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How Does Corruption Affect Public Debt?
An Empirical Analysis

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Abstract: This paper examines the relationship between corruption and public debt in 106 countries. Results suggest that corruption leads to an increase in public debt. We also investigate if the effect of corruption on pblic debt is increased by government expenditure, the shadow economy and military expenditure. We find that the effect of corruption on public debt is compounded by increased government expenditure and increased size of the shadow economy.

Keywords: corruption, public debt, government expenditure, shadow economy, military expenditure

JEL Codes: D78, E26, H2, H11, H26, K42, O5, O11, O16, O17

1: Introduction

Evidence has shown that corruption can be damaging for an economy. Corruption has been found to reduce growth (Tanzi and Davoodi 2002, Mauro 1995; Mo, 2001), discourage investment (Mauro, 1996; Brunetti et al. 1998; Campos et al. 1999); reduce foreign direct investment (Wei, 2000, Abed and Davoodi 2002), and limit productivity (Lambsdorff, 2003). Studies also show that more corrupt countries face higher inflation Al-Marhubi (2000), increase the size of the shadow economy (Friedman et al. 2000 and Johnson et al. 1997, Schneider et al. 2010), affect state bond ratings (Depken and Lafountain 2006), and lower expenditure on education and health (Mauro 1998).

This paper examines specifically the influence of corruption on government debt. Despite the large literature on the effects of corruption on government expenditure, there is little evidence on how corruption affects public debt[1]. Corruption can affect government debt through a number of channels. Tanzi and Davoodi (2002) argue that corruption leads to an increase in public expenditure. As observed by Kaufmann (2010) in order to maximize rent-seeking, government officials could be more inclined towards large capital investments at the cost of labor-intensive ones. Accordingly, if a government finances its expenditure through increased debt, in the event of corruption, there is need for a higher stock of debt leading to higher costs of servicing that debt. Corruption can not only increase the size of public expenditure but also change the composition of public expenditure away from vital sectors such as health and education (Mauro 1998, Wei 2001) towards sectors which involve greater secrecy and less transparency such as defence. Military expenditure may not be closely monitored by tax and customs authorities or be subject to the usual auditing and other legalities (Gupta et al. 2001a). In the event that large scale investment projects and public expenditures such as

[1] There is a literature which investigates the issue of corruption and institutions: See for example, La Porta et al (1999), Shleifer and Vishny. (1993).

defence are financed by borrowing, public debt and debt servicing costs could increase (Kaufmann 2010). Corruption is additionally associated with a larger shadow economy. A large shadow economy reduces the ability of a government to raise tax revenues (Schneider et al. 2010, Kaufmann 2010). A government has to resort to borrowing to finance projects when there is a fall in tax revenues. Therefore the more corrupt a government, a larger proportion of tax revenues would go into bribe payments which can reduce revenues requiring more borrowing. This can lead to a vicious cycle of corruption and borrowing. Therefore a second contribution of the study is to see if the size of the shadow economy, government expenditure and military expenditure increase the negative effect of corruption on public debt. This will be examined by introducing interaction terms between and these variables and corruption.

Results are tested for robustness in a number of ways: additional control variables to capture a range of possible influences on the public debt ratio, interaction terms, different estimation methods including OLS, fixed effects estimation to account for country level time invariant unobservable influences on public debt, and system GMM estimation to correct for any potential endogeneity bias. Given the uncertainty and likely measurement errors in corruption, the robustness of the results are tested using two different data sets on corruption: the Transparency International (TI) and Kaufmann et al. (2013) data sets. Finally, the estimation is carried out by replacing the dependent variable, the public debt to gross domestic product (GDP) ratio with the debt servicing ratio to gross national income (GNI).

Our study is structured as follows: In chapter 2 a short literature review follows, where we summarize studies, which have undertaken similar investigations. A review table of some important studies dealing with related topics are provided. In chapter 3 we describe the data

and the estimation methodology and in chapter 4 we discuss the regression results. Finally chapter 5 presents a summary and some policy conclusions.

2: Literature Review and Some Theoretical Considerations

Corruption distorts public expenditure leading to a less than optimal allocation of government spending. Evidence shows that corruption inflates and changes the composition of government expenditure (Wei and Zechauser 1999, Tanzi and Davoodi 2002, Mauro 1998). Wei and Zechauser (1999) employing firm level survey data from the Global competitiveness report (GCR) index, Transparency international (TI) and Business international (BI) index show that corruption constrains economic development by generating increases in government expenditure and reducing domestic and foreign direct investment. They find that corruption additionally changes the composition of government expenditure away from education, health, and infrastructure, toward less efficient public projects, such as highway construction where there is greater potential for corruption. The Wei and Zechauser (1999) study however, does not involve any empirical estimation. Tanzi and Davoodi (2002) similarly examining the effect of corruption on government spending patterns in 68 countries over 1980-95, show that: corruption increases the size of government sector investment at the cost of private sector investment; leads to higher spending on government sector capital projects reducing funds available for other expenditures; and lowers the quality of existing infrastructure such as roads and buildings, while new projects in more lucrative areas are undertaken. They further find that corruption has a negative impact on government revenues. Using OLS and IV techniques, and a sample of 100 countries, Mauro (1998) argues that corruption changes the composition of government expenditure by channelling expenditure away from education to other more lucrative areas. Mauro also finds some evidence of corruption leading to a fall in spending on health. The results suggest that the direction of the

causal association is from corruption to the composition of spending with corruption leading to a less-than-optimal composition of government expenditure.

Gupta et al. (2001a) in a panel data estimation of the association between corruption and military spending for 120 countries over the 1985-1998 period, concludes that corruption is associated with a higher share of spending on both military expenditure as a percentage of GDP, and total government expenditure. Similar conclusions are put forward by Delavallade (2006). Using 3SLS estimation on 64 countries over the 1996-2001 period, Delavallade (2006) concludes that corruption is associated with a fall in public spending devoted to education, health and social protection, and an increase in expenditures devoted to public services and order, fuel and energy and culture and defence.

Evidence also shows that corruption increases the size of the shadow economy[2]. The study of Friedman et al. (2000) show that corruption is associated with increased unofficial activity which in turn leads to a fall in tax revenues. They argue that only non-corrupt governments can sustain high tax rates. Similar arguments are put forward by Johnson et al. (1997) who argue that tax evasion by the unofficial sector weakens a government's ability to provide public goods to the official sector. These public goods include law and order, effective tax, regulatory institutions and public administration. Meon and Sekkat (2005) similarly using generalized least squares (GLS) estimation and data over 1970-1998 for 63-71 nations, find that a weak rule of law, inefficient government and political violence increase the negative effect of corruption on investment. Dreher and Schneider (2010) on the contrary, show that there is no robust relationship between corruption and the shadow economy when employing perceptions-based indices of corruption. Using an index of measured corruption, the results

[2] See Schneider and Enste (2000) for a survey of the consequences of shadow economies.

indicate that corruption and the size of the shadow economy are complements in low income countries while no robust relationship is detected in high income countries. Schneider (2011) finds that the average size of the shadow economy as a proportion of GDP was 41%, 38% and 17% respectively, in developing transition and the OECD nations respectively in 1999/2000. The findings of Schneider (2011) suggest that an increase in the size of the shadow economy in developing nations leads to a fall in the size of official GDP while in developed and transition economies an increase in the size shadow economy leads to an increase in GDP.

Developing a theoretical model to investigate the relationship between corruption and the shadow economy, Choi and Thum (2005), show that the presence of an unofficial sector acts as a complement rather than a substitute to the official economy. Dreher et al. (2008) similarly, show that an improvement in institutional quality reduces the shadow economy directly and corruption both directly and indirectly by influencing the shadow market. The nature of the relationship between corruption and institutional quality is not clear and dependent upon the effectiveness of the level of institutional quality in the shadow and corruption markets. Some of the aforementioned studies are summarised in Table 1.

[Table 1, about here]

Government control on economic activity could increase or decrease in the presence of corruption. Greater government control may be placed on economic activity and government institutions in the presence of corrupt governments so that the revenue flow from government expenditure and national income can be increased (Johnson 1975). Alternatively, government controls could be waived in exchange for bribes in the presence of corruption (Shleifer and Vishny 1993).

As we have seen there is an extensive literature dealing with theoretical considerations of the effects of corruption on the economy and here also on public debt[3]. There exists a large set of possible consequences of corruption such as higher income inequality, lower GDP per capita, lower investment, budget allocation distortions, worse public sector quality, distor-tions of the markets for emergence of underground economies and tax cheating[4]. Obviously, corruption is responsible for the effect that, ceteris paribus, we have a higher government spending, which can raise public debt. The cost imposed on many far exceeds the profit generated by a few, because corruption distorts the functionality of the whole economy. Corruption contributes to a more extensive fiscal deficit as public revenues are reduced, while public spending is simultaneously increased. This systemic inefficiency exacerbates the exercise of a sound fiscal policy. Certain regulations designed to prevent misbehavior (e.g. corruption) might provide little results in the short term, but will certainly impose pinning effects on corruption in the longer term. Theoretically, corruption has entirely negative ef-fects, because corruption fringes the fundamental human rights to a fair treatment, prevents unbiased decision making and weakens civil and policy status. Corruption leads to the result that the market misallocation of resources is likely to distort economic efficiency, foreign investors are driven away and prospective growth is reduced. Moreover, corruption contributes to environmental damage, illegitimate leaders and organized crime and it also increases social polarization. Also from an economic perspective, corruption destroys incentives and opportunities, distorts efficient market allocations, leads to an innovation- and brain-drain in a country and subsequently leads to an unpleasant business environment, lower growth rates with lower tax revenues and higher public debt. Especially in what Tanzi (1995) has called "grand corruption", political corruption might prevail and negatively affect the three fundamental pillars of the state: legislative, executive and judicial prevalence. Corruption will

[3] Compare e.g. Choi and Thum (2005), Gupta et al. (2001b), Friedman et al. (2000), Johnson et al. (1997), Méon and Sekkat (2005).
[4] Compare e.g. Lambsdorff (2006), Tanzi (1998) and Dimant et al. (2013a,b).

compete economic growth through higher (social and economic) costs, caused by rent seeking behavior as well as lower efficiency and volume of investment; both in the private and public affair[5]. Even indirect effects are considerable, as more corrupt countries might have problems to obtain external funding from the international capital markets, which in turn imposes negative effects on the economic performance and on the government debt situation. Especially true for open economies is that foreign direct investment tends to stay out of corrupt countries. Corruption drives down productivity and innovation.

Furthermore, within the literature on corruption there is the question of whether corruption has a causal effect on macroeconomic indicators and on institutions and whether corruption really is a consequence of this. For example corruption could cause a decrease in GDP per capita through a decrease in investment and productive labor hours (Mauro 1995). However, a decreasing average income would push many people into rent seeking and/or corrupt activities. Van Rijckeghem and Weder (1997) present evidence which shows a negative relationship between wages and corruption in developing countries. This could be true if low wages cause civil servants to spend more time in rent seeking which may make corrupt governments belief, that civil servants are able to earn an adequate income from bribe taking and subsequently reduce their wages. Also corruption leads to higher govern-ment expenditures and to a lower income from custom duties and/or tax revenues. Again, this leads to a higher public debt.

Finally, what is the goal of our study? While our study is closely related to the literature on corruption and the government, it extends upon the literature by examining specifically the impact of corruption on public debt. To the best of our knowledge, this is the first paper

[5] Compare Mauro (1995).

which examines the relationship between corruption and public debt. Consequently the purpose of this paper is to empirically investigate the following three hypotheses:

1) Increased or high corruption leads to an increase in public debt, ceteris paribus. This is our core hypothesis.
2) As the shadow economy erodes the tax base and leads to a decline of public revenues, the shadow economy increases public debt, ceteris paribus.
3) The interaction of shadow economy, government expenditure and military expenditure with corruption lead to an increase in public debt, ceteris paribus.

3: Data and Methodology

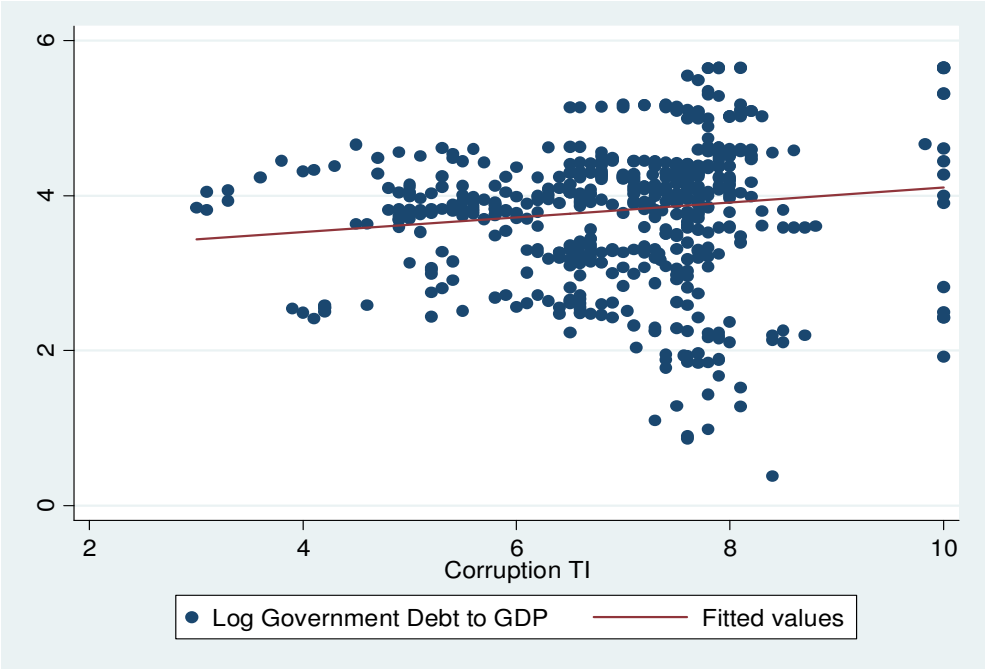
3.1 Data

The data cover the 1996-2012 period for 106 countries. Summary statistics and data sources are provided in the Appendix (Table 1A). The sample constitutes a representative cross section of the regions covering Eastern Europe and Central Asia, the Middle East and North Africa, Latin America and the Caribbean, East Asia and the Pacific, South Asia and Africa. The grouping of regions is based on the World Bank classification. The high income OECD countries are excluded from the analysis as corruption levels in these countries are relatively low.

The dependent variable in the study is the ratio of public debt to GDP. As a robustness check we also estimate the model by replacing the public debt to GDP ratio with the debt servicing ratio to GNI. The main independent variable of interest is corruption. Two measures of corruption are used in the empirical study that follows. One is the corruption measure from Transparency International. Here the estimate of corruption ranges from 0 (totally corrupt) to 10 (not corrupt). The other is the estimate of corruption from Kaufmann et al. (2012) which

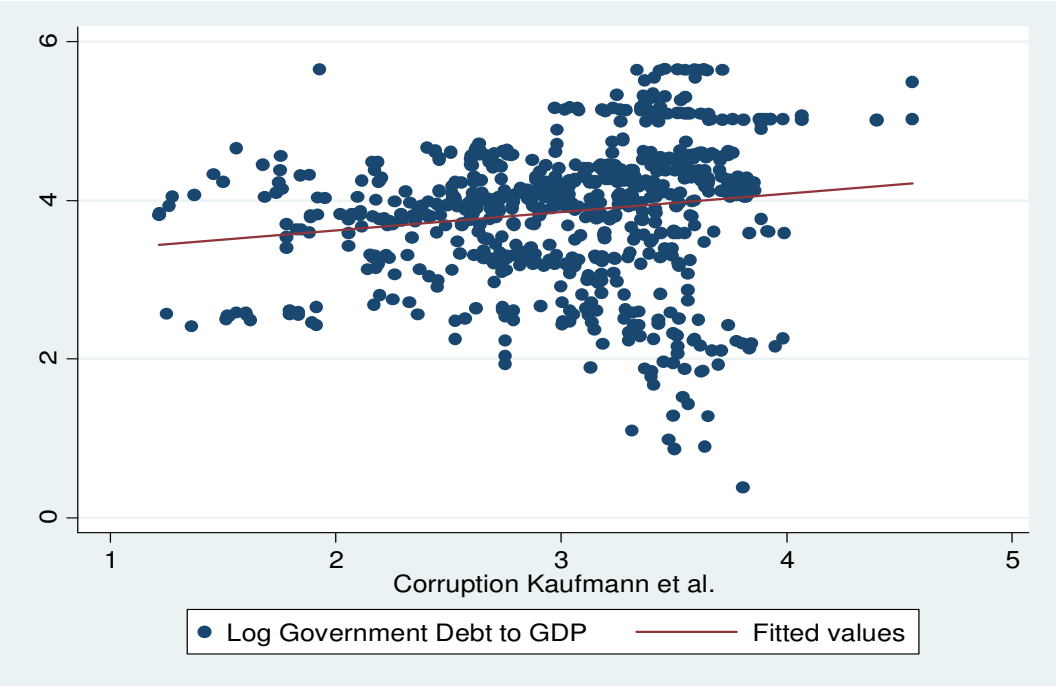
ranges from approximately -2.5 (totally corrupt) to 2.5 (not corrupt). In order to simplify the interpretation of empirical results, the TI measure of corruption has been reversed so that 0 stands for not corrupt and 10 totally corrupt. The Kaufmann et al. measure has been rescaled so that 0 stands for not corrupt and +5 for totally corrupt to maintain consistency with the TI measure. Figures 1 and 2 plot the government debt to GDP ratio (log) against the corrunption indices. The graphs suggest that an increase in corruption leads to an increase in the public debt ratio.

Figure 1: Log Government Debt to GDP Against the TI Corruption Index



Note: The TI corruption index has been reversed so that 0 stands for not corrupt and 10 totally corrupt on the TI measure.

Figure 2: Log Government Debt to GDP Against the Kaufmann et al. Corruption Index



Note: The Kaufmann measure has been rescaled so that 0 stands for not corrupt and +5.

A number of other control variables are used in the empirical analysis. GDP per capita and the secondary enrolment ratio are used to measure the level of development of a country. As aforementioned, as increased government expenditure and military expenditure can increase borrowing, the ratio of government expenditure to GDP and the ratio of military expenditure to GDP are also used as control variables in the empirical analysis that follows (Tanzi and Davoodi 2002, Gupta et al. 2001a). Similarly, the size of the shadow economy can be large in corrupt economies leading to increases in public debt. To account for this, the size of the shadow economy is incorporated as an independent variable (Schneider et al. 2010)[6]. Studies have indicated that the relation between corruption and growth may well be non-linear (Méndez and Sepúlveda 2006, Aidt et al. 2008). To account for non-linearity in the relationship between public debt and corruption, a non-linear term is included for corruption.

[6] Data for the shadow economy are from Schneider et al. 2010).

Additional control variables are also incorporated to account for the omitted variables bias. These include the rate of inflation (Al-Marhubi 2000), tax revenue as a ratio of GDP (Schneider et al. 2010, Kaufmann 2010) and interest payments on debt as a ratio of revenues (Kaufmann 2010).

A second objective of the study is to investigate if the size of the government, military expenditure and the shadow economy increase the effect of corruption on public debt. Interaction terms are incorporated between corruption and these variables in order to test this.

3.2 Methodology

Several alternative methodologies are used to estimate the empirical model. The preliminary estimation is carried out using Ordinary Least Squares (OLS). The model is also estimated using panel fixed effects, and the system General Method of Moments (GMM). The panel data model can be expressed by equation (1) as follows:

$$y_{it} = X_{it}\beta + \varpi_i + \eta_t + \mu_{it} \qquad (1)$$

where y_{it} is the public debt ratio for country i in period t. X_{it} is a vector which includes all independent variables, including corruption and the control variables. ϖ_i captures the country specific effect and η_t, takes into account the relevant time effect. μ_{it} is a random error term that captures the effect of all omitted variables.

Interaction terms are added to the above specification to investigate desired differential effects. Both fixed and random effects models were estimated. However, based on the results of the Hausman test, the fixed effects model was found to be relatively more reliable. Therefore the paper reports results only for panel fixed effect estimation.

It can be argued that all explanatory variables used in our empirical model are not strictly exogenous. An approach that allows controlling for the joint endogeneity of explanatory variables through the use of internal instruments is the Arellano-Bover (1995)-Blundell Bond (1998) system GMM estimator. In summary, equation (2), which involves variables in levels, is combined equation (3), which involves variables in first differences. Equation (2) is instrumented by lagged first differences of the variables, whereas equation (3) is instrumented by lagged variables in levels.

$$y_{it} = \gamma y_{it-1} + X_{it}\beta + \varpi_i + \eta_t + \mu_{it} \qquad (2)$$

$$y_{it} - y_{it-1} = \gamma(y_{it-1} - y_{it-2}) + \beta(X_{it} - X_{it-1}) + \eta_t + (\mu_{it} - \mu_{it-1}) \qquad (3)$$

The variable definitions are the same as above for equation (1), with lagged values of the variables now entering the equation. The GMM estimator is based on the assumption that the error terms are not serially correlated and that the explanatory variables are weakly exogenous or not significantly correlated with future realizations of the error terms under which the following moment condition holds for the first difference estimator:

$E[y_{it-s}\,(\mu_{it} - \mu_{it-1})] = 0$; $E[\boldsymbol{X}_{it-s}\,(\mu_{it} - \mu_{it-1})] = 0$; where $i = 1\ldots..n$, $t = 3\ldots.T$ and $s \geq 2$.

As indicated earlier, the levels equation is instrumented with lagged first differences of the variables, which leads to an additional moment condition as follows:

$E[\Delta y_{it-s}\,(\varpi_i + \mu_{it})] = 0$; $E[\Delta \boldsymbol{X}_{it-s}\,(\varpi_i + \mu_{it})] = 0$ for $s = 1$.

Two diagnostic tests, the Hansen test for over-identifying restrictions under which the null hypothesis is that the instruments are not correlated with the residuals, and the Arellano-Bond test for second order correlation in the first differenced residuals are carried out.

4: Empirical Estimation

The preliminary estimation is carried out using OLS, panel fixed effects, and the system General Method of Moments (GMM). Table 2 reports results using all three methods We start with the most simple version of the model by examining if the ratio of public debt is influenced by corruption. Given the uncertainty and likely measurement errors in corruption, the estimation is carried out by using both the Transparency International (TI) and Kaufmann et al. (2013) corruption indices. The results in table 2 clearly confirm our core hypothesis; the higher the corruption in a country the higher is the ratio of public debt to GDP, ceteris paribus. Both the TI and Kaufmann et al. corruption measures have positive coefficients and in all cases are highly statistically significant. For example, the Kaufmann et al. corruption index in column (1) suggests that a 1 unit increase in the corruption index increases the debt to GDP ratio by 0.23% and in column (2), that a 1 unit increase in the TI corruption index increases the debt to GDP ratio by 0.09%. However the R^2 of the regressions are extremely low, indicating that a number of important factors are missing.

[Table 2, about here]

Due to this we carried out the estimation with a number of control variables. The estimation was carried out using both fixed effects and system GMM. Because the results were qualitatively similar, we report only the results for system GMM estimation. We show in table 3 a linear and non-linear specification of the influence of corruption on the public debt ratio in order to better fulfill the ceteris paribus conditions.

[Table 3, about here]

From the results in table 3 we clearly see that the linear specification with the independent variable “corruption” (both the TI and Kaufmann et al. measures) again has the expected

positive sign and is highly statistically significant. Column (1) suggests that a 1 unit increase in the TI corruption index leads to a 0.07% increase in the debt to GDP ratio and column (2) that a 1 unit increase in the TI corruption index leads to a 0.03% increase in the debt to GDP ratio. The non-linear coefficient does not turn out to have any statistical influence on the dependent variable, the ratio of public debt to GDP. For the independent variable per capita income, we get the theoretically expected negative sign suggesting that the higher the per capita income in a country, the lower the ratio of public debt, and the coefficient is highly statistically significant. The coefficient on the independent variable government expenditure has the theoretically expected positive sign and it is highly statistically significant, implying that the higher the government expenditure, the higher the ratio of public debt. The coefficients on education are negative and statistically significant only in the linear specification. The coefficient on the independent variable, shadow economy, has the expected positive sign and the coefficients are highly statistically significant, meaning, the higher the shadow economy, the higher is the public debt, which points to the erosion of the tax and revenue system of states which results in a higher public debt. In column (3) for example, a 1% increase in the shadow economy leads to a 0.356% increase in the public debt to GDP ratio. The Hansen test and the serial correlation test confirm that the moments conditions cannot be rejected.

Next we investigate if government expenditure, military expenditure and the shadow economy increase the the adverse effect of corruption on public debt. For this we interact corruption with government expenditure, military expenditure and the shadow economy. These results are reported in table 4.

[Table 4, about here]

Again we find that our core independent variable corruption, has a consistently positive highly statistically significant influence on public debt. And again only the linear coefficients on corruption are statistically siginificant. The non-linear terms on corruption are not statistically significant. Per capita income continues to have a highly statistically negative significant influence on public debt and similarly, government expenditure has a positive influence on public debt in all four specifications. The coefficient on the shadow economy is highly statistically significant and positive, suggesting that the higher the shadow economy, the higher is the public debt. The coefficients on the shadow economy have the quantitatively largest influence on the dependent variable. If we consider the interaction variables, corruption x government expenditure has a positive highly statistically significant effect on public debt, meaning, the more corrupt a country, the higher the government expenditure, and the higher is the public debt. The interaction term on corruption x the shadow economy has a positive highly statistically significant effect on the ratio of public debt suggesting that the higher the leve of corruption in a country, the higher the adverse effects of the shadow economy on public debt. Military expenditure and the interaction term on corruption x military expenditure are not statistically significant. This is probably due to the fact that this expenditure is already incorporated in government expenditure.

In table 5 we incorporate additional control variables which include, inflation, the ratio of tax revenue to GDP and interest payments on debt. Al-Marhubi (2000) shows that more corrupt countries face higher inflation. Higher inflation can reduce the real value of the debt stock or alternatively, increase interest payments on debt thereby increasing the stock of debt (Reinhart and Rogoff, 2010). Schneider et al. (2010) show that corrupt economies have larger shadow economies which reduce the ability of governments to raise tax revenues. Finally interest payments are included as more corrupt governments face higher debt servicing costs

(Kaufamnn 2010). The results reported in table 5 show that in addition to our core independent variable corruption, which once again has a highly statistically significant positive effect on the ratio of public debt to GDP, the three new control variables, inflation, tax revenues and interest payments have the expected signs and are highly statistically significant. The higher the inflation, the higher the ratio of public debt to GDP, the higher the tax revenue, the lower the ratio of public debt to GDP, ceteris paribus. The higher the interest payments, the higher is the ratio of public debt to GDP, ceteris paribus. Also in table 5 for the first time, the interaction variable on corruption x military expenditures has a positive influence on public debt and is highly statistically significant, suggesting that the higher the corruption and the higher military expenditure and the higher is the ratio of public debt to GDP.

[Table 5, about here]

Finally in table 6, we replace the dependent variables, the ratio of public debt to GDP, with the debt service ratio to GDI. Again the two corruption variables, which are our main variables of interest, have a highly statistically significant and positive influence on the debt ratio to GNI. Again the variable per capita income has the expected negative sign and a highly statistically significant influence on public debt. The coefficients on government expenditures and the shadow economy again are highly statistically significant, implying that the higher the the government expenditure, and the higher the shadow economy, the greaters the debt servicing ratio to GNI. The enrolment ratio has a statistically significant negative effect on the debt servicing ratio to GNI. The coefficient on military expenditure is not statistically significant. The interaction terms between corruption x government expenditure and corruption x shadow economy have the expected positive sign and are highly statistically significant.

[Table 6, about here]

5: Summary and Policy Conclusions

This study examined the effects of corruption on public debt. It additionally examined if government expenditure, the shadow economy and military expenditure increased the adverse effects of corruption on public debt. The results suggest that corruption measured by both the TI index and Kaufmann et al. index have a highly statistically significant influence on public debt in all regressions. The positive influence is quantitatively important, and robust to various specifications and the inclusion of control variables. This clearly suggests that the higher the level of corruption in a country, the higher is the ratio of public debt. A similar effect is observed for the shadow economy. This variable has a positive statistically significant influence on the ratio of public debt. The interaction terms on corruption x government expenditure and corruption x shadow economy have a positive significant influence on the ratio of public debt implying that government spending and a larger shadow economy contribute to increasing the positive influence of corruption on public debt.

What type of policy conclusions can we draw from these results? We have the following::

(1) Governments should stirve to reduce corruption, because if corruption is reduced, government debt will fall, ceteris paribus.
(2) Governments should aim to reduce the size of the shadow economy as the lower the shadow economy, the lower will be the public debt, ceteris paribus.
(3) High government expenditure and in some cases military expenditure, contribute to increasing the effect of corruption on public debt acting as an additional driving force for increasing public debt. Once again, reduciong corruption should reduce the

adverse effects of corruption on government debt through government and military expenditure. Hence reducing corruption should be a primary policy goal of governments.

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Table 1: Summary of Selected Studies

Author/s	Measure of corruption	Sample	Estimation Technique	Conclusions
Johnson et al.(1997)	Central European Economic Reviews (CEER) index of crime and corruption	Annual data over 1989-1995 for countries of the former Soviet Union.	OLS, panel fixed effects estimation	A large unofficial sector weakens the government's ability to provide public goods to the official sector.
Mauro (1998)	ICRG corruption index	Annual data over 1970-1985.	OLS, IV	A negative, significant, and robust relationship between corruption and government expenditure on education.
Wei and Zechauser (1999)	Global competitiveness report (GCR) index, Transparency international (TI), Business international (BI) index.	1996 firm level survey data from 58 countries.	Does not involve empirical estimation.	Corruption increases government expenditure, reduces domestic investment and FDI and changes the composition of government expenditure away from education, health, and infrastructure, toward less efficient public projects such as road construction, which have greater potential for corruption.
Friedman et al. (2000)	Political risk service index	Annual data over 1990-1993 for 69 countries	OLS, and IV regression.	Corruption is associated with greater unofficial activity.
Gupta (2001a) et al.	ICRG and TI index	Annual data over 1985-1998 for 120 countries.	Pooled OLS, random effects, fixed effects methods.	Corruption is associated with a higher level of military spending.
Tanzi and Davoodi (2002)	The BI index and the ICRG index.	Annual data 1980-1995.	OLS	Corruption increases the size of public investment, and diverts the composition of public expenditure away from essential sectors to those which have greater potential for corruption.
Meon and Sekkat (2005)	The TI index and the Kaufmann et al. index.	Data averaged over 1970-1998.	Generalized Least Squares.	Weak rule of law, government inefficiency and political conflict increase the negative effects of corruption on investment.
Delavallade (2006)	Kaufmann et al. corruption index	Annual data over 1996-2001 for 64 countries.	3SLS	Corruption changes the structure of public spending by reducing the proportion spent on social expenditure

				and increasing the proportion spent on public services and order, fuel and energy, culture and defence.
Dreher et al. (2008)	TI corruption index	Averaged data from 1998-2002 for 18 OECD countries	Structural Equation Modelling	Improvements in institutional quality reduces the shadow economy and corruption.
Dreher and Schneider (2010)	ICRG index, TI index, Kaufmann et al. index and Dreher et al. (2007) index	Averaged annual data from 2000-2002 for 98 countries	OLS	Corruption and the size of the shadow economy are complements in low income countries while no robust relationship is detected in high income countries.

Table 2: Regression of Public Debt on Corruption

Dependent Variable: Log Public Debt to GDP

	OLS		Fixed Effects		System GMM	
	(1)	(2)	(3)	(4)	(5)	(6)
Corruption K	0.231 (0.056)***	-	0.036 (0.006)***	-	0.038 (0.012)***	-
Corruption TI	-	0.094 (0.034)***	-	0.076 (0.037)**	-	0.016 (0.008)**
Lag public debt(-1)	-		-	-	0.815 (0.030)***	0.811 (0.031)***
R^2	0.05	0.08	0.08	0.08		
Hansen Test for over-identifying restriction: p value	-	-	-	-	0.21	0.25
Arellano-Bond Test for 2nd Order Autocorrelation: p value	-	-	-	-	0.34	0.27
Observations	716	667	716	667	646	560

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively. System GMM: The difference equation is instrumented with the lagged levels, two periods, of the dependent variable and the levels equation with the difference lagged one period.

Table 3: System GMM Estimation with Control Variables

Dependent Variable: Log Public Debt to GDP

	(1)	(2)	(3)	(4)
Independent Variables				
Corruption TI	0.066 (0.017)***	-	0.078 (0.032)***	-
Corruption TI^2	-0.003 (0.002)	-	-	-
Corruption K	-	0.031 (0.010)***	-	0.046 (0.009)***
Corruption K^2	-	-0.004 (0.003)	-	-
Log Per Capita Income	-0.164 (0.043)***	-0.145 (0.037)***	-0.229 (0.059)***	-0.237 (0.044)***
Log Government Expenditure to GDP	0.081 (0.040)**	0.130 (0.070)**	0.275 (0.127)**	0.249 (0.149)**
Log Secondary Enrolment	-0.077 (0.079)	-0.052 (0.063)	-0.228 (0.086)*	-0.202 (0.063)***
Polity	-0.009 (0.005)**	-0.006 (0.004)	-0.009 (0.005)*	-0.002 (0.004)
Log Military Expenditure to GDP	-	-	0.018 (0.055)	0.007 (0.046)
Log Shadow Economy to GDP	-	-	0.356 (0.118)***	0.205 (0.012)**
Lag Dependent Variable	0.697 (0.046)***	0.695 (0.043)***	0.781 (0.053)***	0.746 (0.049)***
Hansen Test for over-identifying restriction: p value	0.18	0.20	0.19	0.22
Arellano-Bond Test for 2nd Order Autocorrelation: p value	0.27	0.21	0.28	0.31
Observations	548	507	500	550

Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively. The difference equation is instrumented with the lagged levels, two periods, of the dependent variable and the levels equation with the difference lagged one period.

Table 4: System GMM Estimation with Interaction Terms

Dependent Variable: Log Public Debt to GDP

	(1)	(2)	(3)	(4)
Independent Variables				
Corruption TI	0.473 (0.157)***	-	0.078 (0.032)***	-
Corruption TI^2	-0.028 (0.015)	-	-	-
Corruption K	-	0.321 (0.105)***	-	0.170 (0.051)***
Corruption K^2	-	-0.005 (0.006)	-	-
Log Per Capita Income	-0.210 (0.062)***	-0.254 (0.047)***	-0.250 (0.063)***	-0.251 (0.045)***
Log Government Expenditure to GDP	0.135 (0.060)**	0.153 (0.051)**	0.148 (0.070)**	0.149 (0.040)***
Log Secondary Enrolment	-0.121 (0.096)	-0.147 (0.100)	-0.147 (0.100)	-0.177 (0.073)***
Polity	-0.006 (0.005)	-0.006 (0.005)	-0.006 (0.005)	-0.001 (0.004)
Log Military Expenditure to GDP	0.104 (0.102)	0.101 (0.105)	0.009 (0.008)	0.173 (0.165)
Log Shadow Economy to GDP	0.382 (0.113)***	0.456 (0.115)***	0.302 (0.108)**	0.205 (0.012)**
Corruption*Log Government Expenditure to GDP	0.230 (0.083)***	0.190 (0.060)***	0.242 (0.097)***	0.139 (0.032)***
Corruption*Log Military Expenditure to GDP	0.002 (0.003)	0.015 (0.017)	0.004 (0.003)	0.041 (0.052)
Corruption*Log Shadow Economy to GDP	0.058 (0.017)***	0.027 (0.010)**	0.076 (0.034)**	0.076 (0.034)**
Lag Dependent Variable	0.846 (0.056)***	0.736 (0.054)***	0.803 (0.053)***	0.716 (0.032)***
Hansen Test for over-identifying restriction: p value	0.16	0.19	0.20	0.21
Arellano-Bond Test for 2^{nd} Order Autocorrelation: p value	0.26	0.22	0.28	0.34
Observations	548	507	500	550

Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively. The difference equation is instrumented with the lagged levels, two periods, of the dependent variable and the levels equation with the difference lagged one period.

Table 5: System GMM Estimation with More Control Variables

Dependent Variable: Log Public Debt to GDP

	(1)	(2)	(3)
Independent Variables			
Corruption TI	0.122 (0.031)***	0.103 (0.035)***	0.512 (0.112)***
Log Per Capita Income	-0.192 (0.062)***	-0.076 (0.034)**	-0.171 (0.069)***
Log Government Expenditure to GDP	0.234 (0.061)***	0.247 (0.071)***	0.253 (0.069)***
Log Secondary Enrolment	-0.375 (0.106)***	-0.182 (0.127)	-0.162 (0.135)
Polity	-0.005 (0.005)	-0.006 (0.006)	-0.006 (0.006)
Log Military Expenditure to GDP	0.115 (0.029)***	0.077 (0.037)**	0.062 (0.037)*
Log Shadow Economy to GDP	0.038 (0.011)***	0.019 (0.007)***	0.073 (0.013)***
Corruption* Log Government Expenditure to GDP	0.345 (0.082)***	0.359 (0.093)***	0.363 (0.090)***
Corruption*Log Military Expenditure to GDP	0.033 (0.014)**	0.034 (0.017)**	0.027 (0.016)*
Corruption*Log Shadow Economy to GDP	0.117 (0.053)**	0.051 (0.023)**	0.074 (0.012)***
Inflation Rate	0.010 (0.002)***	-	-
Log Tax Revenue to GDP	-	-0.399 (0.130)***	-
Log Interest Payments to Revenue	-	-	0.162 (0.053)***
Lag Dependent Variable	0.711 (0.058)***	0.840 (0.163)***	0.803 (0.053)***
Hansen Test for over-identifying restriction: p value	0.22	0.24	0.20
Arellano-Bond Test for 2nd Order Autocorrelation: p value	0.32	0.30	0.29
Observations	508	489	510

Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively. The difference equation is instrumented with the lagged levels, two periods, of the dependent variable and the levels equation with the difference lagged one period.

Table 6: System GMM Estimation

Dependent Variable: Log Debt Servicing Ratio to GNI

	(1)	(3)
Independent Variables		
Corruption TI	0.215 (0.077)***	-
Corruption K	-	0.378 (0.089)***
Log Per Capita Income	-0.114 (0.019)***	-0.115 (0.017)***
Log Government Expenditure to GDP	0.135 (0.060)**	0.145 (0.062)**
Log Secondary Enrolment	-0.305 (0.016)***	-0.145 (0.072)**
Polity	-0.008 (0.013)	-0.006 (0.012)
Log Military Expenditure to GDP	0.258 (0.202)	0.071 (0.062)
Log Shadow Economy to GDP	0.311 (0.131)***	0.442 (0.213)**
Corruption*Log Government Expenditure to GDP	0.158 (0.052)**	0.189 (0.091)**
Corruption*Log Military Expenditure to GDP	0.046 (0.073)	0.016 (0.018)
Corruption*Log Shadow Economy to GDP	0.498 (0.187)***	0.112 (0.030)**
Lag Dependent Variable	0.491 (0.166)***	0.497 (0.066)***
Hansen Test for over-identifying restriction: p value	0.32	0.22
Arellano-Bond Test for 2nd Order Autocorrelation: p value	0.21	0.28
Observations	561	561

Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively. The difference equation is instrumented with the lagged levels, two periods, of the dependent variable and the levels equation with the difference lagged one period.

Appendix

Table 1A: Summary Statistics and Data Sources

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum	Source
Public Debt % of GDP	916	65.92	53.94	1.45	287.53	WDI 2013
Corruption Index Kaufmann et al. (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance)	1833	-0.55	0.60	-2.06	1.57	Kaufmann et al. (2013)
Corruption Index Transparency International. (ranges from 0 (totally corrupt) to 10 (not corrupt).	1217	3.06	1.12	0.17	7.5	Transparency International 2013
Government Expenditure % of GDP	1659	14.65	6.52	2.05	69.54	WDI 2013
Shadow Economy % of GDP	891	38.60	11.09	11.9	68.3	Schneider et al. (2010)
Military Expenditure % of GDP	1426	2.27	2.40	0.09	39.62	WDI 2013
Per Capita Income (Constant 2000 US$)	1787	1675.06	1720.68	82.66	9581.06	WDI 2013
Secondary Enrolment %	1207	61.38	27.49	5.16	119.78	WDI 2013
Tax Revenue % of GDP	876	14.40	6.70	0.12	61.02	WDI 2013
Interest Payments % of GDP	847	11.75	12.05	5.43	96.04	WDI 2013
Debt Servicing % of GNI	1695	3.76	34.28	1.00	86.77	WDI 2013
Polity (-10 (hereditary monarchy) to +10 (consolidated democracy),	1730	2.33	6.01	-10	10	Marshall and Jaggers 2013
Inflation	1720	25.87	189.61	-5.97	244.11	WDI 2013