Taxes and Economic Growth in Developing Countries : A Dynamic Panel Approach

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Abstract

This paper looks at the effects of taxes increase on economic growth of 47 developing countries. In developing countries, there is no magic tax strategy to encourage economic growth. Some countries with high tax burdens have high growth rates and some countries with low tax burdens have low growth rates. Despite much theoretical and empirical inquiry as well as political and policy controversy, no simple answer exists concerning the relationship of taxes on economic growth in developing countries. The research takes an empirical approach to analyze the effects of four types of taxes namely taxes revenue, taxes on goods and services, taxes on income, profits, and capital gains and taxes on international trade on economic growth. Mobilizing a dynamic panel data over the period 2000–2012 and using the system GMM estimator to address endogeneity issues, the econometric results yield that (i) there is a non-linear relationship between taxes revenue and economic growth, specifically, these taxes increase economic growth at short run and this effect then increases over time as these taxes increase, and (ii) there is a non-linear (U-shaped) relationship between taxes on income, profits and capital gains, taxes on international trade and economic growth, specifically, these taxes lower economic growth at short run and these effects then diminish over time as these taxes increase.

JEL CODES : C33; H20; H21; H27; O40.

1. Introduction

Although specific tax policy decisions normally are (and should be) debated and contested, there is considerable agreement at the international level about what are the important tax issues and appropriate tax policy directions for developing countries (Fjeldstad, 2013). Much of this relative consensus is reflected in the IMF's latest policy statement "*Revenue Mobilization in Developing Countries*" (IMF, 2011). Thus, Fjeldstad (2013) thinks that an effective tax system is considered central for sustainable development because it can mobilize the domestic revenue base as a key mechanism for developing countries to escape from aid or single natural resource dependency.

Intensified competition between countries and increasing demand for publicly financed services pressure countries' tax systems to be designed in efficient ways. In order to design efficient tax systems it is crucial to know how distortive and harmful different taxes are to economic growth. Even in developed countries with stable, long-established tax systems and excellent data, there is still much we do not understand about the complex subject of the effects of taxation on growth. Our understanding of the relationship of tax on growth in developing countries is even less complete. According to Gordon and Li (2005), tax policies seen in developing countries are much more puzzling on many dimensions, given the sharp contrast between these policies and both those seen in developed countries and those forecast in the optimal tax literature.

Sure enough, there is no magic tax strategy to encourage economic growth in developing countries. Some countries with high tax burdens have high growth rates and some countries with low tax burdens have low growth rates. Despite much theoretical and empirical inquiry as well as political and policy controversy, no simple answer exists concerning the relationship of tax on economic growth especially in developing countries.

Theoretical literature suggests that tax have a negative effect on economic growth. Thus, high tax rates diminish economic growth. The reason for this is that higher rates may be more distortionary and hence impact growth negatively while lower rates may generate revenues that are spent in productive ways. However, the empirical literature suggests both direct and inverse relationship between tax burdens and rates of growth. Sure enough, higher tax burden can decrease or elevate the rate of economic growth. Thus, future economic output may be higher with the optimal rate of taxation and hence future tax revenues would be higher with a lower rate of taxation.

Recent studies (Skinner, 1988; Easterly and Robelo, 1993; Padda and Akram, 2009; Worlu and Emeka, 2012; Bujang et *al.*, 2013; Canavire-Bacarreza et *al.*, 2013; etc.) analyzed the empirical

effets of taxes on economic growth in developing countries and are obtain non consensual clear results as the theory suggests.

Skinner (1988) used data from African countries to conclude that income, corporate, and import taxation led to greater reductions in output growth than average export and sales taxation. Easterly and Robelo (1993) use growth model and sample includes 32 developing countries to experiment with a method of obtaining average marginal income tax rates that combines information on statutory rates with the amount of tax revenue collected and with data on income distribution. As they would expect, there is a positive correlation between their income weighted average marginal tax rates and the level of real per capita income. This simply reflects the fact that developed economies tend to rely more on income taxes than less developed countries. As for them, Padda and Akram (2009) tests whether tax policies conducted by Pakistan, India and Sri Lanka have transitory or permanent effect on their economic growth over the period 1973–2008 and they find that the impact of tax rate changes is transitory and negative for short-term in Pakistan and India but for Sri Lanka its positive for first year and thereafter it has also negative effect on economic growth. By examining the impact of tax revenue on the economic growth of Nigeria judging from its impact on infrastructural development from 1980 to 2007, Worlu and Emeka (2012) find that tax revenue stimulates economic growth through infrastructural development. However, Bujang et *al.* (2013) investigates the long-run relationship between tax structure and economic growth and the other economic indicators via panel unit root tests and panel cointegration analysis in developing and high-income Organisation for Economic Co-operation and Development (OECD) countries. Panel cointegration test reveal that there is no long-run cointegrating relationship between tax structure and both of GDP and gross saving in developing countries. Moerover, Canavire-Bacarreza et *al.* (2013) evaluate the effect of the most important tax instruments of Latin American countries (personal income tax, corporate income tax, general taxes on goods and services, including value added and other sales taxes, and revenues from natural resource) on economic growth using vector autoregressive techniques, and for close to the entire region and a worldwide sample of developing and developed countries using panel data estimation. They find that, for the most part, personal income tax does not have the expected negative effect on economic growth in Latin America. They also find small negative effects of corporate income tax on growth for individual countries, specifically Argentina, Mexico, and Chile. Finally, their results suggest that greater reliance on consumption taxes has significant positive effects on growth in Latin American in general.

In practice, most of the taxes are distortionary in the opposed direction from fixed taxes; ceteris paribus, they have therefore tendency to deform resource allocation through their impact on saving and investment. However, the act that they have or not a perverse effect on growth in the

net terms depends on profits in terms of the expenditures growth that they serve to finance. More generally, it is not all distortionary taxes which have some adverse effects on economic growth at long-term; the net effect depends on the fact that the considered tax is or no used as an instrument to correct negative externalities or other distortions. The effect of taxation on the level of investment operates through the capital cost. The evidence of this effect is limited for developing countries. The taxation can nevertheless affect investment through a differentiated structure of the profits taxation rate (Agénor, 2005).

For Fjeldstad (2013) one issue for empirical research on tax and growth in developing countries should include efforts to mobilize new empirical evidence on the impacts of different corporate tax policies, and tax incentives and exemptions. Because the study of the effect of taxation on growth models continues to be an extremely active research area, this scarcity of empirical work is due to the difficulties involved in measuring the relevant impacts of four types of taxes on economic growth in developing countries. More specifically, the contribution of this research is therefore to analyze the effects of the taxes revenue, the taxes on goods and services, the taxes on income, profits and capital gains and the taxes on international trade on economic growth of 47 developing countries by mobilizing a most recent available dynamic panel data

The paper is organized as follow. The next section presents the model of this study. Section 3 presents the data while section 4 describes the estimation method. Section 5 presents the estimation results and section 6 the graphical analysis. Finally section 7 concludes the paper.

2. Model

The dynamic panel data model which we use is designed to capture the effects of taxes on economic growth in 47 developing countries. To this end, we develop an econometric model in which the characteristics of each country are modeled as specific effects which are here unobservable variables, constants in time and expected to affect their behavior. Taking into account the sources of unobserved heterogeneity allows completing heterogeneity carried by the observable variables included in the model. The regression model which we estimate can be written as follows:

$$y_{it} = \alpha y_{it-1} + \gamma_1 taxrev_{it} + \gamma_2 taxrev_{it}^2 + \delta_1 taxgs_{it} + \delta_2 taxgs_{it}^2 + \psi_1 taxipc_{it} + \psi_2 taxipc_{it}^2 + \phi_1 taxit_{it} + \phi_2 taxit_{it}^2 + \beta x_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where y_{it} is the dependent variable (GDP per capita growth rate of country *i* at time period *t*) $taxrev_{it}$ is the taxes revenue, $taxgs_{it}$ is the taxes on goods and services, $taxipcg_{it}$ is the taxes on income, profits and capital gains, $taxit_{it}$ represents the taxes on international trade, x_{it} is the

vector of explanatory variables. The μ_i terms are fixed country effects (unmeasured shocks). The λ_t terms are sample-wide period effects (temporal specific effect). The error ε_{it} terms are idiosyncratic distributions which vary by country and over time and are assumed to be *iid* (independent and identically distributed) with zero mean and a variance equal to σ_{ε}^{2}. As already noted *i* and *t* respectively represent the country index and the time index. α, γ_1, γ_2, δ_1, δ_2, ψ_1, ψ_2, ϕ_1, ϕ_2 and β are the parameters to be estimated.

We can write now the growth model:

$$y_{it} - y_{it-1} = (\alpha - 1) y_{it-1} + \gamma_1 taxrev_{it} + \gamma_2 taxrev_{it}^2 + \delta_1 taxgs_{it} + \delta_2 taxgs_{it}^2 + \psi_1 taxipc_{it} + \psi_2 taxipc_{it}^2 + \phi_1 taxit_{it} + \phi_2 taxit_{it}^2 + \beta x_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Where the variables and the coefficients are the same as in equation (1).

3. Data

We use available dynamic panel data of 47 developing countries observed over the period 2000-2012 to analyze the effects of taxes on economic growth. The data are annual and come from the statistics tables of the World Bank (World Data Indicator 2014). Table 1 in appendix A shows a summary description of the variables. Appendix A contains also a variable description with their sources (table 2). Further, a list of the 47 developing countries (18 of Africa, 14 of Asia, 8 of Europe and 7 of America) included in this study is presented in appendix C.

$grwgdppc_{it}$ is the dependent variable in our model. It is measured by the GDP per capita growth (annual average in per cent). Between the period 2000-2008, the growth rate of GDP per capita average of 47 developing countries has increased by 177.74% from 37.8% in 2000 to 215.57% in 2012 (see figure 2 appendix B). Then it rose to 182.67% in 2012 representing a decrease of 32.87% on average.

The explanatory variables include the interest variables of this study and the control variables. Taxes namely taxes revenue ($taxrev_{it}$), taxes on goods and services ($taxgs_{it}$), taxes on income, profits, and capital gains ($taxipc_{it}$) and finally taxes on international trade ($taxit_{it}$) and theirs squared terms represent the interest variables of this study, and others variables are the control variables namely initial income per capita ($iipc_{it}$); inflation rate ($infl_{it}$), ratio of government expenditure ($ggfce_{it}$), investment (inv_{it}), ratio of savings as share of GDP (gds_{it}), labor force growth rate (lfg_{it}), unemployment ($unempl_{it}$), dependency ratio of the population ($popag_{it}$) and trade openness ($opne_{it}$).

$taxrev_{it}$ which is the taxes revenue variable refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue. Currently, the governments of developing countries collect much lower proportions of their GDPs in tax revenue than do the governments of the OECD countries: 10-20% rather than 30-40%. Their tax effort indices (revenue collections relative to estimated revenue potentials) are also lower than those of the OECD countries. (Mascagni et *al.*, 2014). Ratios of tax revenue to gross domestic product (GDP) in developing countries are typically in the range of 15 to 20%, compared with 30% in industrialized nations (World Bank, 1991).

$taxgs_{it}$ is the taxes on goods and services variable and include general sales and turnover or value added taxes, selective excises on goods, selective taxes on services, taxes on the use of goods or property, taxes on extraction and production of minerals, and profits of fiscal monopolies.

$taxipc_{it}$ is the taxes on income, profits, and capital gains variable and is levied on the actual or presumptive net income of individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets. Intragovernmental payments are eliminated in consolidation. Patterns of income taxation (both in level and in composition) differ from country to country because of economic, cultural and historical factors (Bonu and Pedro Motau, 2009). It is assumed that a higher income tax rates (ITR) leads to a higher tax revenue collection which in turn, will enhance the economic development of any country, especially in developed nations as compared to developing or under-developed nations (Slemord, 2003).

$taxit_{it}$ is the taxes on international trade variable and include import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes. According to Fjeldstad (2013), for so many developing countries which have fitted into the global division of labour as exporters of primary products, international trade has been the obvious place for their governments to gather revenue. In 1975, trade taxes were a very minor source of government revenue in high income countries, but were significant in both middle and low-income countries. Baunsgaard and Keen (2005) estimate that by 2000 governments of middle-income countries had found other means to replace about 45-60 per cent of the trade revenues they had foregone, while for low-income countries the figure was at best around 30 per cent.

$iipc_{it}$ is the initial income per capita variable. The one is measured by the GDP per capita for the initial year of each subperiod (current prices). This variable allows taking in account the conditional convergence (at the starting point). Solow (1956) growth model predicts that the economies which have an initial income level little high grow more quickly than those in which the initial income level is more important and near their stationary state. Thus, this variable is assumed to influence negatively economic growth in developing countries for the economic growth rhythm of the developing countries having a higher initial GDP per capita is weaker than the one of the developing countries having a weaker initial GDP per capita.

$infl_{it}$ is the inflation rate variable (annual in per cent) in developing countries. This variable is calculated with the Consumer Prices Index (CPI). Although this variable keeps ambivalent relationships with economic growth (Nubukpo, 2007), we assume that this variable must influence negatively economic growth due to his negative impact on purchasing power of consumers.

$ggfce_{it}$ is the government expenditure variable. This one is measured by the general government final consumption expenditure as a share of GDP (in per cent). Theoretically, this variable must influence economic growth negatively due to the distortionary effect of taxation. There is an extensive literature examining the relationship between government expenditures and economic growth. Many of these studies (Barro, 1991; Fölster and Henrekson, 2001 and 2006; Romero-Avila and Strauch, 2008 and Bergh and Karlsson, 2010) tend to find a negative relationship between size of government, typically measured as total government or government consumption expenditures (as in this paper), and economic growth. However, others studies (Ram, 1986; Devaranjan et *al.*, 1996 and Agell et *al.*, 2006) dispute this negative relationship and it is appear that the lack of consensus may not be surprising as the overall size of the government has two contrasting effects. A larger size means higher taxes that impose larger distortions in the economy, but higher levels of public spending may also boost economic growth as part of the spending is growth enhancing. Moreover, using public consummation ratio as a share of GDP (in per cent) over the period 1971-1995, Tenou (1999) obtains a negative relationship with economic growth in the West-African Economic and Monetary Union (WAEMU) countries. Dackehag and Hansson (2012) studying the relationship between income tax (corporate income tax and personal income tax) and economic growth of 25 rich OECD countries find also a negative effect of government expenditures on economic growth.

inv_{it} represents the investment variable. This one is measured with the gross fixed capital formation as a share of GDP (in per cent). For neoclassic school than Keynesian theory, investment is a factor of economic growth. Some empirical studies on African economies (Ojo

and Oshikoya, 1995; Ghura and Hadjimichael, 1996) have highlighted the presence of a positive relationship between investment and economic growth.

gds_{it} is the saving variable and is measured with the gross domestic savings as share of GDP. Dackehag and Hansson (2012) find a negative, although insignificant coefficient for this variable.

lfg_{it} is the labor force growth variable (in per cent). This one is measured with the total labor force growth and assumes to influence negatively economic growth in developing countries.

$unempl_{it}$ is the unemployment variable. The one is measured by the total unemployment as a share of total labor force (in per cent). This variable is assumed to influence negatively economic growth in developing countries.

$popag_{it}$ represents the dependency ratio variable. This variable is measured with the population aged 0-14 and upper 65 as a share of the total population. This one is assumed to influence negatively economic growth in developing countries.

$opne_{it}$ is the openness trade variable and measured with export and import as a share of GDP (in per cent). It is difficult to predict the effect of the openness trade variable on economic growth for the developing countries due to the fact that these ones import much more than they do not export and the strong dependence of their exports to the raw materials submitted to the foreign terms deterioration.

We test the stationary of the all variables included in the model using the unit root tests on panel data of *Fisher-type*. Sure enough, *Fisher-type test* allows unbalanced panels and gaps in any panel to be tested, and performs Augmented Dickey-Fuller (ADF) or Phillips-Perron (PP) tests for each panel. All the series are stationary in level with constant (see table 3 of appendix A).

4. Estimation methods

Sometimes, the lagged levels of the regressors are poor instruments for the first-differenced regressors. Thus, to derive more general conclusions about the relationship between taxes and economic growth in developing countries, we use the system GMM approach of Arellano and Bond (1991). We believe that this strategy allows controlling individual and temporal specifics effects with short-run dynamics and solving variables endogeneity bias, simultaneous bias, inverse causality and omitted variables problems and provides more precise estimates of the effects of taxes on economic growth in developing countries.

The system GMM estimator uses the level equation (e.g. equation (1)) to obtain a system of two equations: one differenced (see equation (3) below) and one in level. By adding the second equation, additional instruments can be obtained. Thus, the variables in levels in the second equation are instrumented with their own first differences. This usually increases efficiency.

$$\begin{aligned} grwgdppc_{it} - grwgdppc_{it-1} &= \alpha\left(grwgdppc_{it-1} - grwgdppc_{it-2}\right) + \gamma_1\left(taxrev_{it} - taxrev_{it-1}\right) \\ &+ \gamma_2\left(taxrev_{it}^2 - taxrev_{it-1}^2\right) + \delta_1\left(taxgs_{it} - taxgs_{it-1}\right) \\ &+ \delta_2\left(taxgs_{it}^2 - taxgs_{it-1}^2\right) + \psi_1\left(taxipc_{it} - taxipc_{it-1}\right) \\ &+ \psi_2\left(taxipc_{it}^2 - taxipc_{it-1}^2\right) + \phi_1\left(taxit_{it} - taxit_{it-1}\right) \\ &+ \phi_2\left(taxit_{it}^2 - taxit_{it-1}^2\right) + \beta\left(x_{it} - x_{it-1}\right) + \left(\lambda_t - \lambda_{t-1}\right) + \left(\varepsilon_{it} - \varepsilon_{it-1}\right) \end{aligned} \quad (3)$$

Where $grwgdppc_{it} = y_{it}$ and

$x_{it} = \left[iipc_{it} \quad infl_{it} \quad ggfce_{it} \quad inv_{it} \quad gds_{it} \quad lfg_{it} \quad unempl_{it} \quad popag_{it} \quad opne_{it}\right]'$.

The first difference eliminates countries specific effect and consequently the bias of time invariant omitted variables. By construction, the term $\left(\varepsilon_{it} - \varepsilon_{it-1}\right)$ is correlated with the lagged variable in difference $\left(grwgdppc_{it-1} - grwgdppc_{it-2}\right)$. The first differences of the explanatory variables are instrumented by the lagged values (in level) of those same variables. The objective is to reduce the simultaneous bias and the bias due to presence of the lagged dependent variable in difference at the left of equation (3).

Equation in first difference (equation 3) is estimated simultaneously with equation in level (equation 1) by the GMM. In the equation in level, the variables are instrumented by their first differences. At this level, only the more recent first difference is used. Using other lagged firsts differences result in redundancy of moments' conditions (Arellano and Bover, 1995). Blundell and Bond (1998) tested this method with the simulations of Monte Carlo. They found that the GMM estimator in system is more efficient than GMM estimator in differences. The latter produces the biased coefficients for small samples. Bias is as much more important than the variables are persistent in time, the specific effects are important and the temporal dimension of the panel is weak.

For equation in level, one uses additional moments' conditions supposing that the explanatory variables are stationary.

$$\mathbb{E}\left[\left(grwgdppc_{it-\tau} - grwgdppc_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \quad (4)$$

$$\mathbb{E}\left[\left(taxrev_{it-\tau} - taxrev_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \quad (5)$$

$$\mathbb{E}\left[\left(taxrev_{it-\tau}^2 - taxrev_{it-\tau-1}^2\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \quad (6)$$

$$\mathbb{E}\left[\left(taxgs_{it-\tau} - taxgs_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \quad \text{for} \quad \tau = 1 \quad (7)$$

$$\mathbb{E}\left[\left(taxgs^2_{it-\tau} - taxgs^2_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{8}$$

$$\mathbb{E}\left[\left(taxipc_{it-\tau} - taxipc_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{9}$$

$$\mathbb{E}\left[\left(taxipc^2_{it-\tau} - taxipc^2_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{10}$$

$$\mathbb{E}\left[\left(taxit_{it-\tau} - taxit_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{11}$$

$$\mathbb{E}\left[\left(taxit^2_{it-\tau} - taxit^2_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{12}$$

$$\mathbb{E}\left[\left(x_{it-\tau} - x_{it-\tau-1}\right)\cdot\left(\mu_i + \varepsilon_{it}\right)\right] = 0 \qquad \text{for } \tau = 1 \tag{13}$$

Moments' conditions above (equations 4 to 13) associate with GMM allow estimating the coefficients of the model. To test the validity of the lagged variables as instruments, Arellano and Bond (1991), Arellano and Bover (1995), and Blundel and Bond (1998) suggest overidentified test of Sargent/Hansen. By construction, the error term in first difference is correlated yields first order conditions, but it must not been to the second order. To test this hypothesis, these same authors suggest a second order autocorrelation test.

Further, we used different approaches to test the robustness of the results. Indeed, the hypothesis of non autocorrelation in the regression model of the errors terms is essential so that the GMM estimator is efficient. Arellano and Bond (1991) proposed a test which allows verifying the absence of first and second order autocorrelation. Thus, if there is absence of autocorrelation in the distribution of errors terms, this test gives a negative and significant value of the differentiated residues in the first order and non significant in the second order. This test which is based on auto-covariance standardized average residues follows a normal law under the null hypothesis. By another way, the authors proposed the instruments validity test of Sargent. Thus, if the weighting matrix is optimally selected for a given instrument matrix, Sargent test statistics follows asymptotically a law of chi2 under the null hypothesis of the validities instruments. Hansen tests and the second order autocorrelation tests of Arellano and Bond in general, do not allow rejecting the hypothesis of the validity of lagged variables in level and in differences as instrument, and the hypothesis non autocorrelation in second order (see table 4 of appendix A). In general, the results of our estimations are robust to eliminate rigorously all bias due to the non observed individual heterogeneity and offer, consequently, a better efficiency of our estimations results.

5. Estimation results and interpretation

Table 6 in appendix A reports the results from the regression of the taxes and the GDP per capita growth of 47 developing countries (see country list in appendix C). In this table, we have done eight (8) estimations.

In column (1) only the lagged GDP per capita growth, the level of the four taxes without their squared terms and the control variables namely initial income per capita, inflation rate, ratio of government expenditure, investment, ratio of savings as share of GDP, labor force growth rate, unemployment, dependency ratio of the population and trade openness are included as explanatory variables. The lagged GDP per capita growth variable has a positive and significant coefficient. This coefficient is statistically significant at the 5 per cent significance levels. Interestingly, the level of the taxes revenue is positive and statistically significant at the 10 per cent significance level. Interestingly again, the level of the taxes on income, profits, and capital gains and the level of the taxes on international trade are negative and statistically significant at the 1 and 5 per cent significance levels respectively. However, the taxes on goods and services have negative, although insignificant coefficients. Moreover, all the control variables have significant coefficients except the investment variable.

In column (2) all the variables with the squared terms of the four taxes variables and the lagged GDP per capita growth except the inflation rate variable are included as explanatory variables. The lagged GDP per capita growth variable has a positive and significant coefficient. This coefficient is statistically significant at the 1 per cent significance level. Interestingly, the level of the taxes revenue is positive and statistically significant at the 1 per cent significance level while the squared term is negative and statistically significant at the 5 per cent significance level. Interestingly again the level of the taxes on income, profits, and capital gains and the level of the taxes on international trade are negative and statistically significant at the 5 and 10 per cent significance levels. The squared term of the taxes on income, profits, and capital gains is positive and statistically insignificant but that of the taxes on international trade is also positive however statistically significant at the 10 per cent significance level. The level of the taxes on goods and services is negative, although insignificant while the squared term is positive and also insignificant. Moreover, all the control variables have significant coefficients except the investment and the trade openness variables.

In columns (3), (4), (5), (6) and (7), we do the same thing as in column (2) however instead of excluding the inflation variable we have exclude the ratio of government expenditure, the investment, the ratio of savings as share of GDP, the labor force growth rate and the unemployment respectively. In columns (8) we include all the variables without exception. The lagged GDP per capita growth variable has a positive and significant coefficient in columns (3)-(8). The value of this coefficient is given by the dynamic panel data specification of Arellano and bound (1991). Therefore, we need to estimate the value of the coefficient $\alpha-1$ in the growth model of equation (2). We calculate the *t-student* of the coefficient $\alpha-1$ which is equal to α/σ_{α}. Table 5 of appendix A gives the values of the coefficient $\alpha-1$ of all our estimations. This

coefficient is negative and statistically significant at the 1 per cent significance level in all our estimations.

In all columns except columns (3) and (7), the level of the taxes revenue has a positive and statistically significant impact on economic growth while the squared term has a negative and statistically significant (except in columns (5) and (7)) effect on economic growth. This suggests that there is a non-linear relationship between taxes revenue and economic growth. Specifically, low levels taxes revenue has a positive influence while higher taxes hamper economic growth.

As the taxes on goods and services variable has insignificant coefficient in all the estimations, we cannot conclude about the effect of these taxes on economic growth of the 47 developing countries of the study. However in the next section we will carry out a graphical analysis for these ones.

Further, in all columns without exception, the level of the taxes on income, profits, and capital gains has a negative and statistically significant impact on economic growth while the squared term has a negative and statistically significant (except in columns (2) and (7)) effect on economic growth. Thus, taxes revenue increase economic growth at short run and this effect then increases over time as these taxes increase in developing countries. Moreover, the level of the taxes on international trade has a negative and statistically significant (except in columns (3) and (7)) impact on economic growth while the squared term has a negative and statistically significant (except in columns (3), (4) and (7)) effect on economic growth. This suggests that there is a non-linear relationship (U-shaped) between taxes on income, profits, and capital gains, taxes on international trade and economic growth. Specifically, low levels taxes on income, profits, and capital gains and taxes on international trade have a negative influence while higher taxes encourage economic growth. Thus, taxes on income, profits, and capital gains and taxes on international trade lower economic growth at short run in developing countries and these effects then diminish over time as these taxes increase.

Turning to the explanatory variables, initial income per capita has a negative and statistically significant impact on GDP per capita growth in all our estimations, supporting the catching-up hypothesis. Inflation and ratio of government expenditure have a negative and statistically significant effect on GDP per capita growth in all our estimations except in column (7) for the ratio of government expenditure variable. This suggests that developing countries must work to maintain the inflation rate at the weak levels and to reduce considerably the general government final consumption expenditure. However, savings, labor force growth rate, unemployment, dependency ratio of the population and trade openness have a positive and statistically significant effect on GDP per capita growth in most of our estimations. This suggests ceteris paribus that

these variables favor GDP per capita growth in developing countries. Finally, the investment variable has a positive (except in columns (1)), although insignificant coefficients.

In general, the magnitude of the coefficients in columns (1) to (8) is fairly stable across the different specifications. Thus, considering column (8), the study suggests that a one per cent increase in taxes revenue raises economic growth in developing countries by approximately 1.342 per cent. Moreover, the study suggests that a one per cent increase in taxes on income, profits, and capital gains or in taxes on international trade lowers GDP per capita growth in developing countries by approximately -0.444 and -0.244 per cent respectively. Finally, the first-order conditions for column (8) with respect to taxes revenue suggests that developing countries can increase their taxes revenue up to 53.68 levels without hamper their economic growth. But the first-order condition for column (8) with respect to taxes on income, profits, and capital gains or with respect to taxes on international trade suggest that increasing of taxes on income, profits, and capital gains or taxes on international trade above 44.4 and 24.4 levels respectively favors economic growth of developing countries. As the economists (Mascagni et *al.*, 2014) agree, these findings suggest that there is considerable potential to increase taxes revenues in developing countries.

6. Graphical analysis

An alternative empirical approach is to draw on the experience of different countries to investigate how tax policy affects economic growth. There is some evidence that how a country collects taxes matters for economic growth. We have carried up as in Mendoza et *al.* (1996) graphical analysis of the relationship between each tax (taxes revenue, taxes on goods and services, taxes on income, profits, and capital gains and taxes on international trade) and GDP growth per capita in developing countries. All plots (see figures 1 to 4 of appendix B) include a linear regression (pooled (overall) regression) curve and a quadratic regression curve which is not appear in the Mendoza et *al.* (1996) graphical analysis. Figures 1 to 4 show the correlation among the developing countries between these taxes and economic growth over the period 2000–2012. The results of table 6 in appendix A reflect the intuition derived from the scatter diagrams in figures 1 to 4 of appendix B.

Sure enough, figure 1 plots GDP growth per capita against taxes revenue for all developing countries included in the study. The plots of figure 1 suggest both a positive relationship, roughly linear except at the extreme ends and a non-linear relationship (quite modest) between taxes revenue and economic growth. We can see that some countries as Angola, South Africa and Namibia which are all African countries exhibit in average a high level of taxes revenue.

Figure 2 plots GDP growth per capita against taxes on goods and services for the same developing countries in all years. Figure 2 suggests both a negative relationship, also roughly linear except at the extreme ends and a non-linear relationship (also quite modest) between taxes on goods and services and economic growth of the 47 developing countries. We can also see that some countries as Guatemala in America, Georgia in Asia, Nicaragua in America and Sri Lanka in Asia exhibit in average a high level of taxes on goods and services.

Figure 3 plots GDP growth per capita against taxes on income, profits, and capital gains for the developing countries included in the study in all years. The plots of figure 3 suggest both a negative relationship, roughly linear except at the extreme ends and a non-linear (U-shaped) relationship between taxes on income, profits, and capital gains and economic growth of the 47 developing countries. Figure 3 shows that some countries as South Africa and Malaysia in Asia, exhibit in average a high level of taxes on income, profits, and capital gains.

Finally, figure 4 plots GDP growth per capita against taxes on international trade for the same developing countries in all years. Figure 4 suggests both a negative relationship, roughly linear except at the extreme ends and a non-linear relationship between taxes on international trade and economic growth of the 47 developing countries. Further, we can see that Cote d'Ivoire in African exhibits in average a high level of taxes on international trade.

For all figures (1-4), we can see that Armenia in Asia exhibits in average the highest impact of taxes on economic growth. However, Cote d'Ivoire exhibits in average the lowest impact of taxes on economic growth.

In general, these scatter plots, largely confirmed in regression analysis (except taxes on goods and services which have insignificant coefficient), suggest that taxes on goods and services, taxes on income, profits, and capital gains and taxes on international trade are more harmful to economic growth than broadbased taxes revenue at short run but at long run it is the inverse phenomenon when the corresponding taxes increase.

7. Conclusion

This paper aims to provide some insights into the relationship between taxation of different sources of income and economic growth. We do so by study the effects of four categories taxes namely taxes revenue, taxes on goods and services, taxes on income, profits, and capital gains and finally taxes on international trade on economic growth of 47 developing countries by mobilizing a dynamic panel data over the period 2000–2012 and using the system GMM estimator to address endogeneity issues. Unlike many previous studies we allow for taxes having a non-linear effect on economic growth. The reason for this is that higher rates may be more distortionary

and hence impact growth negatively while lower rates may generate revenues that are spent in productive ways. We find empirical support for a non-linear relationship form the econometric results which yield two important findings. First, there is a non-linear relationship between taxes revenue and economic growth. Specifically, the taxes revenue increase economic growth at short run. This effect then increases over time as these taxes increase. Second, there is a non-linear (U-shaped) relationship between taxes on income, profits and capital gains, taxes on international trade and economic growth. Specifically, the taxes on income, profits and capital gains and the taxes on international trade lower economic growth at short run. These effects then diminish over time as these taxes increase.

Furthermore, the study suggests that there is considerable potential to increase taxes revenues in developing countries. Sure enough, the first-order condition for column (8) with respect to taxes revenue suggests that developing countries can increase their taxes revenue up to 53.68 levels without hamper their economic growth. But the first-order conditions for column (8) with respect to taxes on income, profits, and capital gains or with respect to taxes on international trade suggest that increasing of taxes on income, profits, and capital gains or taxes on international trade above 44.4 and 24.4 levels respectively favors economic growth of developing countries.

Of course, nearly any tax will tend to distort economic behavior along some margin, so the objective of a well-designed tax system is to avoid highly distortionary taxes and raise revenue from the less distortionary ones. So, it needs to be emphasised that developing countries policymakers will need to examine very carefully the trade-off between these growth-enhancing proposals and other objectives of tax systems particularly equity. According to Fjeldstad (2013), while we know quite a lot about the ways in which tax policy and practices might undermine economic growth, there is little evidence on the ways in which tax systems might be designed positively to accelerate growth. It is important to avoid the temptation to seek general conclusions about how taxation might affect growth (or any other policy objective) without paying close attention to its interaction in specific contexts with other economic policy instruments, with politics and with the financial conditions under which private investment decisions are made.

Appendix A: Tables

Table 1: Descriptive statistics.

Variables	Abbrev.	Obs.	Mean	Std. Dev.	Min	Max
GDP per capita growth	*grwgdppc*	611	3.348778	3.819642	-15.28408	18.50676
Taxes revenue	*taxrev*	562	15.68105	5.201454	0.7797023	39.6604
Taxes on goods and services	*taxgs*	561	33.60719	10.81914	8.765734	60.94431
Taxes on income, profits and capital gains	*taxipc*	560	22.26865	11.85935	1.375151	55.98266
Taxes on international trade	*taxit*	559	11.77163	10.49593	-14.79745	49.84525
Initial income per capita	*iipc*	611	1444.755	1498.524	122.5518	6872.734
Inflation (CPI)	*inf*	608	10.06346	30.79969	-8.237844	513.9069
Government expenditures	*ggfce*	594	13.86403	5.155787	2.05759	42.50581
Investment	*inv*	596	21.47724	5.582428	6.663808	52.50877
Savings	*gds*	596	16.32998	10.45894	-8.524429	56.23207
Labor force growth	*lfg*	611	-0.016477	0.060005	-0.077115	1.39824
Unemployment	*unempl*	611	8.016094	5.210144	0.7	37.6
Dependency ratio	*popag*	610	39.11029	6.871858	27.88127	51.97086
Openness	*opne*	603	79.08871	36.95621	4.560668	220.4074

Table 2: The sources of variables.

Variables	Description	Source
GDP per capita growth	Annual average of GDP per capita growth rate (in %)	WDI
Taxes revenue	Tax revenue (% of GDP)	WDI
Taxes on goods and services	Taxes on goods and services (% of revenue)	WDI
Taxes on income, profits and capital gains	Taxes on income, profits and capital gains (% of revenue)	WDI
Taxes on international trade	Taxes on international trade (% of revenue)	WDI
Initial income per capita	GDP per capita for the initial year of each subperiod, current prices	WDI
Inflation (CPI)	Annual inflation (in %)	WDI
Government expenditures	General government final consumption expenditure as a share of GDP, current prices (in %)	WDI
Investment	Gross fixed capital formation as a share of GDP, current prices (in %)	WDI
Savings	Gross domestic savings as a share of GDP, current prices (in %)	WDI
Labor force growth	Labor force growth (in %)	WDI
Unemployment	Unemployment, total (% of total labor force)	WDI
Dependency ratio	Population aged 0-14 and >65 as a share of total population (in %)	WDI
Openness	Export and import as a share of GDP (in %)	WDI

Note: WDI is defining as World Data Indicator.

Table 3: **Unit root test on panel data (Fisher-type Test).**

Series (Abbrev.)	ADF						PP		
	Constant			Trend			Trend		
	Test (P)	*p-val*	*Int. Or*	*Test (P)*	*p-val*	*Int. Or*	*Test (P)*	*p-val*	*Int. Or*
grwgdppc	430.5750	0.0000	I(0)	318.4544	0.0000	I(0)	318.4544	0.0000	I(0)
taxrev	248.1433	0.0000	I(0)	310.9102	0.0000	I(3)	118.1614	0.0467	I(2)
taxgs	296.5341	0.0000	I(0)	150.0530	0.0002	I(0)	150.0530	0.0002	I(0)
taxipc	255.2307	0.0000	I(0)	135.9717	0.0030	I(0)	135.9717	0.0030	I(0)
taxit	305.4725	0.0000	I(0)	147.1538	0.0004	I(0)	147.1538	0.0004	I(0)
inf	515.8436	0.0000	I(0)	387.8828	0.0000	I(0)	387.8828	0.0000	I(0)
ggfce	279.7148	0.0000	I(0)	171.4154	0.0000	I(0)	171.4154	0.0000	I(0)
inv	232.0402	0.0000	I(0)	147.9684	0.0003	I(0)	147.9684	0.0003	I(0)
gds	287.8671	0.0000	I(0)	125.3683	0.0170	I(2)	130.2819	0.0079	I(2)
lfg	374.2755	0.0000	I(0)	288.3800	0.0000	I(0)	288.3800	0.0000	I(0)
unempl	277.9455	0.0000	I(0)	184.6877	0.0000	I(0)	184.6877	0.0000	I(0)
popag	409.2397	0.0000	I(0)	299.2751	0.0000	I(0)	299.2751	0.0000	I(0)
opne	278.2253	0.0000	I(0)	141.1393	0.0012	I(0)	141.1393	0.0012	I(0)

Source : Author, based on the World Data Indicator (WDI).

Table 4: **Estimations robustness tests.**

	Obs.	Test on AR(1)	Test on AR(2)	Sargent Test	Hansen Test
(1)	540	Z= -4.27 [0.000]	Z= -0.94 [0.345]	chi2(66)= 207.17 [0.000]	chi2(66)= 33.04 [1.000]
(2)	543	Z= -4.54 [0.000]	Z= -0.89 [0.374]	chi2(97)= 246.33 [0.000]	chi2(97)= 30.38 [1.000]
(3)	542	Z= -4.67 [0.000]	Z= -1.03 [0.303]	chi2(97)= 259.45 [0.000]	chi2(97)= 31.47 [1.000]
(4)	540	Z= -4.62 [0.000]	Z= -1.10 [0.271]	chi2(99)= 256.39 [0.000]	chi2(99)= 26.29 [1.000]
(5)	540	Z= -4.43 [0.000]	Z= -1.30 [0.195]	chi2(99)= 256.66 [0.000]	chi2(99)= 29.75 [0.997]
(6)	540	Z= -4.59 [0.000]	Z= -1.16 [0.248]	chi2(97)= 257.35 [0.000]	chi2(97)= 27.34 [1.000]
(7)	540	Z= -4.28 [0.000]	Z= -0.57 [0.567]	chi2(88)= 237.01 [0.000]	chi2(88)= 30.40 [1.000]
(8)	540	Z= -4.58 [0.000]	Z= -1.16 [0.246]	chi2(99)= 257.36 [0.000]	chi2(99)= 26.44 [1.000]

Source : Author, based on the estimations.

Table 5: **Calculation of coefficients values ($\alpha-1$) of the lagged endogenous variable in the growth model**

Estimations	Coef.	Std. Err.	t	P>|t|
(1)	-0.8301907	0.0673983	-12.32	0.000
(2)	-0.8261688	0.0631239	-13.09	0.000
(3)	-0.8211981	0.0617139	-13.31	0.000
(4)	-0.8407496	0.0610315	-13.78	0.000
(5)	-0.8390969	0.0667758	-12.57	0.000
(6)	-0.8466133	0.0612841	-13.81	0.000
(7)	-0.8140474	0.0696662	-11.68	0.000
(8)	-0.8440955	0.0615381	-13.72	0.000

Source : Author, based on the estimations.

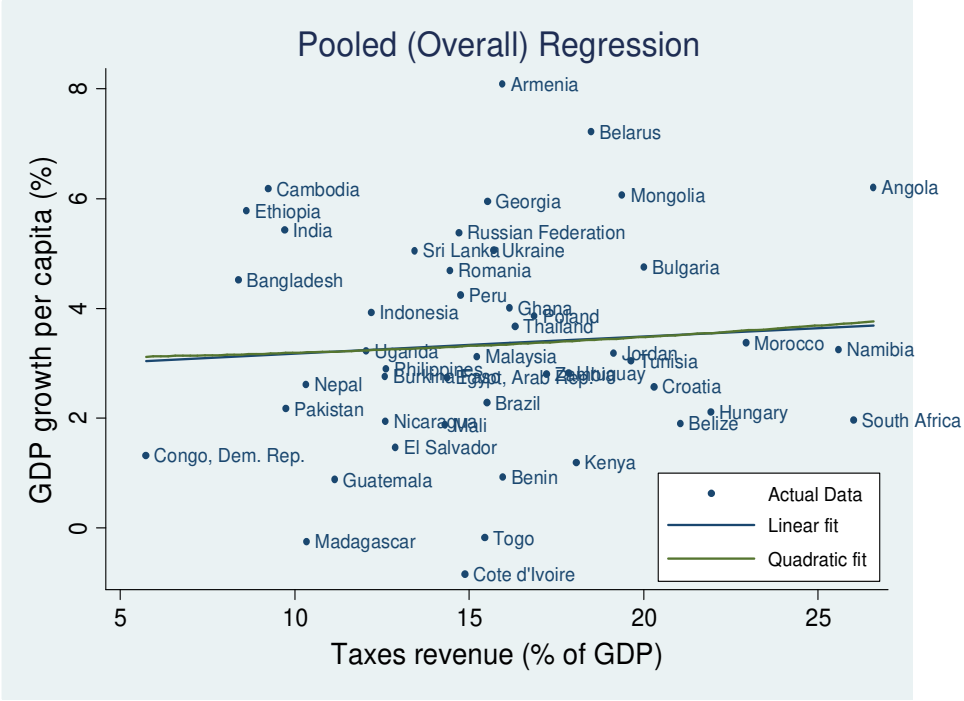
Table 6: Taxes and economic growth, one-step GMM estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP per capita growth lagged (-1)	0.170	0.174	0.179	0.159	0.161	0.153	0.186	0.156
	(2.52)**	(2.75)***	(2.90)***	(2.61)**	(2.41)**	(2.50)**	(2.67)**	(2.53)**
Taxes revenue	**0.404**	**1.920**	**1.017**	**1.370**	**1.108**	**1.339**	**0.468**	**1.342**
	(1.82)*	**(2.93)*****	**(1.46)**	**(2.52)****	**(1.77)***	**(2.30)****	**(0.97)**	**(2.32)****
Taxes revenue squared		**-0.040**	**-0.020**	**-0.026**	**-0.019**	**-0.025**	**-0.006**	**-0.025**
		(2.33)**	**(1.13)**	**(1.88)***	**(1.23)**	**(1.72)***	**(0.57)**	**(1.74)***
Taxes on goods and services	**-0.013**	**-0.057**	**-0.112**	**-0.022**	**-0.045**	**-0.017**	**-0.009**	**-0.021**
	(0.29)	**(0.28)**	**(0.67)**	**(0.12)**	**(0.28)**	**(0.09)**	**(0.06)**	**(0.12)**
Taxes on goods and services squared		**0.001**	**0.002**	**0.000**	**-0.000**	**0.000**	**0.000**	**0.000**
		(0.34)	**(0.96)**	**(0.14)**	**(0.03)**	**(0.12)**	**(0.05)**	**(0.14)**
Taxes on income, profits and capital gains	**-0.184**	**-0.400**	**-0.412**	**-0.444**	**-0.463**	**-0.452**	**-0.311**	**-0.444**
	(3.35)***	**(2.26)****	**(2.33)****	**(2.62)****	**(2.39)****	**(2.60)****	**(1.92)***	**(2.61)****
Taxes on income, profits and capital gains squared		**0.005**	**0.005**	**0.005**	**0.006**	**0.006**	**0.003**	**0.005**
		(1.61)	**(1.75)***	**(1.93)***	**(1.92)***	**(1.97)***	**(1.06)**	**(1.90)***
Taxes on international trade	**-0.113**	**-0.242**	**-0.143**	**-0.241**	**-0.304**	**-0.237**	**-0.082**	**-0.244**
	(1.73)*	**(1.84)***	**(1.29)**	**(1.98)***	**(2.35)****	**(2.00)***	**(0.82)**	**(2.04)****
Taxes on international trade squared		**0.005**	**0.003**	**0.005**	**0.005**	**0.004**	**0.001**	**0.005**
		(1.75)*	**(1.25)**	**(1.65)**	**(1.83)***	**(1.69)***	**(0.36)**	**(1.68)***
Initial income per capita	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(2.51)**	(3.56)***	(2.57)**	(3.18)***	(2.64)**	(3.13)***	(2.03)**	(3.19)***
Inflation	-0.026		-0.012	-0.013	-0.017	-0.013	-0.019	-0.013
	(5.75)***		(1.71)*	(2.29)**	(2.38)**	(2.21)**	(3.88)***	(2.25)**
Government expenditures	-0.527	-0.520		-0.459	-0.529	-0.471	-0.296	-0.456
	(2.01)*	(2.38)**		(2.23)**	(2.39)**	(2.16)**	(1.48)	(2.19)**
Investment	-0.015	0.006	0.029		0.055	0.013	0.040	0.014
	(0.18)	(0.06)	(0.36)		(0.62)	(0.15)	(0.59)	(0.16)
Savings	0.167	0.164	0.181	0.163		0.158	0.113	0.161
	(3.08)***	(3.05)***	(3.34)***	(3.24)***		(3.08)***	(2.65)**	(3.12)***
Labor force growth	3.268	2.877	3.324	3.078	2.816		4.447	3.082
	(1.99)*	(1.96)*	(2.45)**	(2.10)**	(1.90)*		(4.15)***	(2.14)**
Unemployment	0.466	0.432	0.422	0.444	0.408	0.459		0.445
	(2.18)**	(2.40)**	(2.69)***	(2.73)***	(2.36)**	(2.74)***		(2.66)**
Dependency ratio	0.195	0.201	0.211	0.218	0.151	0.212	0.126	0.221
	(1.98)*	(2.09)**	(2.10)**	(2.37)**	(1.55)	(2.43)**	(2.16)**	(2.49)**
Openness	0.057	0.032	0.021	0.037	0.057	0.036	0.060	0.036
	(2.13)**	(1.56)	(1.22)	(1.97)*	(2.51)**	(1.71)*	(2.78)***	(1.88)*
Constant	-6.731	-15.684	-14.645	-12.250	-4.821	-12.163	-3.571	-12.375
	(0.80)	(2.24)**	(1.91)*	(2.06)**	(0.82)	(2.01)*	(0.80)	(2.06)**
F statistic	13.87	8.81	12.13	17.97	9.45	14.77	15.52	15.50
Observation	540	543	542	540	540	540	540	540
Number of countries	47	47	47	47	47	47	47	47

Notes: Significant levels: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust standards errors are in the brackets.

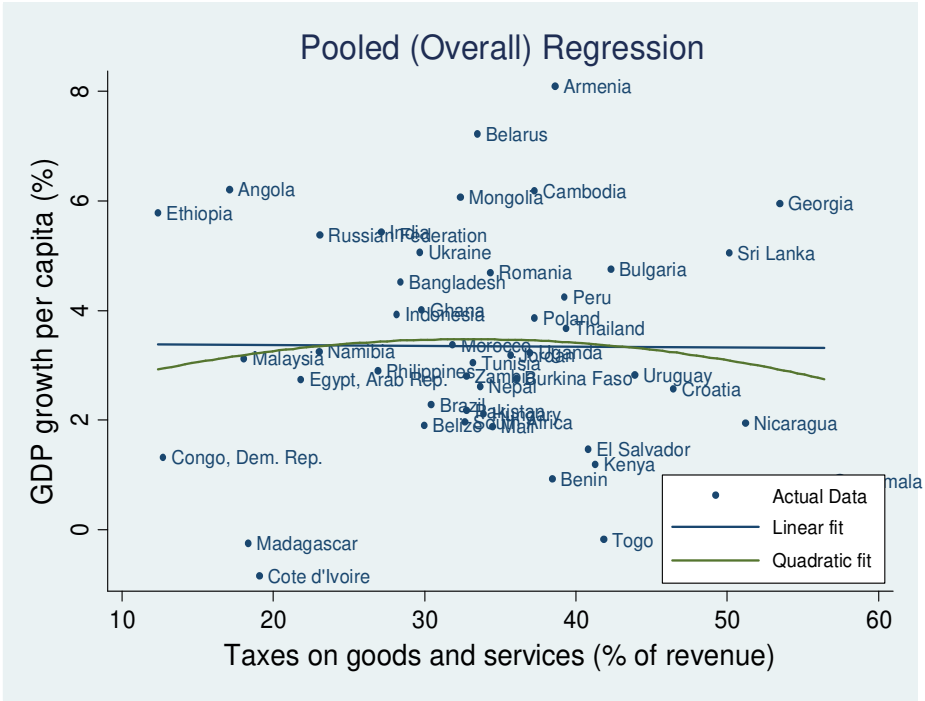
Appendix B: Figures

Figure 1: GDP growth per capita versus taxes revenue.



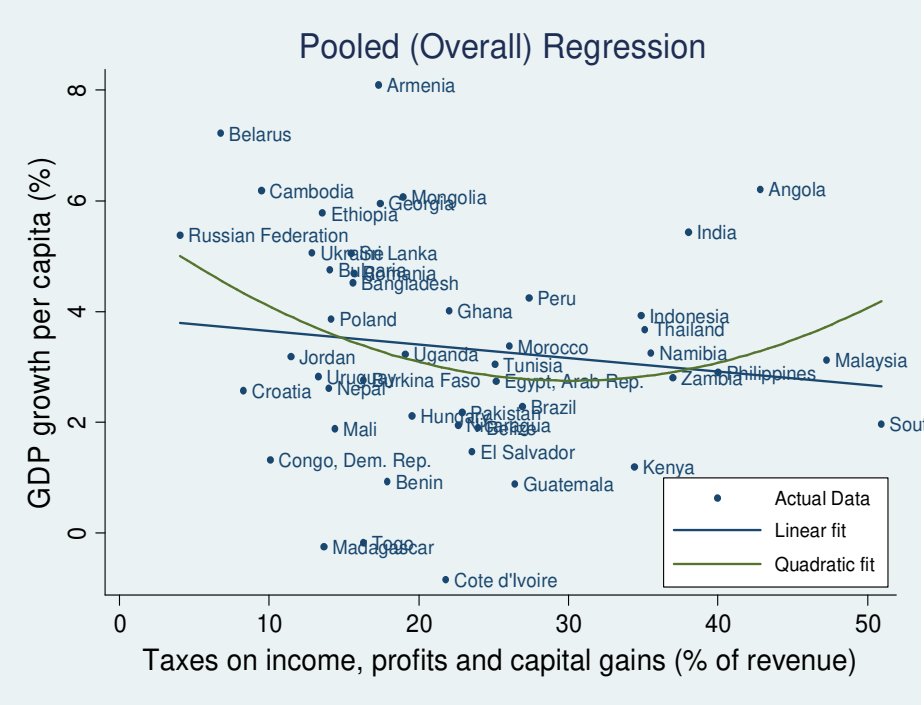
Source : Author, based on the data.

Figure 2: GDP growth per capita versus taxes on goods and services.



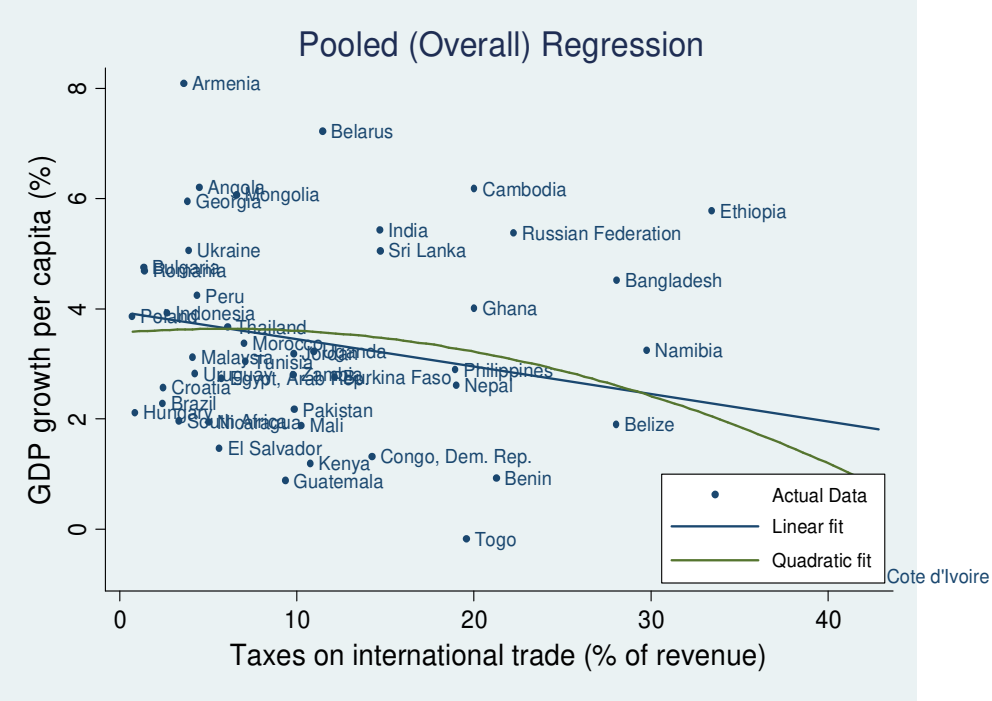
Source : Author, based on the data.

Figure 3: GDP growth per capita versus taxes on income, profits and capital gains.



Source : Author, based on the data.

Figure 4: GDP growth per capita versus taxes on international trade.



Source : Author, based on the data.

Appendix C: Country list

Angola
Armenia
Bangladesh
Belarus
Belize
Benin
Brazil
Bulgaria
Burkina Faso
Cambodia
Congo. Dem. Rep.
Cote d'Ivoire
Croatia
Egypt. Arab Rep.
El Salvador
Ethiopia
Georgia
Ghana
Guatemala
Hungary
India
Indonesia
Jordan
Kenya
Madagascar
Malaysia
Mali
Mongolia
Morocco
Namibia
Nepal
Nicaragua
Pakistan
Peru
Philippines
Poland
Romania
Russian Federation
South Africa
Sri Lanka
Thailand
Togo
Tunisia
Uganda
Ukraine
Uruguay
Zambia

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