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A PRELIMINARY ANALYSIS ON THE LONG-RUN RELATIONSHIP BETWEEN TAXATION AND GROWTH IN TURKEY

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A Preliminary Analysis on the Long run Relationship between Taxation and Growth in Turkey[1]

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Abstract

Although higher taxation may lead to a fall in growth rates through distortion of decisions to invest and save, certain tax policies of the government may also enhance economic growth when government investments aiming at improving the infrastructure induces private investment. This study aims to explore the effects of taxation on growth in Turkey during the period of 1975-2004, by the use of time series analysis. In addition to total taxation, direct and indirect taxes are considered separately (income tax, goods and services tax and foreign trade tax). Engle-Granger two-step cointegration results show that as total taxation/GDP ratio and trade taxation/GDP ratio increase, growth rate decreases. There is no evidence of a long run relationship between goods and services tax/GDP ratio and growth. As for the nondistortionary income taxation, the relationship is in the reverse direction: as growth rate increases, income tax/GDP ratio increases.

Özet

Yüksek vergilemenin, tasarruf ve yatırım dürtülerini bozarak büyüme oranlarında bir düşüşe sebep olabilmesine rağmen, devletin belirli vergi politikaları, altyapıyı iyileştirme amaçlı devlet yatırımlarının özel sektör yatırımlarını artırması yolu ile ekonomik büyümeyi artırabilir. Bu çalışma, zaman serisi analizi kullanarak Türkiye'de 1975-2004 yılları arasında vergilerin büyüme üzerindeki etkilerini araştırmayı amaçlamaktadır. Toplam vergilerin yanı sıra, dolaylı ve dolaysız vergiler de ayrı olarak incelenecektir (gelir vergisi, mal ve hizmet vergisi ve ticaret vergisi). Engle-Granger iki aşamalı eşbütünleşme sonuçları, toplam vergi/GSMH oranı arttıkça, büyüme oranının düştüğünü göstermektedir. Mal ve hizmet vergisi ve büyüme arasında uzun dönem ilişkisi bulunamamıştır. Dolaysız gelir vergisi için ise ilişki ters yönlüdür: büyüme arttıkça gelir vergisi/GDP oranı da artmaktadır.

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1. Introduction

Fiscal policy has crucial implications and effects on an economy's growth of real GDP. Government spending and taxation may affect the incentives of economic agents and therefore influence the micro and macro economic aspects of the economy. However, there are a variety of views on the direction of these effects on certain variables. For instance, government spending may increase income and growth through the multiplier but also it may reduce income through crowding out of private investment.

There is a similar debate about the relationship between taxation and economic growth. In general, both wage and interest income taxation are accepted to have negative effects on economic growth when physical capital and human capital are needed in the human-capital producing sector (Stokey and Rebelo, 1995:520; Baier and Glomm, 2001:2008; Yakita, 2003:468).

In neoclassical growth models, tax measures that influence the savings rate or the incentive to invest in physical or human capital ultimately affect the equilibrium factor proportions rather than the steady-state growth rate. On the other hand, in endogenous growth models, investment in human and physical capital does affect the steady-state growth rate. In these models, distortionary taxes affect the investment decisions of agents by creating tax wedges and distorting the rate of growth, while non-distortionary taxation does not affect saving/investment decisions and therefore has no effect on growth (Kneller, Bleaney, and Gemmelll, 1999: 172-173).

As a consequence, there are two main approaches to the so-called relationship in the literature. Some researchers claim that higher taxation unambiguously leads to a fall in growth rates. This view believes that increasing revenues via taxation distorts decisions to invest and save. Ihori (2001:139) demonstrates that in an endogenous growth model with two types of wealth (life-cycle wealth and transfer wealth) and two types of capital (human capital and physical capital), taxes on bequests and consumption decrease investment and growth.

Some studies argue that certain tax policies of the government may enhance economic growth (Baier and Glomm, 2001:2008). This happens when government investments aiming at improving the infrastructure (e.g. roads, highways, and airports) induce private investment which in turn enhances growth. In addition, in two-period-lived-individual overlapping generations models, the flat-rate-wage-tax associated with lump-sum transfers raises the economic growth rate as increased savings raises the interest rate inducing individuals to invest in human capital accumulation (Ihori, 2001: 147; Yakita, 2003:482).

There are others that find no or small effects of taxation on growth. Hendricks (1999:431; 2001:26) illustrates that growth effects of tax reforms are smaller and much less sensitive to parameter choices in comparison with the neoclassical growth models with human capital and that the range of growth effects consistent with empirically possible parameter values is very wide. By assuming that inputs to human capital accumulation are tax

deductible, he finds that growth effects are small in all model specifications and quite robust to changes in parameters. If inputs are not tax deductible, growth effects depend on a number of assumptions that are implicit in the infinite horizon framework. Hendricks (1999:432) argues that although income taxation affects growth rates only little (due to tax deductibility), taxes that introduce a direct distortion of the incentives for human capital accumulation may have substantial growth effects. According to the simulation results of this study, subsidizing goods inputs to training by 25% may increase the growth rate by 0.35 percentage points. Kneller et al. (1999: 188) use a panel data set for 22 OECD countries over the period of 1970-95. Their empirical findings show that non-distortionary taxes have no effect on growth, but reducing distortionary taxation by 1 % of GDP can modestly increase the growth rate by between 0.1 and 0.2 % per year.

This paper aims to explore the long run relationship between growth rate and taxation in Turkey during the period of 1975-2004. In addition to total taxation, direct and indirect taxes will also be considered separately (income tax, wealth tax, goods and services tax and foreign trade tax). Time series analysis is used to investigate any possible long-run relationship between different ways of taxation and long run growth. First unit root tests are applied on the variables to determine their time series properties. Then, Engle-Granger cointegration methods are implemented to test the long run relationships.

Taxation is only one part of fiscal policy and most of the time, government expenditure and tax policies have to be considered together. In this sense, this study constitutes a preliminary analysis on examining the interactions between fiscal policy and growth rate of the economy.

Empirical results indicate there is a negative long run relationship between total taxation/GDP and economic growth and between trade tax/GDP and growth. However, the relationship between nondistortionary taxation and growth is in the reverse direction: as the economy grows, income tax/GDP ratio also increases. There is no evidence of a long run relationship between goods and services tax/GDP ratio and growth rate.

The rest of the paper proceeds as follows. Section 2 explains the data and methodology, and provides the empirical results, while section 3 concludes.

2. Empirical analysis

A) Data and methodology

The variables used in this study are growth rate of real GDP (*Growth*), total tax/GDP ratio (*Total*), income tax/GDP ratio (*Income*), wealth tax/GDP ratio (*Wealth*), goods tax/GDP ratio (*Goods*), and trade tax/GDP ratio (*Trade*). All data are expressed as ratios. The data is annual and covers the 1975-2004 period. The data is obtained from the on line data sources of International Financial Statistics (IFS) and Central Bank of the Republic of Turkey.

In this paper, cointegration relationships between growth rate and every single tax series are investigated using Engle and Granger two stage cointegration procedure which involves error correction modeling. Besides, Johansen cointegration tests are applied in order to have more reliable results. Before performing the cointegration test procedures, Augmented Dickey-Fuller (ADF) unit root test is applied in order to determine the degree of integration for each of the series. The degree of integration is of great importance when modeling the Engle and Granger two stage cointegration method. The modeling stage is conducted after making sure that all of the series were integrated of the same order.

B) Empirical Results

The time series properties of our variables are tested by ADF unit root test.[1] Test results show in Table 1 that except for wealth tax/GDP, all of our variables are integrated of order 1. This means cointegration analysis can be applied to the variables (except wealth tax/GDP) in this study.

Table 1: ADF Unit Root Test Results

Variables		Augmented Dickey-Fuller (ADF) Test Statistics	
		Without trend	With trend
Total	Level	0.550(0)	-0.361(1)
	First Difference	-6.118(0)*	-7.643(0)*
Income	Level	-1.966(0)	-1.965(0)
	First Difference	-5.185(0)*	-5.087(0)*
Wealth	Level	-3.839(0)*	-4.321(0)*
	First Difference		
Goods	Level	2.734(1)	0.323(1)
	First Difference	-1.970(1)	-8.046(0)*
Trade	Level	-0.306(1)	-1.730(0)
	First Difference	-5.611(0)*	-6.738(0)*
Growth	Level	-2.641(2)	-2.569(2)
	First Difference	-10.050(0)*	-9.823(0)*

Symbol * implies the rejection of the null hypothesis of non-stationarity at 1% level.
Numbers in parentheses denote the number of lags in the augmented terms of ADF regressions and are determined by using model selection criterions such as Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQC).

[1] Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root test is also applied to the variables. The results are consistent to the findings from the ADF test. The results of the KPSS test are available upon request.

The next step is to apply Engle-Granger and Johansen cointegration tests to different tax schemes and growth rate pair wise. The results of these analyses are given below.

i) Growth rate and total taxation:

The Engle-Granger test is simply an augmented Dickey-Fuller unit root test on the residuals of two sets of equations with variables that are integrated of the same order. If the residuals are stationary, then the variables in question may have a cointegrating relationship.

In the second stage of the procedure, an error correction model is constructed with the differenced variables. Lagged value of the error term of the long run equation [say, u(-1)] is also added to the error correction model as an error correcting term. The coefficient of this term must satisfy the range $-1<u(-1)<0$ in order to report that the error correction mechanism is valid and the variables in question are cointegrated.

Table 2: Engle-Granger Cointegration Analysis for *Growth* rate and *Total* taxation

Engle-Granger Cointegration Test	
Model 1	GROWTH = 0.065 - 0.165×(TOTAL) + u1
t-statistic	(1.713) (-0.682)
R^2: 0.016	
Durbin-Watson statistic (CRDW): 2.293	
Model 2	TOTAL = 0.155 - 0.099×(GROWTH) + u2
t-statistic	(16.918) (-0.681)
R^2: 0.016	
Durbin-Watson statistic (CRDW): 0.119	
Error Correction Model	
Model 1.1	D(GROWTH) = 0.00042 - 0.610×D(TOTAL) - 1.178×u1(-1)
t-statistic	(0.042) (-0.786) (-5.807)*
R^2: 0.593	
Durbin-Watson statistic: 1.883	

Symbols *, ** and *** imply the rejection of the null hypothesis of insignificance of the coefficients at 1%, 5% and 10% confidence levels respectively.

ADF test applied to the residual of Model 1 in Table 3 shows that residual u1 is stationary, owing to the fact that the absolute value of the critical value (2.647) at 1% significance level is smaller than the absolute value of the ADF test statistic (6.250). Thus, *Growth* and *Total* may have a cointegration relation.

ADF test applied to the residual of Model 2 shows that u2 is nonstationary, since the absolute value of the ADF test statistic (0.583) is smaller than the absolute values of the critical values at conventional significance levels. For this reason, the null hypothesis of a unit root can not be rejected.

The error correction model is estimated taking into account Model 1 results. It can be seen that the error correction mechanism is not valid, since the error correcting term u1(-1) is not in the range -1<u1(-1)<0 though, it is statistically significant. Other error correction models including the lagged values of the variables D(GROWTH) and D(TOTAL) have statistically insignificant coefficients.

To verify the above results, Johansen cointegration test is also performed to *Growth* and *Total*. The findings of the Johansen cointegration test including trace and maximum eigenvalue tests for the variables *Growth* and *Total* are shown in Table 3 below. Results indicate one cointegrating equation at the 5 % significance level.

Table 3: Johansen Cointegration Test Results for *Growth* rate and *Total* taxation

Trace Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Trace statistic	5% critical value	Probability**
None*	0.468260	16.07370	15.49471	0.0409
At most 1	0.011284	0.283705	3.841466	0.5943
Maximum Eigenvalue Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Max-Eigen statistic	5% critical value	Probability**
None*	0.468260	15.78999	14.26460	0.0285
At most 1	0.011284	0.283705	3.841466	0.5943

Symbol * denotes the rejection of the hypothesis at the 5% level.
Symbol ** denotes MacKinnon-Haug-Michelis (1999) p-values.

So, we conclude that although the ECM does not work, *growth* and *total* are cointegrated. As the ratio of total tax collections to GDP increases, growth in real GDP decreases.

ii) Growth rate and Goods and Services taxes:

Engle-Granger test results for Model 3 show that *growth* and *goods* may be cointegrated as the ADF test of the residual of this model is stationary (the absolute value of the critical value (2.647) at 1% significance level is smaller than the absolute value of the ADF test statistic (6.194)).

ADF test for the residual of Model 4 shows that it is nonstationary since the absolute value of the ADF test statistic (0.036) is smaller than the absolute values of the critical values at conventional significance levels. According to this finding, one can claim that the variables are not cointegrated.

The error correction model for Model 3 indicates that error correction mechanism is invalid, since the error correcting term u3(-1) is not within the interval -1<u3(-1)<0 though, it is statistically significant. Other error correction models including the lagged values of the variables D(GROWTH) and D(GOODS) have statistically insignificant coefficients.

Table 4: Engle-Granger Cointegration Analysis for *Growth* rate and *Goods* and services taxes

Engle-Granger Cointegration Test	
Model 3	GROWTH = 0.040 - 0.017×(GOODS) + u3
t-statistic	(1.954) (-0.051)
R^2: 0.000094	
Durbin-Watson statistic: 2.284	
Model 4	GOODS = 0.055 - 0.005×(GROWTH) + u4
t-statistic	(8.281) (-0.051)
R^2: 0.00009	
Durbin-Watson statistic: 0.053	
Error Correction Model	
Model 3.1	D(GROWTH) = 0.005 - 2.224×D(GOODS) - 1.186×u3(-1)
t-statistic	(0.482) (-1.429) (-6.229)*
R^2: 0.609	
Durbin-Watson statistic: 1.819	

Symbols *, ** and *** imply the rejection of the null hypothesis of insignificance of the coefficients at 1%, 5% and 10% confidence levels respectively.

The Johansen cointegration test for the variables *Growth* and *goods* is shown in Table 5 below. Results of trace and maximum eigenvalue tests both indicate no cointegrating equation at the 5 % significance level.

All taken together, there is no evidence of a long run relationship between growth rate of GDP and goods and services taxes.

Table 5: Johansen Cointegration Test Results for *Growth* rate and *Goods* and Services taxes

Trace Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Trace statistic	5% critical value	Probability**
None*	0.408913	13.56123	15.49471	0.0958
At most 1	0.016519	0.416413	3.841466	0.5187
Maximum Eigenvalue Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Max-Eigen statistic	5% critical value	Probability**
None*	0.408913	13.14482	14.26460	0.0746
At most 1	0.016519	0.416413	3.841466	0.5187

Symbol * denotes the rejection of the hypothesis at the 5% level.
Symbol ** denotes MacKinnon-Haug-Michelis (1999) p-values.

iii) Growth rate and income taxes:

The Engle-Granger test for model 5 in the first part of Table 6 shows that the residual for this model (u5) is stationary (the absolute value of the critical value (2.647) at 1% level is smaller than the absolute value of the ADF test statistic (7.311)). Thus, *Growth* and *income* may be cointegrated.

The ADF test result for the residual of Model 6 also shows stationarity as the absolute value of the critical value (1.953) at 5% significance level is smaller than the absolute value of the ADF test statistic (2.647)).

According to the findings of the Engle-Granger cointegration tests, two error correction models are formed. For model 5.1, error correction mechanism is invalid, since the error correcting term u5(-1) is not within the interval -1<u5(-1)<0 though, it is statistically significant. Other error correction models including the lagged values of the variables D(GROWTH) and D(INCOME) have statistically insignificant coefficients.

For Model 6.1, the error correction term u6(-1) satisfies the required range -1<u6(-1)<0 and the coefficient of the term is statistically significant. This evidence suggests that variables *income* and *growth* are cointegrated and the adjustment process is such that 27.9 percent of any current deviation from the long run equilibrium is removed at the end of each year.

Table 7 shows the Johansen cointegration test including trace and maximum eigenvalue tests for *growth* and *income*. Results of trace and maximum eigenvalue tests both indicate one cointegrating equation at the 5 % significance level.

Table 6: Engle-Granger Cointegration Analysis for *Growth* rate and *Income* taxes

Engle-Granger Cointegration Test	
Model 5	GROWTH = 0.174 - 1.935×(INCOME) + u5
t-statistic	(3.479)(-2.725)
R^2: 0.209	
Durbin-Watson statistic: 2.587	
Model 6	INCOME = 0.074 - 0.108×(GROWTH) + u6
t-statistic	(29.477)*(-2.725)*
R^2: 0.209	
Durbin-Watson statistic: 0.781	
Error Correction Model	
Model 5.1	D(GROWTH) = -0.0009 - 2.079×D(INCOME) - 1.337×u5(-1)
t-statistic	(-0.110) (-2.040)** (-6.919)*
R^2: 0.693	
Durbin-Watson statistic: 1.953	
Error Correction Model	
Model 6.1	D(INCOME) = 0.0002 - 0.049×D(GROWTH) - 0.279×u6(-1)
t-statistic	(0.143)(-2.550)* (-2.025)**
R^2: 0.246	
Durbin-Watson statistic: 1.760	

Symbols *, ** and *** imply the rejection of the null hypothesis of insignificance of the coefficients at 1%, 5% and 10% confidence levels respectively.

Table 7: Johansen Cointegration Test Results for *Growth* rate and *Income* taxes

Trace Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Trace statistic	5% critical value	Probability**
None*	0.635265	29.34795	15.49471	0.0002
At most 1	0.152390	4.133364	3.841466	0.0420
Maximum Eigenvalue Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Max-Eigen statistic	5% critical value	Probability**
None*	0.635265	25.21459	14.26460	0.0007
At most 1	0.152390	4.133364	3.841466	0.0420

Symbol * denotes the rejection of the hypothesis at the 5% level.
Symbol ** denotes MacKinnon-Haug-Michelis (1999) p-values.

The long run relationship between growth and income tax/GDP ratio indicates that as growth increases, income tax/GDP also increases. So as the economy grows, income tax collections also increase.

iv) Growth rate and Foreign Trade taxes:

According to the ADF test results of Model 7, the residual is a stationary process, as the absolute value of the ADF test statistic is 5.978. So there is a prior evidence for a cointegration relationship between trade tax/GDP ratio and growth rate of GDP.

The error term for Model 8 is found to be a nonstationary process, as the absolute value of the ADF test statistic is 0.406. For this reason, the null hypothesis of a unit root can not be rejected.

The error correction model constructed for Model 8 indicates a perfect adjustment process. In other words, the adjustment process is such that 100 percent of any current deviation from the long run equilibrium is removed at the end of each year.

Table 8: Engle-Granger Cointegration Analysis for *Growth* rate and *Trade* taxes

Engle-Granger Cointegration Test	
Model 7	GROWTH = 0.006 + 1.368×(TRADE) + u7
t-statistic	(0.182) (0.961)
R^2: 0.032	
Durbin-Watson statistic: 2.231	
Model 8	TRADE = 0.023 + 0.023×(GROWTH) + u8
t-statistic	(15.210) (0.961)
R^2: 0.032	
Durbin-Watson statistic: 0.212	
Error Correction Model	
Model 7.1	D(GROWTH) = -0.001 + 0.248×D(GROWTH(-2)) + 0.365×D(GROWTH(-3)) + 7.687×D(TRADE) – 0.99×U7(-1) (-0.165) (1.602)*** (2.167)** (2.910)* (-5.579)*
R^2: 0.729	
Durbin-Watson statistic: 1.608	

Symbols *, ** and *** imply the rejection of the null hypothesis of insignificance of the coefficients at 1%, 5% and 10% confidence levels respectively. Numbers in parenthesis which are below the coefficients denote the t-statistic values.

Table 9: Johansen Cointegration Test Results for Growth rate and Trade taxes

Trace Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Trace statistic	5% critical value	Probability**
None*	0.479443	16.70141	15.49471	0.0328
At most 1	0.015086	0.380017	3.841466	0.5376
Maximum Eigenvalue Test Results:				
Hypothesized number of CE(s)	Eigenvalue	Max-Eigen statistic	5% critical value	Probability**
None*	0.479443	16.32140	14.26460	0.0233
At most 1	0.015086	0.380017	3.841466	0.5376

Symbol * denotes the rejection of the hypothesis at the 5% level.
Symbol ** denotes MacKinnon-Haug-Michelis (1999) p-values.

The results of the Johansen cointegration test confirm the existence of a long run relationship between *growth* and *trade*.

3. Conclusion

The importance of fiscal policy on an economy's growth rate is unquestionable. Fiscal policy through its various tools affects the incentives and the living standards of the economic agents in the country. Taxation through which the government collects revenues to finance its expenditures is one of the basic tools of fiscal policy.

There are a variety of views on the effects of taxation on economic growth rate. Some claim that higher taxation leads to a fall in growth rates through the distortion of decisions to invest and save. Others argue that certain tax policies of the government may enhance economic growth when government investments aiming at improving the infrastructure induce private investment.

This paper investigates the long run relationship between growth rate and taxation in Turkey during the period of 1975-2004. Direct and indirect taxes are considered separately (total taxation, income tax, goods and services tax and foreign trade tax). Time series analysis is used to explore possible long run relationships between different ways of taxation and growth. Before Engle-Granger cointegration methods are performed to test the long run relationships, ADF unit root test is applied on the variables to determine their time series properties.

Empirical results indicate as total taxation/GDP and trade tax/GDP increase, growth rate decreases in long run. While, there is no evidence of a long run relationship between goods and services tax/GDP ratio and growth rate, the relationship between nondistortionary taxation and growth is in the reverse direction: as the economy grows, income tax/GDP ratio also increases.

The results confirm partially the view that indirect taxation leads to a decrease in growth. Being aware that taxation is only one part of fiscal policy and most of the time, government expenditure and tax policies should o be considered together, further analysis is required to incorporate the interactions between different fiscal policies and growth rate of the economy.

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