Gebze Technical University

Department of Economics

Working Paper Series

Tax Structure and Economic Growth: Do Differences in Income Level and Government Effectiveness Matter?

GTU Working Paper No: 2017-04

Halit YANIKKAYA *, Taner TURAN*

*Gebze Technical University

November 2017

Gebze Technical University – Department of Economics

<http://www.gtu.edu.tr/economics>

Tax Structure and Economic Growth: Do Differences in Income Level and Government Effectiveness Matter?

Abstract

We empirically examine the effects of both overall tax rate and changes in tax structure on growth by using data for more than 100 high, middle and lower income countries by employing the GMM estimation methods. We classify the countries by their income and their government effectiveness levels. We investigate whether the government effectiveness is important in affecting the nature of the relationship for non-OECD countries. Although there are some exceptions, our results don't support the idea that overall tax rate or changes in tax structure have a significant effect on growth rate. We find that a shift from income to consumption and property taxes leads to a positive and significant effect on growth rate while holding overall tax burden constant. Our results also suggest that a shift from consumption and property taxes to income taxes has a positive effect on growth rate for low-income countries.

Keywords: taxation, growth, tax structure, government effectiveness

JEL Classification: O23, O50

Author Note

Authors declare no conflict of interest. There was no funding for this study.

Correspondence concerning this article should be addressed to Halit YANIKKAYA, Gebze Teknik Universitesi, Isletme Fakultesi, Iktisat Bolumu, Gebze, Kocaeli TURKEY 41400 E-mail: halityanikkaya@gtu.edu.tr

1. Introduction

Determinants of the economic growth and factors that can boost the growth have drawn attention from economists for a long time. It is a well-known fact that taxation affects the decisions of economic agents regarding to resource allocation such as working, saving and investing. Except for the lump sum ones, all taxes cause some distortions. For example, a tax on labor or capital income reduces the returns to working or investing, respectively, and distorts related decisions. Therefore, one can reasonably argue that taxation may be one of the most powerful policies or factors to affect the economic activity and growth in principle. In the famous Solow growth model, fiscal policy, such as a change in tax rates, can have level effects but cannot affect the rate of economic growth in the long run. In this model only exogenously determined technology can affect per capita income growth. Over time some new models, so called endogenous growth models that give a role for policy, like taxation, to affect the growth rate of economy, have been developed (Barro, 1990; Barro and Sala-i Martin, 1992; King and Rebelo 1990; Lucas, 1990; Rebelo 1991). These models have highlighted the importance of fiscal policy and triggered a new literature, which both theoretically and empirically examines the relationship between growth and fiscal policy.

Another important point is that whether different tax structures or the composition of taxes can have different effects on the growth or not. There is no reason to expect that all types of taxes create same distortions or have the same effects on incentives and economic growth. Although taxes on both consumption and income are distortionary, this does not mean that they have necessarily the same growth effects. If it is possible to collect the same amount of revenue from a tax system that is more growth friendly, it is obvious that the existing system is not economically optimal and thus a change in the tax structure can be growth enhancing. Recently this topic becomes more important and popular. We think that this is hardly surprising. Because,

as pointed out by many studies recently, it is more reasonable to focus on tax structures rather than the average tax rates in explaining the effects of taxation on the growth.

At the same time, Butkiewicz and Yanikkaya (2011) report that institutions and the efficiency of government are important factors in explaining the impacts of the composition of government expenditures on growth. We also think that these factors might also be important in explaining the relationship between the tax structure and economic growth. It is possible that same tax policies or combination can cause different growth effects depending on the institutional quality and the efficiency of government. For example, the strong and effective institutions might offset or balance the possible negative effects from normally “harmful” tax structure. In a similar way, the same tax structure might lead to a different growth effects depending on the income level. However, interestingly that point, as far as we are aware of, has not been highlighted or discussed much in the literature.

Our restatement of the taxes-growth hypothesis is based on two major contributions. First, we employ much more reliable and longer data in the panel regressions. Second, our study explicitly considers several econometric issues that render the robustness of previous results uncertain. We employ the generalized method of moments (GMM) estimation (Bond et al. 2001) to tackle number of econometric problem in the panel data such heteroscedasticity, autocorrelation, and potential endogeneity of regressors. While for GMM estimations the validity and strength of internal instruments have been criticized, we consider that these estimations are still valuable as part of a whole portfolio of statistical tests.

This paper examines the relationship between taxation and economic growth by considering the effects of overall tax rate and revenue neutral tax changes on growth and especially focusing on the efficiency of government for non-OECD countries. Although there

are some exceptions, our findings challenge the conclusion that overall tax rates and changes in tax structure are very important in explaining the growth.

We review the literature in section 2, explain the empirical model and specification in section 3, present, discuss the econometric results in section 4, and conclude the paper in section 5.

2. Literature Review

A large volume of both theoretical and empirical literature examines the relationship between taxation and growth. Theoretically, taxation can have two opposing effects on the economic growth in general. On the one hand, by creating distortions and wedges, taxation can reduce the growth. On the other hand, by financing productive government expenditures taxes can foster it. It is thus not clear which effect will dominate the other in theory.

Although the theory predicts that taxation can possibly affect the economic growth, some studies, like Kormendi and Koester (1987), Easterly and Rebelo (1993), Mendoza et al. (1997), Myles (2000) in a survey, fail to find a robust or significant relationship between tax rates and economic growth.

However, many other studies, such as Engen and Skinner (1992), Padavano and Galli (2001), Romero-Avila and Strauch (2008), Barro and Redlick (2011), Arnold et al. (2011) report that there exists a negative relationship between higher taxes and economic growth. Garrison and Lee (1995) find weak evidence, while Folster and Henrekson (2001) find a negative relationship for rich countries including OECD countries. Moreover, Nijkamp and Poot (2004), in a meta-analysis, find some empirical support for the negative relation between higher taxes and growth but also highlight the fact that some studies are not conclusive.

It is likely that income and consumption taxes can have different effects on economic growth after controlling the level of taxation. As Milesi and Roubini (1998:724) put it: “*In endogenous growth models, consumption and income taxes have different growth and welfare effects, the growth effects of consumption taxes being in general less strong.*” This largely stems from inferences that generally consumption taxes, unlike income taxes, do not distort intertemporal decisions, assuming constant over time. As a result, although there are some exceptions, typically consumption taxes are regarded as a less harmful or detrimental than income taxes on economic growth. Thus, any change in tax structure might have a significant growth and welfare effect, holding the overall or average level of taxation constant.

Some studies focus on the effects of possible tax reforms or changes in tax structures on the economic growth by typically developing theoretical models and using calibration methods. Lucas (1990) and Stokey and Rebelo (1995) argue that a change in tax structure doesn't have significant growth effects, while Jones et al. (1993), Kim (1998), and Turnovsky (2000) find that the reforms or changes can have significant growth effects. Turnovsky (2000) find that a shift from income taxes to consumption taxes may lead to a positive effect on the growth. Michaelis and Birk (2006) argue that, in their endogenous growth model, a reduction in capital income taxes financed by higher payroll taxes increase unemployment and growth. In a recent study, Gale and Samwick (2014) suggest that tax changes or reforms can have different effects on the economic growth depending on their design. They also highlight the distinction between deficit financed and spending cut financed tax changes with the latter would be more effective to boost economic growth.

A number of studies empirically investigate the effect of tax structures on economic growth by using data for the OECD countries. Mendoza et al. (1997) highlight the importance of making a distinction among different taxes on growth, using tax rates on consumption, labor income, and capital income, conclude that taxes are not significant determinants of the growth.

Defining income and property taxes as distortionary and consumption taxes as non-distortionary, Kneller et al. (1999), Bleaney et al. (2001), Gemmel et al. (2011) find that only distortionary taxes reduce the growth rate. Widmalm (2001) reports that while personal income taxes have a negative relationship with economic growth, and consumption tax is growth enhancing, capital income taxes do not have any significant relationship with growth. Angelopoulos et al. (2007) conclude that taxes on labor income are negatively related to growth, while taxes on capital income and corporate income have positive effects on growth with only the latter effect is significant. Arnold et al. (2011) rank the tax structure in terms of growth effects as follows: Taxes on immovable property are the least harmful, followed by taxes on consumption, personal income and corporate income, which is the most harmful. However, Xing (2012) argues that there is no robust growth ranking among taxes on corporate income, personal income and consumption. Romero-Avila and Strauch (2008) using data for EU-15 countries find that direct taxes have a negative and statistically significant effect on the growth while indirect taxes and social security contributions don't.

Ojede and Yamarik (2012) examine the impact of different taxes on state-level growth by using data from 48 states in the US from 1968-2008 and find that taxes on property and sales have negative effects on long-run income growth whereas income taxes have no impact. Mertens and Rawn (2012) using the post war US quarterly data from 1950:1-2006:4 and distinguishing between the effects of changes in personal and corporate income taxes, find that tax shocks have a large effect on GDP in short run. They find that generally taxes on personnel income have larger effect than taxes on corporate income.

There are only two studies using data for a larger group of countries to examine the effects of tax structure on growth. Lee and Gordon (2005) for 70 countries during 1970-1997, find that statutory corporate tax rates are significantly negatively correlated with growth rates and also report that increases in corporate tax rates lead to lower future growth rates while other

taxes are not significant. Acosta-Ormaechea and Yoo (2012) using data for 69 countries during the period 1970-2009, find that higher income taxes and lower consumption and property taxes are associated with slower growth. They conclude social security contributions and personal income taxes have a stronger negative relation with growth compared to taxes on corporate income.

3. Empirical model and Data

Our main interest in this study is the relationship between government efficiency and the impact of taxes on economic growth. By controlling for government efficiency, we assess the growth effects of different categories of taxes. Our study also recognizes the effects of taxes may differ among OECD countries, middle-income countries and low-income countries, using three alternative measures of government efficiency.

Our empirical growth model can be written as follows:

$$\gamma_t = f(Y_t, X_t, Z_t)$$

where γ_t is the growth rate of per capita income, Y_t is the initial GDP per capita, X_t is the control variables that are considered as the main determinants of growth, and Z_t represents the different measures of tax variables.

X_t consists of the conditioning variables that are typically used in the empirical growth literature. Data for the growth of real GDP per capita are from the World Bank (2013) and initial GDP data are from Heston, Summers and Aten (2012). Physical capital is measured as the logarithm of gross fixed capital formation as a percentage of GDP. The lagged logarithm of life expectancy is the measure of human capital stock. The logarithm of population growth is expected to have a negative coefficient since the population growth rate reduces growth in the neoclassical growth model.

Tax revenue data are from Easterly and Sewadeh (2002) for the period 1970 -1999¹. The major revision in the IMF's data compilation (2001) makes the data for the 1970-1998 period not comparable with the new series beginning in 1990. Thus, we are forced to use dataset for the 1970-1999 period.

To assess the effects of taxes on economic growth, a variety of tax measures are employed. These include total tax revenue as a percentage of GDP, and various sub-categories of taxes as discussed below, all as a percentage of tax revenue. We take averages of the all variables over five-year periods. There are six five-year periods, beginning with 1970-1974 and following sequentially.

Table 1 report the mean values our variables. Low-income countries (LIC) have lower average growth rates than OECD and middle-income countries (MIC). Focusing only on developing nations, LIC have lower rates of gross capital formation and higher population growth rates, both of which decrease growth. Table 1 indicates that almost all type of taxes increase by the level of income such that OECD countries have the highest level of taxes and LIC have the lowest.

¹ Data availability actually dictates the use of data till of 1999.

Table 1. Mean Values of Data

Variables (Averages of 1970-1999)	All Countries	OECD Countries	MIC	LIC
GDP per capita growth rates (%)	1.44	2.37	1.69	0.99
Initial GDP per capita (log)	3.6	4.33	3.91	3.15
Life expectancy rates (log)	1.79	1.87	1.83	1.73
Gross fixed capital formation (% of GDP)	22.01	22.69	23.16	20.93
Population growth rate (%)	1.86	0.59	1.69	2.27
Tax revenue (% of GDP)	20.51	28.58	20.65	15.02
Income taxes (% of GDP)	9.76	18.24	10.04	4.68
Consumption taxes (% of GDP)	6.63	9.2	6.8	4.89
Consumption and property taxes (% of GDP)	7.08	9.93	7.26	5.16
Taxes on income, profit and capital (% of GDP)	6.23	9.69	6.5	3.97
Social security cont. (% of GDP)	4.77	9.01	4	1.35
Taxes on payroll or workforce(% of GDP)	0.56	0.74	0.68	0.24
Taxes on property (% of GDP)	0.51	0.76	0.49	0.33
Domestic taxes on goods and services (% of GDP)	6.24	8.96	6.24	4.58
Taxes on int. trade and transactions (% of GDP)	3.58	0.59	3.69	5.02
Other taxes (% of GDP)	0.52	0.32	0.65	0.47

Note: See text for sources and definitions.

Over 100 high-income, middle-income and low-income countries are included in the data set². The sample size for each estimated equation is determined by data availability. We base our conclusions on the System General Methods of Moments (SGMM) estimations because fixed-effect and first-differenced GMM estimates eliminate time-persistent cross-section information.

One of the most common problems in empirical growth regressions is the potential endogeneity of the dependent variable. It is not surprise that taxes are both the function of growth and at the same affecting economic growth. This issue requires that one should be extremely careful to evaluate the previous results on the growth effects of taxes.

A GMM approach enables us to investigate the tax-growth relationship while taking care of the dynamic nature of the model and potential endogeneity of some right-hand size variables. Arellano and Bond (1991) have shown that in GMM estimation lagged values of endogenous variables can serve as instruments for first-difference equations. However, Blundell and Bond (1998) have shown that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the first differences. Bond et al. (2001) report that the first-differenced GMM estimations appear to be problematic in the growth context. Bond et al. (2001) argue that the system GMM estimator, introduced by Arellano and Bover (1995) and Blundell and Bond (1998), is superior to difference GMM³. Their modification of the estimator actually includes both lagged levels and lagged differences. Recently, a large number of studies criticize the validity and strength of the internal instruments used in system GMM. Weak and/or invalid instruments for testing hypotheses about the causes

² A list of countries is available from the authors upon request.

³ We use the Stata “xtabond2” routine implemented by Roodman (2009a) with the one-step robust estimator.

Following Blundell and Bond (1998) and Bond et al. (2001) we chose the one-step estimators because it has been found to be more reliable for finite sample inference.

of growth could be problematic. Weak instrumentation in dynamic panel models greatly reduces the identification ability of GMM estimation (see, Bazzi and Clemens, 2009)

4. Estimation results

We examine both the effects of overall tax rate and tax structure on the economic growth. We examine the effect of tax revenue on the GDP per capita growth rate by using OLS, fixed effects, and GMM methods. Table 2 presents the OLS and fixed effect estimation results. The OLS results indicate that tax revenue is not a significant determinant of the growth rate for the aggregate sample and for sub-samples. However, the fixed effect results suggest that the estimated coefficients on tax revenue are positive and significant for the full sample and low-income countries but insignificant for the OECD countries and middle-income countries. Given that overall tax rates for LIC (15%) are almost half of the rates for OECD countries (29%) for the period considered in the study, these preliminary fixed effect results may be interpreted such that when tax rates are low the beneficial effects of government spending can dominate the negative effects of taxation, as argued by Barro (1990). Fixed-effect estimations also suggest that it is necessary to consider parameter heterogeneity to understand the growth effects of taxes for different group of countries.

Table 2. The effects of taxation on the growth (OLS and Fixed Effect estimations)

Dep. Var.: GDP per capita growth rates

Independent Variable	OLS				FIXED EFFECT			
	All Countries	OECD	MIC	LIC	All Countries	OECD	MIC	LIC
Log (Initial GDP per capita, lagged)	-3,02*** (-4,47)	-2.19 (-1,02)	-4,08*** (-3,94)	-4,45** (-2,2)	10,39*** (-4,99)	-9.43 (-1.68)	-8,09** (-2.43)	13,64*** (-3.84)
Log (Life Expectancy, lagged)	30,73*** (6,59)	-11.48 (-0,54)	35,71*** (3,92)	36,05*** (5,06)	32,05*** (4,61)	82,78 (1.68)	42.21 (1.33)	36,12*** (4.78)
Log(Gross Fix. Cap. For., lagged)	0.23 (0,37)	-0.28 (-0,19)	1.77 (1,64)	0.58 (0,67)	-2,69*** (-4,2)	-2.34 (-0.96)	-2.82 (-1.76)	-2,18** (-2.09)
Log (Population growth, lagged)	-44,67** (-2,23)	21.30 (0,51)	-30.33 (-0,9)	-73,31* (-1,97)	11.70 (0,49)	-3.03 (-0.05)	28.50 (0.43)	-14.54 (-0.61)
Log (Tax Revenue, % of GDP)	-0.03 (-0,06)	0.22 (0,33)	0.55 (1,23)	-1.23 (-1,2)	3,76*** (3,64)	-1.46 (-0.62)	0.65 (0.47)	5,19*** (4.22)
# of observations	384	101	145	134	384	101	145	134

Time (dummies) effects are included but not reported here. Constant terms are not reported.

t-statistics are in parentheses.*** Significant at the 1 percent-level.** Significant at the 5 percent-level.* Significant at the 10 percent-level.

Table 3 reports both the first-difference GMM (DGMM) and system GMM (SGMM) results. The GMM estimator considers potential endogeneity of the regressors by using the panel nature of the data. The GMM method produces valid instruments under the assumption that the lagged change in regressors is uncorrelated with the current unexplained change in the error term. Note that since the exogeneity of instruments is not easily tested, validity of GMM estimates is always ambiguous. Although it is sensitive to the instrument proliferation, the Hansen test of overidentifying restrictions is still the best option to check instrument validity for researchers.

The problem and extensivity of potentially weak internal instruments in small samples has been identified by the literature⁴. Thus, if instruments are weak, we must cautiously interpret the significance of estimated coefficients. Therefore, for the instrumentation, we treat all explanatory variables (initial GDP per capita, investment, life expectancy, population growth and tax revenues) as potentially endogenous variables.

With respect to taxes, the GMM results with full instruments⁵ are indeed by and large inconclusive. In the difference GMM regressions, the estimated coefficient tends to be positive and significant, while the system GMM coefficients tend to be insignificantly negative. However, for these estimations we don't have robust and consistent results because our AR test and Hansen test results are not robust enough. As mentioned above, our estimations with full instruments are shattered by the problem of weak instrumentation and instrument proliferation especially when we run the regressions for the sub-group of countries. However, to obtain robust results, the related GMM literature provides some guidelines about to number of the instruments that should be included in the estimations. As a

⁴ See, Roodman (2009b) and Bazzi and Clemens (2009) for elaborate discussion on the weak instruments.

⁵ These estimations are not reported due to the space considerations but available from authors upon request.

rule of thumb, the literature suggests that we must keep the number of instruments close to the number of countries in our panel (see, Roodman, 2009b). One solution to instrument proliferation is to use “collapse” option in the GMM estimations (Rodman, 2009b).

Table 3 reports the GMM estimations with the “collapse” option. As can be seen from the Table 3, we have reasonable and acceptable statistics for AR (2) and Hansen tests. These test results suggest that error terms don’t have the second-order autocorrelation. Hansen test of overidentifying restrictions (with high p values; insignificant statistics) suggests that the models are correctly specified, considering that there are no evidences of correlation between instruments and errors.

Given the discussion above, we have robust and consistent results with the system GMM estimations, and thus from now on we rely on the SGMM estimations. Note that we also include time dummies in the estimations to capture growth trends common to all countries. As for the control variables (see, Table 3), the significant and negative estimated coefficient on the initial GDP per capita indicates that there exists a convergence among the countries in the sample. While the physical capital stock, measured by gross fixed capital formation as a percentage of GDP, has an insignificant effect, the human capital, measured by life expectancy at birth, has a significant and positive effect on growth for the full sample. Population growth seems to exert no significant effect on growth.

Table 3. The effects of taxation on the growth (GMM Collapse estimates)

Dep. Var.: GDP per capita growth rates

Independent Variable	First-Differences GMM				System GMM			
	All Countries	OECD	MIC	LIC	All Countries	OECD	MIC	LIC
Log (Initial GDP per capita, lagged)	-6.03 (-0.6)	-22.42 (-0.65)	-4.26 (-0.2)	-18.18 (-1.28)	-6.57** (-2.53)	-6.92 (-0.94)	10.19** (-2.49)	-6.18 (-1.13)
Log (Life Expectancy, lagged)	24.75 (0.4)	221.06 (0.86)	126.65 (0.64)	12.69 (0.18)	70.45** (2.54)	67.95 (0.88)	117.60** (2.38)	54.81*** (2.69)
Log(Gross Fix. Cap. For., lagged)	-6.10*** (-3.17)	-1.84 (-0.5)	-14.64 (-1.25)	-1.42 (-0.63)	-1.619 (-1.19)	-1.42 (-0.66)	-2.99 (-1.13)	-0.49 (-0.22)
Log (Population growth, lagged)	15.105 (0.17)	-29.23 (-0.15)	302.49** (2.28)	28.13 (0.16)	-13.485 (-0.28)	7.43 (0.08)	36.05 (0.46)	-54.85 (-0.84)
Log (Tax Revenue, % of GDP)	5.34 (1.21)	-3.32 (-0.37)	17.50 (1.49)	16.04*** (2.76)	0.55 (0.45)	-0.79 (-0.36)	0.98 (0.95)	-0.62 (-0.16)
AR2 test (p-value)	0.443	0.05**	0.43	0.79	0.246	0.84	0.89	0.23
Hansen test (p-value)	0.152	0.38	0.31	0.85	0.328	0.82	0.20	0.65
# of instruments	22	22	22	22	28	28	28	28
# of observations	274	80	99	92	384	101	145	134

Note: All GMM regressions use robust standard errors and treat variables as endogenous and regressions follow Roodman (2009b) and collapse the instrument matrix and use all available lags. With two-step GMM estimation, the Windmeijer (2005) finite sample correction for standard errors is employed. The Hansen J-test reports the p-values for the null hypothesis of instrument validity. The values reported for AR(2) are the p-values for second order autocorrelated disturbances in the first differences equations. *, ** and *** denote significance at the 10%-, 5%- and 1%-level, respectively. t-statistics are in parentheses.

Our SGMM results with the “collapse” option indicate that tax revenue does not have a statistically significant effect on growth. Nonetheless, our DGMM results suggest that the tax revenue is significant only for LIC. This implies that taxes raise the rate of growth for these countries. Our DGMM results very similar to the fixed effects estimations though.

As mentioned and argued in the literature review section, we do not have any reason to expect that every type of taxes affect the growth in the same way. Therefore, we analyze the effects of tax mix or structure on growth for full sample and its sub-groupings. Table 4 reports these estimation results. Before interpreting/evaluating our results, we should point out that like some other studies, such as Arnold et al. (2011), Acosta-Ormaechea and Yoo (2012), we consider a shift from one tax mix to other while holding overall level of tax rate constant. For example, when estimating the effect of a shift from consumption and property taxes to income taxes we include income and overall tax rates in addition to other control variables but omit consumption and property taxes from the regression.

The estimation results in Table 4 suggest that for the full sample a change in tax composition while holding overall tax burden constant does not have a significant impact on growth rate except for the property taxes. A shift from income to consumption and property taxes leads to a positive and significant effect of property taxes on growth. We think that this result is in line with other studies, such as Arnold et al. (2011), Acosta-Ormaechea and Yoo (2012), which finds that property taxes are better for growth.

Table 4. The growth effects of tax structure

Dep. Var.: GDP per capita growth rates

		1	AR(2)	2	AR(2)	3	AR(2)	4	AR(2)
	Independent variable	All Countries	Hansen Test	OECD	Hansen Test	MIC	Hansen Test	LIC	Hansen Test
1	Log (Tax revenue)	0.21	0.20	3.59	0.84	0.41	0.94	-1.80	0.16
	Log (Income tax)	-0.68	0.48	-0.98	0.99	1.41	0.26	5.28**	0.62
2	Log (Tax revenue)	1.96	0.59	1.27	0.95	-0.47	0.79	-2.63	0.75
	Log(Income, profit and capital tax)	-3.08	0.34	1.26	0.99	1.35	0.50	1.80	0.94
	Log(social security contributions)	-2.82		-0.31		-0.03		1.49	
	Log (payroll tax)	Not included in the regressions separately due to the lack of adequate observations.							
3	Log (Tax revenue)	0.74	0.39	-1.49	0.05**	2.45*	0.58	-0.59	0.24
	Log (consumption tax)	-0.07	0.21	1.16	0.99	3.40	0.43	-2.78	0.75
4	Log (Tax revenue)	-2.67	0.31	-1.49	0.16	-1.32	0.74	-4.57	0.16
	Log (Good tax)	-2.24	0.18	0.16	0.99	-1.57	0.19	-2.12	0.70
	Log (Taxes on trade)	-0.81		-0.27		0.50		2.18	
	Log (Other tax)	-0.35		-0.08		-0.52		-0.70	
5	Log (Tax revenue)	0.03	0.40	-1.12	0.58	1.03	0.94	0.18	0.19
	Log (Consumption and Property tax)	2.35	0.43	0.18	0.91	0.22	0.24	-0.47	0.67
6	Log (Tax revenue)	1.18	0.26	1.77	0.36	2.59**	0.80	-0.80	0.30
	Log (Consumption tax)	3.00	0.86	0.52	0.98	2.10	0.19	3.20	0.43
	Log (Property tax)	1.79**		0.17		0.57		0.63	
7	Log (Tax revenue)	-4.92	0.37	-0.46	0.46	1.65	0.81	-0.86	0.48
	Log (Good tax)	1.34	0.87	0.11	1.00	1.16	0.43	2.72	0.60
	Log (Taxes on trade)	-0.56		-0.05		-0.06		0.22	
	Log (Other tax)	0.15		-0.36		0.27		0.58	
	Log (Property tax)	1.61**		0.48		0.15		0.71	

Note: Each rows (1 to 7) and columns (1 to 4) are the result of separate regressions.

We report only the variable of interest, namely tax variables. The same control variables are used as in Table 3.

Tax variables are percentage of total tax revenue except for tax revenue, which is percentage of GDP.

*, ** and *** denote significance at the 10%-, 5%- and 1%-level, respectively. t-statistics are in parentheses.

The results in Table 4 also indicate that in OECD countries and MIC, a change in tax structure does not have a significant growth effect. In other words, in these sub-samples a shift from income taxes to consumption and property taxes or vice versa does not have a significant effect on the growth rate. In MIC, overall tax rate has a positive and significant effect, as a result of shifting from income tax to consumption tax and also consumption and property taxes.

In LIC, a shift from consumption and property taxes to income taxes has a positive effect on growth rate while a shift from income taxes to consumption and property taxes does not have a significant effect. These results are important, because as can be seen from Table 1, consumption and property taxes are higher than income taxes in LIC while for MIC and MIC countries income taxes are considerably higher. This positive effect may arise due to the reasons such as an extent of tax evasion and a high share of underground or shadow economy, common to LIC. Acosta-Ormaechea and Yoo (2012) find that a shift from consumption and property taxes to income tax leads to a positive but insignificant effect of property tax on growth in LIC. Our results are different from that of Arnold et al. (2011) and Acosta-Ormaechea and Yoo (2012), which find more significant growth effects arising from a change in tax structure. However, our results do not lend evidence for the proposition that income taxes are more harmful than consumption taxes.

Moreover, it is important to investigate whether government effectiveness matters for the growth impacts of taxes. One can expect that effective governments collect taxes in ways that inhibit growth the least. A number of studies in the literature argue that countries with certain characteristics are more likely to have governments that are more effective. Depending on their effectiveness levels, governments may choose different tax types, and thus they are more likely to be affected differently from taxes.

We thus examine the effects of tax structure for non-OECD countries by considering the distinction between effective and ineffective governments. Following Butkiewicz and Yanikkaya (2011) three criteria are used in making a distinction between effective and ineffective government: Government Effectiveness, British Legal Origin and Ethnicity.

The results in Table 5 do not lend evidence for the hypothesis that government effectiveness matters in non-OECD countries. Our results actually indicate that a change in tax structure does not have a strong growth effect in general. However, there are some exceptions. When the government effectiveness criterion is used, a shift from income and property taxes to consumption taxes leads to a negative and significant growth effect of the taxes on goods and trade for effective governments. In a similar way, a shift from income taxes to consumption and property taxes causes taxes on goods to have a significant and negative growth effect. When the British Legal Origin criterion is used, a shift from income taxes to consumption and property taxes leads to a significant positive effect of the property taxes for ineffective governments. When the ethnicity criterion is used, a shift from income and property taxes to consumption taxes leads that taxes on goods have a significant and negative effect for effective governments.

Table 5. Government effectiveness and the effects of tax structure on growth (Non-OECD countries only)

Dep. Var.: GDP per capita growth rates

	Independent Variable	Government Effectiveness		British Legal Origin		Ethnicity	
		Effective Government	Ineffective Government	Effective Government	Ineffective Government	Effective Government	Ineffective Government
1	Log (Tax revenue)	1.15	1.44	-2.60	0.02	0.11	-1.52
	Log (Income tax)	-4.03	-2.71	-1.43	1.54	-1.6	2.6
2	Log (Tax revenue)	3.35	2.50	NA	0.76	-0.97	-0.72
	Log(Income, prof. and cap. tax)	-0.35	-0.34	NA	0.25	2.04	0.51
	Log(ss contributions)	-1.07	1.06	NA	0.72	0.53	-0.30
	Log (payroll tax)	Do not included in the regressions due to the lack of data.					
3	Log (Tax revenue)	1.10	0.74	-1.59	1.33	0.11	-1.32
	Log (consumption tax)	6.24	0.23	7.12	2.73	-0.29	-0.25
4	Log (Tax revenue)	-4.06	-1.40	-4.38*	1.169	-1.896	-3.696
	Log (Good tax)	-4.02*	-2.69	.136	-.057	-5.73*	-3.886
	Log (Taxes on trade)	-1.39*	.72	-.63	1.14	-1.92	1.25
	Log (Other taxes)	-.976	-.439	.906	.635	-.364	-.90
5	Log (Tax revenue)	-0.30	1.71	-3.46***	0.32	0.56	-1.09
	Log (Cons. and Prop. Tax)	1.31	0.13	-0.33	0.09	-0.75	-0.40
6	Log (Tax revenue)	2.52	3.59	0.25	2.22	2.70	-1.47
	Log (Consumption tax)	8.01	2.98	3.85	-1.20	5.37	-1.30
	Log (Property tax)	1.06	1.05	1.29	2.58**	0.70	0.71
7	Log (Tax revenue)	-2.77	1.13	-3.02	1.672	2.58	2.54
	Log (Good tax)	-2.58	.65	-2.568	.666	-1.469	.11
	Log (Taxes on trade)	-1.98*	1.225	-1.289	.340	.77	-1.07
	Log (Other taxes)	-.51	-.080	.51	.669	.077	-.26
	Log (Property tax)	.31	1.127	.24	1.114	.26	.733

Note: See, notes in Table 4.

Our results substantially differ from those of two recent and similar studies, Arnold et al. (2011) and Acosta-Ormaechea and Yoo (2012). Better estimation methods as well as the use of different data set might be responsible for the explaining somewhat conflicting results. We believe that the system GMM estimation is better suited to deal with econometric problems such as heteroscedasticity, autocorrelation, and potential endogeneity of regressors. Therefore, our results are empirically robust and cast some doubts on some previous findings that there is a robust and significant relationship between taxation and economic growth or changes in tax structure have a significant effect on growth rate. Our estimation results obviously indicate that how some seemingly robust or sensible results would fundamentally change depending on the estimation methods and data sets used.

5. Conclusions

The relationship between the tax rates and long-run growth has been one of the most important research topics in economics. If the tax rate or tax structure has a meaningful effect on growth rate, it has some policy implications for governments to adjust the growth rate. We examine the effect of tax rates and changes in a tax structure on economic growth using panel data for countries over the period of 1970 to 1999. In general, our empirical results are consistent with some previous studies that tax variables are not significant determinants of growth. Our fixed effect estimations suggest that the estimated coefficient on tax revenue is positive and statistically significant in the full sample and LIC. Our DGMM estimates with collapse option indicate that the overall tax rate has a positive and significant effect on growth in only LIC. However, our SGMM results, which we think they are more robust and consistent estimates, indicate that taxes do not have significant growth effects for both the full sample and sub-samples.

Similarly, the changes in tax mix or structure do not seem to have a significant impact on the growth rates in general. For the full sample, a shift from income taxes to consumption and property taxes has a positive effect on growth rates. This result is consistent with other studies. In MIC and OECD countries, a change in tax structure does not have a significant growth effect. Interestingly, a shift from consumption and property taxes to income taxes has a positive effect on the growth rate for LIC. Moreover, our results do not support the argument that income taxes are more harmful than consumption taxes and a change from income to consumption tax can boost the growth rate.

We also examine the effects of tax structure for non-OECD countries classified by their government effectiveness levels. Although there are some exceptions, our results indicate that a change in tax structure does not have a significant growth effect. Although taxation policies are important components of the growth strategies, it is empirically a difficult task to disentangle the effects of taxation on economic growth from other factors. We believe that our results based on better estimation methods and higher quality data shed lights on the somewhat mysterious relationship between taxation and growth.

References

- Acosta-Ormaechea, Santiago and Jiae Yoo (2012), “Tax composition and growth: A broad cross-country perspective” *IMF Working Paper*, WP/12/257
- Angelopoulos, Konstantinos, George Economides and Pantelis Kammas (2007), “Tax-spending policies and economic growth: Theoretical predictions and evidence from the OECD”, *European Journal of Political Economy*, 23, 885-902.
- Arellano, Manuel, and Olympia Bover (1995), “Another look at the instrumental-variable estimation of error-components models”, *Journal of Econometrics*, 68, 29-51.
- Arnold, Jens Matthias, Bert Brys, Christopher Heady, Asa Johansson, Cyrille Schwellnus and Laura Vartia (2011), “Tax policy for economic recovery and growth”, *The Economic Journal*, 121, February, F59-F80.
- Barro, Robert J. (1990) ,“Government spending in a simple model of endogenous growth” *Journal of Political Economy*, 98 (5),103-125.
- Barro, Robert J. and Charles J. Redlick (2011) “Macroeconomic effects from government purchases and taxes”, *The Quarterly Journal of Economics*, 126, 51-102.
- Barro, Robert J. and Xavier Sala-i Martin (1992) “Public finance in models of economic growth”, *The Review of Economic Studies*, 59(4), 645-661.
- Bazzi, S., & Clemens, M. (2009), “Blunt instruments: A cautionary note on establishing the causes”, Center for Global Development, Working Paper 171, May (revised July 2010).

Bleaney, Michael F., Norman Gemmel and Richard Kneller and (2001), “Testing the endogenous growth model: Public expenditure, taxation, and growth over the long run,” *Canadian Journal of Economics*, 34(1), 36-57.

Blundell, R., & Bond, S. (1998), “Initial conditions and moment restrictions in dynamic panel data models”, *Journal of Econometrics*, 87(1), 115–143.

Bond, S., Hoeffler, A., and Temple, J. R. W. (2001), “GMM Estimation of empirical growth models”, *CEPR Discussion Paper* No.3048, November.

Butkiewicz, James L. and Halit Yanikkaya (2011), “Institutions and the impact of government spending on growth” *Journal of Applied Economics*, XIV (2), 319-341.

Easterly, William and Sergio Rebelo (1993) “Fiscal policy and economic growth: An empirical investigation”, NBER Working Paper No. 4499.

Easterly, William. and Mirvat Sewadeh (2002), “Global development network growth database, Macro time series”, World Bank Data Set.

Engen, Eric M. and Jonathan Skinner (1992) “Fiscal Policy and Economic Growth”, NBER Working Paper, No. 4223.

Fölster, Stefan and Magnus Henrekson (2001) “Growth effects of government expenditure and taxation in rich countries” *European Economic Review*, 45, 1501-1520.

Gale, William G. and Andrew A. Samwick (2014), “Effects of Income Tax Changes on Economic Growth”, *Economic Studies at Brookings*, p.1-15.

Garrison, Charles B. and Feng-Yao Lee (1995), “The effect of macroeconomic variables on economic growth rates: A cross-country study”, *Journal of Macroeconomics*, 17(2), 303-317.

Gemmel, Norman, Richard Kneller and Ismael Sanz (2011), “The timing and persistence of fiscal policy impacts on growth: Evidence from OECD countries” *The Economic Journal*, 121, February, F33-F58.

Heston, Alan, Robert Summers, and Bettina Aten, (2012), “Penn World Tables version 7.1”, Philadelphia: Center for International Comparisons at the University of Pennsylvania.

Jones, Larry E., Rodolfo E. Manuelli and Peter E. Rossi (1993), “Optimal taxation in models of endogenous growth”, *Journal of Political Economy*, 101(3), 485-517.

Kim, Se-Jik (1998), “Growth effect of taxes in an endogenous growth model: to what extent do taxes affect economic growth?” *Journal of Economic Dynamics and Control* 23, 125-158.

King, Robert and Sergio Rebelo (1990), “Public policy and economic growth: Developing neoclassical economic implications”, *Journal of Political Economy*, 98(5), 126-150.

Kneller, Richard, Michael F. Bleaney and Norman Gemmel (1999), “Fiscal policy and economic growth: Evidence from OECD countries”, *Journal of Public Economics*, 74, 171-190.

Kormendi, Roger G. and Reinhard B. Koester (1987), “Taxation, aggregate activity and economic growth: Cross-country evidence on some supply-side hypotheses” Division of Research, School of Business Administration, Working Paper 559.

Lee, Young and Roger H. Gordon (2005), “Tax structure and economic growth” *Journal of Public Economics*, 89, 1027-1043.

Lucas, Robert E. Jr. (1990), "Supply-side economics: An analytical review", *Oxford Economic Papers*, New Series, 42(2), 293-316.

Mendoza, Enrique G., Gian Maria Milesi-Ferretti and Patrick Asea (1997) "On the ineffectiveness of tax policy in altering long-run growth: Harberger's superneutrality conjecture" *Journal of Public Economics*, 66, 99-126.

Mertens, Karel and Morten O. Ravn (2012) "The dynamic effects of personal and corporate income tax changes in the United States", *American Economic Review*, 103(4), 1212-1247

Michaelis, Jochen and Angela Birk (2006), "Employment and growth effects of tax reforms" *Economic Modelling*, 23, 909-925.

Milesi-Ferretti, Gian Maria and Nouriel Roubini (1998), "Growth effects of income and consumption taxes", *Journal of Money, Credit and Banking*, 30(4), 721-744.

Myles, Gareth D. (2000), "Taxation and economic growth", *Fiscal Studies*, 21(1), 141-168.

Nijkamp, Peter and Jacques Poot (2004), "Meta-analysis of the effect of fiscal policies on long-run growth" *European Journal of Political Economy*, 20, 91-124.

Ojede, Andrew and Steven Yamarik (2012), "Tax policy and state economic growth: The long-run and short-run of it" *Economics Letters*, 116, 161-165.

Padavano, Fabio and Emma Galli (2001), "Tax rates and economic growth in OECD countries" *Economic Inquiry*, 39(1), 44-57.

Rebelo, Sergio (1991) "Long-run policy analysis and long-run growth", *Journal of Political Economy*, 99(3), 500-521.

Romero-Avila, Diego and Rolf Strauch (2008), "Public finances and long term growth in Europe: Evidence from a panel data analysis" *European Journal of Political Economy*, 24, 172-191.

Roodman, David, (2009a), "How to Do xtabond2: An Introduction to Difference and System GMM in Stata," *Stata Journal* 9 (1): 86-136.

Roodman, David, (2009b), "A note on the theme of too many instruments," *Oxford Bulletin of Economics and Statistics*, 71 (1): 135-158.

Stokey, Nancy L. and Sergio Rebelo (1995), "Growth effects of flat-rate taxes" *Journal of Political Economy*, 103(3), 519-550.

Turnovsky, Stephen (2000), "Fiscal policy, elastic labor supply, and endogenous growth", *Journal of Monetary Economics*, 45, 185-210.

Widmalm, Frida (2001) , "Tax structure and growth: Are some taxes better than others?" *Public Choice*, 107, 199-219.

Windmeijer, Frank, 2005, "A finite sample correction for the variance of linear efficient two-step GMM estimators," *Journal of Econometrics*, Vol. 126, No. 11, pp. 25–51.

World Bank, (2013), *World Development Indicators database*.

Xing, Jing (2012), "Tax structure and growth. How robust is the empirical evidence?" *Economics Letters*, 117, 379-382.