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Domestic Saving and Tax Structure: Evidence from Turkey

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Yurtiçi Tasarruflar ve Vergi Yapısı: Türkiye Örneği

Abstract

The impact of tax policy and tax structure on national saving level is an important question for both macroeconomic stabilization and growth purposes, for especially developing countries. This paper examines the impact of tax structure on domestic saving for Turkey through cointegration and vector error correction models from 1965-2011 annual data. The results indicate that there are unidirectional Granger causalities to domestic saving from variables on tax for short-run coefficients. For the long-run, taxes on income as a share of total tax revenue found to be having negative impact on domestic saving, while the ratio of consumption taxes to total tax revenue found to be having negative impact on domestic saving. While the results are consistent with theoretical literature, they may be expected to contribute to empirical discussion of design the tax policy on developing countries and Turkey where do not have enough empirical finding in the field.

Keywords : Domestic Saving, Tax Structure, Tax Mix, Tax Policy, Vector Error Correction.

JEL Classification Codes : E21, E62, H30.

Özet

Ulusal tasarruf düzeyi üzerinde vergi yapısının ve vergi politikasının etkisi, özellikle gelişmekte olan ülkelerde makroekonomik istikrar ve büyüme açısından önemli bir sorundur. Bu çalışma, 1965-2011 dönemi verisi ile eşbütünleme analizi ve vektör hata düzeltme modelleri aracılığıyla yurtiçi tasarruflar üzerinde vergi yapısının etkisini analiz etmektedir. Kısa dönem katsayılardan elde edilen sonuçlar vergi değişkenlerinden yurtiçi tasarruflara doğru tek yönlü bir Granger anlamda nedenselliğin bulunduğunu göstermiştir. Uzun dönem ilişkisi ise gelir üzerinden alınan vergilerin toplam hasılat içindeki payının tasarruflar üzerinde negatif, tüketim üzerinden alınan vergilerin toplam hasılattaki payının ise pozitif etkiye sahip olduğunu göstermektedir. Bu sonuçlar teorik beklentilerle tutarlı olduğu gibi, konuyla ilgili yeterli ampirik bulgu olmayan Türkiye gibi gelişmekte olan ülkelerde vergi politikası ve vergi sisteminin tasarımı ile ilgili tartışmalara katkıda bulunması beklenmektedir.

Anahtar Sözcükler : Yurtiçi Tasarruflar, Vergi Yapısı, Vergi Karması, Vergi Politikası, Vektör Hata Düzeltme Modelleri.

1. Introduction

Individual decisions on work, save, invest and consume are affected by taxation, in its various forms. The dimension of these effects varies due to tax mix and tax structure as well general level of tax burden. With respect to fiscal policy, whether tax policy may be a tool for promoting the economic performance is an important issue for researchers and policy-makers.

One of main aims in the tax reforms has been to improve the economic incentives on capital formation and economic growth as well fairness and some social goals. Throughout the last thirty years, most countries has attempted to tax reforms which regarding to decrease tax rates on capital income and to enhance consumption taxes to encourage economic growth through increasing investments. To achieve this goal, relative importance of taxing income or consumption in the tax structure has been debated by scholars for a long time.

Taking into account the fact that savings are a key matter of economic growth and performance[1], one should analyze how important are influences of tax system on savings. This matter is especially important for developing countries which are dependent on foreign savings to finance the development since they do not have enough domestic savings. Furthermore, increasing financial opening after 1990s has decreased the level of domestic saving in developing countries (Aizenman et al. 2009). Turkey, also has suffered the low domestic saving rates, like most of developing countries for a long time. The low level of domestic saving reduces economic growth or makes economies more dependent on capital imports to maintain investments. More importantly, recently the low level of domestic saving has created the hazardous level deficit in Turkeys' current account in consequence of increasing foreign savings to finance capital account (Rodrik, 2009). Nowadays, an important concern about Turkish economy has been that high level of the current account deficit leaves the economy vulnerable to the market shocks. However, declining saving rates are not only a problem for developing countries. Most developed countries also have experienced a declining in saving rates for the past quarter of the century.

Therefore, the factors that determine the savings have been analyzed in an extensive literature. Studies have demonstrated that besides some main determinants such as income, interest rate, the level of prices and demographic characteristics, fiscal policy and taxation are also important factors that have impact on the level of saving. This study focuses on the impact of tax structure on the domestic savings, in case of Turkey. Although there

[1] *Aghion et. al., (2009) has displayed that a country's ability to take advantage of international technology diffusion, is positively correlated with the level of its domestic savings. In particular, for developing countries, an increase in the domestic saving leads to an important increase in average future growth rate.*

has been a great discussion about saving rates, economic performance and possible changes in the tax structure, there are little empirical finding related to developing countries, and especially to Turkey. Whereas, it is empirically be known that there are considerable differences between industrial economies and developing countries with regard to responsiveness of domestic saving to fiscal policy changes (Lopez et al., 2000).

The paper seeks to examine the relationship between national saving and alternative taxes (mainly income and consumption taxes), and to provide empirical evidence from Turkish macroeconomic data. For these aims, it first reviews the theoretical and empirical literature on relationships between saving and taxation. Later, it gives an overview of Turkey's national saving problem and Turkey's tax structure. And finally, it empirically analyze the impact of tax mix on domestic saving through cointegration analysis and vector error correction models based on 1965-2011 time series data of Turkey.

2. Effects of Tax Structure on Saving: A Theoretical and Empirical Survey

Tax structure that consists of relative weights of individual taxes alters the incentives to save or to consume. While an income tax reduces disposable income (Y) as well the tax rate (t_y), one can expect that the portion of the income which allocate to saving (S) and consumption (C) falls. On the other hand, that's why a consumption tax raises the cost of purchasing a consumption bundle as well the tax rate (t_c), it does not fall on saving and therefore investments. Thus, at a simple setting, the relationship of tax mix to the tax base is can be shown as following:

$$Y(1 - t_y) = C(1 - t_c) + S \quad (1)$$

Taken into account the interactions between savings, investments and the economic growth[2], one of the main goals of tax reforms which aimed at reducing taxes on income and gains is to provide incentives economic activities through more saving. Of course, the lower income taxes also promote consumption as well saving, but consumption taxes alter composition of income allocated between savings and consumptions in favor of the savings.

However, the effects of taxation on saving and consumption are more complex than this simple setting, since income tax is imposed on return on saving (income from capital) as well earned income. For a neoclassical intertemporal consumption model with two periods and competitive markets[3], the present income (Y_1) equals the sum of the present

[2] *For a discussion on the correlation of saving and investment see. Devereux, (1996).*

[3] *The notation has drawn from Sandmo (1985).*

consumption (C_1) and savings [$Y_1 = C_1 + S$], while consumption is limited by income in that period plus saving with return of saving (r), for the second period [$C_2 = Y_2 + S\ (1 + r)$]. The present value of consumption must be equal to the present value of income, if intertemporal budget constraint is written as following:

$$C_1 + C_2/1 + r = Y_1 + Y_2/1 + r \tag{2}$$

Since an income tax reduces the return on saving, one can expect that it would have a substitution effect in favor of the present consumption (Eq. 3). On the other hand, an indirect taxation on goods instead of an income tax would raise the price of consumption from 1 to ($1+t_c$) (Eq. 4).

$$C_1 + \frac{C_2}{1+r(1-t_y)} = Y_1(1 - t_y) + \frac{Y_2(1-t_y)}{1+r(1-t_y)} \tag{3}$$

$$(1 + t_c)C_1 + \frac{(1+t_c)C_2}{1+r} = Y_1 + \frac{Y_2}{(1+r)} \tag{4}$$

It can be seen from this simplified model that a tax mix change toward the less income tax and more consumption tax would reduce the present-term consumption and therefore increase saving, with given present-term income. Increasing after return on saving would create a substitution effect. Consequently, the structure of the tax system may influence saving both by changing lifetime wealth and, by affecting the rate of return on saving. While a tax on consumption leaves unaltered the relative price of present and future consumption, an income tax on the return on saving distorts the intertemporal resource allocation by increasing the price of future consumption. Furthermore, at a macroeconomic level, an income tax has further implications on saving. High-income households are affected more by income taxes, since income taxes are generally progressive and household saving rates are also progressive related to income (Callen and Thimann, 1997).

It is as generally accepted from other studies and simulations (e.g., Summer, 1981; Auerbach and Kotlikoff, 1983; Kotlikoff, 1984; Sandmo, 1985) on this neoclassic intertemporal optimization model is that lowering taxes on capital income reduce current private consumption not only through substitution effects associated with the higher price of current relative to future consumption, but also through income effects associated with the reduced present value of a household's human capital endowment.

However, it should be noted that since higher after-tax return on saving by changing of tax mix can create an income effect which means that consumers can use raised sources to current consumption as well as saving, the overall impact of reducing income taxes on saving remains unclear. Furthermore, the effect of tax system on saving don't work uniformly, while some provisions may increase saving incentives as well others reduce

saving incentives. The tax system effects saving not only through tax mix, but also tax treatment on individual retirement accounts and capital gains is matter. Most industrialized countries have tax incentives for certain types of savings (such as owner-occupied housing, private pension funds) over others (such as bank deposits) to increase growth by reducing distortions at saving behaviors (Johansson et al., 2008). Studies demonstrate that tax-deferred saving accounts have induced massive portfolio shifts towards tax-favored assets (Poterba, 2001; Jappelli and Pistaferri, 2003).

On the other hand, changing tax mix with respect to reduce income taxes does not affect by similar way all groups in a society. We can expect that since low-income households have a tendency of low saving, reducing income taxes would probably stimulate increasing in consumption for these income levels on the contrary of high-income households (Garner, 1987). Nevertheless, arguments of this neoclassic model with rational consumer have been driving the tax reforms, toward reducing income taxes to promote economic performance, which throughout 1980s and 1990s. Proposes on cutting in income taxes by supply-side economists of U.S. had depended on these arguments which tax cuts raise the after-tax incentives to work, save, and invest.

While its proposals on tax mix are rarely criticized, the model comes under attack concerns the validity of assumptions on rational consumers operating with perfect capital markets and their simplified saving motives. First of all, there are many different motives for saving and an heterogeneity in types of saving, such as Keynesian precautionary purposes, speculative reasons, providing resources for retirement and bequests and deposing for large possible consumption items, while there is the gap between interest rates for saving and borrowing in real economies. Therefore, household may not respond to small changes in after-tax return on saving (Freebairn, 1991; Boadway and Wildasin, 1995).

A numerous studies have employed the after-tax interest rate as a proxy measure of the return on saving, to consider an effect of taxing. However, the empirical evidence presents ambiguous results. For example, Hall (1988) found no effects of interest rates on savings. Bovenberg (1989) argued that the effects of taxes on private savings is relatively small and uncertain, while public saving has direct impact on national savings in the US. However, he accepted that the tax system powerfully affects the composition of savings and investments. One influential study by Boskin (1978) found a substantial sensitivity of saving to after-tax return. Gylfason (1981) also found similar results with Boskin (1978). Other studies (Howrey and Hymans, 1978; Hall, 1985; Blinder and Deaton, 1985) found little sensitivity of saving to the rate of return or no significant effect of after-tax return. Attanasio and Banks (1998) have found from their examination on UK and US that there are little evidences the fact that tax incentives to promote national saving. They concluded that tax incentives to stimulate saving has probably mistargeted, if their aim is to increase saving rates. However, the results from empirical studies point out the controversial findings and have not provided definitive evidence on the sensitivity of saving to after-tax returns because

of probably quite different statistical models adopted (Honohan, 2000; Jappelli and Pistaferri, 2002; Loayza et al., 2000). Tanzi and Zee (1998) argued that inconclusiveness of the empirical results is probably due to the fact that differences in data sets used, differences in definitions of saving, and moreover, most studies heavy relied on the United States where may be characterized by stable tax structure over decades and by occasional important change in tax provisions.

In one of rare studies that use tax mix indicators as explanatory variables, Callen and Thimann (1997) found the ratio of direct taxes to total government revenue to have a significant negative impact on saving, while the indirect tax ratio is significant, from panel data for OECD countries. Tanzi and Zee (1998) found from data of OECD countries that the ratios of total tax revenue, income tax revenue and consumption tax revenue to GDP are statistically significant and negatively relationship to the household saving rate. Furthermore, negative coefficients for income taxes are especially higher than those for consumption taxes. They have also found that when the total taxation as a share of GDP is held constant, household saving rate bears a positive and statistically significant relationship to consumption taxes that this finding could be interpreted as the positive effect on the saving behavior of replacing income with consumption taxes.

Although most studies on determinants of saving are on developed countries, several studies from data on developing countries also provide evidences for negative impact of taxation (especially those of income taxes), as results vary by individual countries. Jenkins (1989) displays that changing in tax structure toward indirect taxes from direct taxes in Sri Lanka has increased the gross capital formation. Cardenas and Escobar (1998) pointed out that general level of taxation negatively affects private savings for Colombia. Dahan and Hercowitz (1998) found that income taxes in Israel are negatively related to saving rates. Kerr and Mongish (1998) have reported that direct taxes have a negative impact on saving in India. For Turkey, Fletcher et al. (2007) found as statistically insignificant the real interest rate which indicates the after-tax return on saving. Değirmen, S. and Şengönül A. (2012) has employed the net tax ratio (total tax revenue minus transfers as a share of GDP) as a regressor, but they have no found a statistically significant coefficient on the variable.

3. Saving and Tax Structure in Turkey: Motivation for the Study

It is widely accepted that the saving provides resources for private capital formation and in turn, raises economic growth and productivity. For the society, a larger capital stock enhances the aggregate output and income per capita. Especially for developing countries who strains to obtain high economic growth and development, higher domestic

saving is needed to spur domestic capital formation without continued reliance on foreign saving[4].

In recent years, one of the most important economic problems of Turkey is pressure which created by low household saving rates and large current account deficit. Since Turkey has low saving rates in international levels, its high growth rates are financed by foreign savings, and in turn, and this economic structure increases current account deficits. As shown in Figure 1, domestic savings in Turkey have continuously declined since the late 1980s despite of temporary increasing in the course of 1997-99. Although the fall in the saving rate was driven by the public sector deficits throughout 1990s, post- 2001, it is due to declining in private savings (World Bank, 2012). In comparison with the other countries, it can be seen that Turkey has considerably lower saving rates among comparable income levels. The countries with upper middle level –that Turkey also is member of this category-, who have high growth rates, follow a contrast path with Turkey after 2000s. If Turkey's high growth rates and high current account deficits are taken into account after 2001, it is understood from the Figure 1 that Turkey has financed its growth with foreign capital inflows. The low level of saving rates and its dependency on external financing not only put at risk the sustainability of investments and economic growth of Turkey, but also it creates a pressure on the economy with respect to possible volatilities in the capital flows.

As known from the previous section, tax structure and tax provisions of the country are important variables to explain behaviours saving and consumption. Undoubtedly, special tax provisions (on retirement funds or financial investments) and after-tax return rates on saving could be more explanatory to examine causality relationships. However, the effect of taxation on saving can be approached through the changing tax mix at a macroeconomic setting, if one would like to investigate effects of the government's financing structure. A tax mix would reflect aggregated effects of individual tax provisions. Taken into account that a bulk of studies[5] finds empirical evidence for the link between tax mix and economic performance and individual types of taxes have different effects on economic behaviours, to change the tax mix can be a policy instrument as well an examining tool for economic effects of taxation. Tax reform initiatives attempt to change the tax mix in favour of an individual type of tax according to aimed efficiency and equality, ultimately.

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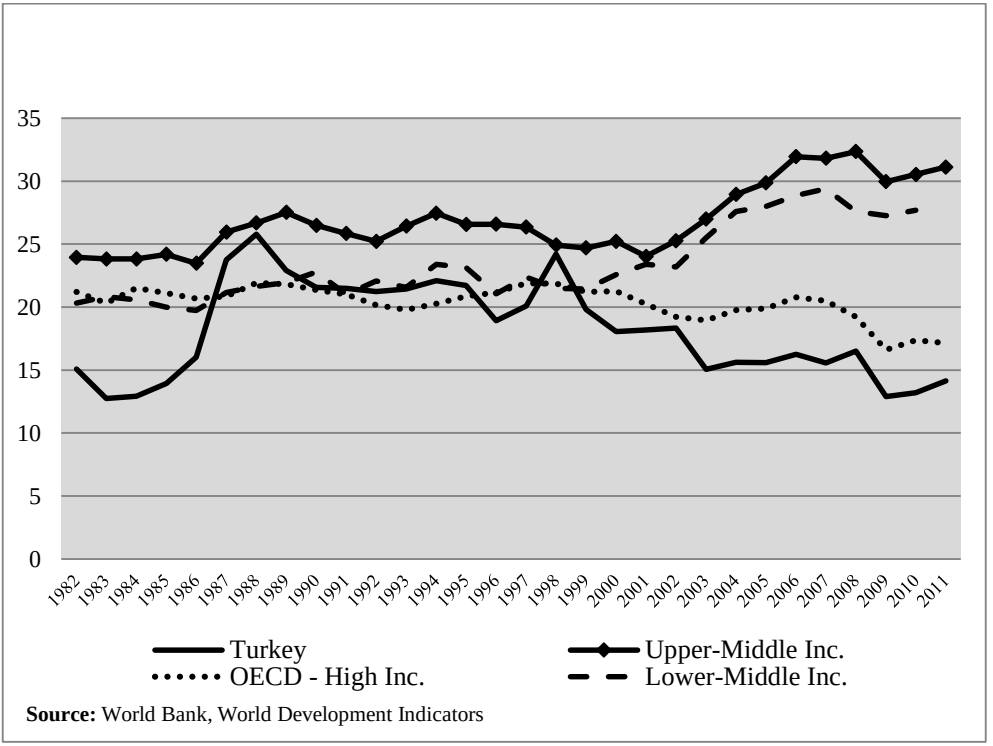
[4] *However, it should be noted that there are ambiguous empirical findings on the association between the growth and national saving for developing countries. For Turkey, Yentürk et al, (2009) has detected bidirectional Granger causality toward private sector savings from GNP, and concluded that increasing private savings do not help initiating growth and investment in Turkey like some other developing countries have excess capacity. On the other hand, Değirmen and Şengönül (2012) recently found that economic growth and public investments positively affects the private savings rates in Turkey.*

[5] *For a discussion on the literature and empirical findings see. Johansson et al. (2008)*

Figure: 1
Gross Saving Rates (% GDP): Turkey and Countries by Income Group



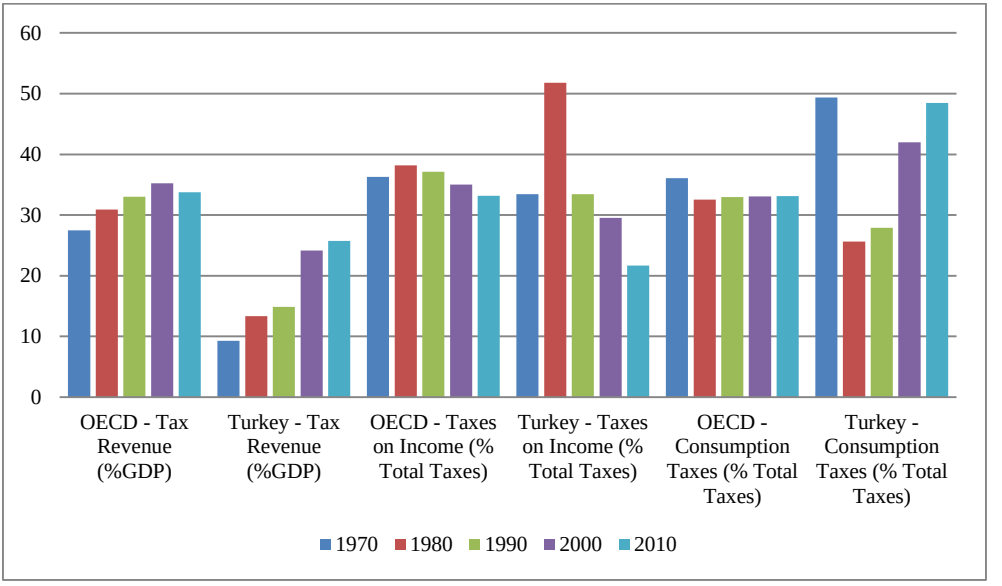
Source: World Bank, World Development Indicators

For the last quarter century, the main pattern in tax reforms at OECD countries is to change tax structure towards flatter personal income tax, cutting corporate tax rates, and decreasing overall top marginal rate on dividends[6]. It is widely accepted personal and corporate income taxes to have biases against savings and capital formation. Despite cross-country differences in the tax structure, it can be said that while countries has a tendency of reducing taxes on income for economic growth goals, global pressures (tax competition to attract capital, increasing indirect environmental taxes, etc.) force to increase indirect taxes from goods and services in most OECD countries, recently. On the other hand, Turkey like most developing countries has tax structure depending on indirect consumption taxes (Figure 2). Developing countries prefer indirect taxes because of political and administrative

[6] *Two special cases for reforms on this way are the dual income taxes in Nordic countries and the flat-rate income taxes in Baltic and former Soviet countries that both of them aim at promoting capital and undermine traditional income taxes with progressive rate and with global structure.*

constraints as well to promote economic growth. It is commonly accepted that since indirect taxes has negative distributional results, developing countries should transform their tax structure into one which weighted income taxes. Undoubtedly, there is a trade-off between economic efficiency and fairness. The possible tendency for many developed countries is also to use indirect taxes to finance the government in consequence of the goal of strengthening the economic performance.

Figure: 2
Tax Structure in Turkey and OECD



4. Data, Empirical Analyses and Findings

4.1. The Data and Econometric Procedure

Taken into account initiatives of tax reform aimed at change tax mix, the empirical analysis of the study focus on examining the causality and the impact of tax structure on domestic saving in Turkish case. Accordingly, it will be used the ratios of income taxes and consumption taxes to total taxation and overall tax burden of economy (the ratio of total tax revenue to GDP) as tax variables. It is possible that tax structure may affects public saving and private saving in different directions. Again, it is probable that there could be an interaction (such as the effect of crowding out) between public and private saving levels such as proposed by the Ricardian equivalence hypothesis (Barro, 1974).

Although World Bank (2012) estimates as very small the Ricardian offset coefficient (the percentage decline in private saving as a result of a one percent increase in public saving) in Turkey[7], it is possible that public savings could be affected by changing in tax mix because of differences at revenue-extracting abilities of individual taxes. Since the study interests in aggregated effect of taxation on Turkey's saving level, it uses per capita domestic saving comprised both private and public saving as the indicator to saving level. From theoretical and empirical examinations in the previous section, we expect that increasing in share of indirect consumption taxes in tax structure may be associated with increasing in saving level, while level of income taxes could decrease saving levels. We hypothesize that since consumption taxes apply the same tax rate on current and future consumption they do not influence the rate of return on savings and individual's savings choices as income taxes do. Hence, consumption taxation may be favoring saving levels relative to income taxation.

The long-run aggregate saving model of an economy can simply be characterized by following general function for empirical aims.

$$S_t = (Y_t, R_t, T_t) \tag{5}$$

where S is aggregate saving, Y is national disposable income, R is interest rate as a proxy of return on saving and T is a variable on taxation. Relying on this base empirical framework, it will be estimated following log-linear models (Eq.6, 7 and 8) in order to investigate effect of tax mix variables on saving.

$$\textbf{\textit{Model}}\ \mathbf{1}: \quad lnLPSAV_t = \alpha + \beta_1\, LPGDP_t + \beta_2 R_t + \beta_4 TAX_t + u_t \tag{6}$$

$$\textbf{\textit{Model}}\ \mathbf{2}: \quad lnLPSAV_t = \alpha + \beta_1\, LPGDP_t + \beta_2 R_t + \beta_4 INCTAX_t + u_t \tag{7}$$

$$\textbf{\textit{Model}}\ \mathbf{3}: \quad lnLPSAV_t = \alpha + \beta_1\, LPGDP_t + \beta_2 R_t + \beta_4 CONSTAX_t + u_t \tag{8}$$

As an indicator to saving, it was employed the gross domestic saving per capita (*LPSAV*) that has calculated by dividing population gross real domestic saving obtained World Bank, World Development Indicators after it was deflated with GDP deflator. Explanatory variables are per capita real GDP (*LPGDP*) calculated from data obtained the Turkish Ministry of Development and the Turkish Statistical Institute, the discount rate (*R*) as a proxy of interest rate that obtained IMF International Financial Statistics, and tax variables as the ratio of total tax revenue to GDP (*TAX*), the ratio of income taxes to total tax revenue (*INCTAX*), and the ratio of consumption taxes to total tax revenue (*CONSTAX*). Tax variables were drawn from OECD Tax Database with exception of the ratio of tax

[7] *Özcan et al. (2003) had found that an increase in the public saving rate by one percentage decreases the private saving rate by 0.30 percentages for Turkey.*

revenue to GDP which has been calculated by data from Turkish Revenue Administration. The data on income taxes consist of personal income tax and corporate income tax, while the data on consumption taxes comprise of sum of general sales taxes (i.e. value added tax), excise taxes and taxes on international trade - customs. LPSAV and LPGDP were used by their logarithmic transformations in analyses by following the related literature.

The estimations were performed on annual observations for period 1965-2011. Although using annual data is be criticized with respect to a satisfactory degree of freedom, in order to obtain quarterly data with high frequency is also difficult for all variables in Turkey case. On the other hand, since quarterly data is required seasonally adjusting that could distort temporal relationship between variables, it may also be undesirable. Furthermore, as noted by Hakkio and Rush (1991) having a long time span rather than a high frequency of observations could be more important, especially if one interests in causality relationship.

Basic econometric strategy adopted in empirical analyses is as following: Firstly, variables were tested for the unit root, since it is known the fact that many economic time series are not stationary. In the second step, equations were tested for cointegration. Since each of three equations was found the cointegrations relationship, the vector error correction models were constructed to analyze causality for both short and long term between domestic saving and tax variables. This procedure was separately followed for each of the models (Eq.6, 7 and 8). We especially interest in differences between results from Model 2 and Model 3.

4.2. Testing for Unit Roots

Since non-stationary series could generate a spurious regression and the econometric methods which will be choice depend on integration level of variables, it is be required variables to be tested for unit root. A unit-root process is one that is integrated of order one, meaning that the process is non-stationary but that first-differencing the process produces a stationary series. Figure 3 which presents time series plots of variables supports visually all variables to be non-stationary. First column of the Figure presents the time series in levels of variables, while second column displays the time series at their first differences.

Figure 3. Time Series Plots of Variables in Their Levels and First-Differences

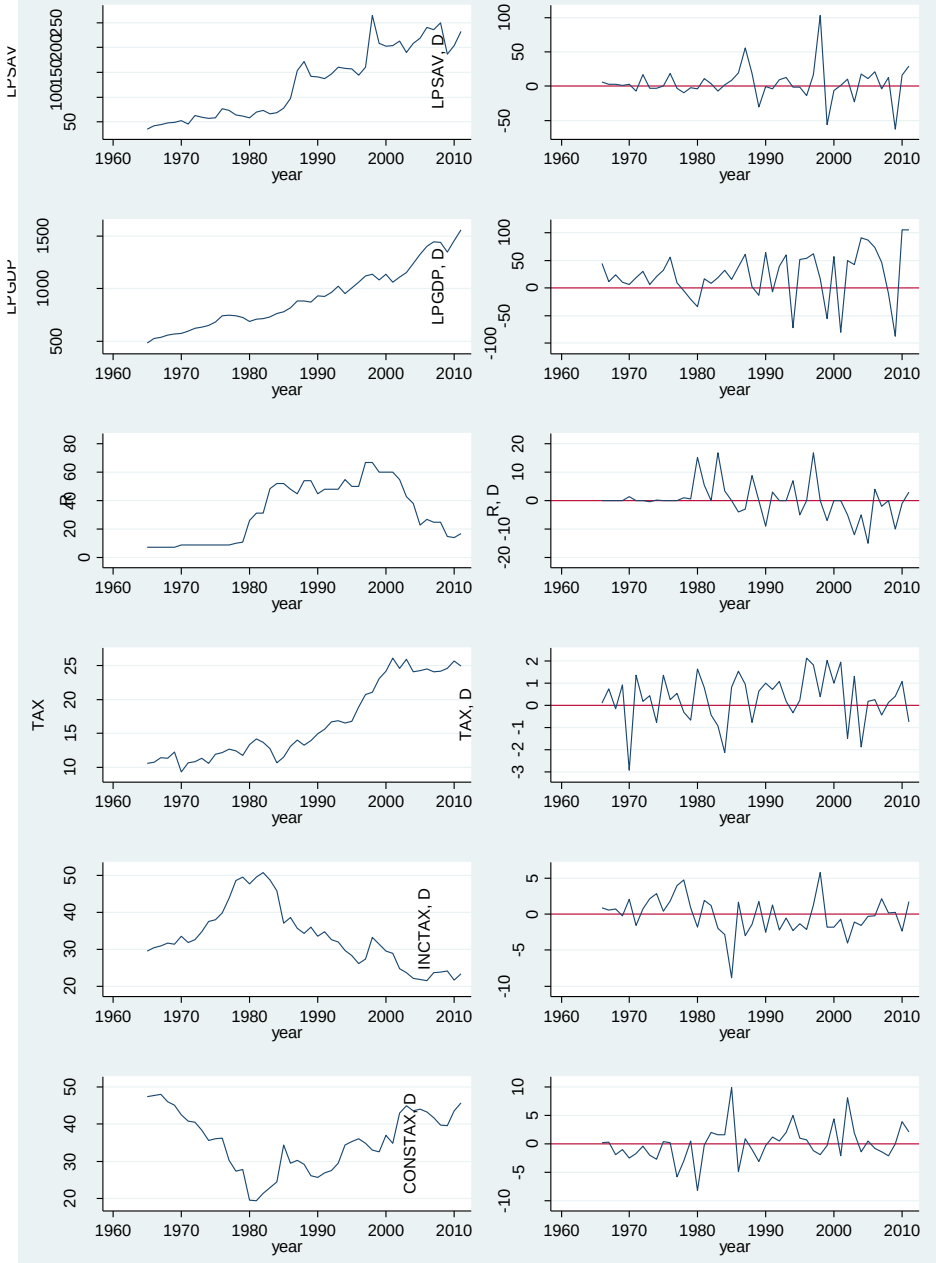


Table: 1
ADF and PP Unit Root Tests

		ADF Test			PP Test	
Variable	**Form**	**Lag**[(a)]	**Intercept**	**Intercept and trend**	**Intercept**	**Intercept and trend**
LPSAV	Level	(1)	-0.896	-3.628**	-1.342	-21.755**
	First difference	(0)	-7.755***	-7.660***	-43.575***	-43.562***
LPGDP	Level	(1)	1.001	-1.616	1.051	-7.046
	First difference	(0)	-6.301***	-6.489***	-41.881***	-41.709***
R	Level	(1)	-1.370	-0.511	-3.233	-1.240
	First difference	(0)	-5.781***	-6.089***	-40.929***	-42.194***
TAX	Level	(1)	-0.103	-1.916	-0.167	-6.828
	First difference	(0)	-7.292***	-7.263***	-50.096***	-50.123***
INCTAX	Level	(1)	-0.924	-1.988	-2.499	-5.408
	First difference	(0)	-3.560***	-3.666**	-40.619***	-42.375***
CONSTAX	Level	(1)	-1.538	-1.665	-4.853	-4.114
	First difference	(0)	-6.351***	-6.856***	-48.037***	-49.379***

*, **, *** indicates the significance at 10%, 5% and 1%, respectively.
[(a)] The lag selection is based on Akaike's information criterion (AIC), Hannah and Quinn's information criterion (HQIC), and Schwarz's Bayesian information criterion (SBIC).

However, obtaining the exact integration levels of the variables is only possible with formal tests. Therefore, three formal tests has been carried out for all variables as Augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1979), Phillips-Perron (PP) test (Phillips and Perron, 1988), and a modified version of Dickey-Fuller test (DF-GLS) suggested by Elliott et al., (1996). DF-GLS is a modified Dickey–Fuller t test for a unit root in which the series has been transformed by a generalized least-squares regression, and Elliott et al., (1996) have shown that this test has greater power than ADF version.

Tests of ADF and PP are reported in Table 1 and DF-GLS is in Table 2. Both tests from Table 1 indicate that all of variables are stationary in the first differences. The null hypothesis of a unit root is rejected for the variables at the 1% significance level. However, tests with constant and trend for LPSAV shows a doubt of having unit root at the level. Therefore, DF-GLS test for unit root that is a more advanced test is applied. As can be seen Table 2, DF-GLS is not able to reject the unit root hypothesis. Therefore we conclude that all series are integrated of order one, I(1), and it is appropriate to proceed to test for the cointegration analysis.

Table: 2
DF-GLS Test for Unit Root

Variable	Form		Test Statistics	Lag[a]	Decision
LPSAV	Level	Intercept	-0.178	(1)	I(0)
		Intercept and trend	-3.190*	(1)	
	First difference	Intercept	-5.680***	(1)	I(1)
		Intercept and trend	-5.624***	(1)	
LPGDP	Level	Intercept	2.148	(1)	I(0)
		Intercept and trend	-1.705	(1)	
	First difference	Intercept	-3.637***	(1)	I(1)
		Intercept and trend	-4.043***	(1)	
R	Level	Intercept	-0.972	(1)	I(0)
		Intercept and trend	-0.893	(1)	
	First difference	Intercept	-3.958***	(1)	I(1)
		Intercept and trend	-4.243***	(1)	
TAX	Level	Intercept	0.331	(1)	I(0)
		Intercept and trend	-1.480	(1)	
	First difference	Intercept	-3.656***	(1)	I(1)
		Intercept and trend	-3.777***	(1)	
INCTAX	Level	Intercept	-0.986	(1)	I(0)
		Intercept and trend	-1.209	(1)	
	First difference	Intercept	-3.043***	(1)	I(1)
		Intercept and trend	-3.333**	(1)	
CONSTAX	Level	Intercept	-0.954	(1)	I(0)
		Intercept and trend	-0.901	(1)	
	First difference	Intercept	-4.200***	(4)	I(1)
		Intercept and trend	-5.156***	(4)	

*, **, *** indicates the significance at 10%, 5% and 1%, respectively.
[a] Lags are determined by Schwarz information criterion and modified Akaike's information criterion

4.3. The Cointegration Analysis

Since all variables found to have stationary at their first differences, the cointegration rank can be estimated to determine the presence of a long-run relationship among the variables of each model, and the parameters from vector autoregressive models by following Johansen methodology (Johansen, 1988; Johansen and Jelius, 1990 and Johansen, 1995).

Before testing the cointegation of variables, one must determine the optimal lag length which will be small enough to allow the estimation, and which be high enough to ensure the errors to be white noise approximately. Findings for the optimal lag orders based on VAR models of equations has been reported at Appendix A, which minimize related information criterion. It was selected the optimal lag order as 4 for each of three models (VAR(4)). The AIC, the final prediction error (FPE) and modified LR test statistics confirm this lag specification.

By relying on lag order in underlying VAR from Appendix A, the null hypothesis of no-cointegration was tested by using Johansen trace statistics for a VAR model with both only constant and a constant and a trend. Table 3 reports the results from the cointegration analysis based Johansen trace statistic (λ_{trace}) to determine cointegrating vectors. It is seen from Table 3 that there are two cointegrated vectors in order to explain the long-run relation in Model 1, while it is one for Model 2 and Model 3, at the 1% significance level.

Table: 3
Johansen Cointegration Test

	Constant				**Constant and trend**			
Maximum Rank	**Eigenvalue**	**λ_{trace}**	**5% critical value**	**%1 critical value**	**Eigenvalue**	**λ_{trace}**	**5% critical value**	**%1 critical value**
Model 1.								
0		70.7092	47.21	54.46		80.7673	54.64	61.21
1	0.58595	32.7928****	29.68	35.65	0.60665	40.6463	34.55	40.49
2	0.40614	10.3851**	15.41	20.04	0.38099	20.0217***	18.17	23.46
3	0.19038	1.3040	3.76	6.65	0.28138	5.8133	3.74	6.40
4	0.02987				0.12645			
Model 2.								
0		58.9079	47.21	54.46		77.7559	54.64	61.21
1	0.64083	14.8783***	29.68	35.65	0.64287	33.4802***	34.55	40.49
2	0.20886	4.8043	15.41	20.04	0.38059	12.8837	18.17	23.46
3	0.10171	0.1920	3.76	6.65	0.18364	4.1589	3.74	6.40
4	0.00446				0.09219			
Model 3.								
0		77.2946	47.21	54.46		84.9788	54.64	61.21
1	0.72718	21.4399***	29.68	35.65	0.72890	28.8520***	34.55	40.49
2	0.23199	10.0899	15.41	20.04	0.33747	11.1494	18.17	23.46
3	0.20452	0.2510	3.76	6.65	0.19332	1.9116	3.74	6.40
4	0.00582				0.04348			

*, **, *** indicates the significance at 10%, 5% and 1%, respectively.

Therefore, we conclude that there is long-run equilibrium relationship for among variables in each of three models. It can be said that there is the one-way causality at least according to Engle and Granger (1987). Although the cointegration relationship does not point out the direction of the causality, it allows estimating of the causality relationships through a vector error correction model (VECM).

4.4. Vector Error Correction Models and Causality between Domestic Saving and Tax Structure

Since the variables are first-difference stationary and the presence of cointegration relationship in the equations, the Granger causality cannot be estimated in a simple VAR model. However, estimating of the causality between variables requires the model to be specified in VECM framework. A VECM is used to model the stationary

relationship between multiple time series that contain unit roots. In a VECM, the long-run relationships between the variables should converge and the short-run variations can be examined through the correction coefficients which measure the speed of adjustment between time series. A stable VECM displays that deviations from the relationship represent disequilibria that cannot persist indefinitely, since the cointegrating relationship describes the long-run relationship that links the levels of the stationary variables. VECM helps analyze how this equation systems return to equilibrium.

As pointed out by Engle and Granger (1987), if the variables are cointegrated, a VAR in first differences would be misspecified. A VAR(p) with *p* lags and contains the cointegration relationship can be expressed as a VECM as Eq. (9) following:

$$\Delta y_t = \boldsymbol{v} + \boldsymbol{\Pi} y_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}\, \Delta y_{t-i} + \epsilon_t \qquad (9)$$

where y_t is a *K x 1* vector of variables, v is a *Kx1* vector of parameters, and ϵ_t is a *K x 1* vector of disturbances. ϵ_t has mean 0, and is i.i.d normal over time. Matrices of parameters are $\boldsymbol{\Pi} = \sum_{\mathrm{j=1}}^{\mathrm{j=p}} \mathrm{A_j} - \mathrm{I_k}$ and $\boldsymbol{\Gamma}_i = -\sum_{\mathrm{j=i+1}}^{\mathrm{j=p}} \mathrm{A_j}$. If the variables $\mathrm{y_t}$ are *I(1)* the matrix $\boldsymbol{\Pi}$ has $0 \leq \mathrm{r} \leq \mathrm{K}$, where *r* is the number of linearly independent cointegrating vectors. Since it omits the lagged level term $\boldsymbol{\Pi} y_{t-1}$, a VAR in first differences of variables is misspecified (Engle ve Granger, 1987).

A VECM as in Eq. (9), in fact, does not contain the deterministic trends stemmed from the mean of the cointegrating relationship or the mean of the differenced series. Because, a constant in an equation for the first-difference of a variable would represent a linear trend in the level of the variable, or a quadric time trend in the level would represent a linear time trend in the first-difference equation. Taken into account these deterministic components, a VECM is rewritten as in Equation 10:

$$\Delta y_t = \boldsymbol{\alpha}(\boldsymbol{\beta}' y_{t-1} + \boldsymbol{\mu} + \boldsymbol{\rho} t) + \sum_{i=1}^{p-1} \boldsymbol{\Gamma_i}\, \Delta y_{t-i} + \boldsymbol{\gamma} + \boldsymbol{\tau} t + \epsilon_t \qquad (10)$$

Thus, a VECM may include five possible trend conditions. Eq. (10) represents a VECM contained all possible deterministic components (unrestricted trend). In second case, the trends in the levels are linear but not quadric one ($\boldsymbol{\tau} = \mathbf{0}$). In third case, the levels of the data have linear trends but the cointegrating equations are stationary around constant means ($\boldsymbol{\tau} = \boldsymbol{\rho} = \mathbf{0}$). In the restricted constant case, there is no a linear time trend in the levels and the cointegrating equations are stationary around constant means ($\boldsymbol{\tau} = \boldsymbol{\rho} = \boldsymbol{\gamma} = \mathbf{0}$). And finally, the specification may not include nonzero means or trends. This case of no-trend assumes that the cointegratinf equations are stationary with means of zero and that the differences and the level of the data have means of zero ($\boldsymbol{\tau} = \boldsymbol{\rho} = \boldsymbol{\gamma} = \boldsymbol{\mu} = \mathbf{0}$).

The results from a VECM is sensitive its trend components as well optimal lag selection and estimated rank number of cointegrating relationships. In order to determine deterministic components of our VECMs, it was performed the likelihood-ratio tests. Firstly, a encompassing model which include possible all trend components (the alternative hypothesis), then this model was tested against a nested models (the null hypothesis) sequentially.

Table: 4
The Likelihood-Ratio Tests for Deterministic Components of VECMs

Assumption	*LR Chi2*	*Probability*	*Decision*
Model 1.			
$\tau = 0$	2.73	0.2554	$\tau = 0$
$\tau = \rho = 0$	3.75	0.1534	$\tau = \rho = 0$
$\tau = \rho = \gamma = 0$	18.40	0.0001	$\tau = \rho = 0$
$\tau = \rho = \gamma = \mu = 0$	34.40	0.0000	$\tau = \rho = 0$
Model 2.			
$\tau = 0$	2.08	0.5564	$\tau = 0$
$\tau = \rho = 0$	0.37	0.5431	$\tau = \rho = 0$
$\tau = \rho = \gamma = 0$	17.66	0.0005	$\tau = \rho = 0$
$\tau = \rho = \gamma = \mu = 0$	24.43	0.0001	$\tau = \rho = 0$
Model 3.			
$\tau = 0$	8.63	0.0347	Unrestricted trend
$\tau = \rho = 0$	9.16	0.0572	$\tau = \rho = 0$
$\tau = \rho = \gamma = 0$	19.77	0.0002	$\tau = \rho = 0$
$\tau = \rho = \gamma = \mu = 0$	50.04	0.0000	$\tau = \rho = 0$

As seen in the Table 4, it was preferred the specifications with unrestricted constant from likelihood-ratio tests for each of three model. Although likelihood-ratio tests for lag exclusion were also performed to assess the possibility of trimming parameters numbers, previously determined lags (at Appendix A) were found to be suitable. In addition to these tests, diagnostic checks were performed such as the Lagrange multiplier test (LR) for autocorrelation at lag order; Jaque-Bera test, skewness and kurtosis tests for normality of disturbances; and test for eigenvalue stability[8]. Diagnostic tests have been reported at Appendix B. It could not been identified any significant departures from the standard assumptions.

[8] *If the estimated VECM is stable then the inverse roots of characteristics Autoregressive (AR) polynomial will have modulus less than one and lie inside the unit circle. There will be* kp *roots, where* k *is the number of endogenous variables and* p *is the largest lag.*

4.5. The Long and Short-Run Relationships from VECMs

The VECM approach allows distinguishing between short-term and long-term causality in addition to the direction of Granger causality among variables. The coefficients of correction terms (α parameters) represent how fast deviations from the long-term equilibrium, while β parameters from cointegrating equations could be interpreted as long-run relationship between variables in the model. On the other hand, the short-run coefficients (the matrix Γ from Eq.10) present short-run relationship between variables that they could be subjected to a Wald Test to determine short-run Granger causality. Adjustment coefficients have been found to be negative and statistically significant for all three VECM models.

Table 6 presents short-run Granger causality between gross domestic saving and the variables on tax structure, which obtained the Wald test based on the short-run coefficients. The Wald test has been performed only for the saving (LPSAV) and tax variables (TAX from Model 1, INCTAX from Model 2, and CONSTAX from Model 3), the study interested in relationships between these variables.

Table: 6
Short-Run Granger Causality: the Wald Tests based on the VECMs

Causality	Chi2	p value	Result
TAX - LPSAV	12.34	0.0063	TAX Granger cause LPSAV
LPSAV - TAX	0.39	0.9432	LPSAV does not Granger cause TAX
INCTAX - LPSAV	6.04	0.1098	INCTAX does not Granger cause LPSAV
LPSAV - INTAX	1.13	0.7707	LPSAV does not Granger cause INCTAX
CONTAX - LPSAV	29.78	0.0000	CONSTAX Granger cause LPSAV
LPSAV - CONSTAX	2.18	0.5365	LPSAV does not Granger cause CONSTAX.

It is apparent from Table 6 that the Granger causality between LPSAV and variables on tax is unidirectional and toward LPSAV from tax variables. However, there is no Granger causality between saving and income taxes. As it is be expected from theoretical empirical considerations in previous sections, there are significant results of Granger causality between domestic saving and taxes on consumption and overall tax burden for even short-term.

Table 7 reports the long-run equilibrium relationships obtained from error correction coefficients for each model. All coefficients in the equations are significant at %1 level. Even though the coefficients vary among the models, in general, the long-run coefficients for per capita GDP and interest rate are positive and statistically significant as

expected. The coefficients for GDP can also be interpreted as the elasticity, since the variables LPSAV and LPGDP have been used in their logarithmic forms in the analyses.

Table: 7
Long-Run Relationships from Cointegrating Equations

MODEL 1.	LPSAV= 1.858*R + 8.313*TAX – 2.267 (.3473065) (1.430986)
MODEL 2.	LPSAV = 0.1799*LPGDP + 1.070*R – 0.886*INCTAX – 27.352 (.0070395) (.0897957) (.2316404)
MODEL 3.	LPSAV = 1.828* LPGDP + 1.402*R + 1.375*CONSTAX – 122.67 (.0050867) (.0870442) (.1869351)

Standard errors have been reported in brackets.

Turning to variables on tax structure, interestingly, there is positive relationship between overall tax burden (total tax revenue as a share of GDP) and domestic saving. This finding can be understood if results for Model 3 and the main characteristics of Turkish tax structure are taken into account. Because, results for Model 3 used consumption taxes as tax variable indicate that there is a positive association between domestic saving and the share of consumption taxes in the total tax revenue, and as known that Turkish tax system is heavily depend on consumption taxes. Thus, the positive association between domestic saving and total tax revenue may be stemmed from this phenomenon. More importantly, results for tax structure are consistent with hypothetical expectations and findings of previous studies. In the long-term, the share of taxes on income to total tax revenue has negative impact on domestic saving (Model 2), while the share of indirect taxes on consumption to tax revenue has a positive impact on domestic saving (Model 3). For the related sample, this finding supports theoretical considerations on effects of taxation on saving as well efforts on policy design about tax reform.

Although indirect consumptions taxes are a justifiable cause of concern due to their regressive effects on income distribution, they have positive impact on saving relative to income taxes. In fact, this impact of consumption taxes can be seen as related to income distribution itself. As known, saving tendency is also related to household's income level. One can expect that households with high income have high saving rates, while households with low income level have high consumption tendency. Findings from the recent studies which based on Turkish micro-data by Rijckeghem and Üçer (2009) and Aktaş et al., (2012) also support this fact. A tax structure heavily depended on consumption tax may be increasing total domestic saving by distorting income distribution at the same time, household with high income has been encouraged in consumption taxes instead of income

taxes. On the other hand, decreasing in consumption taxes could only promote household with low income to consume more, they still need basic consumption goods.

5. Conclusion

The study examines the impact of tax structure on domestic saving in Turkey by using cointegration and vector error correction models. Three equations were estimated and the variables in all equations found to be cointegrated. For all equations, it has been found per capita GDP and interest rates to have the positive impact on domestic saving. From Model 1, overall tax burden found positively related to domestic saving. From Model 2 and Model 3, the share of consumption taxes as the percentage of total tax revenue is positively related to gross domestic saving, while the share of income taxes as the percentage of total tax revenue is negatively related to gross domestic saving, for a long-term relationship. The short-run Granger causality imposes unidirectional causality toward saving from tax system, except for the variable on income taxes. These findings may support the reform initiatives of reducing income taxes to promote economic performance throughout the world, and the fact that consumption taxes are favor of saving. Undoubtedly, design of tax mix also depends on other policy priorities such as redistribution, but findings point out that a change in tax mix in favor of indirect consumption taxes rather than income taxes (personal or corporate) may create an increasing in national saving rates in case of a developing country. However, it should be noted that in Turkey, indirect consumption taxes already play a very important role in tax revenues. It is possible that the further increasing of consumption taxes in the tax system would create heavy distortions and economic costs especially with regard to distributional issues. But, the results of the study also imply that a changing in tax mix toward income taxes could impose costs related to domestic saving.

Nevertheless, these findings need to be interpreted with caution due to the study's limitations. First of all, the analysis does not distinguish the effect of discretionary fiscal policy from changing of tax revenues caused by business cycle. It is obvious that conversions in tax structure may due to discretionary changes of the legal components (rate, deductions, credits etc.) of related tax as well changes at macroeconomic base (such as national disposable income or household consumption level) of any individual tax. Therefore, an exact policy suggestion can be drawn an analysis whose data should be corrected according to these two sources of changing. Future research should be done to investigate the effects of discretionary tax policy. Another issue is the fact that the previous studies has displayed that empirical results are sensitive to definition of saving as well statistical methods adopted. We employed the gross total domestic saving to considerate tax policy options and to investigate the impact of tax system in case of Turkey's low saving rate, however, household saving or private saving also could use to investigate different dimensions of the subject. It should be noted that Turkey has not data on household saving for long time series, even

though private saving can be obtained. Finally, results have been obtained from annual observations.

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Appendices

Appendix: A
Optimal Lag Order for the Models

Lag	LL	LR	Degree of freedom	Prob.	FPE	AIC	HQIC	SBIC
Model 1.								
0	-772.181				5.6e+10	36.1014	36.1618	36.2653
1	-600.806	342.75	16	0.000	4.1e+07	28.8747	29.1768*	29.6939*
2	-588.436	24.74	16	0.075	4.9e+07	29.0435	29.5873	30.518
3	-573.705	29.462	16	0.021	5.5e+07	29.1026	29.888	31.2324
4	-543.289	60.832*	16	0.000	3.1e+07*	28.432*	29.4591	31.2172
Model 2.								
0	-813.145				3.8e+11	38.0067	38.0671	38.1706
1	-627.561	371.17	16	0.000	1.4e+08	30.1191	30.4212*	30.9383*
2	-614.624	25.876	16	0.056	1.7e+08	30.2616	30.8053	31.7361
3	-604.599	20.048	16	0.218	2.3e+08	30.5395	31.3249	32.6693
4	-574.272	60.654*	16	0.000	1.3e+08*	29.8731*	30.9002	32.6583
Model 3.								
0	-814.376				4.0e+11	38.064	38.1244	38.2278
1	-639.134	350.48	16	0.000	2.4e+08	30.6574	30.9595*	31.4765*
2	-627.329	23.61	16	0.098	3.0e+08	30.8525	31.3963	32.327
3	-615.607	23.444	16	0.102	3.9e+08	31.0515	31.8369	33.1813
4	-583.984	63.245*	16	0.000	2.1e+08*	30.3248*	31.3519	33.11

* indicates optimal lag number selected by related information criteria.

Appendix: B
Diagnostic Tests for VEC Models

	J.B. Test	Skewness	Kurtosis	LM Test (2)
MODEL 1	Chi2 - 9.952	Chi2 - 6.328	Chi2 - 3.624	Chi2 - 13.6665
	Prob. 0.26841	Prob - 0.17593	Prob - 0.45934	Prob - 0.62354
MODEL 2	Chi2 - 7.388	Chi2- 3.649	Chi2 - 3.739	Chi2 - 19.2765
	Prob - 0.49542	Prob - 0.45554	Prob - 0.44254	Prob - 0.25458
MODEL 3	Chi2 - 9.217	Chi2 - 4.752	Chi2 - 4.465	Chi2 - 18.5555
	Prb - 0.32430	Prob - 0.31366	Prob - 0.34673	Prob - 0.29239