The Effect of Corruption on The Relationship Between Taxation and Growth: An Econometric Investigation

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Summary: This paper aims at analyzing the possible effect of corruption on the relationship between taxation and economic growth in developing countries. In order to empirically investigate this relationship, we used a dynamic panel data models with a dataset of 70 developing countries over the period 1996-2016. To deal properly with dynamic panel models, we used the Generalized Method of Moments (GMM) estimator. Our findings are based on a non-parametric analysis as well as an econometric investigation, the non-parametric analysis supports the assumption of a non-linear relationship between taxation and growth. Regarding the econometric investigation, our results from GMM estimation show that the more countries are corrupt, the stronger harmful impact of taxation on economic growth.
Keywords: Growth; Corruption; Taxation; GMM; Developing Countries.
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I- Introduction :

Over the past few decades, there have been a numerous literature which have attempted to figure out whether taxation is good for economic growth or not. A dominant view argues that taxation is harmful to growth because it discourages investment which is very important to growth. In contrast, there is an alternative view which contends that taxation should not be analyzed independently from the surrounding institutional and economic environment (Philippe Aghion, 2016). The important role of government efficiency and control of corruption could help clarify and explain why the efficient governments of Scandinavia are prosperous in spite of top marginal income tax rates of 60% to 70% (Kleven, 2014).

The economic literature has distinguished various transmission channels through which corruption may affect economic growth, taxation is one of these transmission channels. Corruption reduces tax revenues and distorts the country's tax structure, it has also a negative effect on the tax morality of taxpayers (Torgler, 2007). Moreover; corruption could also have an indirect positive effect on growth if the revenue from the unpaid taxes is used to finance a new investment (Attila, 2008).

Minimizing corruption can lead to better good governance and greater transparency in public finance administrations and hence increases public resources. However, consistent with the "Laffer curve", raising tax pressure could lead to harmful effects on economic activities (Attila, 2008). Hence, even though increases in public resources are likely to help governments in providing more public goods, these benefits may be offset by adverse effects on economic growth due to higher taxes. As regards these two opposing effects, a tradeoff is needed.

Accordingly, the questions that can be raised in this regard are: what is the possible impact of taxation on economic growth? And what is the influence of corruption on this interaction?

To answer these critical questions, we are going to provide an empirical investigation using dynamic panel data in order to analyze the relationship between corruption, taxation, and economic growth.

The rest of the paper is organized as follows, in the following section, the relevant literature is reviewed, section 2 explores the data and the econometric methodology, section 3 presents and discusses the empirical results, the final section concludes the paper.

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I.1.Literature Review

During the last two decades, a numerous literature has emerged, which have studied the causal factors of economic growth, within this literature, an increasing number of studies have focused on the links between corruption and economic growth, on the one hand, and taxation and economic growth on the other hand. In other words, the two scopes have often been studied independently of each other.

From a theoretical point of view, Barreto and Alm (2003) have adopted an endogenous growth model in order to explain the relationship between corruption, taxation, and growth. They consider a population composed of two categories of agents: private and public agents. Each agent maximizes its utility function which depends on the consumption of a public good but also that of a private good. Corruption is regarded here as a form of rent on the provision of public goods for the production of the private sector. Two types of taxes exist in such an economy: the income tax paid by only private agents and the consumption tax supported by both categories of agents. These taxes are the two sources by which the state finances its activities. Not only do the authors model corruption in another form, but they take into consideration the effect of corruption on the provision of public goods which are necessary to the private sector.

Bareto and Alm (2003) argued that in the presence of corruption, the optimal tax mix relies more heavily on consumption taxes than on income taxes. They also claimed that, in general, the agents have different preferences with respect to the tax structure. The public agent prefers a high income tax rate and a low tax rate on consumption while the private agent has an opposite preference.
Moreover, they confirmed that fiscal policy is decidedly influenced by corruption and affected in ways that are heavily consistent with expectations. In particular, a corrupt economy must have a tax mix that relies more heavily on consumption taxes than income taxes.

Coppier (2005) also tried to explain the relationship between taxation, corruption, and growth, he has argued that there is a linear relationship between the tax rate and the steady-state economic growth rate. He considers corruption as an additional tax on investment, Coppier indicated that in the presence of corruption and taxation, tax rate increases do not lead to lower revenues provided that the tax rate is lower than a given threshold. Moreover , he mentioned that the growth rate increases as long as the number of undetected corrupt agents increases. Indeed, those entrepreneurs who pay lower bribes than taxes invest more in the economy. However, when the number of the detected corrupt agent's increases, the growth rate is reduced.

From the empirical point of view, the interaction between corruption, taxation, and growth has been highlighted in two works, Atilla (2008) and Aghion (2016).

Unlike Coopier (2005) and Baretto (2003), Attila had developed an endogenous growth model, where he introduces corruption in two different ways: bribes taken from public fiscal revenue and bribes taken from public expenditure (Attila, 2008).

As for the practical part, Attila had performed an econometric analysis in order to analyze the interaction between corruption, taxation, and growth. With a sample of 90 countries covering the period 1980-2002 the author had done a regression based on Generalized Method of Moments (GMM). He treated corruption as an endogenous variable because corruption and institutional variables are generally considered endogenous (Acemoglu, 2011) (Dreher, 2006) (Mauro, 1995) since they are likely to affect economic growth but conversely economic growth could help to build better institutions and hence reduce corruption. In addition, Attila supposed that the relationship between taxation and economic growth is non-linear. He found that corruption has two different effects on growth: a negative direct effect lowering both public expenditure and tax revenues, and an indirect positive effect, positive once the harmful effects are accounted for. He also indicated that in the most corrupt countries, there is a higher impact of taxation on growth.

Philippe Aghion (2016) developed a Schumpeterian growth model of the relationship between taxation, corruption, and economic growth in order to answer this critical question: is taxation good or bad for growth? He provided empirical evidence on the effect of corruption and income taxation on economic growth using panel variation across states and counties within the United States over a period of 25 years. The model that have been adopted by Aghion predicts an inverted-U shaped relationship between taxation and economic growth, with corruption reducing the optimal taxation level. The authors found that the marginal effect of taxation on growth for a state at the 15th or 20th percentile of corruption is positive. Whereas, the marginal effects of taxation on growth for a state at the 95th percentile of corruption are much lower across the board.

II– Methods and Materials:

II.1 Data and variables

For this study we use a sample of 70 developing countries over the period 1996-2016 (the period and countries are selected based on data availability), the data are drawn from the World Bank dataset (WB) and the Worldwide Governance Indicators (WGI).

We choose the real per capita GDP to represent the economic growth (our dependent variable). As for the independent variables, we use “control of corruption” as a measure of corruption, this variable is obtained from WGI, where it ranks countries from 0 (lowest) to 100 (highest), so that higher value indicates lower corruption and vice versa. Besides, we measure taxation by tax revenue as a percentage of GDP.

In addition to the variables of tax revenue and control of corruption, we introduce a set of control variables, they are selected in accordance with the previous literature. The purpose of their inclusion is to avoid the bias on the coefficients of tax revenue and control of corruption, among these controls variables, we have Trade openness measured as the sum of exports and imports as a percentage of GDP, Government expenditure as a percentage of GDP, Political Stability as an institutional variable, Human capital as measured by the number of years of secondary education, Population Growth and Infant Mortality Rate. All variables were converted into natural Log form, except “population growth” because it contains negative values.

II.2 Econometric specification

In order to examine the impact of corruption on the relationship between taxation and growth in developing countries, we formulate the following model:

$$\boldsymbol{lnGDP_{it} = \alpha lnGDP_{it-1} + \beta_1 lnCOR_{it} + \beta_2 lnTAX_{it} + \beta_3 lnCOR_{it} * lnTAX_{it} + \beta_4 lnX_{it} + u_i + v_t + \varepsilon_{it}} \;\ldots\ldots\ldots.\; (1)$$

With $\boldsymbol{GDP_{it}}$, $\boldsymbol{COR_{it}}$, $\boldsymbol{TAX_{it}}$, $\boldsymbol{X_{it}}$ representing respectively real per capita GDP, Control of Corruption, Tax revenue and the vector of other control variables. $\boldsymbol{u_i}$ captures unobserved individual (country-specific) effects and $\boldsymbol{v_t}$ takes into account the relevant time effect. $\boldsymbol{\varepsilon_{it}}$ *N(0,1)* is the term error that captures the effect of all omitted variables , $\boldsymbol{i}$ and $\boldsymbol{t}$ represent the individual countries and periods .

All independent variables are treated as exogenous variables, except the corruption variable which is endogenous according to the literature, corruption and institutional variables are generally considered endogenous (Mauro, 1995) because they are likely to influence economic growth but conversely growth can help to build better institutions and consequently reduce corruption. So, we have reason to believe that corruption is endogenous.

We use the method of dynamic panel models, which handles with the issue of omitted unobserved variables by taking the first differences. Thus, the estimated growth equation takes the following dynamic form:

$$\boldsymbol{\Delta lnGDP_{it} = (\alpha - 1) lnGDP_{it-1} + \beta_1 lnCOR_{it} + \beta_2 lnTAX_{it} + \beta_3 lnCOR_{it} * lnTAX_{it} + \beta_4 lnX_{it} + u_i + v_t + \varepsilon_{it}} \;\ldots.\; (2)$$

To estimate our empirical model, we use the Generalized Method of Moments (GMM) estimators, recommended for the dynamics of adjustment that were created by Arellano and Bond (1991), and Blundell and Bond (1998). Many researchers used 2SLS method to deal with the endogeneity problem [*], but there are preferences of GMM over 2SLS and IV in the presence of heteroskedasticity , the GMM estimator is more efficient and effective than the IV estimator according to (Baum, 2003) .Moreover , GMM deals with the potential endogeneity of regressors and the country specific effect (Ahmed, 2010). Further, our panel dataset consists of a short time dimension (21 years) and a larger country dimension (70 countries), thus the use of GMM in this paper is appropriate as it deals with potential endogeneity issues of the regressors and incorporates fixed effects (Saha, 2016).

In equation (2) the first reason for endogeneity is that the first lagged of GDP variable appearing in the side of independent variables which is correlated with the country specific random effect $\boldsymbol{u_i}$, the

[*] Endogeneity emerges when right hand side variable (independent variable) is correlated with the random error term of the equation.

second reason is the corruption variable which is endogenous as we have said before. One way to deal with this issue is to estimate equation (2) by GMM using the lagged values of the endogenous variables and the other exogenous variables as instruments.

We use two diagnostics tests proposed by Arellano and Bond (1991), and Blundell and Bond (1998), the Sargan test of over-identifying restrictions, and a test of the absence of second-order serial correlation in the differenced error term, if the null hypothesis of both tests cannot be rejected, this would mean that the instruments are valid and the model is sufficiently specified.

The estimation has been implemented by using Rstudio software, we have used the “pgmm” function from “plm” package to estimate our model.

III- Results and discussion :

III.1 Non-parametric Analysis

The purpose of conducting a non-parametric analysis is to examine the nature of the relationship between economic growth and taxation (decreased, increased, or monotone), we give y_i to per capita GDP (growth) and x_i to tax revenue (taxation), therefore the relationship between taxation and growth would take the following form:

$$y_i = g(x_i) + \varepsilon_i \qquad \text{……………..……… (3)}$$

In contrast to the parametric approach, the non-parametric approach estimates the function $g(x_i)$ with unknown functional form. The general form of non-parametric regression estimator would take the following form:

$$\hat{g}(x)_n = \sum_{i=1}^{n} W_{hi}(x)\, y_i \qquad \text{………………. (4)}$$

where $\boldsymbol{W_{hi}}$ is a weight function of (Nadaraya, 1964) and (Watson, 1964), which can have the following form:

$$W_{ni} = \frac{\frac{1}{nh} K\left(\frac{x_i - x_0}{h}\right) y_i}{\frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x_i - x_0}{h}\right)} \qquad \text{……………….. (5)}$$

Where **K** is the Kernal function, **h** is the bandwidth.

The results of this non-parametric regression are presented in Figure 1, X-axis and Y-axis stand respectively for the tax revenue and per capita GDP. The Figure 1 indicates a non-monotonous relationship between taxation and economic growth, in other words, the general trend in the curve is either increasing or decreasing relationship between economic growth and tax revenue.

The aim of the non-parametric analysis is to detect the nature of correlation between taxation and growth, according to the graph there is a non-linear relationship between these two variables. However, applying a non-parametric investigation with three variables and more is little complicated.

III.2 Econometric Results

According to our purpose of study, we examine the effect of taxation on economic growth and the impact of corruption on this interaction. We use GMM technique as we have explained in section 2.

Table 1 shows the results from GMM estimators, the second column presents the estimation results using First-difference GMM. Whereas, the third column presents the estimates done using System GMM.

The tax revenue displayed a positive coefficient that was statistically significant in both columns at 5% statistical significance. Thus, a 1% increase in Tax revenue leads to an increase in the Growth of 0.75%. The estimated coefficient of the corruption variable in the two columns has also a positive sign (the high index values indicate the lack of corruption and the low values are related to a pervasive corruption) and statistically significant at 5% level. With regard to Public expenditure, it has a negative coefficient in both difference and system estimators which is statistically significant at 5% level, this finding is in line with economic theory.

With regard to the influence of corruption on the interaction between taxation and growth, the coefficient of interaction variable is negative and significant at 5% statistical significance in both columns (Difference and System GMM estimators), the significance of the interaction term and its negative sign suggest that in countries with high corruption, the harmful effect of taxation on economic growth is greater.

Besides, other control variables, as openness and political stability also impact significantly the economic growth. For instance, results from column (2) shows that openness significantly and positively impacted on growth at 5% level, however, the coefficient is not significant at any level in the case of System GMM, conversely with the political stability which has a positive and significant coefficient at 5% level in the third column (system GMM) and is not significant at any level in the case of first-difference GMM.

Sargan overidentification test is clearly not rejected with a P-value more than 0.99 for both System and Difference GMM estimators. On the other hand, The AR test for second order autocorrelation is accepted with a P-value greater than 0.21 in both columns. These findings would indicate that our model is correctly specified.

IV- Conclusion:

We have scrutinized in this paper the effect of corruption on the relationship between taxation and economic growth in developing countries, using panel data models with a dataset of 70 developing countries over the period 1996-2016. To deal properly with dynamic panel models, we used GMM estimators developed by Arellano and Bond (1991), Blundell and Bond (1998).

Our findings are based on a non-parametric analysis as well as an econometric investigation, the non-parametric analysis supports the assumption of a non-linear relationship between taxation and growth. Regarding to the econometric investigation, our results from GMM estimation show that the more countries are corrupt, the stronger harmful impacts of taxation on economic growth.

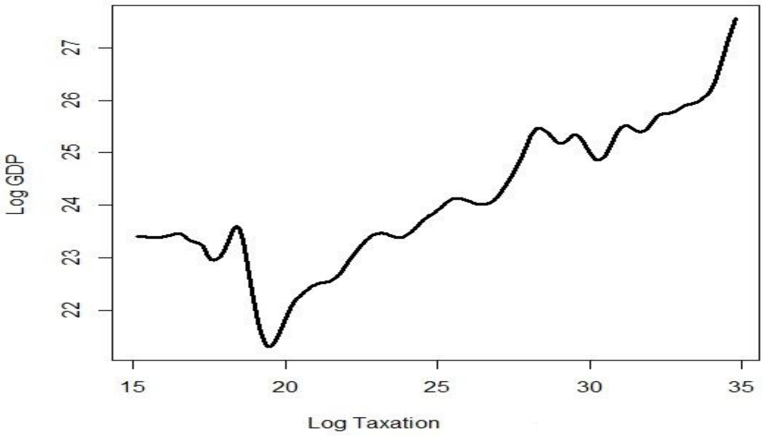
Our findings have confirmed Atilla 'results (2008) who argued that in the most corrupt countries, there is a higher impact of taxation on growth. The results are also in line with Philippe Aghion' paper (2016) who found that the marginal effect of taxation on growth for a state at the 15th percentile of corruption is positive. Whereas, the marginal effects of taxation on growth for a state at the 95th percentile of corruption are much lower across the board.

In policy term, developing countries should intensify their fight against corruption so as to make their fiscal policies more effective and efficient. Furthermore, efforts should be made by governments to strive against fiscal corruption by reducing its opportunities in tax administrations as well as by making an independent and rigorous judicial system which can vigorously apply the required laws against corrupt people.

The current paper can be extended by using microeconomic variables, instead of macroeconomic variables in order to examine the relationship between the different components of tax structure, corruption, and economic growth.

- Appendices:

Figure 01: Non-Parametric Analysis



Source**:** Author's calculations based on R studio software

Appendix 01: List of Countries

Albania Algeria Angola Armenia Azerbaijan Bahamas
Bahrain Barbados Belarus Belize Bhutan Bolivia
Botswana Brazil Bulgaria Burkina Faso Cambodia Chile
China Colombia Congo, Rep. Costa Rica Croatia Dominican, Rep.
Egypt El Salvador Georgia Guatemala Honduras India
Indonesia Iran Jamaica Kazakhstan Kuwait Lao PDR
Latvia Lebanon Lithuania Macedonia, FR Madagascar Malaysia
Maldives Malta Mexico Moldova Morocco Nepal
Oman Pakistan Paraguay Peru Philippines Poland
Qatar Romania Russian Federation Rwanda Senegal Serbia
Seychelles Slovak Republic South Africa Sri Lanka Suriname Thailand
Togo Tunisia Uruguay Vietnam.

Table 01: Dynamic Panel data Estimation using Difference and System GMM.

Dependent Variable: Ln. Per Capita GDP Growth		
Independent Variables	**Difference GMM (1)**	**System GMM (2)**
Ln. Lagged per capita GDP	0.866^{***} (0.024)	1.005^{***} (0.006)
Ln. Corruption	0.608^{***} (0.189)	0.20^{**} (0.093)
Ln. Taxation	0.75^{***} (0.291)	0.295^{**} (0.141)
Ln. Corruption *Ln. Taxation	-0.191^{***} (0.073)	-0.074^{**} (0.035)
Ln. Public Expenditure	-0.288^{***} (0.076)	-0.033^{**} (0.014)
Ln. Investment	0.016 (0.044)	0.101 (0.013)
Ln. Openness	0.199^{***} (0.073)	0.16 (0.015)
Ln. Secondary Education	-0.234^{**} (0.095)	0.018 (0.022)
Ln. Political Stability	0.0006 (0.03)	0.009^{*} (0.004)
Ln. Infant Mortality Rate	-0.208^{***} (0.074)	0.018^{*} (0.01)
Population Growth	0.02^{**} (0.008)	0.001 (0.004)
Observations	1470	1470
Sargan test (p-value)	1	0.991
Arellano and Bond test AR2 (p-value)	0.21	0.60
Note: '***', '**', '*' Mean respectively 1%, 5% and 10% significance.		

Source**:** Author's calculations based on R studio software.

Referrals and references:

1. Acemoglu, D. S. (2001). "**The Colonial Origins of Comparative Development: An Empirical Investigation**". *American Economic Review 91*, p 1369–1401.
2. Ahmed, T. A. (2010). "**The Effect of Corruption and Governance on Tax Revenues**". p17.
3. Alm, R. A. (2003). "**Corruption, Optimal Taxation, and Growth**". *Public Finance Review*.
4. Andrzej Cieslik , Łukasz Goczek . (2018).” **Control of corruption, international investment, and economic growth – Evidence from panel data** “, World Development 103 (2018). p 323–335.
5. Arellano, M. a. (1991). “**Some tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations**” . *Review of Economic Studies 58 (2)*, p277-297.
6. Attila, G. (2008). “**Corruption, taxation and economic growth:theory and evidence** “. *CERDI, Etudes et Documents*.
7. Barreto, R. a. (2003). "**Corruption, Optimal Taxation, and Growth**". *Public Finance Review, vol. 31, no. 3*,, P.207.
8. Baum, C. F. (2003). "**Instrumental variables and GMM:Estimation and testing**". *The Stata Journal, Vol. 3*, P 1-31.
9. Blundell, R. a. (1998). “**Initial Conditions and Moment Restrictions in Dynamic Panel Data Models**”. *Journal of Econometrics. 87*, P115-143.
10. Coppier, R. (2005). "**Corruption, tax revenue and growth: a non linear relationship?"** . *Università Degli Studi di Macerata, Temi di discussione n.27.*
11. Dreher, A. a. (2006). "**Corruption and the Shadow Economy**”. *IZA Discussion Paper No.1936*.
12. Kleven, H. J. (2014). "**How Can Scandinavians Tax So Much?** ".*Journal of Economic Perspectives—Volume 28*, P 78-98.
13. Marcelo P. Dabós and Ernesto R. Gantman (2010) . “**The fading link? A new empirical analysis of the relationship between financial development and economic growth**”. MFI Working Paper Series.
14. Mauro, P. (1995). "**Corruption and Growth. *Quarterly Journal of Economics***", *vol.60, n° 3* ,P681-712.
15. Mushfìq Swaleheen (2016).”**Economic growth with endogenous corruption: an empirical study”** . Public Choice, Vol. 146, No. 1/2 . P. 23-41.
16. Mustapha Sadni. Monnet Benoît. René Sandretto(2008). **“Foreign Direct Investment, Macroeconomic Instability And Economic Growth in MENA Countries**”. DOCUMENTS DE TRAVAIL - WORKING PAPERS.
17. Nadaraya, E. A. (1964)." **On estimating regression**" . *Theory of Probability and Its Applications , Vol. 9*, P 141-142.
18. Njangang Ndieupa Henri.(2018).” **Impact of Corruption on Public Debt: Evidence from Sub-Saharan African Countries** “ . American Journal of Economics ,P14-17.
19. Philippe Aghion, J. C. (2016). "**Taxation, Corruption, and Growth**" . *European Economic Review,P24-51.*
20. Saha, G. M. (2016). "**Corruption and growth: a complex relationship**".

21. Tanzi, V. a. (2000). "**Corruption, growth, and public finances**". *IMF working paper no. WP/00/182*.

22. Torgler, B. (2007). "**Tax Compliance and Tax Morale: A Theoretical and Empirical Analysis".** *Edward Elgar Pub*.

23. Watson, G. S. (1964). "**Smooth regression analysis**". *Sankhya Series A, Vol. 26*. p359-372.

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