraining budget policy. The economic downturn of 1985-1986 had provided in August 1986 the implementation of the Structural Adjustment Program (SAP) based on neo-liberal agenda where the World Bank and the IMF are the lead financing agencies. In this context, since 1991, fiscal policies have led negative values of the fiscal adjustment. Nevertheless, during the period 1992-2002 doubts and scepticism rose to the extent that the evolution of the net fiscal adjustment shows an important gap in relation to the gross adjustment. However during the period (2003-2010) significant measures were undertaken by authorities and they were effective in reversing the trend of exploding fiscal adjustment as a share of GDP.

4.2. Econometric Methodology and Results

After the assessment of key variables using equations 4 and 9 of the above model, it would be possible to consider the analysis of the sustainability of fiscal adjustment process, where the sustainability is considered as the authorities' ability and the willingness to keep under control the gap between primary fiscal deficit and the fiscal deficit sustainable threshold.

For this review, we suggest specifying the possible relationships using a dynamic Error Correction Model (ECM) (Engle and Granger, 1987). This econometric methodology will help to check whether the Tunisian fiscal history displays a significant negative reaction of the primary fiscal deficit-GDP ratio to an increase in the fiscal adjustment, such a negative response is sufficient for adjustment sustainability.

In line with Trehan and Carl E (1988; 1991), Smith and Zin (1991), Burger *et al.* (2011) and Kanoun (2014), the ECM model is given by:

$$\Delta pd_t = \gamma_1 z_{t-1} + \sum_i \gamma_{2i} \Delta pd_{t-i} + \sum_i \gamma_{3i} \Delta pdst_{t-i} + \xi_{1t} \qquad \textbf{(11 - 1)}$$

$$\Delta pdst_t = \mu_1 z_{t-1} + \sum_i \mu_{2i} \Delta pdst_{t-i} + \sum_i \mu_{3i} \Delta pd_{t-i} + \xi_{2t} \quad \textbf{(11 - 2)}$$

(11)

Where pd_t is ratio of the primary budget deficit-GDP at period t, $pdst_t$ is the ratio of the net sustainable threshold-GDP at period t, ξ_{1t} and ξ_{2t} are white noise processes and $z_t = pd_t - \beta_t pdst - c$ is the I(0) residual of the cointegration equation. $\gamma_1 (\mu_1)$ controls the speed of adjustment to long run equilibrium. $\gamma_1 \prec 0$ and $\mu_1 \succ 0$ are considered as indicators of the fiscal adjustment sustainability process because the two coefficients predict the short run reaction of the primary fiscal deficit (primary deficit sustainable threshold) when one of the two cointegrated variables has increased (decreased) above (below) its long-run ratio[6]. The lagged terms in the ECM predict the short run dynamics between variables in first difference.

An analysis of the stochastic properties of the primary budget deficit-GDP, pd_t, and the primary budget deficit sustainable threshold, $pbst_t$, allows to establish whether these two variables share a long and/or a short-run relationship. Fiscal adjustment persistence, as shown in Figure n°5, suggests a long run relationship between pd_t and $pdst_t$.

In order to devoid 'spurious regression' results of our structural model, we should first conduct a unit root tests for each variable. Table-1 reports the results of Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) non stationarity test of primary budget deficit-GDP, pd_t, and the primary budget deficit sustainable threshold, $pdst_t$. These two variables are found to be integrated in order one I(1) with 1% critical value.

To provide a formal framework for testing for cointegration and estimating long run equilibrium relationships among primary budget deficit-GDP and primary budget deficit sustainable threshold, we turn to the issue of determining the cointegrating rank of the system, which is done by using Johansen's maximum eigenvalue and trace tests for cointegration.

Prior testing cointegration relationships, the determination of the potential number of lags to be included in the model is needed. Two tests are considered for the selection of the joint lags the VAR Lag Order Selection Criteria and the VAR Lag Exclusion Wald Tests. Lag length is set to 1 based on the Akaike Information Criterion (AIC), Schwarz Criterion (SC), Hannan-Quinn (HQ) criterion and the Likelihood Ratio (LR) and on Exclusion Wald tests as shown in Table-2 and Table-3. Moreover, the robustness of the underling VAR estimates also needs to be verified. The VAR Residual Serial Correlation LM Tests (LM-Stat= 2.6 and *P*-value = 0.62) show that there is no serial correlation at this lag order 1 and residuals are multivariate normal as evidenced by the Jarque-Bera normality test (2.87, *p-value* = 0.23)

In addition to that, to select one of the five deterministic trend cases considered by Johansen (1995) for the cointegration test, SC criteria is considered and represented in Table-4. Thus, our cointegration test assumes no deterministic trend in data: intercept (no trend) in cointegration equation- no intercept in VAR. An annual dummy (d85-86) is included as exogenous variables in

the model to span the acutest crisis years (1985-1986) which takes the value of 1 over this period and 0 otherwise. This dummy captures an exceptional temporary shock resulting from negative real rate growth (-2%) which had provided the implementation of the Structural Adjustment Programme (SAP) in August 1986.

Table-5 shows the results from the Johansen (1991) cointegration tests. Both the Trace and Max-eigenvalue statistics indicate a rejection of the null hypothesis of no cointegration. However, the results reveal evidence for the existence for one cointegrating vector amongst primary fiscal deficit and the related sustainable threshold, which is equivalent to the acceptance of stability in the long-run behaviour.

After cointegration estimation has been carried out, and certain significant results have been obtained, we implement an error correction mechanism (ECM) to model dynamic relationship and to check the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. Thus the estimated equations are a first-order ECM. Moreover, for the purpose of figuring out how adequate our ECM model is, VEC Residual Serial Correlation LM Tests and Residual Normality Tests[5] are performed. It is clear that null hypothesis of "no autocorrelation in the residuals at the first lag order" (LM-Stat = 1.24; p-value = 0.87) and "residuals are multivariate normal" (Jarque-Bera = 0.17; p-value = 0.91) are accepted. Moreover, the adequacy of the model is proved by R-Squared. Here the related value to the equation 11-1(11-2) is 0.38 (0.42) that means the independent variable in the model can predict 38% (42%) of the variance in dependent variable.

The estimated coefficient of the error-correction term in the equation (11-1) reported in Table-6, is statistically significant and has a negative sign $(\gamma_1 = -0.61, \ t - Student = -4.07)$, which confirms that the error correction term contributes to explaining the changes in primary budget deficit: if the primary budget deficit has increased above its long-run ratio which means positive disequilibrium error, the ECM predicts that pd_t will decrease in the following period to restore the long run equilibrium. The speed of adjustment to long-run equilibrium shows that about 61 % of the fiscal disequilibrium is corrected each year which involves the willingness and the ability of the authorities to stabilize or reduce fiscal adjustment.

In the second equation (11-2), the estimated coefficient of the error correction term is positive and statistically significant ($\mu_1 = 0.88, t - Student = 2.63$). It means that the error term does contribute to explaining the changes in primary budget deficit sustainable levels: if the primary budget deficit has increased above its long-run ratio, the ECM predicts that primary deficit sustainable threshold will increase to restore the long run equilibrium.

The significant estimated adjustment coefficients of the equation 11 mean that adjustment forces are in operation to restore long-run equilibrium following a short run disturbance which involves that primary budget deficit and the related required adjustment are sustainable.

In order to assess the direction of causality between the two variables forming the VAR, we proceed to perform VEC Granger Causality Test which is reported in Table-7. The result indicates

that the null hypothesis of primary budget deficit does not Granger cause primary budget deficit sustainable level, is accepted. However, the null hypothesis is rejected when we check the causality from $\Delta pdst$ to Δpb. There exists a unidirectional causality from sustainable primary budget deficit threshold to primary budget deficit

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

This paper has attempted to quantify the fiscal deficit thresholds and the related required adjustment on the basis of a specific accounting framework developed for fiscal disequilibrium in Tunisia. The main purpose is to examine the long run and short run causal relationship between primary fiscal deficit and the corresponding sustainable threshold. By employing cointegration and error correction methodology using annual data over the period 1976 to 2010, the results show stable short and long run relationships between primary fiscal deficits and the corresponding sustainable thresholds. In fact, if the primary fiscal deficit has increased above its long-run ratio which means positive disequilibrium error, the applied ECM predicts that primary fiscal deficit will decrease in the following period to restore the long run equilibrium. Furthermore, if the primary fiscal deficit has increased above its long-run ratio, the ECM predicts that primary sustainable threshold deficit will grow more than its long-run ratio to restore the long run equilibrium. Thus, it can be concluded that the fiscal adjustment process is sustainable.

By looking back at Tunisian fiscal story, we have found that fiscal adjustment policies are conducted as a sustainable process by keeping under control the budget deficit evolution. Here, the results create a room for fiscal manoeuvring and allow fiscal policy a greater leeway, in the short run, to respond to social demand and ensure a political transition. Nowadays, the revolution has imposed its own social and political rules and the realized fiscal buffers until 2010 was used to address social demands during the crisis such as public sector wage hikes, food and energy subsidies and youth unemployment. While there are still some needs to maintain expansionary fiscal policy, there are several important questions to ask and answer: are the fiscal buffers sufficient to sustain the expansionary fiscal policy and will the ability and the willingness to adjust in the past budgeting process continue in the future when the fiscal deficits reach record levels?

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APPENDICES

Appendix-1.

$$PD_t + i_t B_{t-1} + i_t^* E_t B_{t-1}^* = \Delta B_t + E_t \Delta B_t^* + \Delta CN_t^{cb} \qquad \text{(A11)}$$

For the consolidation, we start from the simplified Central Bank balance sheet:

Central Bank Balance Sheet	
Assets	**Liabilities**
$E_t NFA_t^*$	FPt
CN_t^{cb}	CUt
RFt	Rbt
	NWt

The balance sheet shows that the Central Bank's liabilities consist of currency held by the public CUt, equities (FPt) and commercial banks reserves (Rbt). On the assets side, there are the net foreign assets (NFA_t^*), the net credit to government and RF_t is the bank refinancing with Central Bank. The balancing item is the central bank's net worth NW_t.

$$C_{ut} + R_{bt} = M_{ot} \qquad \text{(A12)}$$

where currency in the hands of public (CUt) and reserves held by commercial banks at the Central Bank, equal the supply of base money (M_{0t}). The balance sheet shows that M_{0t} can be interpreted as the Central Bank net liability to the private sector. It is also the uses of the funds issuing zero-interest debt.

If we take the first difference of the Central Bank budget identity (A13):

$$NW_t = E_t NFA_t^* + CN_t^{cb} + RF_t - (C_{ut} + Rb_t) + FP_t \qquad \text{(A13)}$$

We get then:

$$\Delta NW_t = E_t \Delta NFA_t^* + NFA_{t-1}^* \Delta E_t + \Delta CN_t^{cb} + \Delta RF_t - \Delta(C_{ut} + Rb_t) \qquad \text{(A14)}$$

The profit-and-loss account of the central bank is presented as follow:

Profit-and-loss account	
Assets	**liabilities**
Current expenses	$i_t^{MM} RF_{t-1}$
ΔNW_t	$E_t i_t^* NFA_{t-1}^*$
	$NFA_{t-1}^* \Delta E_t$

The Central bank's asset consists of interest earnings on credit to commercial banks $i_t^{MM} RF_{t-1}$ (i_t^{MM} is interest rate on the market money) and on the net foreign assets $E_t i_t^* NFA_{t-1}^*$ and the changes in the exchange rate $NFA_{t-1}^* \Delta E_t$. For simplicity we assume that the Central Bank current expenses are equal to zero. This leads to:

$$i_t^{MM} RF_{t-1} + E_t i_t^* NFA_{t-1}^* + NFA_{t-1}^* \Delta E_t = \Delta NW_t \qquad \text{(A15)}$$

To consolidate the Central Bank activities with the government budget and to provide economically meaningful concept of net public sector debt, we subtract (A11)-(A15), assume that $i_t \cong i_t^{MM}$ and add and subtract ΔRF_t, $E_t \Delta NFA_t^*$ on the right-hand side of the equation. This yields to:

$$PD_t + i_t(B_{t-1} - RF_{t-1}) + i_t^*(B_{t-1}^* - NFA_{t-1}^*)E_t$$
$$=$$
$$\Delta(B_t - RF_t) + E_t \Delta(B_t^* - NFA_t^*) + \left[\Delta CN_t^{bct} + E_t \Delta NFA_t^* + NFA_{t-1}^* \Delta E_t + \Delta RF_t - \Delta NW_t\right] \qquad \text{(A16)}$$

From (A16) and taking into account equation (A12), the consolidated public sector deficit identity can be represented by:

$$PD_t + i_t(B_{t-1} - RF_{t-1}) + i_t^*(B_{t-1}^* - NFA_{t-1}^*)E_t = \Delta(B_t - RF_t) + E_t \Delta(B_t^* - NFA_t^*) + \Delta M_{0t} \qquad \text{(A17)}$$

Equation A17 corresponds to equation 2 of the model

Appendix-2.

Equation (A17) can be expressed as follow:

$$PD_t + (1 + i_t)(B_{t-1} - RF_{t-1}) + (1 + i_t^*)(B_{t-1}^* - NFA_{t-1}^*)E_{t-1}\frac{E_t}{E_{t-1}}$$
$$=$$
$$(B_t - RF_t) + E_t(B_t^* - NFA_t^*) + \Delta M_{ot} \qquad \text{(A21)}$$

Given that:

$$\frac{E_t}{E_{t-1}} = \frac{E_t \dfrac{P_t^*}{P_t}}{E_{t-1}\dfrac{P_t^*}{P_t}} = \frac{e_t}{e_{t-1}\dfrac{1+\pi_t^*}{1+\pi_t}} = \frac{(1+\hat{e}_t)(1+\pi_t)}{(1+\pi_t^*)} \qquad \text{(A22)}$$

Where e_t denotes the real exchange rate, $\hat{e}_t$ depreciation rate of the real exchange rate and π_t^* the external inflation rate.

In real terms and as percentage of GDP and taking into account (A22), equation (A21) can be represented by:

$$\frac{PD_t}{P_tY_t} + \frac{(1+i_t)}{(1+\pi_t)(1+n_t)}\frac{(B_{t-1}-RF_{t-1})}{P_{t-1}Y_{t-1}} + \frac{(1+i_t^*)(1+\hat{e}_t)}{(1+\pi_t^*)(1+n_t)}\frac{(B_{t-1}^*-NFA_{t-1}^*)E_{t-1}}{P_{t-1}Y_{t-1}}$$

$$=$$

$$\frac{B_t-RF_t}{P_tY_t} + \frac{E_t(B_t^*-NFA_t^*)}{P_tY_t} + \frac{\Delta M_{ot}}{P_tY_t}$$

(A23)

Given that the real internal and external interest rates are represented respectively by

$$1+r_t \equiv \frac{1+i_t}{1+\pi_t}, \quad 1+r_t^* \equiv \frac{1+i_t^*}{1+\pi_t^*}$$

(A24)

And where lowercase letters denote the ratio of the corresponding uppercase variables to nominal GDP, we get:

$$pd_t + \frac{r_t-n_t}{1+n_t}(b_{t-1}-rf_{t-1}) + \frac{(1+r_t^*)(1+\hat{e}_t)-(1+n_t)}{1+n_t}(b_{t-1}^*-nfa_{t-1}^*)$$

$$=$$

$$\Delta(b_t-rf_t) + \Delta(b_t^*-nfa_t^*) + s_t$$

(A25)

Equation (A25) corresponds to equation 3 of the model

Endnotes

1. Internal flow debt minus net central bank transfers to government

2. $it = \pi m, \ \Delta m_t = 0 \ and \ \frac{n_t}{1+n_t} \approx nm,$

3. From 1999, the Government did no longer issue this category of bonds which were substituted by stocks issued on the capital market (bond market). This market is open to loan notes issued by the State and local public organisations admitted to negotiation on the market.

4. As a result of an overvalued dinar and a growing foreign debt sparked a foreign exchange crisis in the mid-1980s. In 1986, the government launched a Structural Adjustment Program to liberalize prices, reduce tariffs, and reorient Tunisia towards a market economy.

5. To save space, we do not report all the results of these tests. More detailed results are available upon request by e-mailing the author.

6. For more details see Kanoun (2014)

TABLES

Table-1. Results of the Unit Root tests

Test	Augmented Dickey-Fuller(ADF)			Phillips-Perron(PP)		
hypothesis	H0: X has unit root (non stationarity)			H0: X has unit root(non stationarity)		
variable	T statistic	p-value	Test specification	T statistic	p-value	Test specification
pd_t	-2.56	0.1096	Intercept	-2.36	15.76	Intercept
$\Delta(pd_t)$	-7.07***	0.0000	Intercept	-14.8***	0.000	Intercept
$pbdst_t$	-1.43	0.1394	Intercept	-2.39	0.1499	Intercept
$\Delta(pbdst_t)$	-6.59***	0.0000	Intercept	-6.71***	0.0000	Intercept

Note: In the ADF and PP tests are based on MacKinnon (1996) critical values and their one sided p-values. The lag lengths for the ADF test are selected automatically using AIC and SIC criteria with a maximum lag of 3 because of the sample ranges from 34 annual data (1976-2010). In the PP test, the spectral estimation method is the Bartlett Kernel and the Bandwidth selection is Newey-West. Asterisk*** denotes rejection of the null hypothesis at the 1% significance level. The symbol Δ is the first-difference operator.

Table-2. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-143.7112	NA	35.04119	9.231952	9.415169	9.292683
1	-123.5853	35.22031*	12.81938*	8.224084*	8.590518*	8.345546*
2	-120.6982	4.691682	13.83027	8.293634	8.843285	8.475828
3	-119.8831	1.222622	17.09163	8.492692	9.225560	8.735617

*Note: Two variables in level are considered in this VAR, the primary deficit (pd) and primary deficit sustainable threshold (pdst). d85-86 is a dummy variable which takes the value of 1 in the crisis period (85-86) and 0 otherwise. LR: sequential modified LR test statistic (each test at 5% level); FPE stands for Final prediction error;, SC represents Schwarz information criterion, HQ are the initials of Hannan-Quinn information criterion, AIC are the initials of Akaike information criterion. Asterisk * indicates the selection by the criterion.*

Table-3. VAR Lag Exclusion Wald Tests

	pd	pdst	Joint
Lag 1*	6.680642	10.95909	17.14461
	[0.035426]	[0.004171]	[0.001812]
Lag 2	2.660179	1.797112	4.618270
	[0.264454]	[0.407157]	[0.328753]
Lag 3	0.172494	0.933486	1.248946
	[0.917368]	[0.627041]	[0.869976]
df	2	2	4

Note: The numbers are Chi-squared test statistics for lag exclusion. Numbers in [ ] are p-values. The null hypothesis of the lag exclusion Wald test is endogenous variables at a given lag are jointly zero for each equation and for all equations jointly.* denote the rejection of the null hypothesis at 1% level.

Table-4. Information Criteria by Rank and Model

Data Trend: Rank or No. of CEs	None No Intercept No Trend	None Intercept No Trend	Linear Intercept No Trend	Linear Intercept Trend	Quadratic Intercept Trend
Log Likelihood by Rank (rows) and Model (columns)					
0	-137.3303	-137.3303	-136.8138	-136.8138	-136.6324
1	-132.3000	-125.3410	-125.3410	-121.8661	-121.8152
2	-130.8680	-123.6150	-123.6150	-119.4334	-119.4334
Schwarz Criteria by Rank (rows) and Model (columns)					
0	8.746869	8.746869	8.927476	8.927476	9.128391
1	8.865821	8.550015*	8.655970	8.551326	8.654197
2	9.202849	8.975185	8.975185	8.933665	8.933665

Note: * indicates the selection of the rank and the appropriate deterministic trend specification by the criterion. The five deterministic trend cases (Models) are considered by Johansen (1995, p. 80-84) for the cointegration test.

Table-5. Johansen cointegration test

Test	Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
hypothesis	Null hypothesis: number of cointegration vector is less than or equal to k (k=0 ;k=1)			Null hypothesis: number of cointegration vector is equal to k (k=0 ;k=1)		
Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	27.43065	20.26184	0.0043	23.97871	15.89210	0.0022
At most 1	3.451938	9.164546	0.4998	3.451938	9.164546	0.4998
1 Cointegrating Equation(s):			Log likelihood			-12:
Normalized cointegrating coefficients						
pd	pdst	C				
1.000000	-0.266641	-2.192990				
	(0.05822)	(0.38516)				

Note: pd is the primary fiscal deficit and pdst is the primary fiscal deficit sustainable threshold. The specification of the cointegration test is with intercept (no trend) in cointegration equation- no intercept in VAR and 1 lag interval. d85-86 is introduced as a dummy variable which takes the value of 1 over the crisis period (85-86) and 0 otherwise.* denotes rejection of the null hypothesis at the 5% level based on the MacKinnon *et al.* (1999). Trace test indicates 1 cointegrating eqn(s) at the 0.05 level. Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level.. Numbers in () are standard errors

Table-6. Vector Error Correction Estimates

Cointegrating Eq:	CointEq1	
pd_{t-1}	1.000000	
$pdst_{t-1}$	-0.266641	
	(0.05822)	
	[-4.57978]	
C	-2.192990	
	(0.38516)	
	[-5.69377]	
Error Correction:	Δpd_t	$\Delta pdst_t$
CointEq1	-0.610250	0.886327
	(0.14974)	(0.33702)
	[-4.07531]	[2.62991]
Δpd_{t-1}	0.135279	-0.577694
	(0.17028)	(0.38324)
	[0.79445]	[-1.50740]
$\Delta pdst_{t-1}$	-0.124685	-0.199021
	(0.06616)	(0.14889)
	[-1.88473]	[-1.33668]
d85_86	1.471964	-10.50533
	(0.96475)	(2.17131)
	[1.52575]	[-4.83824]
R-squared	0.386576	0.481594
Adj. R-squared	0.323118	0.427965
Sum sq. resids	39.60766	200.6289
S.E. equation	1.168666	2.630254
F-statistic	6.091868	8.980221

Note: pd is the primary fiscal deficit and pdst is the primary fiscal deficit sustainable threshold Standard errors in ( ) & t-statistics in [ ]. d85_86 is introduced as a dummy variable which takes the value of 1 during the crisis period (85-86) and 0 otherwise.

Table-7. VEC Granger Causality

	Chi-sq	df	Prob.
Dependent variable: Δpd_t			
$\Delta pdst_{t-1}^{*}$	3.552200	1	0.0595
Dependent variable: $\Delta pbdst_t$			
Δpd_{t-1}	2.272248	1	0.1317

Note: pd is the primary fiscal deficit and pdst is the primary fiscal deficit sustainable threshold. *denotes rejection of the Null hypothesis (H0: independent variable does not cause dependent variable) at the 10% level
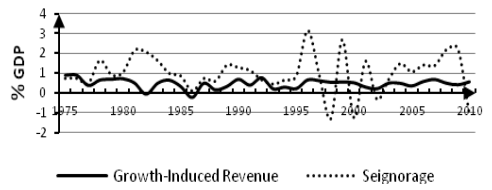
FIGURES
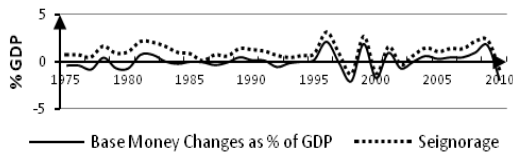
Figure n°1. Seignorage and Inflation Tax
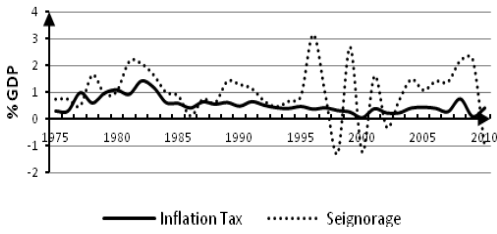
Source: author' calculations

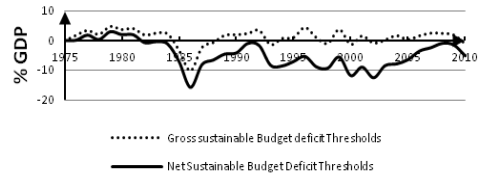### Figure n°2. Seignorage and Growth-Induced Revenue

Source: author' calculations

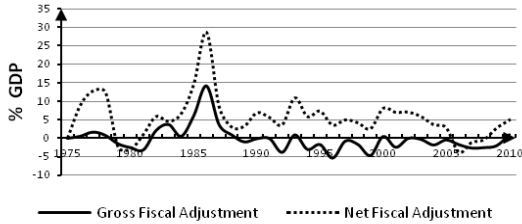### Figure n°3. Seignorage and Base Money Changes

Source: author' calculations

Figure n°4. Primary Budget Deficit Sustainable Thresholds

Source: author' calculations

Figure n°5. Fiscal Adjustment

Figure n°6. Privatization Revenues

Source: author' calculations