Uluslararası Sosyal Araştırmalar Dergisi
The Journal of International Social Research
Cilt: 10 Sayı: 50 Volume: 10 Issue: 50
Haziran 2017 June 2017
www.sosyalarastirmalar.com Issn: 1307-9581

THE APPLICATION OF THE LAFFER CURVE IN THE ECONOMY OF TURKEY•

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Abstract
Laffer curve is based on the assumption that in case of the spendable income increase after tax, investors make much more investment. In this paper, tax policies were examined over the period 1980-2014 for Turkish economy through to 4 different models. Following ADF Unit root test , total tax variable, direct tax variable and income tax variable were tested for each model in order to understand tax policies was appropriate for Turkish economy in the light of Laffer curve. For each model, shape of laffer curve was found as a parallel of theoretical expectations. Besides, both tax rates that makes tax revenues maximum and minimum were not found appropriate with theoretical expectation.
Keywords: Tax Rates, Tax Revenue, Laffer Curve.
Jel Classification: O1, H2, H29

Introduction

Supply side economy, which was developed against the Keynesian theories in the 1970's, has found an opportunity in many applied studies after its presentation in 1974. Supply side economy and Laffer curve asserted by Arthur Laffer claims that the rise in tax rates could lead to the fall in tax revenues and a fall in tax rates could cause an increase in tax revenues. (Atkinson et al.,2009:113).

It has been discussing for a long time that, the low ratio of taxation supports high economic growth. However, the tax revenues are one of the most important income source for the fulfillment of public services such as social security services, state investments and to be met of the another public expenditure.

1. Supply Side Economics

The supply-side approach was born as a reaction to the narrow concentration on aggregate demand in the standard Keynesian macroeconomic model. Opposite of the Keynesian economics, the supply-side Economics suppose that all issues about economics are originated from supply.
According to Evans (1983), supply-side economics based on the assumptions as below;

- Reductions in corporation income tax and corporate tax
- As a parallel of tax reduction, decreasing of public expenditures
- Legal and institutional liberalization Policy

Evans claims that if government perform the supply-side programs, economy will reach the high productivity, high economic growth and low inflation rate. Tax reduction is necessarily for supply-side economics. Other assumptions of supply-side economics is listed below.

a) According to supply side supporters, reduction in the tax increases the tax income and total market production in the long run term. They also claim that economic targets such as economic sustainability and income equality can be realized in the long run term.
b) Supply-side economics focuses on the relationship between tax rates and tax income. According to this relationship, reduction in the tax rate doesn't diminish the tax income as expected. On the contrary, tax income will increase and GDP will be affected positively from increments of tax income.

2. Laffer curve

Laffer curve as an important phenomenon of supply-side economics has been taken for many applied studies after its announcement in 1974 by Arthur Laffer. According to Laffer, increase in tax rate may cause the decrease in tax income. Laffer curve is based on the assumption that in case of the spendable income increase after tax, investors make much more investment. If mentioned assumption realizes, increase

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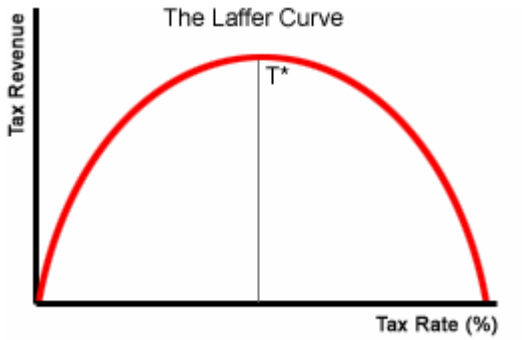
in tax income will be reached the expected result (Buchanan and Lee, 1982: 819). It should be considered that sometimes tax policies cause the asymmetric information problem. If policy makers increases the tax rates, investors and entrepreneurs think as if they are punished and they make false statement about their earning.(Mitchell,Çev. Çukurçayır, 2011: 335).

Figure 1: Laffer curve



According to figure 1, horizontal axis shows tax rate and vertical axis shows tax revenue. T*is a point that policy makers implement the tax rate on the T* points, they get maximum tax revenues. In this paper, by using four different models, try to understand T* point for Turkish economy.

3. Econometric analysis of the Relationship between Tax ıncome and Tax Revenue

3.1. Econometric Model: Methods and Data Set

In this paper, econometric analysis over the period 1980-2014 was carried out by 4 different models. Model of Yamak and Yamak (1995) was used as a reference. The regression equation representing by each model does not include constant term which means semi logarithmic. The reason of not involving the constant term in the regression equation is that if the income tax rate were 0 percent, the government gets zero revenue because it isn't collecting any money.

Table 1: Variables, Symbols and Sources

Variable	Symbol	Source
Reel Tax Revenue	rtr	Turkish Statistical Institute
Tax rate (Tax / GDP)	txr	Ministry of Finance
Square of Tax rate	txr^2	Ministry of Finance

Relationship between tax rate and tax revenue can be considered as quadratic function due to Laffer curve assumptions and Optimization Theory. Laffer curve was introduced with quadratic function by Beenstock (1979) as well.

By using variables as can be seen from the table 1, we can formulize Laffer curve like equation (1) below;

$$[rtr]_t = f([txr]_t \ [txr]_t^2)$$

In the 1st model, it is assumed for examined periods that Laffer curve does not change and optimal tax revenues will be same for every year.

Model 1:

$$Model\ 1 = Lnrtr_t = \alpha_0 txr_t + \alpha_1 txr_t^2 + \varepsilon_t \quad (1)$$

Contrary to the model 1, In the Model 2, model 3 and model 4, Laffer curve is assumed that there might be a change from year to year and accordingly optimal tax rate would change.

Model 2

$$Model\ 2 = Lnrtr_t = \alpha_0 txr_t + \alpha_1 txr_t^2 + \alpha_2 (trend * txr_t) + \varepsilon_{2t} \quad (2)$$

Model 3

$$Model\ 3 = Lnrtr_t = \alpha_0 txr_{2t} + \alpha_1 txr_t^2 + \alpha_2 (rtr_{t-1} * txr_t) + \varepsilon_{3t} \quad (3)$$

Model 4

$$Model\ 4 = Lnrtr_t = \alpha_0 txr_t + \alpha_1 txr_t^2 + \alpha_2 (GDP_{t-1} * txr_t) + \varepsilon_{4t} \quad (4)$$

In models, Ln denotes logarithmic transformation , α_1, α_2 and α_3 denote the parameters of variables they represent and ε_t and denotes Error Correction terms. And also reel GDP was used in equation 4. Annual data was used for each variables and not only for income and corporate (corporation) taxes, but also for direct and indirect taxes, 1980-2014 periods was considered. In the study, in contrast to Yamak and

Yamak (1995) ,tax revenue considered as the sum of income and corporate taxes. An indirect tax is a tax collected by an intermediary from the person who bears the ultimate economic burden of the tax and , direct tax is generally a tax paid directly to the government by the person on whom it is imposed. Corporate tax refers to a tax imposed on entities that are taxed at the entity level in a particular jurisdiction and income tax is a government levy (tax) imposed on individuals or entities (taxpayers) that vary with the income or profits (taxable income) of the taxpayer. Table 2 presents the tax realization over the period between 1980 and 2014.

Table 2: Tax Rate Realization in Turkey for 1980-2014

Year	TTR / GDP	ITR/GDP	DTR/GDP	Year	TTR/GDP	ITR/GDP	DTR/GDP
1980	0.17	0.065	0.101	1998	0.16	0.075	0.092
1981	0.18	0.078	0.111	1999	0.16	0.074	0.093
1982	0.15	0.068	0.090	2000	0.17	0.075	0.092
1983	0.16	0.072	0.096	2001	0.17	0.076	0.094
1984	0.13	0.074	0.074	2002	0.15	0.076	0.088
1985	0.13	0.076	0.065	2003	0.17	0.074	0.089
1986	0.15	0.076	0.079	2004	0.16	0.077	0.091
1987	0.15	0.075	0.077	2005	0.18	0.078	0.092
1988	0.14	0.071	0.070	2006	0.19	0.076	0.090
1989	0.15	0.071	0.081	2007	0.18	0.077	0.093
1990	0.16	0.072	0.084	2008	0.18	0.079	0.113
1991	0.18	0.068	0.089	2009	0.19	0.081	0.141
1992	0.16	0.069	0.086	2010	0.20	0.080	0.062
1993	0.13	0.068	0.087	2011	0.18	0.076	0.094
1994	0.13	0.072	0.088	2012	0.18	0.079	0.124
1995	0.15	0.070	0.091	2013	0.20	0.082	0.131
1996	0.17	0.071	0.090	2014	0.18	0.080	0.133
1997	0.14	0.072	0.089				

Source: The Ministry of Finance, TTR denotes, total tax revenue, ITR denotes indirect tax revenue and DTR denotes direct tax revenue

Table 3: Tax Rate Realization in Turkey for 1980-2014(Continuation of the table 2)

Year	Income Tax Rate / GDP	Corporation Tax / GDP	Year	Income Tax Rate / GDP	Corporation Tax / GDP
1980	0.089	0.008	1998	0.061	0.210
1981	0.089	0.019	1999	0.058	0.211
1982	0.082	0.021	2000	0.059	0.241
1983	0.076	0.018	2001	0.060	0.253
1984	0.058	0.014	2002	0.062	0.251
1985	0.048	0.016	2003	0.060	0.220
1986	0.053	0.024	2004	0.058	0.267
1987	0.053	0.022	2005	0.060	0.268
1988	0.047	0.021	2006	0.061	0.315
1989	0.058	0.021	2007	0.060	0.318
1990	0.065	0.016	2008	0.060	0.335
1991	0.065	0.016	2009	0.062	0.284
1992	0.067	0.018	2010	0.062	0.308
1993	0.059	0.019	2011	0.064	0.317
1994	0.061	0.023	2012	0.062	0.317
1995	0.060	0.021	2013	0.078	0.341
1996	0.059	0.023	2014	0.081	0.343
1997	0.061	0.023			

Source: The Ministry of Finance

3.2. ADF Unit Root

Before estimating the models, we will examine if data lead to spurious regression problem or not by using ADF unit root tests. Stationary of the time series means fixing the variance and the average over time. In other words a stationary time series is one whose statistical properties such as mean, variance, autocorrelation, etc. are all constant over time (Gujarati, 1999:712,713). In the case of non-stationary, time series includes the deterministic or stochastic trend. In this case, we can meet the spurious regression problem. Our ADF equation is like below:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + c \sum \Delta Y_{t-1} + u_t \quad (5)$$

$H_0: \gamma = 0$
$H_1: \gamma \neq 0$

If H_0 hypothesis is rejected, Y variable is stationary at original level. If H_0 hypothesis is not rejected, Y variable is non stationary. In this case, we get difference of variables to provide stationary. Table 4shows the result of ADF unit root test.

Table 4: Results of ADF Test

Variables	Lag	ADF Values	Lag	First Differencies
rtr	1	-2.99 **	1	-8.21 *
txr	3	-1.87	3	-11.10 *
GDP	3	-1.87	3	-11.10 *

Note: (*) denote the rejection of the null hypothesis at first difference of variables for % 1 level and (**) denote the rejection of the null hypothesis at level of variables for % 5 level. Mc Kinnon Critique values at % 1 level and % 5 level are respectively -3.421 and -2.312.

It is understood from the ADF result that reel tax revenue (rtr) is a stationary at level and tax rate (txr) and Gross Domestic Product (GDP) are stationary at first difference for % 5 significant level.

3.3. Findings

Econometric analysis over the period 1980-2014 was carried out by 4 different models and findings for each item below. Respectively total tax rates, direct tax and income tax rates reported as below.

4.3.1. Findings for Total Tax

Estimated statistical findings of Laffer curve for total tax revenues are given table 5 below.

Table 5: Findings of Total Tax

	Model 1	Model 2	Model 3	Model 4
α_0	199.1*	1988*	233*	376*
α_1	-791.1*	-821*	-866 *	-809 *
α_2	-	0.33**	1.9-9 **	5.32-18 *
$sum\ of\ (ERT)]^2$	3.12	5.12	5.11	5.31*
Durbin Watson	2.21	2.21	1.98	1.90
Auto Corelation Parameter	0.81*	*0.58	0.56*	0.71*
RMTRM	0.17	0.18-.20	0.17	0.17

ERT: Error Correction term, RMTRM: Rate Makes Tax Revenue Maximum, *and **, denote 1%, 5%, levels of significance respectively.

It can be seen from the table 5 that all estimation variables were estimated in the expected direction for each model and the signs of parameters are as expected. In addition, variable parameters were found statistically significant level of at least 0.05. The parameters of the quadratic term ($\alpha_1 1)$ in the regression equation is negative and statistically significant. This result revealed for each model that obtained Laffer curve is shaped as bell curve.

In model 1, tax rate, which make maximum to total tax revenue, is 17 % . For the all models, The Laffer Curve is shaped like an upside down U.

In model 2, the rates make tax revenues maximum is between 18%, 19% and 20%. For model 3 and 4, rate is %17 like model 1. As a result of Findings for total tax, tax rates exceeded the optimal rates in 1981, and last 10 years for model 1,3 and 4. This realization means that Turkey implemented inefficient tax policy

for mentioned periods. However, many years such as from 1984 to 1988, lover tax rates were implemented than RMTRM for each model. So that for this years, if tax rates had been increased at least small amount, tax revenues would have increased.

3.3.2. Findings for Direct Tax

Estimate of direct tax revenues are presented table 6 below,

Table 6: Findings of Direct Tax

	Model 1	Model 2	Model 3	Model 4
a_0	25.4*	24.6*	24.3*	24.6*
a_1	-121.1*	-101*	-105 *	-105 *
a_2	-	-0.004	11.10	5.32-18 *
$sum\ of\ ([ERT])^2$	0.074	0.07	0.056	0.064*
Durbin Watson	3.31	2.21	1.99	1.90
Auto Corelation Parameter	0.81*	0.58*	0.56**	1.00*
RMTRM	0.11	0.12	0.12	0.12

Average tax rate that makes the direct tax revenue maximum (optimal) is 12% according to result as it can be seen from table. However, the Tax Rates Realization in Turkey (Table 3) remained minimum 0.062 and maximum 0.133 which means Turkey allocated less and more in different years than expected. According to results, all variables were estimated in the expected direction for each model and the signs of parameters are as expected in accordance with Laffer curve. a_0 and a_1 parameters were estimated as expected and statistically significant. When DTR/GDP ratio from table 2 compared with the tax realization in Turkey, it is understood that in some years such as 1985 and 2010, Turkey implemented lower tax rates than the Rate Makes Tax Revenue Maximum.

3.3.3. Findings for Income Tax

In this paper, after the direct tax revenues, indirect tax and corporation tax was disregarded and focused on the analyses of income tax revenue. Result of analysis for Income Tax Revenues was presented as below.

Table 7: Findings of Income Tax

	Model 1	Model 2	Model 3	Model 4
a_0	498.1*	524.6*	524.3*	552.3*
a_1	-785.1*	-796.3*	-801.5 *	-809.1 *
a_2	-	-0.42	11.10	5.32-18 *
$sum\ of\ ([ERT])^2$	0.074	0.07	0.056	0.064*
Durbin Watson	3.31	2.21	1.99	1.90
Auto Corelation Parameter	0.81**	0.58**	0.56** 0.65*	1.00*
RMTRM	0.70	0.68	0.72	0.72

As it can be seen from table 7, the tax rates that makes tax revenue maximum is 72% for model 3 and model 4 but 0.70% for model 1 and 68% for model 2. Comparing with the result of Tax Rate realization in Turkey for 1980-2014, it is seen that ineffective tax policies were implemented for many years such as from 1980 to 1983 and in 2013 and 2014 (Table 3) . Mentioned years, implemented tax rates are over the RMTRM values. These results revealed that tax policies from 1980 to 1983 and in 2013 and 2014 realized in the inefficient area of Laffer curve.

Conclusion

According to Laffer, increase in tax rate may cause the decrease in tax income. Laffer curve is based on the assumption that in case of the spendable income increase after tax, investors make much more investment. In this paper, tax policies were examined over the period 1980-2014 for Turkish economy through to 4 different models. For each model, shape of Laffer curve was found as a parallel of theoretical expectations. Besides, both tax rates that make tax revenues maximum and minimum were not found appropriate with theoretical expectation. This result is similar with Yamak and Yamak (1995).

By this study, we can see that many times, Turkey implemented inappropriate tax policies and collected tax revenues than it could be more. And also, many times, Turkey implemented inappropriate tax rate that exceeded the optimal tax rate. This study also can be reference to fiscal and tax policy makers to determine appropriate tax rates. Especially implemented inefficient tax rates certain years increases the importance of this study. By using various models, optimal tax rates can be found and will be able to implement more efficient policies.

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