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Monetary and Fiscal Policies and the Growth Laffer Curve: Panel Data Evidences

Roohollah Zare (PhD) and Syed Aziz Arman (PhD) *

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Abstract:
The present paper examines the mitigating effect of monetary and fiscal policies on the "Growth Laffer curve" (GLC) using a panel data of 38 high income countries over the period 2003-2012. Adopting generalised method of moments (GMM) estimators, the paper finds evidence substantiating the presence of an inverted-U GLC. Moreover, the evidence suggests that the GLC shifts downward by employing expansionary monetary and fiscal policies and that the tax rate turning point beyond which economic growth decline is higher in countries with higher level of debt-to-GDP ratio and money supply. These results are robust to addition of alternative controlled variables in the GLC specification. Our results strengthen the case for heterogeneous GLC across countries. As an implication, a government may enhance the efficiency within the "fiscal space" by either raising the productivity of public spending or cutting fiscal debt. Moreover, using money as a financing instrument should be carefully supervised due to its impact in generating large inflation rates and distorting capital accumulation and economic growth.

JEL classification**:** E52; E63; H62

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* Yong Researchers and Elite Club, Beyza Branch, Islamic Azad University, Beyza, Iran. (corresponding author: rz2380@yahoo.com) and Department of Economics, Faculty of Economics and Social Sciences, Shahid Chamran University, Ahvaz, Iran. (saarman2@yahoo.com)

1. Introduction

The relation between taxes and economic growth has captured much attention in recent years. Arguably, as stated by Barro (1990) in an endogenous growth model with public investment, taxes and economic growth form an inverse U-shaped relation, namely the ‘‘Growth Laffer Curve’’ (GLC). The increasing side of this GLC is a consequence of the fact that higher taxes provide more resources for public investment, which is growth-enhancing. On the other hand, higher taxes also generate more distortion in private capital accumulation, and, consequently, in economic growth. Once the tax rate is above a threshold value, the economy reaches the downward side of the GLC, so taxes and economic growth are negatively correlated (Ehrhart et al., 2014). This postulated taxes–economic growth relation has undergone extensive empirical experiments to verify its presence as well as to determine the tax rate threshold point (see, for example, Bleaney et al., 2001; Alesina et al., 2002, Myles, 2009 and Ehrhart et al., 2014 for a survey on the relation between growth and taxation).

In the present paper, we make further attempt to contribute to the existing literature by studying the way fiscal and monetary policies deform the GLC in high income countries. This investigation is of great importance since fiscal and monetary policies affect the ways of financing public spending in these countries through issuing debt or seigniorage. It comes close to the recent concept of “fiscal space”, which depicts the optimal way of financing public spending through different means of financing, in order to be growth-enhancing (see the discussion in Roy and Heuty, 2009). Beside, using money as a financing instrument should be carefully supervised since it may create large inflation, distort capital accumulation and therefore reduce economic growth. Thus, we take into account in this paper the respective impacts of fiscal and monetary policies on growth, as they might deform the existing relationship between taxes and growth. This study can provide guidance for policymakers to set monetary and fiscal policies in order to foster economic growth.

In the analysis to test the existence of GLC and the role played by monetary and fiscal policies in deforming the GLC, we rely on the generalised method of moments (GMM) estimation approach, to be detailed later, to a panel of 38 high income countries. The empirical results of this study indicate validity of GLC in the sample countries and that monetary and fiscal policies do play a role in the shape of the GLC. More specifically, expansionary monetary and fiscal policies shift the GLC downward but they increase GLC-maximizing tax rate (tax rate turning point). The rest of the paper is structured as follows. In the next section, we detail the empirical framework and data. Then, section 3 discusses estimation results. Finally, Section 4 concludes with a summary of the main findings and some concluding remarks.

2. Empirical approach and data

2.1. Model specification and data

To test empirically the presence of GLC in a panel of 38 high income countries (the list of countries included in our sample are presented in Table 1) over the period 2003-2012[1], we adopt a standard quadratic relation between GDP per capita growth($GDPPG$) and tax rate measured as tax revenue in % of GDP(Tax), written as:

$$GDPPG_{it} = \alpha_i + \beta_1 Tax_{it} + \beta_2 Tax_{it}^2 + \beta_3 \boldsymbol{X}_{it} + \varepsilon_{it} \qquad (1)$$

Where subscripts i and t refer to country and year respectively, α_i is a country-specific effect, β_1,β_2 and β_3 are the slope parameters to be estimated, ε_{it} is the model's error term and X_{it} is a vector of relevant control variables (to be discussed below). The focal parameters in the model are β_1 and β_2. The presence of the GLC is verified by β_1 being significantly positive and β_2 significantly negative. Based on Eq. (1) the tax rate turning point can be estimated as $-\frac{\beta_1}{2\beta_2}$. Note that Eq. (1) assumes a homogenous pattern of GLC for all countries. This is very restrictive since the

[1] We choose this period because macroeconomic data before 2003 especially for the main variables considered in the models contain too many missing observations.

relation between Tax rate and GDP per capita growth is likely to differ across countries. To examine our central thesis that monetary and fiscal policies can be a potential determining factor of the difference in GLC across countries and how these factors deform GLC, we extend Eq. (1) by incorporating interactive terms of tax and square tax with monetary and fiscal policy indicators.

$$GDPPG_{it} = \alpha_i + \beta_1 Tax_{it} + \beta_2 Tax_{it}^2 + \beta_1^*(Tax_{it} \times \boldsymbol{Z}_{it}) + \beta_2^*(Tax_{it}^2 \times \boldsymbol{Z}_{it}) + \beta_3 \boldsymbol{X}_{it} + \varepsilon_{it} \quad (2)$$

Where vector Z_{it}includes fiscal policy measured as central government debt in % of GDP (debt ratio) and monetary policy measured as$M2$ (money and quasi money) in % of GDP (M2 ratio).Debt ratio and M2 ratio are considered as suitable fiscal and monetary policy indicators respectively, since these variables affect the ways of financing public spending in these countries through issuing debt or seigniorage and then can deform GLC (Roy and Heuty, 2009 and Ehrhart et al., 2014).Based on Eq. (2) the tax rate turning point is:

$$-\frac{[\beta_1+(\beta_1^*\times Z_i)]}{2[\beta_2+(\beta_2^*\times Z_i)]} \quad (3)$$

From (2) and (3), monetary and fiscal policies will have significant influence on the shape of GLC if β_1^* or β_2^* or both are statistically significant. More specifically, if β_1^* is significantly negative the GLC will shift downward by implementing expansionary monetary and fiscal policies. In addition, the tax rate turning point is lowered with higher level of debt ratio or M2 ratio if β_2^* is significantly less than 0. However, if β_2^* is positive, whether debt ratio or M2 ratio lowers or increases the tax rate turning point depends on the relative size (in absolute term) of β_1^* and β_2^*.

The vector of control variables $\boldsymbol{X_{it}}$ is inspired by growth literature emphasizing traditional determinants of economic growth (Barro, 1990; Easterly and Rebelo, 1993; Temple, 1999; Sala-i-Martin et al., 2004, and Adam and Bevan, 2005). First, we include government consumption measured as general government final consumption expenditure in % of GDP. The Second control variable is investment measured as gross fixed capital formation in % of GDP. The third variable is inflation computed as the annual percentage change in the consumer price index. Finally, we consider the trade openness degree, which has been found to be a significant economic growth determinant. This variable is measured as the sum of exports and imports in % of GDP. Data on all variables are sourced from World Development Indicators. Table 1 presents the list of countries and descriptive statistics for all variables used in the empirical models.

Table 1: Descriptive statistics

variables	description	Mean	Std. dev.	Min	Max
$GDPPG$	GDP per capita growth	1.793	3.974	-16.589	13.267
Tax	tax revenue in % of GDP	19.808	8.462	7.078	65.903
$debt$	government debt in % of GDP	55.205	32.199	3.671	163.558
$M2$	money and quasi money in % of GDP	95.110	69.896	29.938	511.501
Gov	general government final consumption expenditure in % of GDP	18.953	3.803	8.418	28.064
Inv	gross fixed capital formation in % of GDP	22.577	4.095	11.711	36.750
inf	Inflation rate	2.929	2.615	-4.480	19.380
$trade$	Trade openness measured as the sum of exports and imports in % of GDP	108.212	81.280	22.450	439.657

Notes: Countries: Australia, Austria, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Russian Federation, Singapore, Slovak Republic, South Korea, Slovenia, Spain, Sweden, Switzerland, UK, USA and Uruguay. N = 38 cross-country. T = 2003–2012.

2.2. Estimation method

Given the panel nature of our data, we adopt panel estimation techniques to estimate (1) and (2). As emphasized by Islam (1995), Caselli et al.(1996) and Temple(1999) growth regressions should be considered with many concerns. One important concern is the incorrect treatment of country specific effects representing differences in technology or preferences. Second, due to the presence of lagged dependent variable, most explanatory variables might be endogenous to economic growth, and the presence of simultaneous or reversed causality can generate a bias in the estimation. Accordingly, the standard panel models like pooled OLS regression model, fixed-effect panel model and random-effect panel model are not appropriate due to the presence of country-specific effects and lagged dependent variable or potential endogeneity of explanatory variables. To handle these issues Arellano and Bond (1991) suggest a generalised method of moments (GMM) estimator. More specifically, the GMM method wipes out country-specific effects or any time-invariant country-specific variable by taking the first differences of (1) and (2).Then, to resolve the resulting correlation between lagged dependent variable and disturbance terms after first differencing, Arellano and Bond (1991) suggest instrumental variables known as the first-difference GMM estimator to be used. In this method, the differenced lagged dependent variables and other endogenous variables can be instrumented with their lags in levels, lagged two or more periods while the exogenous variables can serve as their own instruments. This method can be either one-step GMM estimator or two-step GMM estimator. The one-step GMM estimator assumes independent or terms and homoscedastic error variances across countries and times. Meanwhile, the second-step GMM estimator uses residuals of the first-step estimation to construct a consistent variance – covariance matrix when the assumptions of independence and homoscedasticity do not hold.

The main problem in first-difference GMM estimator is that potential information in the level relationship and in the relations between the levels and the first differences is neglected. To solve this problem Arellano and Bover(1995) suggest estimating the level and first-difference regressions as a system known as system-GMM estimator. This method combines, in a system, level regression, instrumented by lagged first-differenced variables, with first-differenced regression by using lagged level variables as instruments. In light of these econometric issues, we adopt the two-step system GMM in the analysis. Still, results from the two-step first-difference GMM are also reported for comparison. The consistency of GMM estimator depends on two specification tests, Sargan over-identifying restrictions and a serial correlation test in disturbances (Arellano and Bond, 1991). To test overall validity of the instruments, we use Sargan over-identifying restrictions in the estimation process. Failure to reject the null of Sargan test would imply that the instruments are valid and the model is correctly specified. To test the serial correlation in disturbances, one should reject the null of the absence of first-order serial correlation (AR1) and not the absence of second-order serial correlation (AR2), respectively.

3. Estimation results

Table 2 contains results of estimating GLC without and with fiscal policy indicator (government debt in % of GDP), i.e. model (1) and model (2), estimated using both first-difference GMM and system GMM estimators. Moreover, Table 3 presents results for estimating GLC without and with monetary policy indicator (M2 in % of GDP). Specification tests reported in both tables suggest the appropriateness of GMM estimators. Sargan test does not reject over-identification restrictions, suggesting that we have valid instruments. Moreover, correlation test fails to reject the null of no second-order autocorrelation (AR2) while it rejects the null of no first-order auto correlation (AR1).The results from estimating model (1) as given in columns 2 and 3 of Table 2 and Table 3 provide empirical support for the existence of an inverted-U shaped GLC as indicated by the significantly positive coefficient of tax rate (tax revenue as a percentage of GDP) and significantly negative coefficient of tax rate squared. Based on the information of columns 2 and 3 in Table 2 corresponding to model (1), ax rate threshold point is 22.14 % (first-difference GMM) and 21.84 (system GMM). Based on columns 2 and 3 of Table 3, tax rate threshold point is 20.68 % (first-difference.

Table 2: GMM estimation results of the GLC indexed by fiscal policy

	Model 1 (without debt)		Model 2 (with debt)	
	Difference GMM	System GMM	Difference GMM	System GMM
Main variables				
tax	1.727 (0.000)	2.140 (0.003)	1.942 (0.081)	1.659 (0.001)
tax^2	-0.039 (0.000)	-0.049 (0.002)	-0.057 (0.010)	-0.053 (0.000)
$tax * debt$	-	-	-0.015 (0.000)	-0.013 (0.000)
$tax^2 * debt$	-	-	0.001 (0.000)	0.001 (0.000)
Control variables				
gov	-2.898 (0.000)	-1.854 (0.000)	-2.881 (0.000)	-1.914 (0.000)
inv	0.380 (0.000)	0.827 (0.000)	0.225 (0.008)	0.951 (0.000)
inf	-0.442 (0.000)	0.095 (0.000)	-0.494 (0.000)	0.059 (0.041)
$trade$	0.070 (0.000)	-0.053 (0.000)	0.085 (0.000)	-0.034 (0.000)
$constant$	25.717 (0.002)	4.901 (0.468)	35.716 (0.014)	12.035 (0.017)
Observations	203	203	203	203
No of countries	30	30	30	30
No of instruments	42	47	44	49
Sargan test: p-value	0.745	0.905	0.805	0.925
AR1: p-value	0.002	0.003	0.001	0.045
AR2: p-value	0.494	0.228	0.622	0.782

Note: numbers in parentheses are p-values. Data for debt variable was only available in 30 countries over the time span considered in the study. Accordingly to compare the results of model (1) and model (2) in the same group of countries, mode (1) is also estimated for 30 countries.

Table 3: GMM estimation results of the GLC indexed by monetary policy

	Model 1 (without M2)		Model 2 (with M2)	
	Difference GMM	System GMM	Difference GMM	System GMM
Main variables				
tax	1.200 (0.008)	2.720 (0.000)	3.036 (0.019)	4.207 (0.000)
tax^2	-0.029 (0.001)	-0.059 (0.000)	-0.080 (0.014)	-0.094 (0.000)
$tax * M2$	-	-	-0.011 (0.000)	-0.009 (0.000)
$tax^2 * M2$	-	-	0.0003 (0.008)	0.0003 (0.001)
Control variables				
gov	-3.383 (0.000)	-2.492 (0.000)	-3.227 (0.000)	-2.776 (0.000)
inv	0.373 (0.000)	0.811 (0.000)	0.439 (0.000)	0.514 (0.000)
inf	-0.320 (0.000)	0.019 (0.421)	-0.283 (0.000)	-0.153 (0.000)
$trade$	0.054 (0.000)	-0.059 (0.000)	0.072 (0.000)	-0.013 (0.044)
$constant$	40.526 (0.000)	10.971 (0.252)	27.761 (0.040)	10.806 (0.389)
Observations	229	229	229	264
No of countries	35	35	35	35
No of instruments	42	47	44	52
Sargan test: p-value	0.743	0.798	0.625	0.956
AR1: p-value	0.005	0.005	0.007	0.001
AR2: p-value	0.230	0.443	0.123	0.613

Note: numbers in parentheses are p-values. Data for debt variable was only available in 35 countries over the time span considered in the study. Accordingly to compare the results of model (1) and model (2) in the same group of countries, mode (1) is also estimated for 30 countries.

We next estimate GLC with the presence of monetary and fiscal policy indicators, i.e. model (2), to address our central thesis that how these factors deform GLC. The results are also presented in

Table 2 and 3. According to the results provided in columns 4 and 5 of Table 2 and 3, the coefficient of tax rate remains significantly positive and the coefficient of tax rate squared remains significantly negative. Thus inclusion of monetary and fiscal policy indicators in models does not overturn the validity of GLC. Moreover, as reflected by the significance of the two interactive terms at conventional levels of significance, the results suggest the importance of monetary and fiscal policies in influencing GLC. The significant negative coefficient of the interaction between Tax rate and debt ratio and M2 ratio suggests that the growth rate of real GDP per capita is lower for a country with higher level of debt ratio or M2 ratio. In other words, GLC shifts downward as debt and M2 increase. And finally, according to Eq. (3) positive coefficient of the interaction between tax rate squared and debt and M2suggests that threshold point can be lower or higher for a country with higher level of debt and M2depending on the relative size (in absolute term) of β_1^* and β_2^*. For instance, according to Table 2 and based on system-GMM estimation method, an increase in debt ratio will raise tax rate turning point due to the bigger absolute size of β_1^*(0.013) than β_2^* (0.001). This result is also verified using first-difference GMM method. Based on information provided in columns 4 and 5 of Table 3, an increase in M2 ratio also increases the tax rate turning point. To sum up, these empirical results confirm the existence of a hump-shaped curve between taxes and economic growth, and that this GLC changes in response to a change in the debt ratio and M2 ratio.

To substantiate the validity of GLC further, we perform a robustness check by incorporating trade openness degree, investment ratio, government consumption ratio and inflation in GLC specification. The results of all possible combinations of control variables[2]soundly support our earlier conclusion that there is an inverted-U shaped curve between taxes and economic growth and that economic growth tends to be less for a country with higher debt ratio and M2 ratio. Besides, tax rate threshold point tends to

[2] The results are not reported here to save space but are available upon request.

be higher for a country with higher debt ratio and M2. Consequently, our main findings do not seem to suffer from common omitted variable bias.

4. Conclusion

The present paper examines the role played by fiscal policy proxied by debt ratio (government debt in % of GDP) and monetary policy proxied by M2 ratio (money and quasi money in % of GDP) as two important ways of government financing in growth–taxes relation for a panel of 38high income countries. More specifically, the paper empirically assesses the impact of monetary and fiscal policies on GLC specification and the way these variables affect tax rate threshold point using panel GMM estimators. Our results provide supportive evidence for validity of GLC in the sample countries, as reflected by positive coefficient of tax rate and negative coefficient of its squared value. Then, by interacting fiscal and monetary policy indicators with both tax rate and tax rate squared, we observe significant coefficients of both interactive terms. This means that fiscal and monetary policies do play a role in the shape of GLC. We note that expansionary fiscal and monetary policies tend to reduce economic growth by shifting GLC downwards at any given level of tax rate, after holding other determining factors of economic growth constant. Interestingly, we also find evidence suggesting higher tax rate threshold point for a higher level of debt ratio and M2 ratio. These conclusions have added credence as they are robust to the inclusion of various controlled variables in GLC specification.

These results have several important implications. First, they strengthen the case for heterogeneous GLC across countries. Accordingly, any study that treats GLC to be homogenous may yield misleading conclusion. Second, due to the impact of debt ratio in decreasing economic growth by shifting GLC downwards, as noted by Heller (2005) a government may enhance the efficiency within "fiscal space", which explores the optimal way in which different financing methods may finance government spending, by either raising the productivity of public spending or cutting fiscal debt. Finally, as noted by Ehrhart et al. (2014) using money as a financing instrument should be carefully supervised, since excessive money growth rates may not only generate large inflation rates, reducing the real value of available seigniorage resources, but they equally distort capital accumulation and reduce economic growth, particularly when tax rates are fairly high.

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