



Does Economic Growth Undermine Public Sector Corruption? A Cross Sectional Analysis

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Abstract: This paper uses cross country data to test empirically whether investment increases with corruption. The estimates show that Public sector corruption is low among developed countries and high among developing countries. Based on inter-regional tax model we develop a model of inter-regional competition to estimate the external shocks on Public sector corruption. The estimate show stability or growth in the economic indicator variables decreases the impact of public sector corruption. In addition, increases in total factor productivity with governance effective measures decrease the level of public sector corruption. And the consumers' ability to switch between regional acquisitions of public sector services enhances regional competition in the provision of Public sector services and reduces "kick back tax" charged on the procurement of these services.

Keywords: Inter-regional tax model, Public sector corruption, Consumer, Economic growth, Sub-regions, Developing Country.

1. Introduction

Definitions of corruption are subjective [1]. The literature shows varied views on the effects of corruption on economic growth of countries. The verdict on corruption literature is under the assumption that it is an illicit trade, which involves illegal practices, and it is characterized by a unique distributional effect. From this perspective, corruption was one of the major factors of global financial crisis [2] hence deteriorating the economic growth of countries. Economic disparities in terms of income increase with corruption¹, especially among developing countries.

On the other hand, recent research and literature asserts, corruption has positive effects on economies. [3] find in a study of Latin American countries: that increase in corruption reduces income inequality. An explanation

¹ Dong & Torgler (2013) found a positive relationship of corruption and disparities in incomes.

could be that during election campaign period specifically in most African countries and among some Latin American countries, this is the period where wealth is redistributed in the form of vote-buying. This redistribution feature tends to allocate wealth to the marginalized that usually expand their business during this occasion. Rather than promoting marginalization it tends to promote inclusiveness [3]. That is in the presence of “bottlenecks and red tapism” an alternative rule of law emanating from corruption latently supersedes the accepted rule of law [4].

Research has focused mainly on the macro economic analysis of corruption with little attention to micro analysis of the subject, partly due to the difficulty in assessing micro level data. Measurements have been the effect of corruption on macro -economic indicators. While researchers agree on a positive strong correlation between economic development and growth, they have failed to explain why corruption is higher in some developing countries but lower in developed countries [5]. The paper therefore seeks to provide empirical evidence to: (1) the role of public sector corruption in economic growth. (2) Whether there are external shocks on **Public sector corruption**

Politicians have been at the receiving end of corruption [4]. After World War II, proponents of economic growth had argued capital-output ratio as more important hence the term “increased capital spending, increased growth”. These scholars praise countries whose share of capital spending per government expenditure was higher. In addition, borrowing was all right as long as it is for investment projects. On the contrary Politicians adopted the bias and took advantage of the theory. In developing countries infrastructure projects such as roads, irrigation dams, power/electricity supply plants, hospitals, schools among others commensurate with ribbon and sod-cutting are a sure ticket to political power. The cost of the project however, is usually “swept under the carpet”, infrastructure brings economic growth which is more essential.

However, politicians are evanescent. Street level bureaucrats [6] are the permanent structure of economies that interface with temporal political office holders and the citizens. They generally facilitate the disbursement of government budgets and ensure execution and implementation of investment projects. Most often corruption among street level bureaucrats is ignored. [7] provide a first micro empirical evidence of economic growth and corruption. The findings suggest economic growth reduces the incidence of this illicit trade and enhances the effectiveness of public sector institutions.

First, we layout a simple multiple linear and non-linear least square model in which predicted residual fitted values of public sector corruption and with other control variables is used to extract empirical information on investment. With the same intuition we estimate an alternative regional model to check for bias of the estimation. The second part of the analysis examines the external productivity shocks on public sector corruption. The purpose is add to literature on why least corrupt countries have higher economic growth and vice versa.

2. Model Foundation for The First Part of Our Estimations:

For the first section of our estimations, we follow the basic linear log model to predict the fitted values for public sector corruption. The intuition is if investment has a positive correlational relationship with corruption, then the hidden cost of corruption grows with time which is un-accounted for in the data.

$$Y_t = a^* \exp(\delta t) = a^* e^{\delta t} \quad (1)^2$$

² Where (a) is the initial value and (delta) is the exponential growth. For a linear function we transform equation one by taking natural logarithms. Mauro(1995) in his 2SLS results used corruption index on the instruments and on the right hand side variables, further the predicted value of corruption is then used as instrumental variables in his estimations.

Where a , is the initial value and δ is the positive growth factor. A log linear transformation regression is used to estimate equation (1). After which the predicted values is regressed on the right hand of our multiple linear and non-linear least square models. Multiple linear estimations of this model however, were not encouraging. Psc fitted values were only applied to multiple non-linear models at 78 iterations. See appendix A2.1

We premise the second part of our estimation on the basis that street level bureaucrats are able through the offices and positions they occupy extract “kick back tax” from consumers.³ The consumer and in this case entrepreneurs and firms who have mobility capability, individual consumers are usually restricted to a particular geographical areas in relation to public sector services. In under-developed markets, the stress with which to access public services by consumers in arears of documentations, health services, applications for financial packages among others facilitates payments of “kick back tax” to smooth out the process. Inadvertently, it becomes a “kick back tax”.⁴ This is considered a “win win situation”. Which leads to the question: (1) does total factor productivity increases affect public sector corruption? (2) does public sector corruption effect essential modifications in consumer behavior?

The basic idea of inter- regional tax theory is that, decentralization in taxation and expenditure policies among a non-symmetric regions distorts allocations where regions have little funds from taxes to finances local public goods and mobile factors [8]. That is inter-regional differences in taxation benefits firms to adjust their locations. According to [8] the implication is the various regions are confronted with a similar case of “prisoner dilemma”. As a consequence regions adapt and implement inefficient tax systems to either prevent capital flight or retain firms.

To answer the second part of our estimations, we set out two regions (R1 ,R2), with consumers, in a sequential move game. Street level bureaucrats set out “kick back tax” at a rate C_p . The consumer then decides whether to go through the normal long and stressful process to complete a transaction or pay “kick back tax” to access the service at a rapid rate. The consumer then compares the marginal effect of C_p to the marginal efficiency it provides, and whether to switch to other regions for the same service.

Following from a neo classical model of Bai, Jayachandran, Malesky & Olken(2013), we adapt the equilibrium corruption level expression⁵: $\pi_{R1}^* = \text{Max}_{K,L \geq 0} (1 - C_p)AK^\alpha L^\beta - K - L$. In equilibrium regions, $(R1^*=R2^*.....+R^n)$. Where there are many firms.

For a consumer to decide whether to move, the rate of “kick back tax” affects his optimal choice. That is the consumer will stay if he gets much satisfaction in terms of public sector services from region 1 compared to region 2. And also if the cost of acquiring similar services in region 1 is less than in region 2. $\pi_{R1}^* \geq \pi_{R2}^* - m$, where m is the moving cost. $m_i = \theta A^n \epsilon_i$, A^n increases with respect to consumer. The n th term is greater than 0. θ is the cost paid to public sector officials.

Setting up a basic production equation for Public sector officials in period 1, taking into consideration the consumer’s response with a given C_p ,

$$\max_{C_{p1} \geq 0} C_{p1} A K^{\alpha} L^{\beta} \left(1 - \frac{\pi_2^* - \pi_1^*}{\theta A^n}\right), \quad (2)$$

³ Consumers herein refer to individuals, entrepreneurs, firms who interface with public office holders and street level bureaucrats in their day to day activities, official and un-official business transactions and or for a service.

⁴ An alternative unconventional form of tax known among consumers and public sector officials paid to fast track transactions among others.

3. Data and Variables

We collect data for 134 countries of developed, developing and third world countries. The sample period is between the periods of 2010 to 2017. We rely on macro-economic data due to a limited nature of micro level data which would have been of a more significance to draw inductive conclusions.

Corruption indices are obtained from Transparency International Corruption Perception Index and World Bank Indicators for the period 2010 to 2017. The index ranges from 0 and 10 with higher scores of 10 indicates lower corrupt countries and scores of 0 represents a highly corrupt countries. Even though the CPI has become the accepted measure of corruption globally, it still has some limitations. Starting 2012 CPI scores are comparable which was not the case was in the previous years.

3.1.1 Investment

Investment [9] is a very important variable in our analysis. There are many ways in which the public sector does influence what goes into investment, and not all that goes into this necessarily determines economic growth. Conditions leading economic growth are manifold, this include capital investment itself, the socio-cultural climate of the country, the political systems, effectiveness of the judicial systems, the countries relations with international partners among others. Obviously, scholars agree that the tax system is one major area of capital accumulation by governments not only for redistribution but to create the conducive environment to aid both public and private investment. The quality, transparency or otherwise of a tax has implications on the consumer market and consumer productivity.

Throughout the analysis gross fixed capital formation which is gross capital formation plus the first difference of savings is used.

$$GFCF = GCF + \Delta SAVINGS$$

3.1.2 Corruption

The term corruption perception index [10] is used as a proxy variable for a country's Public sector corruption [11]. The CPI aggregates data from a number of sources based on the perceptions of business and experts on the level of corruption in public sectors of countries. As mentioned above with the standardization of CPI from 2012 allows a year on year comparison per country. In the first part of our analysis we estimate a log linear model of public sector corruption as a predictive variable to determine whether a rapid growth of PSC have any effects on investment. The standardized weights for of PSC are used in the second part of our estimations.

3.2 Control variables

Conventional models have been successful in explaining aggregate investment. However, within the 1980's the dynamic model specification gained popularity among researchers who tested the effects of financial development indicators on investment, because economic growth is a proxy variable or a mediating variable for welfare growth. The study employed macro-economic control variables which include Bank capital adequacy ratio⁶, domestic credit⁷, Real Gross domestic product, per capita GDP, inflation, unemployment, household consumption, consumer

⁶ Also called capital-to-risk weighted assets ratio protects depositors with the purpose of protecting depositors and to ensure stability, soundness and efficiency in the financial sectors.

⁷ Determines the robustness of lending capacities of central banks of countries to borrowers, private institutions, commercial banks and government itself.

price index,⁸ and savings rate, Primary energy consumption⁹, total factor productivity, governance indicators, and we generate a set of regional dummies¹⁰. [2] indicates that “RGdp and inflation¹¹ co-move with corruption level”, they further found a correlation between per capita Gdp and Corruption. However, a study by [12] concluded that inflations adverse effect on high income countries is weaker. We found a high correlation (0.9984***) between Rgdp and inflation.¹²

3.2.1 Institutional quality

Institutional quality¹³ variables have become inevitable when studying and analyzing the impact of corruption on economic growth. This idea has gained popularity among research studies. Initiated by [13], the TI reports indexes on the quality of governance provided by experts, citizens among others in developed and developing countries. The world governance indicators include: voice and accountability, political stability, Government effectiveness, regulatory quality, rule of law.

3.3 Econometric strategy

From model (1) we consider estimation of multiple linear regressions of the dependent variable and public sector corruption with other control variables. To check for regional bias we further estimate by regions using the standardized public sector corruption index.

$$Y = \alpha_0 + \alpha_1 \text{psc} + \alpha^! A + \alpha^! Dm + \epsilon. \quad [14]$$

Y is investment, psc is public sector corruption, α are coefficients of A (Gdp per capita, capital to asset ratio, inflation, employment and household consumption) the explanatory variables, Dm the regional dummy variables.

From model (2) the second part of our estimations and following from [7] we consider whether total factor productivity and household consumption is affected by payment of “Kick back tax”. The proposition predictive theory is that as total factor productivity increases public sector corruption decreases. Difficulty with which to acquire “kick back tax” we use standardized values from Psc as proxy variable for each region at time t.

$$PSC_{Rt} = \alpha + \beta_0 TFP_{Rt} + \beta_1 HC_{Rt} + Dm_t + \epsilon_{Rt} \quad (3)$$

Where the subscript Rct terms captures the cost of mobility from region 1 region 2. We further interact household consumption as proxy for cost of mobility for the consumer. The consumer considers payment of “kick back tax”

⁸ A measure of the price weighted averages of the basket of consumer goods.

⁹ We use this as a measure of the level of technology of a country.

¹⁰ Dummy variables (instruments) include ALAC=United States and Latin America and Caribbean, EAC= Europe and central Asia, MEN= Middle East, SA= South Asia, SSA= Sub-Saharan Africa.

¹¹ Correlation between real gdp and inflation was very high hence we drop Rgdp in the first estimations to correct for multicollinearity

¹² Similarly estimations revealed a very high variance inflation factor between Rgdp and inflation; we therefore drop Rgdp variables from our first estimations.

¹³ Vaal and Ebben(2011); Mendez and Sepulveda(2005) includes variables such as political stability, property rights, and political systems to explain corruption and economic growth.

and mobility cost as part of his/her cost of production. The intuition is to test the effect on public sector corruption, when the consumer(s) has the ability to switch between regions to acquire similar satisfactory public services.

$$PSC_{Rt} = \alpha + \beta TFP_{Rt} + \beta_1 HC_{Rt} + \varphi_2 TFP_{Rt} * HC_{Rt} + Dm_t + \epsilon_{Rt} \quad [14]$$

Finally we test if public sector corruption is affected by stability or growth in the economic variables, using economic growth indicators. We estimate the logistic odd ratio by creating a binary variable from public sector corruption using its median of 2.485. ($psc < 2.485$) = 0.

3.4 Estimations

First, we take a rough look of key variables through a regression and correlation estimate. The result is illustrated below;

Table 1. Dependent variable: Investment

VARIABLES	[1-2] ooled)	[1-3] A)	[1-4] (EAC)	[1-5] ALAC)	[1-6] (MEN)	[1-7] (SA)	[1-8] (SSA)
Psc	715*** (.205) (.0169)	1.010 (0.617) (0.0967)	0.530 (0.408) (0.0348)	-4.896*** (0.683) (0.0571)	3.283*** (0.389) (0.0530)	-2.807 (2.248) (0.111)	0.994** (0.390) (0.0262)
Constant	..94*** (.463)	28.86*** (7.181)	31.42*** (3.131)	44.00*** (4.434)	30.74*** (5.178)	103.4*** (11.45)	43.99*** (2.236)
Observations	097	128	336	160	64	64	344
R-squared	200	0.102	0.076	0.305	0.706	0.755	0.329
Correlations							
(Invest,PSC)	.0680***	0.2540***	0.1083**	-0.4105***	0.2911**	-0.0936*	0.0892*

Note: Authors calculation is based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The rough multiple sub-regional regression estimates reveal that even though public sector corruption is a global phenomenon (coefficient of psc under the pooled estimates is 0.715 and significant at the 1 percent), it is very much prevalent in East Asian(1.010) and the sub-Saharan African countries(0.994) respectively. The ALAC [1-5] showed a negative coefficient at a 1 percent significant level. Similarly, SA [1-7] shows a negative coefficient but with an insignificant level; hence corruption has a less effect on the ALAC sub-region. Care must be taking with this interpretation, because of the inclusion of United States with the Latin American countries. The pooled correlation coefficient showed a positive relationship between investment and public sector corruption [1-2]. Positive correlational relationships were recorded among the sub-regions of EA, EAC, MEN and SSA while ALAC and SA sub-regions recording a negative correlational relationship between investment and public sector corruption. The reasons are quite unclear. Further we estimate a multiple linear and non-linear regressions (See Appendix A1.1 for a scatter diagram).

With the inclusion of institutional quality variables, estimations from Table 2, revealed public sector corruption is significant in models [2-1],[2-2],[2-4],[2-5],[2-6],[2-7] except [2-3]. The results show deterioration in the control variables of Gross domestic income per capita, capital to asset ratio of banks, inflation rate, unemployment and household consumptions at the 1%, 5% and 10% significant levels. Introduction of the interactive terms on the world governance indicators further showed public sector corruption loses its significant effects. With the introduction and interacting voice and accountable, rule of law, and political stability variables with public sector corruption even though significant at the 10 percent level the coefficients were negative showing public sector corruption deteriorates in the presence of the aforementioned indicators respectively. In addition it is obvious that investment¹⁴ increases with public sector corruption. With the exception of [2-3] and [2-6] psc increases were above 1 percentage points in [2-1] and [2-4], and 4[2-2] respectively at a 1 percent significant level.

Table 2 Pooled Multiple Linear Estimates

VARIABLES	[2-1]	[2-2]	[2-3]	[2-4]	[2-5]	[2-6]
Psc	1.021*** (0.210)	4.458*** (0.664)	0.0630 (0.758)	1.091*** (0.198)	0.957*** (0.219)	-1.415** (0.563)
Gdppc	- 0.000146*** (1.88e-05)	-0.000137*** (1.86e-05)	-0.000158*** (2.09e-05)	-0.000168*** (1.78e-05)	- 0.000150*** (1.92e-05)	-0.000142*** (1.87e-05)
Cap	-0.170*** (0.0449)	-0.144*** (0.0445)	-0.166*** (0.0450)	-0.147*** (0.0423)	-0.169*** (0.0449)	-0.161*** (0.0445)
Inflation	0.00257*** (0.000589)	0.00253*** (0.000581)	0.00248*** (0.000592)	0.00234*** (0.000555)	0.00255*** (0.000589)	0.00249*** (0.000583)
Emp	-0.283*** (0.0373)	-0.260*** (0.0371)	-0.283*** (0.0373)	-0.324*** (0.0353)	-0.285*** (0.0373)	-0.260*** (0.0373)
Hc	-0.210*** (0.0185)	-0.219*** (0.0183)	-0.209*** (0.0185)	-0.215*** (0.0174)	-0.210*** (0.0185)	-0.212*** (0.0183)
va#psc		-23.80*** (4.366)				
rq#psc			4.367 (3.319)			
rl#psc				-0.469*** (0.0400)		
ge#psc					0.278 (0.264)	
ps#psc						-10.10*** (2.167)
Constant	40.03*** (1.722)	39.80*** (1.700)	40.36*** (1.740)	40.95*** (1.625)	40.12*** (1.724)	40.20*** (1.706)
Observations	1,097	1,097	1,097	1,097	1,097	1,097
F value	32.90***	33.43***	30.32***	45.40***	30.25***	32.54***
Adj R-squared	0.243	0.262	0.243	0.327	0.243	0.256

Note: Authors calculations based on CPI and World Bank WDI

¹⁴ Generally most studies enforce this finding.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3 below, shows estimation using the multiple nonlinear least squares model. Here the predicted residuals from the log linear model of public sector corruption is used as a control variable. In model [3-1],[3-2],[3-3],[3-4],[3-5],[3-6], psc (fitted) is significant at the 1 percent level. Similarly bank asset ratio, gross domestic income per capita and unemployment further deteriorates with the log linear transformed values of public sector corruption. At the 1 percent level of significance, inflation worsens in all models. Essentially interacting psc fitted values with world governance indicator such as voice and accountability [3-2] and rule of law [3-4], psc loses its effectiveness

Table 3. Nonlinear pooled estimates

variable	[3-1]	[3-2]	[3-3]	[3-4]	[3-5]	[3-6]
Psc($a^* \exp(\delta t)$)	15.30*** (0.6026)	19.71*** (0.8358)	12.71*** (0.9746)	15.47*** (0.5700)	15.28*** (0.6029)	13.12*** (0.7348)
Cap	-0.1408*** (0.0449)	-0.0879** (0.0444)	-0.1231*** (0.0449)	-0.0989** (0.0426)	-1.1401*** (0.0449)	-0.1244** (0.0445)
Gdppc	-0.00013*** (0.0000188)	-0.00012*** (0.0000185)	-0.00017*** (0.0000224)	-0.00015*** (0.000017)	-0.00014*** (0.000019)	-0.00013*** (0.000018)
Inflation	0.0021*** (0.00058)	0.0019*** (0.00057)	0.0019*** (0.00058)	0.0018*** (0.00055)	0.0021*** (0.00058)	0.0019*** (0.00058)
Unemp	-0.2796*** (0.0377)	-0.2215*** (0.0375)	-0.2773*** (0.0375)	-0.3225*** (0.03581)	-0.2113*** (0.0377)	-0.2547*** (0.0376)
HC	-0.2108*** (0.0186)	-0.2169*** (0.0182)	-0.2156*** (0.0186)	-0.2077*** (0.0176)	-0.2113*** (0.0186)	-0.2147*** (0.0185)
Rq	-13.92 (15.05)					
Va		-95.41*** (12.84)				
Ps			-4.3289 (5.3970)			
Rl				-1.0452*** (0.0918)		
Ge					0.1260 (0.6551)	
Dm	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,097	1,097	1,097	1,097	1,097	1,097
Adjusted R ²	0.89	0.90	0.91	0.91	0.89	0.90
Iterations	2	2	2	2	2	2

Note: Authors calculations based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

To correct for possible bias as a result of the pooled estimates, a sub-regional model¹⁵ is estimated to evaluate the magnitude of public sector corruption on the regions. The model revealed a negative coefficient on gdppc, cap, and household consumption. Inflation was highest among the EAP regions in both models. More essentially, EAC, ALAC sub regions which mostly consists of developed economies showed a negative coefficient of (-0.16) and (-3.25) respectively at a 10 percent and 1 percent level of significance. The MEN (4.04) showed the highest level of psc, followed by SSA (1.78) respectively at a 1 percent level of significance.

Table 4. Multiple linear regression estimates by region

	EAP	EAC	ALAC	MEN	SA	SSA
Psc	1.639* (0.877)	-0.1573 (0.3197)	-3.2506*** (0.4883)	4.0415*** (0.4258)	1.1346** (1.7494)	1.7765*** (0.4235)
Gdppc	-6.39e-06 (5.57e-05)	-0.000040 (0.000033)	-0.00011** (0.000048)	-0.00042*** (0.000069)	-0.00027 (0.00039)	-0.000038 (0.000083)
Cap	-0.124 (0.189)	0.23922*** (0.0533)	-0.1837 (0.1204)	-0.0609 (0.1444)	-0.0110 (0.1576)	-0.3491*** (0.07773)
Inflation	1.103*** (0.274)	0.0932** (0.0406)	-0.2617** (0.1097)	0.0529 (0.1143)	0.4036 (0.2517)	0.0032*** (0.00074)
Unemp	0.397 (0.434)	-0.2652*** (0.04892)	0.2111** (0.1436)	-0.6248 (0.3931)	0.2308 (0.7655)	-0.3238*** (0.0742)
Households	-0.0373 (0.107)	-0.0324 (0.0306)	-0.3298*** (0.0430)	0.0676 (0.0637)	-0.7936*** (0.0829)	-0.2577*** (0.0309)
Ge	-0.469 (1.899)	0.0296** (0.6749)	1.5901 (1.6499)	4.3067** (1.6078)	1.3687 (1.9679)	0.3387 (1.3163)
Rl	14.37 (50.97)	-1.2119*** (0.1595)	-1.036*** (0.2059)	-33.36 (49.52)	-19.83 (103.40)	5.8942 (6.1097)
Constant	21.90*** (8.231)	25.89*** (3.6365)	55.49*** (7.1932)	11.56 (23.67)	-66.43** (22.81)	49.18*** (7.3175)
Observations	128	336	160	64	64	345
F value	3.45***	31.28***	31.75***	24.12	52.48***	19.54***
Adjusted R ²	0.175	0.498	0.680	0.80	0.890	0.372

Note: Authors calculations based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

To answer the question corruption is highest among least developed countries and vice versa, we adopt the World Bank classification of countries as of 2017 with the benchmark GNI greater than \$12,055 for high income countries, less than \$955 for low income and \$996-\$3895 for lower middle-income countries. See appendix A5 for classification.

Table 5. Dependent Variable: Investment

variables	High income countries [5-1]	Low income countries [5-2]
psc	0.6134** (0.2815)	1.3468** (0.4708)

¹⁵ We use government effectiveness and rule of law indicators for the alternative estimations. Estimating all indicators was problematic. Standard values from world governance indicators and corruption perception index were used.

gdppc	-0.000078** (0.000025)	3.32e-06 (0.00014)
cap	-0.0683 (0.0837)	-0.1846** (0 .0785)
unemp	-0.2063** (0.0965)	-0.4182*** (0 .0647)
household	-0.1791*** (0.0477)	-0.2304*** (0 .0334)
RD	YES	YES
constant	34.95***	41.47***
obs	360	457
f-values	14.37***	17.80***
Adj. R square	0.271	0.269

Note: Authors calculations based on CPI and World Bank WDI

Lower middle income and lower income countries are classified in the same category

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 show that at a 5 percent significant level psc increase by 61 percent[5-1] in high income countries and approximately 135 percent[5-2] in low income countries. This is twofold gap increase.

3.5 Economic Growth

Effects of increase in productivity and consumer incomes on payment of “kick back tax”.

Data from 118 countries were used, a reduction from 134 countries due to missing values. Results from Table 6 showed that total factor productivity is insignificant at the 10 percent level in the OLS model [6-1] . The implication is that productivity increases does not affect payment of “kick back tax”. On household consumption the coefficient is negative (-0.0061)[6-1], (-0.0065)[6-2] and significant at the 10 percent level respectively. This implication is that an increase in household consumption that is incomes reduces the rate of payment of “kick back tax” to public sector officials. However, the point must be made that with the inclusion of government effectiveness indicator TFP is significant at the 5 percent level with a coefficient of (-0.00027). The implication is that as total factor productivity increases by 10 percent of output, payment of “kick back tax” to public sector official’s decrease by 0.027 percent

Table 6. Dependent variable: psc

Variable	[6-1] OLS	[6-2] OLS
Tfp	-0.000015 (0.000068)	-0.00027** (0.00009)
Hc	-0.0061** (0.00257)	-0.0065** -0.0026
Ge	-	16.95*** (3.2353)
Dm	-	Yes
constant	3.075***	-0.1627*
Observations	708	708
Adj. r-square	0.007	0.092

Note: Authors calculations based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.5.1 Effect of mobility of the consumer on the payment of “kick back tax”

In this section we estimate the effect on public sector corruption if the consumer (per the theory of inter-regional taxation) could purchase the same service(s) and or relocate to other regions to acquire similar services. Interacting household consumption with total factor productivity showed a negative coefficient at a 10 percent significant level. The implication is as consumer’s switching ability increases, collection of “kick back tax” by public sector officials decreases. The magnitude of this impact in percentage points is 0.78 percent in the rate of drop of “kick back tax”.

Table 7. Mobility and “kick back tax”

Variable	[7-1] OLS
Tfp	0.0019*** (0.00025)
Hc	0.0095 (0.0029)
Tfp#hc	-0.000038* (4.45e-06)
Dm	Yes
constant	2.20
Obs	708
Adj R-squared	0.14

Note: Authors calculations based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.5.2 Estimate the impact of macro-economic growth in the indicators on Public sector corruption.¹⁶

Estimation of the odds ratio is to determine the cardinal impact of the indicators on corruption. A 1 percent increases in consumers purchasing power decreases corruption by 2 percentage points. The energy consumption factor which determines the level of technological capacity indicates a 1 percent increase, decreases corruption by 0.1 percentage points. A 1 percent increase in the level of secondary education and total factor productivity decreases corruption by 1 and 0 percentage point respectively. A 1 percentage point’s increase in world governance indicators such as voice and accountability, political stability decreases corruption by 85 and 16 percentage points respectively. The analysis did not give any meaningful estimates of dc, gdppc, tert, hhcgdp, ge, rq and rl respectively.

Table 8. Growth of indicators and corruption

Variables	Ols	Odds Ratio
Dc	2.49e-11*** (6.20e-12)	1 (2.59e-08)
Gdppc	-6.76e-06**	-2.85e-05**

¹⁶ In dealing with the issue of spurious effects first we look at specific crackdowns on corruption. Here we include the governance indicators variables as control variables aside the main the variables. We rerun the OLS along the odds ratio as an identification assumption. We use the standardized weights of WGI, fitted values of household consumption in the estimate.

	(2.99e-06)	(1.35e-05)
Cpi	0.000051* (0.000051)	1.0232* (0.0155)
Emp	-0.0246*** (0.0044)	-0.125*** (0.0242)
Ecf	0.0141 (0.0160)	1.0843* (0.0918)
Sec	0.00173 (0.00159)	1.0108* (0.0075)
Tert	-0.0032 (0.00291)	-0.0185 (0.0136)
Tfp	0.0002496** (0.0000968)	1.0011** (0.00045)
Hhcgdp	-0.000068 (0.000107)	-0.000371 (0.000505)
Gfc	-0.0002 (0.0021)	1.0015* (0.0105)
Va	2.4124 (2.3848)	8.857* (12.64)
Ps	0.5266 (1.0662)	4.1687* (20.96)
Ge	-0.7902 (2.225)	-4.760 (10.92)
Rq	0.0476 (1.579)	8.6655* (65.63)
Rl	-0.0339** (0.0175)	-0.442 (1.201)
Constant	0.3294 (0.4121)	-0.685 (1.915)
Obs	580	580

Note: Authors calculations based on CPI and World Bank WDI. Adj R-squared(OLS) = 0.1294 Pseudo R2(odds ratio) = 0.1363. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.6 Conclusion

The paper set out to establish the following facts. First investment increases with public sector corruption. Second, the level of corruption is highest among low income countries and low among high income countries. Third corruption reduces the level of economic growth. Fourth is that increases the level of total factor productivity with effective governance systems decreases the level of public sector corruption. Consumers' ability to acquire similar public services across regions decreases the payment of kick back tax (corruption fees).

We provide causal evidence and not just correlational evidence through rigorous regional estimations. The estimations showed Middle East, East Asian Pacific and sub-Saharan African countries had a higher level of public sector corruption and Europe and the Latin Americas had a less public sector corruption.

In addition, is the fact that a consistent growth in the macroeconomic indices coupled with effective systems of voice and accountability, political stability, among others reduces the level of public sector corruption. The paper affirms the theory that, inter-regional competition among public sector institutions ensures efficiency,

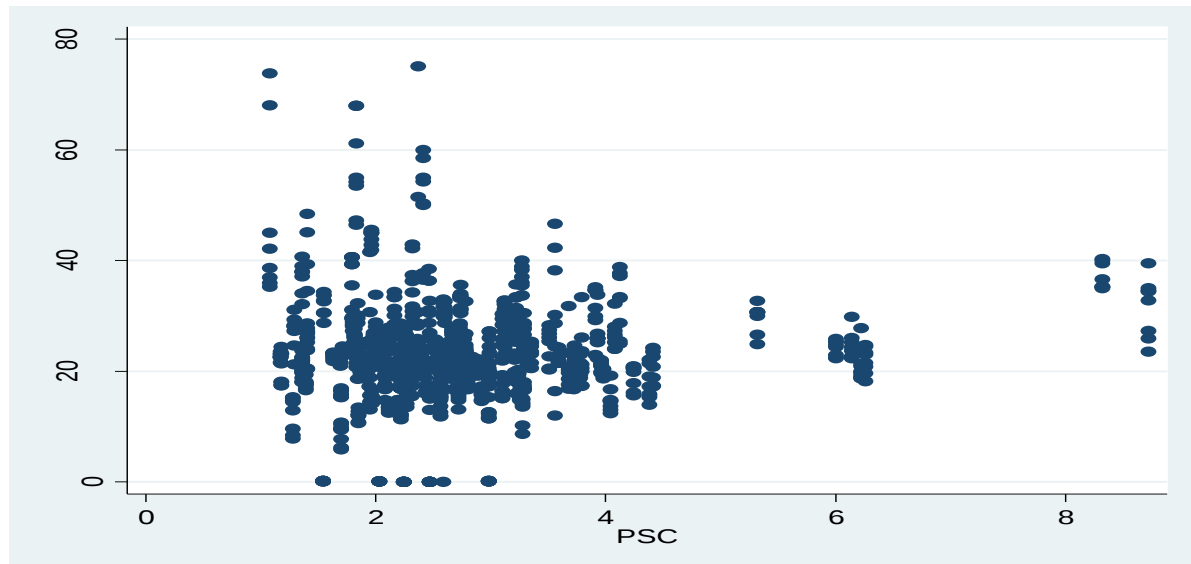
productive competition and reduces the level of corruption among public sector officials. Therefore it is essential for governments of third world countries to focus on improvement in the various regional and administrative districts through “competitive pressure” as a development measure.

Appendix 1

A1. Description of variables

Variable	meaning	Measurement method
Explanatory variables		
Psc	public sector corruption	Standardize weights from CPI-2010-2017
Y_t	log transformation of psc	$a^* \exp(\delta t)$
DC	domestic credit	Rate of access to credit facilities(WDI)
Rgdppc	income per head	Ratio of population to Gdp(WDI)
Hc	consumption	Consumer price index(WDI)
Tfp	total factor productivity	Dividing output by weighted average of capital and labour (WDI)
Employ	employment	Labor force participation rate(WDI)
Unemp	Unemployment	% total labour force (WDI)
Cap	capital to adequacy ratio	Rate of capital to assets(WDI)
Sec and Tert	secondary and tertiary education	Average total schooling years of people aged 15 and over(WDI)
Gcf	gross capital formation	Savings and gross fixed capital formation(WDI)
Ecf	primary energy consumption	Energy productivity(WDI)
VA	voice and accountability	Standardized weights
PS	political stability	Standardized weights
GE	government effectiveness	Standardized weights
RQ	regulatory quality	Standardized weights
RL	rule of law	Standardized weights
DM	regional dummies	In each case EAC,LAC,MEN,SA,SSA 1 for the region and 0 for others

A1.1: scatter plot investment and public sector corruption



A2.0 Log linearized Psc

VARIABLES	(1) a0	(2) delta
Constant	3.780 (43.95)	-0.000155 (0.00577)
Observations	1,097	1,097
R-squared	0.839	0.839
Iteration	76	76

Source Authors calculation

Note. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A2.1 Descriptive statistics

variable	obs	mean	Std.dev	Min	max
cap	1,097	8.232247	6.076303	0	50.4
gdppc	1,097	19407.46	19860.21	-3.1	107640.6
inflation	1,097	45.95057	482.3852	-3.749145	6089.84
unemp	1,097	7.923731	7.405987	0	69.28793
households	1,097	63.35439	18.04411	9	150.059
invest	1,097	22.86108	9.121997	0	75.1
va	1,097	.1308022	.0200067	.1	.26
ps	1,097	.221185	.0469358	-.76	.36
ge	1,097	.1901276	.3425324	-1.77	2.22
rq	1,097	.189289	.0275397	.13	.31
rl	1,097	.458031	2.56578	-1.27	24.7
psc	1,097	2.769426	1.214524	1.08	8.72
ECA	1,097	.3062899	.4611619	0	1

LAC	1,097	.1458523	.3531191	0	1
MEN	1,097	.0583409	.2344939	0	1
SA	1,097	.0583409	.2344939	0	1
SSA	1,097	.3144941	.4645258	0	1

A3. Endogeneity test

VARIABLES	(a)Invest
Psc	-0.168 (0.780)
Cap	-0.0872* (0.0506)
gdppc	-4.52e-05*** (1.47e-05)
inflation	0.00433*** (0.000649)
unemp	-0.213*** (0.0366)
v1hat	1.222 (0.812)
Constant	26.41*** (1.955)
Observations	1,097
R-squared	0.115

Note: Authors calculations based on CPI and World Bank WDI

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A4:

variable	obs	mean	Std.dev	Min	max
psc2 (0,1)	711	.4978903	.5003475	0	1
Dc	697	5.51e+08	5.99e+09	-10.15183	8.00e+10
gdppc	708	18800.56	18846.93	.4486821	89007.46
Cpi	708	52.68045	518.1459	-3.749145	6089.84
Emp	708	7.893137	7.5153	.299	69.28793
Hc	708	63.57043	18.75245	9	150.059
Gfcp	707	22.60006	8.910735	0	68.08492
Ecf	708	1.193376	1.605657	0	10.68784
Sv (Savings)	708	18.80935	15.04325	-40.8	77.75
Sec	708	61.43347	26.5057	7	98.12
Tert	708	15.02736	12.32192	.51	57.71
Tfp	708	736.8029	705.9667	46.56	2819.54
Va	708	.1276271	.0177207	.1	.24
Ps	708	.224548	.0213331	.17	.33
Ge	708	.2053531	.0186235	.16	.3
Rq	708	.1873164	.0281665	.13	.31
Rl	708	.305339	1.758974	.12	21.4

ECA	708	.3305085	.4707288	0	1
LAC	708	.1440678	.3514067	0	1
MEN	708	.059322	.2363934	0	1
SA	708	.0677966	.2515743	0	1
SSA	708	.2966102	.4570861	0	1

A5: Classification of countries

High income countries	Low income countries
Argentina	Afghanistan
Australia	Albania
Austria	Algeria
Belgium	Angola
Brunei Darussalam	Armenia
Chile	Bangladesh
Croatia	Belarus
Czech Republic	Bhutan
Denmark	Bolivia
Estonia	Bosnia and Herzegovina
Finland	Botswana
France	Brazil
Germany	Bulgaria
Greece	Burundi
Hong Kong SAR, China	Cambodia
Hungary	Cameroon
Iceland	Central African Republic
Ireland	Chad
Israel	China
Italy	Colombia
Japan	Congo
Korea, Rep..	Costa Rica
Kuwait	Cote d'Ivoire
Latvia	Djibouti
Lithuania	Dominican Republic
Luxembourg	Ecuador
Malta	Egypt, Arab Rep.
Netherlands	El Salvador
New Zealand	Equatorial Guinea
Norway	Ethiopia
Panama	
Poland	
Portugal	
Saudi Arabia	
Seychelles	
Singapore	
Slovak Republic	
Slovenia	

Spain	Gabon
Sweden	Gambia
Switzerland	Georgia
United Arab Emirates	Ghana
United Kingdom	Guatemala
United States	Guinea
Uruguay	Guinea-Bissau
	Guyana
	Honduras
	India
	Indonesia
	Iran (Islamic Republic of)
	Iraq
	Jamaica
	Jordan
	Kazakhstan
	Kenya
	Kyrgyz Republic
	Lebanon
	Lesotho
	Liberia
	Madagascar
	Malawi
	Malaysia
	Mali
	Mauritania
	Mauritius
	Mexico
	Moldova
	Mongolia
	Morocco
	Myanmar
	Namibia
	Nepal
	Nicaragua
	Niger
	Nigeria

	Pakistan
	Paraguay
	Peru
	Philippines
	Romania
	Russian Federation
	Rwanda
	Senegal
	Serbia
	Sierra Leone
	South Africa
	Sri Lanka
	Sudan
	Tajikistan
	Tanzania
	Thailand
	Togo
	Tunisia
	Turkey
	Uganda
	Ukraine
	Vanuatu
	Vietnam
	Zambia
	Zimbabwe

Note: upper middle income countries were excluded

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