

## Tax smoothing hypothesis: The Tunisian case

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**Abstract.** *This paper tests the tax smoothing hypothesis for Tunisia using annual data for the period of 1972-2015. According to this approach, an optimal fiscal rule is to smooth tax rates over time and to finance temporary difference between government expenditure and tax revenue by debt creation. Tax smoothing implies that the tax rate behaves as a random walk and changes in the tax rate are nearly unpredictable. For this reason, two tests are used. The first, is a unit root test performed on Tunisian data to examine the null hypothesis of non-stationary of the tax rates. The results show that the null hypothesis of the unit root cannot be rejected, indicating that the tax rate is nonstationary and, thus, it follows a random walk. The second is the cointegration test which indicate that the future tax rate is cointegrated with the current permanent government expenditure rate. Therefore, Tunisia is trying to keep close correspondence between these two variables. In this context, the best policy option would be an initiation of prompt action program of tax base expansions and expenditure rationalization.*

**Keywords:** tax smoothing, Tunisia, fiscal policy, permanent expenditure.

**JEL Classification:** E62; H21; C32.

## 1. Introduction

Increasing considerations on the sustainability of fiscal policy and tax smoothing hypothesis have been acquiring a significant position in the theoretical background. The sustainability of fiscal policy requires convergence of government expenditure and its revenues in the long run (Hakkio and Rush, 1991). The tax smoothing hypothesis (TSH) which was provided by Barro (1979), suggests an optimal fiscal rule which consists in smoothing the tax rates over time and financing the temporary difference between the government expenditure and tax revenue through debt creation.

Thus, tax smoothing is a theory of optimal public finance which enables governments to reduce tax distortions by smoothing tax rates rather than adjusting them based on the budget requirements. Therefore, the main idea is to use budget deficits or surpluses in order to keep tax rates relatively stable (Henri, 2017). Consequently, using debt instruments becomes the best way to smooth taxes and shape taxation policies. In fact, during permanent increases in predictable government spending, changes cannot occur in the tax rates (Turan et al., 2014).

For Tunisia, high debt levels are a major macroeconomic issue that needs to be solved by expanding the understanding of debt and taxation. In the aftermath of the revolution, a debt financed expansionary fiscal policy is followed. Contrary to the TSH, permanent government expenditures in Tunisia are financed by debt rather than taxes. Indeed, public debt has increased from 40.7% of GDP in 2010 to 70% of GDP at the end of 2017 (BCT 2017). For this reason, it appears to us that a TSH can help Tunisia to find better solutions to manage high levels of debt and collect more information on how taxation and debt are allocated.

So far, there have been many studies that have tested TSH by checking whether tax rate follows a random walk or not, but the evidence in support of a random walk does not necessarily support the TSH. Taking cue from the methodology of Jawawickrama and Abeysingh (2013), we present an empirical literature where a direct testing is made to examine the existence of tax smoothing in Tunisia during 1972-2015 period. The rest of this paper is organized as follows. The next section depicts the literature review. Section 3 shows the empirical findings for Tunisia. Finally, section 4 presents the concluding notations and offers some policy implications.

## 2. Literature review

Numerous papers have tested the TSH that has very diverse results. Moreover, most of these studies have examined the hypothesis for different subgroups of countries. The core ideas of tax smoothing were articulated with Barro (1979, 1981). In this preliminary stage of the literature, Barro was one of the earliest writers who found evidence that this theory for the United States involves three stages. First, Barro (1974) was the first to explicitly expose the model of debt neutrality in his article entitled "Are government bonds net wealth?" by interfering with the economic effects of fiscal policy and public debt. After this step, Barro (1979) showed the failure of the « Ricardian equivalence » theorem

because the public debt financing occurs when the savings of households increase after an anticipation of future tax rise which could induce a negative effect on the investment and consumption level. Second, Barro (1986) proposed the random walk test of tax rate series to check if there is a tax smoothing behavior. This test comes out by the fact that changes of the tax should be unpredictable as they reflect only the new information on the time path of government expenditure, output, and other variables. Finally, Barro (1999) suggested financing public debt by issuing bonds indexed to nominal GDP so as to prevent future sovereign debt crises since indexed government bonds tend to have much longer maturities than nominal government bonds.

According to Ghosh (1995) and Bohn (1990), there are at least two reasons to go beyond the random walk tests of tax smoothing models. First, it is often difficult to reject the null hypothesis of a random walk for many economic time series in finite samples. Thus, such tests may have very low power. Second, even if the tax rates really follow a random walk, this does not necessarily imply that governments smooth taxes. Indeed, tax smoothing is only one of many possible explanations for tax rate changes being unpredictable (Padda, 2009; Lusinyan and Thronton, 2009, 2011; Reitschuler, 2010, 2011; Jayawickrama and Abyeinghe, 2013; Padda, 2014).

The presence of tax smoothing behavior has also been tested by Huang and Lin (1993), Serletis and Schorn (1999), Cashin et al. (1998, 1999, 2002), Strazicich (2002), Adler (2006), Pasten and Cover, (2011), Turan et al. (2014) using the VAR methodology for tax rate and budget surplus. In this approach, the authors propose to estimate the forecast time path of the budget surplus which is optimal for the government to follow. Their models pursue an indirect method that has been used in most tax smoothing studies. However, Sahasakul (1986) presented a direct test for the TSH. This test implies that tax rate is related to the permanent component of the government expenditure rate. On the other hand, the author found evidence against the TSH by regressing the US current marginal tax rate on the permanent and transitory components of the government expenditure rate and some other variables.

It is difficult to measure the permanent expenditure and income. Therefore, some researchers preferred the other aspects of the TSH. They studied whether the fiscal deficit is informative about future changes in government expenditures (Huang and Lin, 1993; Ghosh, 1995; Olekalns, 1997; Serletis and Schorn, 1999; Cashin et al., 2002; Niepelt, 2004). Huang and Lin (1993) found that TSH is excluded for the United States for the period 1947-1988 but not for 1929-1988 periods. On the other hand, according to Ghosh (1995), the TSH was accepted for Canada and the United States for 1962-1988 and 1961-1988. However, Olekalns (1997) noted that the TSH was rejected for Australia. For their part, Olekalns and Crosby (1998) examined the TSH for the United Kingdom, Australia and the United States and concluded that tax smoothing is accepted only for the latter.

Moreover, by testing the TSH for India, Pakistan and Sri Lanka, respectively, Cashin et al. (1998, 1999) showed that the TSH holds only for Sri Lanka. On the other hand, by testing the TSH using the Swedish central government data, Adler (2006) found that it is not possible to statistically reject the TSH for the full period 1952-1999, but the TSH could be rejected using the sub-sample period from 1970 to 1996. According to Rocha (2001), the

TSH is rejected for Brazil for the period between 1970 and 1994 using the VAR methodology. Nevertheless, other studies use a unit root and co-integration tests on government revenue and expenditure series to check the TSH. In this context, Jayawickrama and Abeysinghe (2013) presented a direct test of tax smoothing by showing that if the TSH holds, then the future tax rate should cointegrate with the current permanent government expenditure rate even though the tax rate follows a random walk. This procedure also enables the authors to distinguish between ‘strong tax smoothing’, ‘weak tax smoothing’ and ‘no-tax smoothing’, which are consistent with the random walk behavior of the tax rate. Checking this test for Australia, Canada, Italy, Japan, the Netherlands, New Zealand, the UK and the US shows evidence that supports the weak forms of tax smoothing.

In fact, our study contributes to the empirical literature by examining the existence of TSH in Tunisia during the 1972-2015 period using the direct methodology of Jayawickrama and Abeysinghe (2013). To the best of our knowledge, there is no study that has evaluated the TSH for Tunisia.

### 3. Data and methodology

In this study, we use data about the tax rates, government expenditures, money growth rate and real output for the 1972-2015 period. The average tax rate ( $T_t$ ) is calculated as a tax burden ratio, the government spending rates ( $G_t$ ) is decomposed by means of Hodrick-Prescott (HP) (with the smoothing parameter set at 100) and Baxter- King filters<sup>(1)</sup> into two parts: permanent government rate ( $G_t^p$ ) and transitory government spending rate ( $G_t^T$ ). The real output growth is the growth of real gross domestic product ( $GDP_t$ ). The growth rate of money ( $M_t$ ) supply is used to control for inflation and seigniorage effect. Data are obtained from the World Bank Development Indicators (WDI), from reports of the Tunisian Central Bank, the Tunisian Institute of Competitiveness and Quantitative Studies, the Tunisian National Institute of Statistics, and the Ministry of Finance. Descriptive statistics for the data series are displayed in Table 1.

**Table 1. Descriptive statistics (1972-2015)**

	M	GDP	T	G
Mean	0.128048	0.045216	0.204376	0.286526
Median	0.124540	0.046922	0.204351	0.274710
Maximum	0.281860	0.177427	0.231000	0.396045
Minimum	0.044361	-0.019172	0.177892	0.201967
Std. Dev.	0.055966	0.033216	0.014294	0.046558
Observations	44	44	44	44

As recommended by Barro (1986) and Trehan and Walsh (1988), we check in a first step the unit root in the tax rate series to determine whether the TSH holds or not. In this context, the presence of the unit root in the tax rate series of a country argues for the TSH:

$$\Delta\tau_t = c + \beta_1 T_{t-1} + \varepsilon_t \quad (1)$$

As tax rate follows a martingale property (follows a random walk), the unit root component of the government spending rate (permanent government spending rate) can be extracted

and used in the co-integration test between the tax rate and the permanent government spending rate:

$$T_t = \beta HP g_{t-1}^P + \mu_t = (\text{HP filtered series})$$

or

$$T_t = \beta BK g_{t-1}^P + \mu_t = (\text{Baxter -King filtered series}) \quad (2)$$

Alternatively, this can be written in an empirically testable form as:

$$T_t = \beta g_{t-1}^P + \mu_t \quad (3)$$

where  $\beta$  is expected to be a unity,  $u_t = \rho u_{t-1} + \varepsilon_t$  and  $\varepsilon_t$  is assumed to be a zero-mean white noise process. The autocorrelation parameter  $\rho$  ( $0 \leq \rho \leq 1$ ) measures the degree of cointegration (Rajaguru and Abeysinghe, 2008). If the tax rate follows a random walk, equation (3) yields a case where two random walks cointegrate, and the TSH holds (Jayawicrama and Abeysinghe, 2013). Since Equation (3) enables to have transitory components, we can define three cases depending on the parameter  $\rho$ . If  $\rho = 0$  (the highest degree of cointegration) then we have a case of strong tax smoothing. If  $0 < \rho < 1$  (lowest degree of cointegration) then we have a case of weak tax smoothing. Finally, if  $\rho = 1$  (no cointegration) then we should reject the TSH even if the tax rate follows a random walk. To analyze such a situation following ECM between the tax rate series and the permanent part of the expenditure series can be estimated as follows:

$$\Delta T_t = c + \beta_1 g_{t-1}^t + \beta_2 GDP_{t-1} + \beta_3 M_{t-1} + \lambda_1 g_{t-2}^p + \alpha_1 (T_{t-1} - g_{t-2}^p) + \varepsilon_t \quad (4)$$

If  $\alpha_1 = 0$ , then the TSH does not hold. If  $-1 < \alpha_1 < 0$ , the weak form of TSH holds. However, the strong form of tax smoothing holds if  $\alpha_1 = -1$ . In the case where the TSH is satisfied,  $\lambda_1$  generally equals 0.

#### 4. Empirical results

For the analysis of tax smoothing, the usual first step is to check the unit root in the tax rate series as suggested by Barro (1986) and Trehan and Walsh (1988). Table 2 presents the ADF unit root test results for the tax and expenditure rates for Tunisia. It also clearly shows that the null hypothesis of non-stationarity is accepted for tax and expenditure rates, so all the variables having a unit root in level are stationary in first difference. This concludes that there is a possibility of a long-term association between these variables integrated of the same order. Numerous studies used only the unit root test in tax rate series to check the existence of tax smoothing (Barro, 1986; Trehan and Walsh, 1988; Strazicich, 1997). However, the presence of random walk behavior of tax rate is only a necessary condition, but not a sufficient one to hold for the presence of tax smoothing,

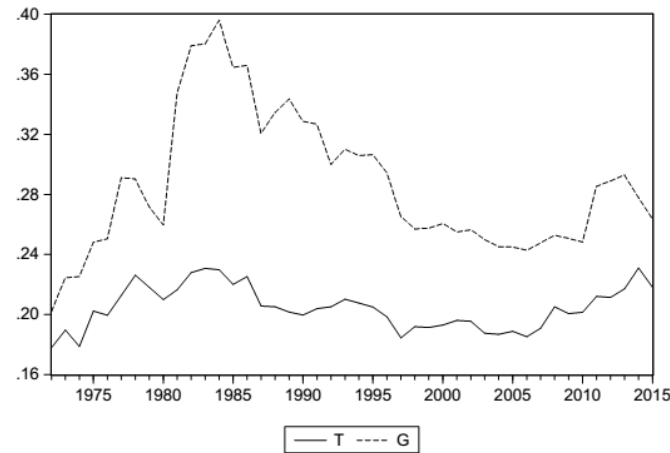
**Table 2.** ADF unit root test result

Variables	T statistics	Probability
$T_t$	-2.430025	0.1398
$dT_t$	-7.563851	0.0000
$G_t$	-2.218646	0.2035
$dG_t$	-5.903251	0.0000

Source: Author's estimations.

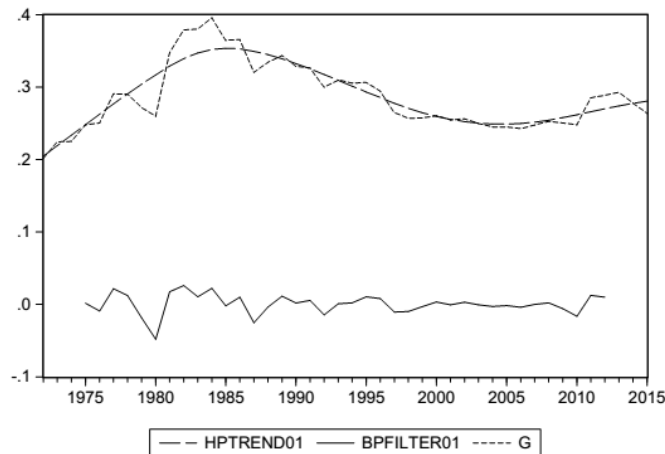
The tax rate and actual government-spending rate are depicted in Figure 1. Both series seem to follow a form of random walk.

**Figure 1.** Tax and government spending rates in % of GDP



Actual and filtered government-spending rates are presented in Figure 2. There is a close correspondence between the actual and the permanent components suggesting that most of the fluctuations in government expenditure rates over the sample period are dominated by long-term shifts in the government expenditure rates. Figure 2 also shows that government transitory expenditures have been negligible for Tunisia.

**Figure 2.** Actual and filtered government spending rates



To test the existence of co-integration (based on equation 2) between tax rates and permanent government expenditure rates (for HP and BK series), we use Johansen's cointegration test. The results of unrestricted cointegration rank test (Trace test and Eigenvalue) are presented in Table 3. These results show that the null hypothesis of no cointegration among the variables is rejected in both tests. Both Trace and Maximum eigenvalue tests indicate one or two cointegrating equations at 5% level of significance.

This means that tax rates and permanent expenditure rate are cointegrated or have a long-term relationship.

**Table 3.** *Johansen's cointegration test results*

	Eigenvalue	Trace statistics	5% critical value	Prob.	Max Eigen statistics	5% critical Value	Prob.
HP series							
None*	0.562584	31.8666	15.49471	0.0001	29.76732	14.26460	0.000
At most 1	0.056648	2.09936	3.841466	0.1474	2.099361	3.841466	0.1474
BK series							
None*	0.880198	95.1876	15.49471	0.000	86.99867	14.26460	0.000
At most 1	0.181048	8.18893	3.841466	0.004	8.188934	3.841466	0.004

The AR and ARCH tests do not show any autocorrelation or heteroscedasticity problem effects (Table 4). To test the TSH, the ECM in Equation (4) is applied to HP and BK series. Therefore, we estimated two different models. The first one includes the HP decomposed series and the second one includes the series derived from the Baxter- King Filter smoothing method. These models are labelled as the HP and BK models.

The estimated  $\alpha_1$  values of the HP and the BK models are -0.19 and -0.23, respectively. The results estimated on  $\alpha_1$  are statistically significant for both models, which confirms the presence of cointegration between  $T_t$  and  $g_{t-1}^p$  (Table 4).

The degree of cointegration is lower than the required value by the strong version of the TSH which assumes that  $\alpha_1$  equals -1. The statistically significant estimated  $\lambda_1$  (the coefficient on the permanent government spending) implies the lack of a one-to-one relationship (Turan et al., 2014).

The coefficient of money growth is positive but insignificant for both models. This probably indicates that the Tunisian government does not use seigniorage to finance its budget deficit (Smida et al. 2009). Besides, the findings of our analysis are consistent with those of Evans and Amey (1996), which estimated the extended tax smoothing model for a significant number of OECD countries and found that the adopted seigniorage policy does not reflect any optimal strategy that enables to minimize the social cost of financing government expenditure. In addition, Ashworth and Evans (1998) could not find that the rate of taxation could grow by increasing the nominal income for a sample of 32 developing countries. However, for Padda (2014), the insignificance of money growth is caused by countries that no longer finance their deficit by borrowing from the Central Bank. Besides, the effects of transitory components of the government expenditure rate on the tax rate are not significant in any of the models, which indicates that tax rates have not responded to the transitory changes in the government expenditures and proves the presence of tax smoothing in Tunisia.

The coefficient of GDP growth is positive and significant for both models showing that economic development increases tax base (Clitz and Morrissey, 2011).

The insignificant impact of transitory expenditure on the tax rate changes may be due to their negligible size of total government expenditure. Another possible reason that justifies this result could be the exaggeration of financing the transitory expenditures by issuing bonds (Padda, 2014).

**Table 4.** ECM for testing tax smoothing (Dependent Variable is  $\Delta T_t$ )

Explanatory variable	HP filter	t-values	BK filter	t-values
Constant	0.001137	0.335825	0.000120	0.124487
$EC_{t-1}$	-0.020355	-0.129148	-0.207271	-2.978241*
$g_{t-1}^i$	0.102340	0.825164	0.354284	0.765401
$M_{t-1}$	0.000310	1.000315	0.000134	0.621785
$GDP_{t-1}$	0.090299	1.790058*	0.081665	2.095647*
$g_{t-2}^p : \lambda_1$	1.428480	0.161516	0.247878	2.340970*
$(T_{t-1} - g_{t-2}^p) : \alpha_1$	-0.194867	-1.797948**	-0.234937	-3.532524
	Diagnostic	p-values	Diagnostic	p-values
R square	0.49		0.72	
Durbin-Watson stat	2.095		2.32	
AR(2) F test	1.33	0.2791	1.14	0.2585
ARCH F test	0.17	0.6788	0.02	0.8884

\*, \*\* denotes a significance at 5 and 10% levels.

Source: Author's estimations.

## Conclusion

In this paper, we examined whether the TSH holds for Tunisia, during the period 1972-2015 using a direct testing method recently developed. Our initial estimation results show the existence of the weak form of tax smoothing. The results also show that the observed random walk behavior of the tax rate does not guarantee the verification of the hypothesis application. In fact, the presence of cointegration between the tax rates and permanent government expenditure rates shows that Tunisia is trying to keep close correspondence between these two variables. The insignificance of money growth in Tunisia is justified by the lack of financing public deficit by borrowing from the Central Bank.

Two specific and important remarks can be drawn from these results. First, Tunisia has not been perfectly smoothing its tax rate over the sample period, which shows the presence of a weak tax smoothing. Second, Tunisia has been facing difficulties in arranging revenue requirements to finance transitory shocks and its expenditures by borrowing. Hence, financing its transitory expenditure by taxes made it difficult to smooth the tax rates. Indeed, the severe debt crises that Tunisia have faced can be attributed to its failure to do tax smoothing in a systematic fashion and its inability to synchronize its spending, taxation and borrowing decisions. Keeping in view these findings, it would be better for Tunisia to widen its tax base, use its revenue for necessary and economically productive projects and minimize their non-development expenditure (Omrane and Gabsi, 2017).

Furthermore, an analysis should be carried out to determine what part of the government expenditure is permanent and what part is transitory. This requires that the government should finance all its permanent expenditures with taxes (Beatrice, 2017). Certainly, only contingent debt should be created to finance the temporary expenditures. To this end not only should expenditure be controlled but also, it seems to be more important to revamp the entire tax system (Padda, 2014). This can be considered as a rule adopted by the Tunisian government in budget implementation.

## Note

- (1) Many types of smoothing methods can be distinguished like the Baxter-King filter and the Hodrick-Prescott filter. These filters extract the business-cycle component of macroeconomic series.



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