A BRIEF ANALYSIS OF THE TAX SMOOTHING HYPOTHESIS IN TURKEY

Mesut KARAKAS
Taner TURAN
Halit YANIKKAYA

Mesut KARAKAS
Assistant Professor, Department of Economics, Gebze Institute of Technology, Gebze/Kocaeli, Turkey
Tel: 0090-262-605.1431
E-mail: mesutkarakas@gmail.com

Taner TURAN
Department of International Trade and Finance, Adana Science and Technology University,Seyhan/Adana, Turkey
Tel: 0090-322-455.0041
E-mail: turantaner01@yahoo.com

Halit YANIKKAYA
Professor, Department of Economics, Gebze Institute of Technology, Gebze/Kocaeli, Turkey
Tel: 0090-262-605.1435
E-mail: halityanikkaya@gyte.edu.tr

Abstract

This study examines the existence of tax smoothing in the case of Turkey using data for the time period between 1923 and 2011. Unit root tests, auto-regression and vector auto-regression (VAR) models are applied to tax rates, government expenditures and real output data. Unit root tests and auto-regression results initially point out the existence of tax smoothing in Turkey.

However, further in-depth analyses by means of the vector auto-regression model provide strong evidence against the tax smoothing hypothesis for the Turkish case as contemporary tax rates can be predicted with using lagged values of tax rates and government spending rates.

Keywords: tax smoothing, vector auto-regression model, optimal taxation, public debt management, Turkey.

Transylvanian Review of Administrative Sciences,
No. 42 E/2014, pp. 78-93

1. Introduction

Tax smoothing, which is a theory of public debt management first suggested by Barro (1979, pp. 941-954) in a partial equilibrium context, is one of the most important concepts in fiscal policy literature. In a deterministic context, optimal tax rates are constant, but in the case of a stochastic economy with incomplete financial markets, tax rates follow a more random pattern generated by a martingale process. Thus, the tax smoothing hypothesis requires tax rates to be altered only when unpredicted shocks occur; this means that there should be no predictable changes in tax rates in ordinary times. Tax smoothing has important policy implications, since it is plausible to expect that tax distortions or excess burdens of taxation increase more than proportionally with tax rates, government can minimize tax distortions by keeping tax rates relatively smooth or constant rather than raising them in some periods and loweringt hem in other periods.

Tax smoothing literature makes a distinction between permanent and temporary changes in government spending and economic activity. Tax rates are mainly determined by the level of permanent government expenditure and public debt and governments should adjust tax rates when there are permanent changes in government spending by spreading tax distortions over time. Governments should also use budget deficits (surpluses) to keep tax rates stable when temporary increases (decreases) occur in government spending. For example, increases in government spending arising from a war should be mainly financed by debt. In a similar way, budget imbalances should be considered when there are temporary fluctuations in economic activity. In other words, when there is a temporary shock to government spending or economic activity, instead of changing tax rates, public debt levels should be adjusted. In practice, the tax smoothing hypothesis enables us to determine the usage of budget deficits and surpluses.

Our study contributes to the growing empirical literature on the tax smoothing hypothesis by examining the existence of tax smoothing in Turkey within the time span of 1923-2011. There is a lack of empirical studies on tax smoothing for Turkey (to the best of our knowledge, there is only one published study done by Bolatoglu (2003) ontax smoothing in Turkey). Bolatoglu (2003) employs relatively simple techniques to examine the hypothesis and reports evidence for the existence of tax smoothing behavior in the Turkish economy. Our analysis goes beyond the use of prior methods such as unit root tests and it takes a step further for the analysis of tax smoothing hypothesis for Turkey. We perform unit roots tests and employ auto-regression and Vector Auto-regression (VAR) methods to evaluate the tax smoothing hypothesis. Even though the estimation results of unit roots tests and auto-regression favor the existence of tax smoothing in Turkey, the results of VAR indicate that the tax smoothing hypothesis does not hold for Turkey.

Section 2 briefly reviews the literature related to tax smoothing hypothesis. Section 3 outlays the empirical methodology and section 4 presents empirical results. Lastly, section 5 concludes the study.

2. Literature review

After Barro's (1979) seminal paper, the tax smoothing hypothesis was further generalized by Lucas and Stokey (1983, pp. 55-69) in an influential paper. Aiyagari *et al.* (2002, pp. 1251-1252) show theoretically that a general tax smoothing idea is valid in a real economy without state contingent debt. Schmitt-Grohe and Uribe (2004, pp. 206-207) extend the results of Barro (1979, p. 962) and Aiyagari *et al.* (2002, pp. 1251-1252) by assuming prices are sticky and government can only issue nominal, non-state contingent bonds and prove that a benevolent government minimizes the tax distortions by spreading required tax increases over time and a tax smoothing behavior induces near random dynamics into the tax rate and public debt. Fisher and Kingston (2004, pp. 4-7) examine the tax smoothing policy in a small open economy context and derive the conditions for the optimality of tax smoothing. In a more recent contribution to the theoretical literature, Angyridis (2009, pp. 440-444) evaluates a concept of balanced budget as an alternative to tax smoothing with continuous lending and borrowing and (p. 459) concluding that, in a small open economy model, tax smoothing is better than maintaining a balanced budget in terms of welfare consequences.

There are a large number of empirical studies that examine the tax smoothing hypothesis. Most of these studies analyze the hypothesis for developed countries or subgroups of developed countries for different time periods. Many studies report evidence for the tax smoothing hypothesis. For the case of US, Barro (1979, pp. 954-969) and Barro (1981, pp. 16-38) present empirical evidence in favor ofthe tax smoothing hypothesis using data for the period 1917-1976 and 1884-1979, respectively. Kingston and Layton (1986, pp. 1-19) focus on the behavior of tax rates and find that tax rates follow random walks for Australian data between 1949/1950-1984/1985. Kingston and Layton (1986, pp. 1-19) findings supports the existence of tax smoothing for Australia for the period considered. Bohn (1990, pp. 1221-1229), utilizing post-war US data, finds that tax smoothing cannot be rejected on the basis of time path of taxes.

However, Bohn (1990, p. 1229) concludes that since some security returns are correlated with tax rates, the tax smoothing hypothesis can be rejected on that basis and also argues that governments could use some nontraditional liabilities such as issuing foreign currency debt to improve tax smoothing. Huang and Lin (1993, pp. 320-325), and Ghosh (1995, pp. 1035-1041) employ similar approaches that exploit the close analogy between consumption smoothing and tax smoothing.This approach is based on constructing a theoretically optimal budget surplus/deficit data series and these optimal data series are then compared toactual data series. Under the tax smoothing hypothesis, we expect for these two series to be identical. This strongly implies that when a government anticipates an increase in its expenditure, it will raise taxes immediately and give more budget surpluses or smaller budget deficits. In other words, when a government expects a change in its expenditures, it will react immediately even before this expectation is realized. So changes in budget surpluses or deficits can be a signal for future changes in government expenditures.

In this context, Huang and Lin (1993, p. 318) argue that an optimal tax policy has two implications; first, public debt responds to temporary changes in government expenditures and output and second, optimal tax rate is determined only by permanent components of these variables. Following this line of thought, Huang and Lin (1993, pp. 325-336) employ US data for the 1929-1988 period and are able to reject the tax smoothing hypothesis for the full sample, but they are unable to reject it for the post-1947 period. Huang and Lin (1993, p. 337) suggest that the rejection of the hypothesis should be attributed to differences in statistical properties of different samples and conclude that the tax smoothing hypothesis provides a good approximation to the tax rates in the post-1947 period. Ghosh (1995, p. 1038) claims that even if tax rates follow a random walk, this does not necessarily mean that a government implements the tax smoothing principle. Ghosh (1995, pp. 1041-1044) examines the existence of tax smoothing for the United States and Canada for the periods between 1961-1988 and 1962-1988, respectively. Ghosh (1995, p. 1044) finds evidence for the existence of tax smoothingfor these two countries.

In an extensive study, Serletis and Schorn (1999, pp. 391-395) analyze tax smoothing, inflation smoothing and revenue smoothing for Canada, France, the UK and the US. Serletis and Schorn (1999, p. 395) argue that the tax smoothing hypothesis holds for the cases of Canada, France, the UK and the US, but they are unable to find evidence for the existence of inflation and revenue smoothing for these countries. Employing data from 19 industrialized countries for the period 1955-1988, Strazicich (2002, pp. 2328-2329) states that changes in tax rate are unpredictable, which implies the existence of tax smoothing hypothesis in these countries.

Moreover, Strazicich (2002, p. 2329) argues that the unpredictability of tax rates and the existence of tax smoothing are not affected by idiosyncratic political variables. For the post-World War II period (1947-2000), Fisher and Kingston (2005, p. 1118) report that the US fiscal policy has been consistent with the tax smoothing hypothesis. Lloyd-Ellis, Zhan and Zhu (2005, pp. 705-709) develop a tax smoothing model with stochastic interest rates and conclude thata behavior of debt/GDP ratios for the US in 1980s is consistent with the idea of tax smoothing. However, Lloyd-Ellis, Zhan and Zhu (2005, p. 715) also argue that a departure from optimal tax smoothing behavior takes place during the late 1990s. Adler (2006, pp. 88-92) tests the tax smoothing hypothesis for Swedish data between 1952-1999 and fails to reject the tax smoothing hypothesis for the full period but rejects it for the period of 1970-1996. Adler (2006, p. 93) claims that although it is statistically rejected, visual evidence still supports a tax smoothing and concludes that the tax smoothing model provides a useful benchmark. Recently, Jayawickrama and Abeysinghe (2013, pp. 2308-2310) find evidence for a weak form of tax smoothing using annual data for Australia, Canada, Italy, the Netherlands, the UK and the US.

There are also a number of studies presenting evidence against the tax smoothing hypothesis for developed countries. For the case of US, Sahasakul (1986, pp. 266-271) uses data for the time span of 1937-1982 and concludes that tax rates respond not

only to permanent government expenditures but also temporary defense purchases, the general price level, and a time trend. Thus, Sahasakul (1986, p. 271) rejects the tax smoothing hypothesis.

Roubini and Sachs (1988, pp. 21-27) consider the tax smoothing issue from a different perspective and emphasize the role of institutional arrangements on large budget deficits in industrial democracies and underline the importance of political consensus in debt reduction decisions. Roubini and Sachs (1988, p. 13) point out that changes in tax rates for some industrialized countries are mainly related to the transitory changes in government expenditures and present evidence against tax smoothing in industrial democracies such as Austria, Belgium, Canada, Denmark, France, Germany, Italy, Ireland, Japan, Norway, Netherlands and Sweden.

In an extensive study related to the validity of tax smoothing hypothesis for the US, Trehan and Walsh (1988, pp. 436-443) reject the existence of tax smoothing hypothesis in the US for the period of 1890-1986. In another study, Trehan and Walsh (1990, pp. 105-110) analyze the revenue-smoothing hypothesis by examining the long term relationship between taxes and inflation for the US data over the period 1914-1986 and reject the existence of revenue smoothing for the US. Employing Australian data between 1964-1995, Olekalns (1997, pp. 254-255) reports that systematic differences exist between theoretical optimal budget surplus and actual data, which presents evidence against the tax smoothing hypothesis even though the data are consistent with random walk and Granger causality predictions. Olekalns (1997, p. 255) also argues that a distortionary tax structure may be tolerated in the case of optimal provision of public goods or countercyclical policies.

Malley, Philippopoulos and Economides (2002, pp. 304-308) develop a general equilibrium model in which a benevolent government finds optimal to keep tax rates constant over time. Malley, Philippopoulos and Economides (2002, pp. 309-311) apply this model to 22 OECD countries for the period of 1970-1996 and reject the validity of the model; they conclude that keeping the tax rate flat over time to smooth out its distorting effects on growth does not hold in general equilibrium settings in which private agents and policy makers endogenously interact with each other.

Analyzing the relationship between tax rates and permanent changes in government spending, Kula (2004, p. 507) reports some evidence against tax smoothing for the US states. Considine and Gallagher (2008, pp. 326-327) compare active debt management with tax smoothing for the UK and find evidence for active debt management rather than the existence of tax smoothing over the period of 1919-2001.

Some other studies examining the tax smoothing concept report more mixed results; for example, Strazicich (1997, pp. 313-322) studies the tax smoothing hypothesis for Canada and the US at federal and local levels of government. Strazicich (1997, p. 323) points out that resource mobility at state and province levels may cause the departure from a tax smoothing and finds that the tax smoothing hypothesis cannot be rejected for the US, Canadian federal governments and Canadian provinces. On the other hand, the existence of tax smoothing can be rejected for the state and local governments (Strazicich, 1997, p. 323).

Reitschuler (2010, pp. 243-250) examines whether the 3 percent deficit rule of the Maastricht Treaty affected the ability of fifteen member states of European Union to implement tax smoothing. Using the longest available time intervals for each country, Reitschuler (2010, p. 250) states that the tax smoothing hypothesis is valid only for four countries out of fifteen countries. Reitschuler (2010, p. 249) also performs structural break tests and determines a structural break for the 3 percent deficit rule of the Maastricht Treaty, concluding that while the existence of tax smoothing cannot be rejected for Germany and the Netherlands before the 3 percent deficit rule of the Maastricht Treaty, it can be rejected for all countries after the break. These results support the claim that the deficit rule of the Maastricht Treaty may have caused the departure from tax smoothing in these two countries. In a more recent study, Reitschuler (2011, p. 2598) also tests tax smoothing for the twelve new member states of the European Union and concludes that tax smoothing is valid only for five countries (the Czech Republic, Hungary, Lithuania, Poland and Romania).

While there are a large number of studies examining the tax smoothing hypothesis for developed countries, there is a lack of empirical studies for developing countries. For example, Cashin, Oleklans and Haque (1998, pp. 22-30) examine the tax smoothing hypothesis for India using data for the period of 1951-1997 and find that the central government smooths tax rates, while regional governments do not. Cashin, Oleklans and Haque (1998, p. 34) also discuss the possible reasons, such as countercyclical policies and political economy factors that can lead to the deviations from the tax smoothing hypothesis.

Moreover, Cashin, Haque and Oleklans (1999, pp. 19-26) use Pakistan and Sri Lankan data for the periods 1956-1995 and 1964-1997, respectively and find that while Pakistan's fiscal behavior is consistent with tax smoothing, Sri Lanka's is not. Cashin, Oleklans and Haque (1998, p. 34) and Cashin, Haque and Oleklans (1999, pp. 30-31) argue that governments of developing countries should prefer public borrowing since they are unable to collect enough revenues from conventional sources.

Rocha (2001, pp. 325-330) rejects the tax smoothing hypothesis for Brazil using data for the period of 1970-1994 and suggests that behavior of public debt may be better explained by the perspective of political economy rather than concepts related to the tax smoothing. Pasten and Cover (2011, pp. 424-425), using Chilean data for 1972-2003 period, find strong evidence for tax smoothing when royalties from copper industry are assumed not to be under the government control. On the other hand, Pasten and Cover (2011, pp. 424-425) present weak evidence for the tax smoothing hypothesis, when royalties from copper industry are assumed to be under government control.

In a recent paper, Kurniawan (2011, pp. 193-194) uses Indonesian data for the period 1969-2008 and examines the predictability and random walk behavior of tax rate by performing unit root tests. Kurniawan (2011, p. 195-196) regresses changes in the tax rates on its own lagged values and also on lagged values of changes in the government expenditures and real output growth. Their results lend support to the tax smoothing hypothesis for Indonesia.

For the Turkish case, Bolatoglu (2003) employsTurkish data for the period of 1969-2001 and concludes that the tax smoothing hypothesis is valid. Using an approach developed by Jayawickrama and Abeysinghe (2013, pp. 2307-2308) and Turkish data for the period of 1949-2010, Turan, Karakas and Yanikkaya (2013) fail to accept the tax smoothing hypothesis for Turkey since the results indicate that government spending is not exogenous.

The present paper mainly follows the methodology developed in Kurniawan (2011, pp. 191-192) because of its detailed approach towards the tax smoothing issue. It also employs longer time series dataset compared to previous studies. Simultaneous and in depth analysis of real output, government expenditures and tax rates provides consistent results, which contradict the results of preliminary analyses on the existence of tax smoothing.

3. Data and methodology

In this study, we use data on tax rates, government expenditures and real output for the period of 1923-2011. Data on tax revenues and government expenditures denominated in Turkish currency (Turkish Lira) are taken from the Turkish Ministry of Finance (General Directorate of Public Accounts, 2013).

For the years between 1923 and 2005, consolidated budget data are used, but for the period after 2005, central government budget data are utilized in the analyses due to the change in the Turkish budgetary system. Tax rate τ_t and government spending rate g_t are measured as percentages of gross domestic product (GDP). We also employ real output growth (y_t) in our analysis; real output (Y_t) data at 1998 prices, also denominated in Turkish Lira, are from the Ministry of Economic Development and Turkish Statistical Institute. Real output data for the years between 1923 and 2010 can be retrieved from the Ministry of Economic Development (Economic and Social Indicators, 2013). However, real output data for the year 2011 is missing in this dataset, thus, we retrieve this figure from the Turkish Statistical Institute (TurkStatMain Statistics, 2013).

To determine whether the tax smoothing hypothesis holds or not, we employ the Augmented Dickey Fuller (ADF) test, Dickey Fuller test with Generalized Least Squares (DF-GLS), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test, Elliot, Rothenberg, and Stock Point Optimal (ERS) test, and Philips-Perron (PP) test to check the existence of unit root in tax rate series.

The theoretical framework also requires querying the possibility to predict the tax rates from their lagged values. To investigate this issue, we apply an autoregressive model to tax rates using the following equation:

$$\Delta\tau_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i \Delta\tau_{t-i} + \varepsilon_t \quad (1)$$

Optimal lag length for the model in equation (1) is chosen by means of Schwarz Information Criterion. The significance of coefficients is determined with the F test, since the F test is usually sufficient to determine the joint significance of coefficients

on variables except intercept. We use this testing procedure with the null hypothesis of H_0: $\alpha_1 = \alpha_2 = \cdots = \alpha_k = 0$.

Another issue for the testing of the tax smoothing hypothesis is to check whether changes in tax rates can be predicted by means of other related variables. To cope with this issue, we utilize a vector auto-regression model (VAR). We use changes in tax rates ($\Delta\tau_t$), government spending rates (Δg_t) and real output growth rates (Δy_t) in the VAR model in equation:

$$\psi_t = \lambda + \Theta_1\psi_{t-1} + \Theta_2\psi_{t-2} + \cdots + \Theta_p\psi_{t-p} + \varepsilon_t \quad (2)$$

where ψ_t is a vector of $(\Delta\tau_t, \Delta g_t, \Delta y_t)$ and $\Theta_1, \Theta_2, \ldots, \Theta_p$ are coefficient matrices with ε_t being the residual vector.

Similar to the auto-regression model, we employ the F test to determine the joint significance of coefficients on variables in equation 2. Also, lag exclusion tests are applied to the VAR structure; optimal lag structures for VAR are chosen via Akaike Information Criterion and lag exclusion test results.

4. Empirical results

The results of various unit root tests on tax rates are given at Table 1; these tests imply the existence of unit root in tax rates with intercept only and with intercept and trend at a 5 percent level of significance. Our findings support non-stationarity of the tax rate series, a property of tax rates satisfies the main condition of tax smoothing hypothesis but it does not guarantee its existence.

Table 1: Unit Root Test Results for the Tax Rate

Unit Root Test	Intercept Only		Intercept and Trend	
	Lag/Bandwidth	Statistics	Lag/Bandwidth	Statistics
ADF	0	-1.0232	0	-3.1405
DF-GLS	0	-0.5249	0	-2.7621
KPSS	7	1.0652	6	0.1989
Elliott-Rothenberg-Stock	0	15.3250	0	7.8163
PP	11	-0.7228	4	-3.0435

Notes: Optimal lag lengths are given for ADF, DF-GLS, Elliott-Rothenberg-Stock tests and optimal bandwidths are given for PP and KPSS tests. T statistics for ADF, DF-GLS, PP tests, LM statistics for KPSS test, and P statistic for Elliott-Rothenberg-Stock are given. All statistics favor unit root at 5% significance level.

Equation 1 is used as a further step to investigate the tax smoothing hypothesis. The results of auto-regression on the changes in tax rates are represented up to five lags in Table 2. According to AIC, the best model for the auto-regression is the one with one lag. In this model, the coefficient on the first lag of the changes in tax rates is not significant.

Actually, individual coefficients on all lagged variables are insignificant in five different models. F tests from all models also fail to reject the joint insignificance of coefficients on variables at 5 percent significance levels. All these results point out that

Table 2: Auto Regression on Tax Rates

Coefficient	Number of Lags in the Model				
	Lag 5	Lag 4	Lag 3	Lag 2	Lag 1
Constant	0.2632	0.2578	0.2765	0.2411	0.196
	(-1.3095)	(-1.3179)	(-1.454)	(-1.2845)	(-1.0543)
α_1	-0.13516	-0.1368	-0.1438	-0.1207	-0.1029
	(-1.1833)	(-1.2138)	(-1.3082)	(-1.1103)	(-0.9491)
α_2	-0.1676	-0.1697	-0.1785	-0.1578	
	(-1.4548)	(-1.51)	(-1.6281)	(-1.4508)	
α_3	-0.1565	-0.1559	-0.1623		
	(-1.3252)	(-1.3512)	(-1.4344)		
α_4	0.0379	0.0372			
	(0.3189)	(-0.3198)			
α_5	0.0195				
	(0.1652)				
AIC	4.0327	3.9981	3.9647	3.9543	3.9489
F-stat	0.9822	1.2441	1.7162	1.5253	0.9008
Prob. (F-stat)	0.4342	0.2991	0.1701	0.2235	0.3452

Note: t statistics are in parentheses.

changes in tax rates cannot be predicted by means of changes in past periods, thus the tax smoothing hypothesis is supported by the autoregressive model.

Table 3 presents crucial information on the equations in VAR methodology given in equation 2 as equations up to five lags are analyzed at this table. The F statistics reject the joint insignificance of lagged dependent variables of $\Delta\tau_t$, Δg_t and Δy_t for all lag structures.

These results show that the unpredictability of changes in tax rates is violated in these models; these contradicting results require further and deeper investigation of the tax smoothing hypothesis. Based on the AIC, we found the VAR model with four lags to be the best explanatory choice, but for the sake of consistency, we continue to provide the models up to five lags.

Table 4 displays lag restriction tests. These tests are specific versions of F tests but they are carried on individual lags. One lagged equation is appropriate for the change in tax rates as adding further lags/past information does not increase the predictability of $\Delta\tau_t$. In other words, the changes in tax rates can be explained quite well by one period lagged values of $\Delta\tau_t$, Δg_t and Δy_t. However, these results contradict the random walk behavior of tax rates and it is also contrary to the tax smoothing hypothesis. Furthermore, one lagged equation is also more suitable to explain the changes in government expenditure.

Table 3: F Tests on Lag Structure/Akaike Information Criterion

Dependent Variable	Lag	Complete VAR	
		F Stat.	Prob.
$\Delta\tau_t$	Lag 1	7.4916	0.0002
	Lag 2	4.4030	0.0007
	Lag 3	3.4486	0.0013
	Lag 4	2.8258	0.0033
	Lag 5	2.2092	0.0145
Δg_t	Lag 1	4.4398	0.0061
	Lag 2	2.5997	0.0238
	Lag 3	2.6121	0.0112
	Lag 4	2.4677	0.0095
	Lag 5	2.3267	0.0099
Δy_t	Lag 1	15.8451	0.0000
	Lag 2	10.6799	0.0000
	Lag 3	9.2747	0.0000
	Lag 4	9.9345	0.0000
	Lag 5	8.6898	0.0000
Var AIC	Lag 1	15.3804	
	Lag 2	15.3937	
	Lag 3	15.3100	
	Lag 4	15.1473	
	Lag 5	15.2089	

However, the appropriate lag structure for real output growth is an equation with four lags. The predictability of changes in government expenditure and real output growth in our case does not harm the test of tax smoothing; actually, it is a condition which is desired in empirical studies. Barro (1981, p. 38) emphasizes this fact and argues that it is more proper to test tax rate changes in a case where future changes in government expenditure and real output growth are quite forecastable.

Because individual lag exclusion tests give mixed results, we proceed with joint tests on lag exclusion in Table 5. Joint tests show that the most appropriate lag structure for the VAR model is the one with 4 lags.

Table 4: Lag Exclusion Tests on Variables

Dependent Variable		$\Delta\tau_t$		Δg_t		Δy_t	
Lag Length	Lag Number	Chi Square	Prob.	Chi Square	Prob.	Chi Square	Prob.
1 Lag	Lag 1	22.4749	0.0001	13.3194	0.0040	47.5352	0.0000
2 Lags	Lag 1	23.6655	0.0000	13.9582	0.0030	59.2361	0.0000
	Lag 2	3.9305	0.2691	2.4013	0.4934	11.8041	0.0081
3 Lags	Lag 1	23.7431	0.0000	13.4213	0.0038	71.4899	0.0000
	Lag 2	4.0571	0.2554	0.8023	0.8489	22.4874	0.0001
	Lag 3	4.4725	0.2148	7.3156	0.0625	7.3958	0.0603
4 Lags	Lag 1	24.8988	0.0000	15.6806	0.0013	86.6555	0.0000
	Lag 2	3.5241	0.3177	0.3170	0.9568	39.6887	0.0000
	Lag 3	5.3656	0.1469	5.2933	0.1515	19.6136	0.0002
	Lag 4	2.8555	0.4145	5.3567	0.1475	24.2311	0.0000
5 Lags	Lag 1	22.9515	0.0000	12.8624	0.0049	65.7244	0.0000
	Lag 2	3.1478	0.3694	2.1526	0.5414	21.6451	0.0001
	Lag 3	4.8589	0.1824	5.5180	0.1376	10.4995	0.0148
	Lag 4	2.8771	0.4110	8.9846	0.0295	13.2718	0.0041
	Lag 5	1.2530	0.7403	5.2415	0.1549	3.3762	0.3372

Table 5: Joint Lag Exclusion Tests

Lag Length	Lag Number	Chi Square	Prob.
1 Lag	Lag 1	74.3648	0.0000
2 Lags	Lag 1	88.4086	0.0000
	Lag 2	19.2549	0.0231
3 Lags	Lag 1	98.9650	0.0000
	Lag 2	26.9768	0.0014
	Lag 3	14.0671	0.1200
4 Lags	Lag 1	116.8750	0.0000
	Lag 2	44.4569	0.0000
	Lag 3	26.8688	0.0015
	Lag 4	33.6097	0.0001
5 Lags	Lag 1	90.8791	0.0000
	Lag 2	28.1498	0.0009
	Lag 3	18.0824	0.0342
	Lag 4	26.4165	0.0017
	Lag 5	9.9681	0.3531

The results of the VAR model with 4 lags are presented at Table 6. Changes in tax rates are significantly predicted by the first lags of changes in tax rates ($\Delta\tau_{t\text{-}1}$) and government spending rates ($\Delta g_{t\text{-}1}$) in equation 1 of Table 6.

Table 6: VAR Results

Dependent Variable	Equation 1 $\Delta\tau_t$		Equation 2 Δg_t		Equation 3 Δy_t	
Independent Variables	Coefficient	t statistics	Coefficient	t statistics	Coefficient	t statistics
Constant	0.2801	1.5719	0.2530	0.8216	0.0758	0.0956
$\Delta\tau_{t\text{-}1}$	-0.6560	-4.3432	-0.6878	-2.6346	1.7773	2.6419
$\Delta\tau_{t\text{-}2}$	-0.3005	-1.7146	0.0193	0.0638	0.9895	1.2676
$\Delta\tau_{t\text{-}3}$	-0.2048	-1.1359	-0.1092	-0.3505	-0.5238	-0.6521
$\Delta\tau_{t\text{-}4}$	-0.0628	-0.3690	0.4240	1.4410	-1.7359	-2.2898
$\Delta g_{t\text{-}1}$	0.3898	4.5685	0.5683	3.8538	-0.3149	-0.8286
$\Delta g_{t\text{-}2}$	0.1349	1.4017	-0.0448	-0.2691	-1.2864	-3.0002
$\Delta g_{t\text{-}3}$	-0.0421	-0.4185	-0.2101	-1.2085	0.1825	0.4074
$\Delta g_{t\text{-}4}$	0.1340	1.3623	0.0175	0.1030	0.1659	0.3785
$\Delta y_{t\text{-}1}$	-0.0164	-0.6916	-0.0313	-0.7649	-0.8599	-8.1635
$\Delta y_{t\text{-}2}$	0.0177	0.6316	0.0227	0.4679	-0.6651	-5.3206
$\Delta y_{t\text{-}3}$	0.0208	0.7577	0.0327	0.6903	-0.5378	-4.4076
$\Delta y_{t\text{-}4}$	-0.0029	-0.1370	-0.0034	-0.0920	-0.3720	-3.9312

An increase in tax rates in a year ago causes a decrease on the present change in tax rate. On the contrary, an increase in government spending rates in a year ago creates an upward pressure on present tax rate changes. The first lags of changes in tax rates ($\Delta\tau_{t\text{-}1}$) and in government spending rates ($\Delta g_{t\text{-}1}$) are significant and effective on the equation for the changes in government spending rates (in equation 2). Similar to the case of equation 1 of Table 6, changes in government spending rates are affected negatively by the first lag of changes in tax rates ($\Delta\tau_{t\text{-}1}$). Conversely, the first lag of changes in government spending rates ($\Delta g_{t\text{-}1}$) has a positive effect. Equation 3 of Table 6 shows the case for the changes in real output growth. First and fourth lags of the changes in tax rates ($\Delta\tau_{t\text{-}1}$, $\Delta\tau_{t\text{-}4}$), second lag of changes in government spending rates ($\Delta g_{t\text{-}2}$), and all four lags of changes in real output growth rates ($\Delta y_{t\text{-}1}$, $\Delta y_{t\text{-}2}$, $\Delta y_{t\text{-}3}$, $\Delta y_{t\text{-}4}$) significantly affect current changes in real output growth. Changes in real output growth rate are positively dependent on the first lag of the changes in tax rates, but are negatively related to the fourth lag. The effect of the second lag of changes in government spending rates on real output growth rate is negative. Interestingly, changes in real output growth rate relate negatively to all its lags.

Based on the VAR results at Table 6, we can safely conclude that all three variables are predictable in the VAR model. The predictability of the changes in government spending rates and real output growth rates does not violate the tax smoothing hypothesis. However, these results indicate that changes in tax rates can be predicted

quite easily and this conclusion thus leads to the rejection of the tax smoothing hypothesis in Turkey.

5. Conclusion

In this paper, we investigate the existence of tax smoothing in Turkey. To find evidence for the unpredictability of tax rates in Turkey, we use three different approaches. First of all, we employ various unit root tests such as ADF, DF-GLS, KPSS, Elliot, Rothenberg, and Stock Point Optimal (ERS) and PP tests; our test results indicate that tax rates are non-stationary and this result supports the random walk behavior of tax rates. Secondly, an autoregression model is applied to the changes in tax rates and the results indicate that changes in contemporary tax rates cannot be determined by means of its own lagged values, a fact also supports the tax smoothing hypothesis for Turkey. Finally, we employ a VAR model on the changes in tax rates. One lagged values of changes in tax rates and government spending rates are found to be statistically significant in predicting changes in the contemporary tax rates. Even though our first two approaches lend evidence for the unpredictability of tax rates and lead to the conclusion of the random walk behavior of tax rate, the VAR model provide contradictory results suggesting the predictability of tax rates. Thus, our overall results imply that the tax smoothing hypothesis does not hold for Turkey, meaning that distortionary effects of taxation have not been minimized over the period studied. In other words, there have been losses in Turkish social welfare due to the suboptimal fiscal policies.

According to the tax smoothing hypothesis, there should be a distinction between permanent and temporary government spending. Since, in practice, having a distinction between these two types of spending is not a trivial issue, governments should find a way or design some mechanisms to make this distinction better and more precise. Otherwise the implementation of tax smoothing policies may be impossible and the dead weight losses stemming from suboptimal fiscal policies cannot be minimized.

One of the most important policy implications of tax smoothing refers to balancing the budget (contrary to a popular belief, a balanced budget may not always be optimal). The tax smoothing hypothesis is based on the assumption of a benevolent government that uses budget deficits and surpluses to minimize dead weight losses. But nowadays, governments tend to give continuous budget deficits rather than budget surpluses. AsRoubini and Sachs (1988, p. 25) argue, the main reasons that lead to this situation are political motivations and institutional culture. Without a consensus on debt reduction in a fragmented political structure with coalition parties, governments tend to employ asymmetric policy responses to economic fluctuations. This behavior results in the violation of tax smoothing and gives rise to excessive budget deficits that are considerably higher than what tax smoothing entails. Even in the case of political instability and coalition governments, there are some measures available such as effective fiscal institutions and well-designed fiscal rules that allow government to smooth taxes. These measures would be useful to restrict implementation of suboptimal or myopic fiscal policies and they may avertun necessary budget deficits.

These types of measures can also help governments to have a sound public finance and enhance the credibility of government policies.

Sound public finance with credible government policies are the key factors that make the implementation of the tax smoothing principle easier. A government with a weak public finance or limited fiscal space is inevitably forced to change tax rates frequently as a response to a change in government spending regardless of the source of the change. As a result, such a government may respond to changes in temporary government spending with changes in tax rates and can cause social welfare losses. Similarly when a government has a credibility problem, for example due to excessive budget deficit and public debt, public and markets can give unexpected and undesired reactions to an increase in budget deficitand public debt even if they arise largely from the implication of the tax smoothing principle.

References:

1. Adler, J., 'The Tax-smoothing Hypothesis: Evidence from Sweden, 1952-1999', 2006, *Scandinavian Journal of Economics*, vol. 108, no. 1, pp. 91-95.
2. Aiyagari, R.S., Marcet, A., Sargent, T.J. and Seppala, J., 'Optimal Taxation without State-Contingent Debt', 2002, *Journal of Political Economy*, vol. 110, no. 6, pp. 1220-1254.
3. Angyridis, C., 'Balanced Budget vs. Tax Smoothing in a Small Open Economy: A Welfare Comparison', 2009, *Journal of Macroeconomics*, vol. 31, no. 3, pp. 438-463.
4. Barro, R.J., 'On the Determination of Public Debt', 1979, *Journal of Political Economy*, vol. 87, no. 5, pp. 940-971.
5. Barro, R.J., 'On the Predictability of Tax-rate Changes', NBER Working Paper No. 636, Cambridge, M.A.: National Bureau of Economic Research, 1981.
6. Bohn, H., 'Tax Smoothing with Financial Instruments', 1990, *The American Economic Review*, vol. 80, no. 5, pp. 1217-1230.
7. Bolatoglu, N., 'An Application on the Validity of Tax Smoothing Hypothesis for Turkey', 2003, *Hacettepe University Journal of Economics and Administrative Sciences*, vol. 21, no. 2, pp. 97-108.
8. Cashin, P., Haque, N. and Olekalns, N., 'Spend Now, Pay Later? Tax Smoothing and Fiscal Sustainability in South Asia', IMF Working Paper, WP/99/63,1999.
9. Cashin, P., Olekalns, N. and Sahay, R., 'Tax Smoothing in a Financially Repressed Economy: Evidence from India', IMF Working Paper, WP/98/122,1998.
10. Considine, J. and Gallagher, L.A., 'UK Debt Sustainability: Some Nonlinear Evidence and Theoretical Implications', 2008, *The Manchester School*, vol. 76, no. 3, pp. 320-335.
11. Economic and Social Indicators, '1. Section: National Income and Production (Table 1)', Turkish Ministry of Economic Development, [Online] available at http://www.mod.gov.tr/en/SitePages/mod_easi.aspx, accessed on March 1, 2013.
12. Fisher, L.A. and Kingston, G.H., 'Theory of Tax Smoothing in the Small Open Economy', *Economics Letters*, 2004, vol. 85, no. 1, pp.1-7.
13. Fisher, L.A. and Kingston, G.H., 'Joint Implications of Consumption and Tax Smoothing', 2005, *Journal of Money, Credit and Banking*, vol. 37, no. 6, pp. 1101-1119.
14. General Directorate of Public Accounts, 'Public Accounts Bulletin', Turkish Ministry of Finance, [Online] available at https://portal.muhasebat.gov.tr/mgmportal/faces/khb_yeni?_adf.ctrl-state=1bc2n1iw0y_4, accessed on March 1, 2013.

15. Ghosh, A.R., 'Intertemporal Tax-smoothing and Government Budget Surplus: Canada and the United States', 1995, *Journal of Money, Credit and Banking*, vol. 27, no. 4, pp. 1033-1045.
16. Huang, C.H. and Lin, K.S., 'Deficits, Government Expenditures, and Tax Smoothing in the United States: 1929-1988', 1993, *Journal of Monetary Economics*, vol. 31, no. 3, pp. 317-339.
17. Jayawickrama, A. and Abeysinghe, T., 'The Experience of Some OECD Economies on Tax Smoothing', 2013, *Applied Economics*, vol. 45, no. 16, pp. 2305-2313.
18. Kingston, G.H. and Layton, A.P., 'Tax Smoothing and Australian Fiscal Policy', *Macquarie University School of Economic and Financial Studies Research Paper*, no. 308, Sydney, 1986.
19. Kula, M.C., 'US states, the Medicaid Program and Tax Smoothing', 2004, *Southern Economic Journal*, vol. 70, no. 3, pp. 490-511.
20. Kurniawan, R., 'Tax Smoothing: Tests on Indonesian Data', 2011, *International Journal of Economics and Finance Studies*, vol. 3, no. 1, pp. 187-197.
21. Lloyd-Ellis, H., Zhan, S. and Zhu, X., 'Tax Smoothing with Stochastic Interest Rates: A Reassessment of Clinton's Fiscal Legacy', 2005, *Journal of Money, Credit, and Banking*, vol. 37, no. 4, pp. 699-724.
22. Lucas, R.E. and Stokey, N.L., 'Optimal Fiscal and Monetary Policy in an Economy without Capital', 1983, *Journal of Monetary Economics*, vol. 12, no. 1, pp. 55-93.
23. Malley, J., Philippopoulos, A. and Economides, G., 'Testing for Tax Smoothing in a General Equilibrium Model of Growth', 2002, *European Journal of Political Economy*, vol. 18, no. 2, pp.301-315.
24. Olekalns, N., 'Australian Evidence on Tax Smoothing and the Optimal Budget Surplus', 1997, *Economic Record*, vol. 73, no. 222, pp. 248-257.
25. Pasten, R. and Cover, J.P., 'Does the Chilean Government Smooth Taxes? A Tax-smoothing Model with Revenue Collection from a Natural Resource', 2011, *Applied Economics Letters*, vol. 18, no. 5, pp. 421-425.
26. Reitschuler, G., 'Fiscal Policy and Optimal Taxation: Evidence from a Tax Smoothing Exercise', 2010, *Scottish Journal of Political Economy*, vol. 57, no. 2, pp. 238-252.
27. Reitschuler, G., 'Optimal Taxation and Budget Deficits: Evidence for the EU's New Member States', 2011, *Economics Bulletin*, vol. 31, no. 3, pp. 2593-2602.
28. Rocha, F., 'Is There Any Rationale to the Brazilian Fiscal Policy?', 2001, *Revista Brasileira de Economia*, vol. 55, no. 3, pp. 315-331.
29. Roubini, N. and Sachs J., 'Political and Economic Determinants of Budget Deficits in the Industrial Democracies", NBER Working Paper, no. 2682, Cambridge, M.A.: National Bureau of Economic Research, 1988.
30. Sahasakul, C., 'The US Evidence on Optimal Taxation over Time', 1986, *Journal of Monetary Economics*, vol. 18, no. 3, pp. 251-275.
31. Schmitt-Grohe, S. and Uribe, M., 'Optimal Fiscal and Monetary Policy under Imperfect Competition', 2004, *Journal of Macroeconomics*, vol. 26, no. 2, pp. 183-209.
32. Serletis, A. and Schorn, R.G., 'International Evidence on the Tax- and Revenue Smoothing Hypothesis', 1999, *Oxford Economic Papers*, vol. 51, no. 2, pp. 387-396.
33. Strazicich, M.C., 'Does Tax Smoothing Differ by the Level of Government? Time Series Evidence from Canada and the United States', 1997, *Journal of Macroeconomics*, vol. 19, no. 2, pp. 305-326.

34. Strazicich, M.C., 'International Evidence of Tax Smoothing in a Panel of Industrial Countries', 2002, *Applied Economics*, vol. 34, no. 18, pp. 2325-2331.
35. Trehan, B. and Walsh, C.E., 'Common Trends, the Government's Budget Constraint, and Revenue Smoothing', 1988, *Journal of Economic Dynamics and Control*, vol. 12, no. 2-3, pp. 425-444.
36. Trehan, B. and Walsh, C.E., 'Seigniorage and Tax Smoothing the United States 1914-1986', 1990, *Journal of Monetary Economics*, vol. 25, no. 1, pp. 97-112.
37. Turan, T., Karakas, M. andYanikkaya, H., 'Tax Smoothing Hypothesis: A Turkish Case', 2013, unpublished mimeo.
38. TurkStat Main Statistics, 'Gross Domestic Product by Expenditure Approach', [Online] available at http://www.turkstat.gov.tr/UstMenu.do?metod=temelist, accessed on March 1, 2013.