The Khaldun-Laffer Curve Revisited: A Personal Income Tax-Based Analysis for Turkey

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10 April 2017

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This Version: April 27, 2017

Abstract

The objective of this paper is to revisit as well as empirically examine an old but still discussed postulate, the Khaldun-Laffer curve, on the basis of personal income tax by making use annual time-series data for Turkey for the period 1970-2015. The findings of the paper confirm the validity of the Khaldun-Laffer curve hypothesis. In addition, we infer that the optimal tax rate that maximizes the tax revenue generated from personal income taxation in Turkey is 15.03 percent. This rate is well-below than the current rate which we estimate as 15.37 percent, implying that Turkey's current tax rate for personal income tax takes place in the prohibitive range of the Khaldun-Laffer curve. These findings suggest that the current tax rate should be lowered and to its optimal level to collect more tax revenue. Getting down the current rate to its revenue-maximizing rate not only would it enable the Turkish authorities to collect more revenues with a relatively lower rate, but also would allow them to minimize the substitution effects of personal income tax while maximizing the income revenues from it.

Key Words: Tax Policy, Khaldun-Laffer Curve, Laffer Curve, Optimal Tax Rate, Personal Income Tax, Turkey.

JEL Codes: E62, H2, H21, H30, H6

1. Introduction

No doubt, one of the most important as well as well-known arguments of the advocate of the supply-side economics is the notion behind the Khaldun-Laffer curve. Based on persistent high tax rates in the US, the proponents of supply-side economics have argued that lower tax rates would mean higher tax revenues as higher rates refer to lower tax revenue. Hence, reducing current tax rates would be a good tax policy option not only for revenue-maximizing, but also for stimulating economic activities. This argument of the supply-side economics made the Khaldun-Laffer curve[1] popular in the early 1980s.

[1] Throughout the present paper, we use "the Khaldun-Laffer curve and "the Laffer curve" interchangeably.

It is the graphical representation of the postulate that depicts a classic bell-shaped relationship[2] between tax rates and tax revenue, referring to increases in tax rates that raise the amounts of government tax revenue till a certain point, optimal tax rate, at which government collects the maximum amount of revenue from taxation. After that point, the rising tax rates will result in decreasing government's tax revenues due to substitution/ disincentive effects of taxes. Laffer (1981, 2004, 2008) argues that higher tax rates will discourage work and production by removing incentives, triggering to sluggish growth, and thereby diminishing tax revenue collected by the government.

Like for many other countries, revenue-maximizing is an important fiscal target for Turkey as well. Considering the undesired consequences of the alternative financing ways of budget deficits –especially, through borrowing and money creation– as a number of developing countries have experienced for the past three-four decades, the significance of having an ideal tax system in which tax rates generate maximum tax revenue for government without inducing a dampening effect on the economy has been well understood. This paper revisits and attempts to empirically examines the Khaldun-Laffer curve and based on this postulate, finds out the optimal tax rate at which the maximum amount of tax revenue for the government can be collected by considering the case of Turkey. Additionally, other expectations from the paper may be itemized as follows: i) to investigate whether actual tax rates are lower or higher from the revenue-maximizing tax rates, ii) to form a judgement for income and substitution effects of tax rates and thereby design ideal tax rates for fiscal policy purposes, iii) to avoid undesired consequences of taxation stemmed from high tax rates, i.e. tax avoidance, tax incidence, tax evasion, preferring leisure to work, changing the scope and/or structure of economic activities, etc., resulting not only in a reduction in government tax revenues, but also negatively affecting economic activities and thus, growth, and iv) to contribute particularly to the limited empirical literature related to the Khaldun-Laffer curve for developing countries like Turkey.

Since the Khaldun-Laffer curve theoretically establishes a parabolic link between tax rates of a tax instrument and tax revenues, and considers that tax rates are only exogenous variables that explain

[2] In the relevant literature, the theoretical relationship between tax rate and tax revenue in the context of the Khaldun-Laffer curve is presented under different terms such as "classic bell-shaped curve", "inverted U-shaped curve", "hump-shaped curve". See, for instance, Hsing (1996) and Tanzi (2014) for the first-type of description; Sanyal et al. (2000), Slemrod (1996) for the second-type of description; and Fullerton (1982) and Ballard et al. (1985) for the third-type of description. Mathematically, this terminology represents a nonlinear relationship between two variables: tax rate and tax revenue.

changes in tax revenue, throughout this paper, therefore, we can take only one tax into consideration. For this purpose, we have chosen the personal income tax for the testing of the Khaldun-Laffer curve. The reasons for doing so, first and foremost, personal income tax is a tax that is levied on individuals' taxable income. Second, this tax constitute the largest share of the central governmet's tax revenue after VAT and special consumption tax. And lastly, the personal income tax is a tax instrument that well-suits examining the Khaldun-Laffer curve.

Personal income tax is one of four important taxes, yielding highest tax revenue in the Turkish tax system. Other taxes are corporate income tax, value-added tax, and special consumption tax. These four taxes account for, on average, well over 80 percent of total government tax revenue. Although two indirect taxes -value-added tax, and special consumption tax- have a dominant role in the tax system and constitute about 70 percent of the total tax revenue on average, personal income tax has a significant place in the tax system, accounting for nearly 20 percent of total tax revenue. In addition, personal income tax is the only progressive tax except for wealth tax, inheritance and gift tax which generate an insignificant amount of revenue. At present, personal income tax includes four brackets with the tax rates of 15, 20, 27 and 35 percent, respectively. These rates are not frequently amended. The latest alteration was made in the year 2006 and then the number of tax brackets was reduced from 6 to 4. However, every end of the year, before starting fiscal year, tax brackets are expanded for subsequent fiscal years in line with the developments in CPI inflation of the current year.

The remainder of the paper is set out as follows: Section 2 looks into the theoretical background and related empirical literature, which will shed light on our paper. Section 3 deals with the econometric methodology and data, while Section 4 presents the estimation strategy and results of the paper alongside their interpretation. Finally, Section 5 summarizes and concludes.

2. Theoretical Background and Existing Empirical Literature

With Laffer's expression himself, while he was discussing the US President's proposal for tax increases in a dinner meeting,[3] he charted a curve on a cocktail napkin, illustrating the trade-off between tax rates and government tax revenues (Laffer, 1981, 2004, 2008; Wanniski, 1978, 2005; Tanzi, 2014). Soon later, as again Laffer (2004, 2008) noted, this trade-off was named by

[3] As reported by Wanniski (2005), the dinner took place at the Washington Hotel in Washington D.C. on 13rd September, 1974 with his friends including Jude Wanniski (and then-the associate editor of the Wall Street Journal), and top US policymakers of that time, such as Dick Cheney and Donald Rumsfeld.

Wanniski (1978) as the Laffer curve. However, Laffer (1981, 2004) states that the postulate behind the curve belongs to Ibn Khaldun, a 14th-century Muslim philosopher, and the curve was not invented by himself; Khaldun (1980[1377]) suggests that "it should be known that at the beginning of the dynasty, taxation yields a large revenue from small assessments. At the end of the dynasty, taxation yields a small revenue from large assessments" (p. 80) from his well-known book, the Muqaddimah.

However, contrary to the arguments above, some authors, such as Fullerton (1982), Ballard et al. (1985), van Ravestein and Vijlbrief (1988), and Hsing (1996), relate the issue with Adam Smith (2008[1776]), by citing from his well-known work, The Wealth of Nations, as "high taxes, sometimes by diminishing the consumption of the taxed commodities, and sometimes by encouraging smuggling, frequently afford a smaller revenue to government than what might be drawn from more moderate taxes" (p. 835). Despite these counter arguments,[4] we name the curve as the Khaldun-Laffer curve by Laffer's premise. It is specified by a one-way causality from tax rates to government tax revenues, illustrating a hump-shaped relationship between tax rates and tax revenues.

In the literature, the upward-sloping side of the Khaldun-Laffer curve is called the normal range, whereas the downward-sloping side is the prohibitive range (see, for example, Wanniski, 1978; Fullerton, 1982; Ballard et al., 1985; and Laffer, 1981, 2004, 2008). This implies that a given revenue can be collected with two different tax rates, one falls into the normal range, and the other one falls into the prohibitive range of the curve. In such a case, the rational fiscal policy option would be choosing the lower rate, falling into the normal range where income/incentive effect is dominant to substitution/disincentive effect of taxation.

The Khaldun-Laffer curve has been still under discussion, although more than three decades have passed since its postulate by Laffer. The focal point of discussion is whether the Khaldun-Laffer curve is true or false, or only an approximation. The discussions have centered specifically on whether there is such a relation between tax rates and government tax revenue, as emphatically argued by Laffer (1981, 2004, 2008). If so, what is the revenue-maximizing tax rate, i.e. optimal tax rate?

[4] It is worth noting that there are also some other arguments, which relate the Khaldun-Laffer curve to the Dupuit curve and/or the Burke curve. See Blinder (1981), Fullerton (1982), and Ballard et al. (1985) for further arguments in this regard.

The Khaldun-Laffer curve received a great attention especially in the early 1980s with the arguments of the leading supply-side economists,[5] asserting that "lower tax rates would mean higher revenues because existing rates were too high to maximize government tax revenues, –that is, tax rates were so high that fewer taxed goods were being produced and the overall effect was lower tax revenues" (Becsi, 2000, p. 53).

In reviewing the literature, we see at first glance that although there have been many studies on the Khaldun-Laffer curve, a large majority of which have focused on the theoretical or theoretical/ mathematical aspects of the curve, rather than empirically exploring it.[6] There are also numerous counter-studies,[7] which critically assess the curve in terms of different aspects, ranging from its assumptions to validity. However, this does not mean that there have been no empirical studies related to the issue. To the best of our knowledge, however, these sorts of studies are highly scant.[8] As also pointed out earlier, theoretical and/or theoretical/mathematical studies are beyond the scope of this paper.[9]

As mentioned earlier, the main contribution of the present paper is not only focusing on personal income taxation of Turkey within the context of the Khaldun-Laffer curve in the long run, but also including control variables other than tax rate and its square as determinants of tax revenues in order to prevent omitted variable bias that may produce misleading results.

An early study by Stuart (1981) calibrates the Laffer curve for Sweden for the 1970s based on a two-sector model, which contains a taxed sector –in which employed labor is taxed- and a non-taxed sector –in which supplied labor is not taxed– and finds that the Swedish tax rate on labor income is higher than the revenue maximizing tax rate. He estimates the revenue maximizing marginal tax rate for Sweden between 69-73 percent, while the actual tax rate is about 80 percent. This confirms that Swedish tax system was in the prohibitive range of the Khaldun-Laffer curve in the 1970s. On the other hand, for the same country, Feige and McGee (1983) develop a simple macroeconomics model, which derives the Laffer curve for Sweden. Their model takes into

[5] The leading supply-side economists are Arthur B. Laffer, Jude Wanniski, Alan Reynolds, Robert Bartley, Paul Craig Roberts, Michael K. Evans, Michael Boskin, and Martin Feldstein (see Brunner, 1982; Bartlett, 2003).
[6] See Henderson (1981), Sanyal et al. (2000), Busato and Chiarini (2013) for these sorts of studies, among others.
[7] Henderson (1981), Blinder (1981), Dalamagas (1998), and Becsi (2000) are just some of them.
[8] See Feige and McGee (1983), van Ravestein and Vijlbrief (1988), Hsing (1996), Heijman and van Ophem (2005), Trabandt and Uhlig (2011, 2013), Karas (2012), and Nutahara (2013).
[9] Meanwhile, it would be useful to remind readers that some of these works, such as Stuart (1981), Feige and McGee (1983), Pecorino (1995), Dalamagas (1998), Heijman and Van Ophem (2005), develop a theoretical model first and then calibrate it to the Khaldun-Laffer curve.

account the effects of the following three aspects of tax revenues: the strength of supply-side effects, the progressivity of tax system and the size of the unobserved economy. Using parameterizations of each of these effects, they attempt to estimate the curve for Sweden. Taking 1979 as the base year, they find that the marginal tax rate was about 0.83, whereas the revenue-maximizing rate was 0.58. These figures imply that Sweden was to the right of its Laffer curve peak in 1979. This reflects the necessity of cutting tax rates for this country not only for obtaining revenue maximizing rate, but also reducing substitution effects of taxation, stemming from high tax rates. As shown clearly from the results of the both studies, the optimal tax rate is lower than the actual tax rate for Sweden.

van Ravestein and Vijlbrief (1988) employ a similar model to Stuart (1981) and then estimate the actual tax rate and the peak level of the Laffer curve for the Netherlands, by taking 1970, 1980, and 1985 as base years. They find that all the actual tax rates are lower than the revenue-maximizing rate, reflecting the availability of room for rising the marginal tax rates for this country. On the other hand, Pecorino (1995) analyze the relationship between tax rates and the present value of income tax collections for the US by using an endogenous growth model, assuming the existence of a two-sector economy in which tax treatments differ across sectors. In his model, growth is generated by human capital accumulation and human capital is taxed at a lower rate than the production of the consumption/physical capital good. He finds that the present value of income tax revenue is maximized at 0.64 for the US economy.

Another study by Hsing (1996) on US economy investigates the Laffer curve over the period 1959-1991 by calibrating a quadratic function to time series annual data. He employs a single-factor model, considering the tax revenue per capita as a response variable, and the ratio of tax revenue change to gross income change. His findings indicate that the revenue-maximizing tax rate changes for the personal income tax between 32.67 percent and 35.21 percent for this country. On the other hand, the average tax rate was 19.58 percent based on tax liability and 20.18 percent based on tax payment in 1991. Based on these figures, he argues that there is room for increasing the average tax rate to collect more tax revenue. Following the almost same methodology with Hsing (1996), Karas (2012) investigates the revenue-maximizing personal income tax rate for the Czech Republic for the period 1993-2010. He observes that there is an inverted U-shape relationship between the tax rates and government tax revenues, as charted by Laffer. Quantitatively, he finds that the revenue-maximizing rate for personal income tax, for the Czech Republic is equal to 33.13 percent of gross annual income.

An interesting study by Walewski (1999) on three transition economies (the Czech Republic, Poland, and Hungary) explores the evidence of the presence of the Khaldun-Laffer curve in these countries by developing the "tax burden index", that is a special measure of taxes which takes into account both tax rates and tax ceilings in measuring the average taxation. His empirical findings show that the curve for the aforementioned three countries can be classic bell-shaped. However, he argues that the relationship between tax rates and tax revenues does not seem to play an important role in determining budget revenues in these countries. Rather than this, country-specific factors are significant in revenue differences among the countries analyzed. Walewski (1999) goes further in that both the Czech Republic and Poland are still on the upward sloping side of the Laffer curve, whereas Hungary swings around the Laffer hill –that refers to the peak point of the curve.

Apart from the studies on individual countries, there exists also other prominent studies focusing on country groups, such as OECD and EU countries. For instance, Heijman and van Ophem (2005) developed a simple model for 12 OECD countries.[10] With the exception of Sweden, in all other countries, the optimal marginal tax rate is higher than the actual marginal tax rate. However, it is lower than the actual one for Sweden. Another interesting finding of their study is that even with a very low willingness to pay tax, the optimal marginal tax rate is always higher than 36 percent.

Dalamasgas (1998) investigates the Laffer curve for 13 OECD countries[11] in the context of an endogenous growth model accompanied by suitable auxiliary equations for the period 1964-1994. His findings yield controversial results regarding both the validity and shape of the curve. More specifically, his findings reveal the limitations of the assumption that the Laffer curve has the familiar concave shape. His findings document that a permanent reduction in tax rates has a potential of generating more tax revenues in the long run for the highly taxed countries alone. However, he argues that a permanent reduction in average tax rates may give rise to increases in long-run government budget deficits in economies with crowding-out characteristics, thus providing a strong refutation of the dynamic Laffer curve proposition.

Two influential follow-up studies by Trabandt and Uhlig (2011) and Trabandt and Uhlig (2013), attempt to examine the shape of the Laffer curves quantitatively for labor taxation and capital

[10] Including Austria, Belgium, Switzerland, Germany, Spain, France, Italy, Ireland, Japan, Netherlands, Sweden, and the UK.

[11] These countries are Australia, Belgium, Canada, Finland, France, Germany, Greece, Italy, Japan, Norway, Sweden, the UK, and the US.

income taxation for the US, EU-14[12] as well as some other non-EU countries by comparing the balanced growth paths of a simple neoclassical growth model, a dynamic general equilibrium model, for the period 1995-2007. They conclude that there exist robust steady states the Laffer curves for labor taxes as well as capital taxes. Moreover, they argue that both the US and EU-14 are located on the left side [upward sloping side] of the curve, but the EU-14 countries are much closer to the slippery slopes than the US. Quantitatively, they found that increasing tax revenues by 30 percent in the US requires raising labor taxes but only 6 percent by raising capital income taxes. However, the same requirement for the EU-14 is 8 percent and 1 percent respectively. Furthermore, they observed that tax cuts in the EU-14 countries were self-financing to a much higher degree compared to the US. Another interesting finding of them is that in the US, 32 percent of a labor tax cut and 51percent of a capital tax cut are self-financing in the steady state, whereas in the EU-14 countries, 54 percent of a labor tax cut and 79 percent of a capital tax cut are self-financing.

Relying on the same methodology used by Trabandt and Uhlig (2011, 2013), Nutahara (2013) explores Laffer curves for labor, capital and consumption taxes in Japan. He finds similar results to those of Trabandt and Uhlig (2011, 2013) for Japan. According to the empirical findings of Nutahara (2013), the Laffer curves for labor and capital taxes have single peaks, whereas consumption tax revenue increases monotonically with respect to the tax rate. Furthermore, while the labor tax rate is smaller than that at the peak of the Laffer curve, the capital tax rate is either very close to, or larger than, that at the peak of the curve.

What we have seen from the review of the literature is that a large number of empirical studies related to the Khaldun-Laffer curve, concentrate on either an industrialized country or on the OECD or the EU countries by developing different theoretical models and then employing them. The studies focus on the Khaldun-Laffer curve for other countries, i.e. developing, emerging, and transitional, are quite limited as evaluated above. However, it is a fact that taking into account the fiscal and economic conditions of these countries, the revenue-maximizing tax rate is at least as important as industrialized one. This necessitates doing much more empirical studies related to the Khaldun-Laffer curve focusing on these countries as well.

[12] Excluding Luxembourg from the EU-15 due to the lack of data related to this country.

As shown above, with few exceptions, virtually in all studies different models have been used. Clearly, this makes difficult to make comparison among countries, unless the same models are used for different country groups. On the other hand, most of the assumptions of the models used in the empirical studies are extremely far from the reality. That is to say that they do not match with actual economy and taxation system.

Unlike many other studies on the Khaldun-Laffer curve, in this paper we specifically examine the Khaldun-Laffer curve in the context of a specific tax, which is the personal income tax. Secondly, in contrast to a large strand of previous studies that only consider tax rate and its square as independent variables for tax revenues; we employ a long-run estimation analysis with multiple variables (trade share, agriculture share, external debt share, inflation rate and GDP per capita) to avoid misspecification problem. As opposed to similar contributions, in this paper we work with relatively longer time span with 46 observations.

3. Econometric Methodology and Data

3.1. Data

In the paper, we employ annual data that are collected from reliable domestic and international sources. Data spans the period from 1970 to 2015 with a total of 46 observations.[13] Specifically, data related to taxes are taken from the Ministry of Finance Database, and all the other variables are obtained from the World Bank Database. The availability of the data is the main reason to choose this time period and the following variables. Increasing the precision of the econometric methodology highly depends on the number of observations, so we try to find the time horizon as large as possible to increase the reliability of our econometric model.

3.2. Econometric Methodology

In this section, besides the econometric methodology for our model, we also mention the theoretical framework for the variables we chose. As noted earlier, there are several theoretical/mathematical formulations of the Khaldun-Laffer curve, each of which is based on different assumptions. In the literature, empirical studies on the Khaldun-Laffer curve mainly

[13] In the literature, there is no consensus over the ideal number of sample size in time series analysis. Large sample size leads to increased precision in estimates of population. So, "more is better" phrase suits well. In addition, forecasting by using time series analysis requires higher sample size. However, in this paper we do not focus on forecasting. Rather, concentrating on finding out an optimal tax rate (i.e. interpreting the coefficient). For many developing countries, lack of data is observed excessively due to several reasons; such as making reforms more frequently, changing the calculation methods in data collection or collecting data for different time lines. As a result of all these, analyzing for a developing country case is challenging. In our analysis, the number of observations is larger than 30, and the degrees of freedom is also higher than 30. We believe that statistically all these are fair enough for interpreting the coefficients.

employ single factor model. In other words, they are taking tax revenue as dependent variable and tax rate and its square as only independent variables such as Hsing (1996), Karas (2012). However, omitting a relevant variable causes specification error, called "omitted variable bias". Underspecifying the model by excluding a relevant variable violates one of the Gauss-Markov assumptions: Zero conditional means of the error term (Woolridge, 2012). This violation harms the unbiasedness of estimated coefficients. Hence, if the expected values of estimated coefficients are not equal to population parameters, it will be meaningless to interpret them. In order to prevent this misspecification problem, some control variables are included in our analysis.

In the present paper, we depict the Khaldun-Laffer curve by controlling other determinants of personal income tax revenue different from its tax rate. These variables are listed as follows: i) GDP per capita, ii) share of agriculture, iii) share of trade, iv) share of external debt, v) inflation rate. With the exception of GDP per capita and the inflation rate, all other variables are expressed as a fraction of GDP.

Wagner and Weber (1977) argue that as economy progress, i.e. increase in per capita income, is observed, public sector tends to expand. This principle is called as Wagner's Law in the literature. In this paper GDP per capita is used as a proxy for the overall development of the economy. Combining with the Wagner's Law, a positive relationship is expected between personal income tax revenue and GDP per capita (Gupta, 2007).

On the other hand, sectoral decomposition of output is significant for tax revenue because collecting tax from certain industries is easier (Leuthold, 1991; Stotsky and WoldeMariam, 1997; Gupta, 2007). Lack of bookkeeping and existent of subsistence farming make the agriculture sector for many developing countries difficult to tax. So, the share of agriculture is used as a proxy for an informal sector that cannot be taxed properly from personal income. Hence, personal tax revenue is negatively affected by the share of agriculture (see Stotsky and WoldeMariam, 1997; Agbeyegbe et al., 2004; Gupta, 2007; Mahdavi, 2008).

The relationship between inflation rate and personal tax revenue is straightforward since high inflation rates imply rises in the wages in nominal terms. In the view of the progressivity of personal income tax, inflation drives incomes up and into higher tax brackets, resulting in bracket creep depending on inflation's speed and the structure of progressiveness. Hence, the bracket creep allows the government to generate artificially more personal income tax revenue by

boosting real tax burden of personal income tax payers that is called in the literature as "taxflation". On the other hand, it is also very likely that inflation may reduce the real value of tax revenue due to the so-called the "Tanzi effect" or "the Olivera-Tanzi effect" that emerges in the existence of followings: i) high inflation, ii) lags in tax collection, iii) inelastic tax structure.[14] In a nutshell, it is highly likely theoretically that inflation may positively or adversely affect personal tax revenue depending on the case we explained above. The inflation rate is the annual percentage change in the Consumer Price Index (CPI), taken from the World Bank database. Another control variable, that is external debt, shows government's revenue performance. When the government needs more revenue to finance its expenditures or to pay its due debt, the government has to increase its tax revenue. So, the expected sign of external debt is positive (Gupta, 2007).

In the literature, the sum of exports and imports as a share of GDP is frequently used as a proxy of openness of the economy to the international trade. International trade affects tax revenue through various channels. Firstly, the positive effect of international trade on economic development is an accepted idea, starting from Adam Smith. Accordingly, as income increases, personal income tax revenue increases. Secondly, compared to domestic activities, foreign trade activities are relatively easier to tax since they are taken place at specific locations.

The challenging point in this paper is to define tax rate since Turkish personal income tax is a progressive tax rate. Subject to the level of taxpayers' current income, the tax rates are set down as 15, 20, 27 and 35 percent. Since it is practically almost impossible to access the number of taxpayers who are in which tax bracket during the fiscal year, instead, we opt for using personal income tax revenue for each employed –to– GDP per capita ratio which can be interpreted as the individual's income tax burden.[15] This kind of calculation methodology is frequently applied in the literature especially in the cases when there is no flat tax rate as in the case of Turkey. The calculated value can be called marginal tax rate. As a dependent variable, personal income tax revenue is used. In order to eliminate the price effect, we convert the nominal level of tax revenue into the real level.

[14] See Tanzi (1977; 1978) and Şen (2003) for detailed explanations as well as implementations for Argentina and Turkey respectively.
[15] In other words, tax rate is the ratio of personal income tax revenue over number of employed people as well as GDP per capita.

After controlling for the following variables, our aim is to find out threshold level for the tax rate when the behavior of tax revenue changes. The appropriate econometric model for this purpose can be designed as follows:

$$T_t = \beta_0 + \beta_1 tax_t + \beta_2 tax_t^2 + \beta_3 X_t + \varepsilon_t$$

where, *T* and *tax* stand for personal income tax revenue and tax rate respectively, whereas *X* stands for control variables which are listed before so that $\beta_0, \beta_1, \beta_2$ are scalars and β_3 is a parameter vector.

In this paper we attempt to find where Turkey is in the Khaldun-Laffer curve for personal income tax. Proving the possible existence of the Khaldun-Laffer curve for Turkey, the expected sign of the coefficient of personal income tax rate, β_1, should be positive while the coefficient of tax rate square, β_2 should be negative. Accordingly, the optimal tax rate can be calculated by taking the first order derivative of tax revenue with respect to tax rate and equalizing it to zero will give the maximum points (tax*, T*), we obtain:

$$T = \beta_1 tax + \beta_2 tax^2 + C \rightarrow \frac{\partial T}{\partial tax} = \beta_1 + 2\beta_2 tax = 0 \rightarrow tax^* = \frac{-\beta_1}{2\beta_2}$$

4. Estimation Strategy and Results

The problem of spurious regression may arise when time series data is applied to the non-stationary form. One of the solutions is to make the series stationary by taking first-differences. However, differencing of the series would hinder long-run analysis (Davidson et al., 1978). To avoid this problem, there are various methods. Davidson et al. (1978) propose an error correction mechanism (ECM) by using first differences of the short-run and undifferenced values for the long-run dynamics. However, Engle and Granger (1987) prove the necessity of cointegration relations in order to be able to implement this method. Johansen Cointegration test is preferred to find out the long-run relation among variables.[16] To do so, the first step is to test the variables in terms of stationarity. Null hypothesis of Dickey Fuller (DF) unit root test states that the data needs differencing to be stationary, whereas alternative hypothesis argues the opposite. In other words, data may not need differencing to be stationary. According to the results of DF unit root test, we

[16] Stata/SE 12.0 program is used.

cannot reject the null hypothesis that implies all variables are non-stationary. To see the integration order, DF unit root test is applied to the first differences. As shown in Table 1, the results of this test indicate that all the differenced variables are stationary. Since all the variables are *I*(1), it is suitable to apply cointegration analysis.

Table 1. DF Test Results

Variable	DF Test Statistic[a]	Change in Related Variable	DF Test Statistic[b]
Agriculture Share	-2.75	ΔAgriculture Share	-5.84
Trade Share	-1.04	ΔTrade Share	-6.12
External Debt Share	-1.48	ΔExternal Debt Share	-6.19
Inflation Rate	-2.05	ΔInflation Rate	-7.91
GDP Per Capita	-0.18	ΔGDP Per Capita	-6.28
Tax Rate	-2.69	ΔTax Rate	-6.80
Tax Rate Square	-2.51	ΔTax Rate Square	-6.85
Tax Revenue	2.54	ΔTax Revenue	-11.06

[a] 1% critical value is -3.614

[b] 1% critical value is -3.621

Source: Authors' Calculation

One of the most crucial assumptions of Johansen Cointegration test is that all variables should be in the same integration order as also stated earlier. As shown in Table 1, this criterion is satisfied for our case. Johansen Trace test results confirm that there is a strong long-run relationship among the variables considered in our model (see Table 2). In addition, the Lagrange multiplier (LM) test for auto-correlation concludes the rejection of the null hypothesis, which represents the non-existence of auto-correlation problem at 95 percent confidence level. Jarque-Bera Normality test shows that residuals are normally distributed. Furthermore, the significance of error correction term with positive sign implies the non-existence of long-run causality.

Table 2 also presents three different Johansen Trace test results. In the first one all seven independent variables are included, whereas in the second one external debt share is excluded. In the last one, additional to external debt share, the inflation rate is omitted.[17]

[17] It will be clear why we omit these variables while explaining Table 3 in the following page.

Table 2. Johansen Rank Test for Cointegration

Maximum Rank	Trace Statistic (1)	5% Critical Value	Trace Statistic (2)	5% Critical Value	Trace Statistic (3)	5% Critical Value
0	182.44	165.58	140.45	131.70	114.44	102.14
1	129.17**	131.70	97.13**	102.14	71.76**	76.07
2	91.31	102.14	68.29	76.07	47.89	53.12
3	67.27	76.07	46.14	53.12	30.21	34.91

** There is one cointegrating relationship at the 95% confidence level.

The main purpose of this paper is to construct the Khaldun-Laffer curve for personal income tax for Turkey and to find out the current place of Turkey on this curve. As stated earlier, the control variables are inserted into the model to prevent spurious regressions. Given the non-stationary properties of the variables, the long-run analysis is implemented. The results of our long-run estimates are threefold. According to first regression, the share of agriculture, trade and external debt are insignificant and all other variables are significant at the 95 percent confidence level. In the second regression, external debt share is omitted, which is one of the insignificant ones. In the last regression, the inflation rate is excluded besides external debt share. All variables are significant at the 99 percent confidence level and have expected signs. From now on, we will take into account the results of the last regression (Table 3) since it performs along the lines of our suggested theoretical framework. In addition, at the end of each column there is an optimal tax rate, which is estimated with coefficients of tax rate and tax rate square as presented in Econometric Methodology sub-section as elaborated above.

Table 3. Long-run Estimates of the Khaldun-Laffer Curve for Personal Income Tax

Dependent Variable: Personal Income Tax Revenue (in thousands TL)

Independent Variables	(1)	(2)	(3)
Agriculture Share	276669	-134572	-163644**
	(182515.2)	(115401.7)	(83788.5)
Trade Share	197589	732340***	676825.2***
	(120379)	(128027)	(121849.2)
External Debt Share	144198.6		
	(104241)		
Inflation Rate	54239.8**	557	
	(23815.8)	(26636)	
GDP Per Capita	804.8**	1621.7***	1628.9***
	(351.2)	(367.3)	(238.4)
Tax Rate	3712064**	9221823***	7551050***
	(2104365)	(2333558)	(2226549)
Tax Rate Square	-131609**	-308133***	-251211.4***
	(70442.3)	(78444.9)	(74801.9)
Constant	$-3.99x10^7$**	$-6.23x10^7$***	$-4.98x10^7$***
	($1.83x10^7$)	($1.74x10^7$)	($1.63x10^7$)
Optimal Tax Rate Level[b]	14.10	14.96	15.03
N. of observations: 45[a]			

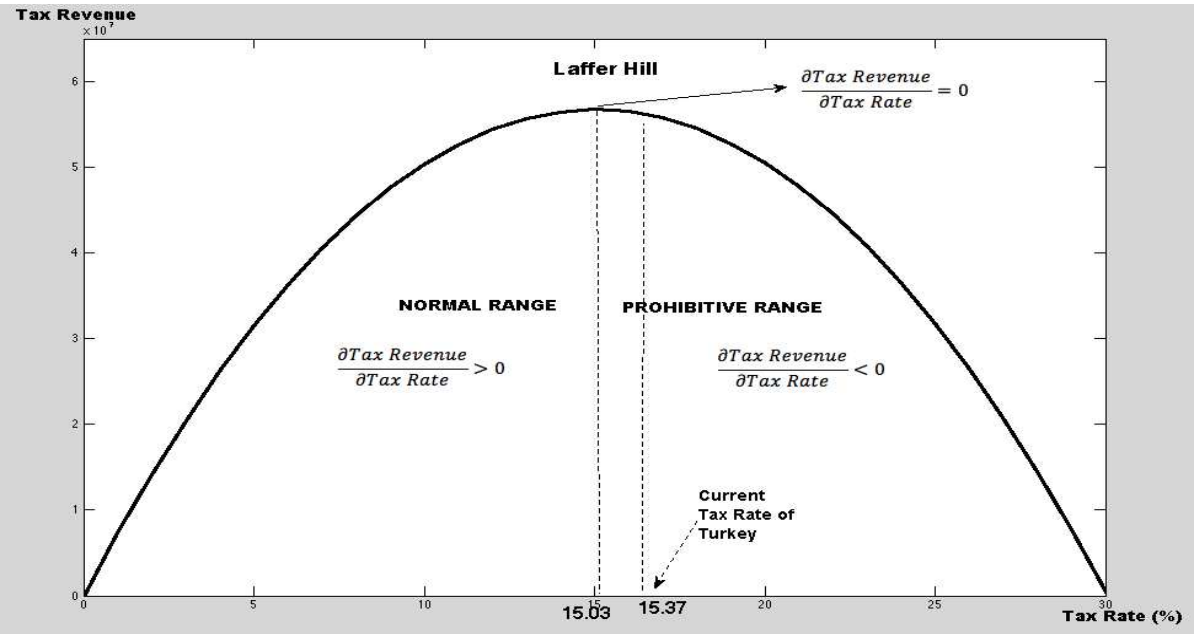
[a] The observation period is 1970-2015. However, one lag is imposed in the vector error correction model by AIC and SBIC criteria.

[b] Optimal tax rate level is the maximum point of the Khaldun-Laffer curve.

*** Significant at the 1% level. ** Significant at the 5% level.

According to our long-run estimates, the revenue-maximizing tax rate for personal income tax is 15.03 percent. The actual tax rate, on the other hand, for the year 2015 is estimated at 15.37 percent. Based on these findings, we can conclude that Turkey is on the right side of the Khaldun-Laffer curve that refers to the prohibitive range of the curve (see Figure 1). This finding suggests that if the Turkish government attempts to raise personal income tax rate further with the purpose of generating more revenue from this tax, this tax policy action will give rise to a significant reduction in personal income tax revenues, rather than an increase. Therefore, in order not to allow such a case, the current tax rate should be lowered to the rate that corresponds to the Laffer hill, which is 15.03 percent.

Figure 1: The Khaldun-Laffer Curve for Personal Income Tax in Turkey[18]



Source: Authors' figure

5. Summary and Conclusions

In this paper, we revisited and then empirically tested the potential existence of the Khaldun-Laffer curve for Turkey within the context of personal income taxation in the long run. To do this, we used annual data set for Turkey for the period 1970-2015. As is known well, the Khaldun-Laffer curve is one of the most important arguments in favour of supply-side economics thought. The curve establishes a classic bell-shaped link between the rates of a certain tax instrument and the revenue generated from it, and then argues that there is a strong as well as uni-directional causality running from tax rates to government tax revenue. Accordingly, if tax rates rise in a continuous manner from zero percent towards 100 percent, personal income tax revenue would also increase till a certain point after which it would tend to decrease gradually due to income and substitution effects of taxation.

[18] Based on Table 3, this figure is constructed by the authors depending on the coefficients coming from long-run estimates. Under the assumption of zero control variables since the aim is only to see the classic bell-shaped relationship between tax rate and tax revenue.

Our estimation results confirm the validity of the Khaldun-Laffer curve for personal income tax for Turkey. We find the optimal tax rate for personal income tax as 15.03 percent and then actual tax rate as 15.37 percent. These findings imply that the current tax rate in Turkey is over its optimal level, falling into the prohibitive range of the curve. This means that the current rate of the personal income taxes in Turkey adversely affect the potential tax revenue that would be collected.

When our findings are compared with related literature, as stated earlier, there are very few studies that only focus on personal income tax. For instance, Hsing (1996) finds that optimal tax rate for the US economy, for the personal income is between 32.67 to 35.21 percent over the period 1959-1991 and so in the prohibitive range as Turkey in our paper. Also, Karas (2012) calculates the revenue maximizing personal income tax rate for the Czech Republic for the period 1993-2010 as 33.13 percent and so Czech government has room to increase tax rate even more in order to collect more tax revenue. Most of the studies in the literature are concentrated on testing the validity of the Khaldun-Laffer curve for all tax revenue and rate without diminishing them into tax categories. So, it might be misleading to compare our findings with the studies above or their similarities.

The following itemized conclusions may be drawn from this paper. First and foremost, our empirical testing confirms the validity of the Khaldun-Laffer curve for personal income tax for Turkey. Secondly, we estimated the optimal tax rate for personal income tax as 15.03 percent for Turkey on annual basis. This is the rate that makes the revenue obtained from personal income tax maximum. This means that all the tax rates above this rate will bring about a reduction in tax revenue. Because higher tax rates will create substitution effect that would discourage working as well as force taxpayers to look for the ways of how to get rid of objective and subjective tax burden.

According to our estimation results, Turkey's current personal income tax rate is 15.37 percent that falls into the prohibitive range of the Khaldun-Laffer curve, reflecting a relatively high tax rate in comparison to the optimal rate of 15.03. As shown, Turkey's current personal income tax rate is well above than it must be. To remove, at least minimize, revenue losses arising from high tax rate, the current rate of 15.37 percent should be diminished to the revenue-maximizing rate of 15.03 percent. If done so, it would be possible to collect more revenue for Turkish tax authorities with a low rate.

From a policy perspective, the nearness of the current rate of personal income tax (15.37 percent) to the lowest level of tax bracket that is 15 percent as pointed out earlier suggests that the main source of personal income tax revenue comes from individuals with lower income level. In other words, the individuals with lower income whose taxable incomes fall into the first two brackets of the personal income tax largely bear the tax burden of the personal income tax. Additionally, the optimal rate for personal income tax implies that in order to maximize tax revenue, the government should not exceed the lowest level of tax bracket of this tax.

Acknowledgements

We, as the authors, are indebted to Philip Arestis of Cambridge University and to Barış Alpaslan, Metehan Cömert, Şahin Yeşilyurt, Ümit Acar, and Savaş Kaptan of Ankara Yıldırım Beyazıt University for their valuable and constructive comments, suggestions, and other contributions.

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