Why Corrupt Governments May Receive More Foreign Aid

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Online Appendix

Appendix A - Extension with Productive Government Spending

The time resource constraint is

$$1 = l_c + l_g + l_x. \tag{1}$$

Labor productivity a depends on the government good g through the function

$$a = \bar{a} g^{\lambda}, \tag{2}$$

with $\lambda \in (0, 1)$. $\bar{a}$ is a parameter reflecting exogenous productivity factors, such as soil quality or technological level. Assuming that firms are operated by self-employed workers, per-capita income is equal to average productivity a.

Total consumption of the private good c is given by output minus taxes:

$$c = a\, l_c - t.$$

The government resources include taxes t and some general financial assistance from abroad, z. Both are used to produce the government good g. The production function in the government sector is given by a concave function of labor input l_g, which we assume to be given by $\sqrt{l_g}$ to obtain explicit solutions, where l_g is labor input in this sector. A part l_x/ν of the product is diverted from its purpose, with l_x representing the labor input devoted to corruption activities, and ν a parameter measuring the quality of institutions. Given the time spent in corruption activities l_x, if institutions are of high quality, the share of government spending diverted from its purpose is small (corruption is better controlled). The effective production of the government good is:

$$g = (1 - l_x/\nu)\sqrt{l_g}.$$

The budget constraint of the government can be rewritten as:

$$\underbrace{t}_{\text{taxes}} + \underbrace{z}_{\text{aid}} = \underbrace{\sqrt{l_g}}_{\text{total spending}} = \underbrace{g}_{\text{effective output}} + \underbrace{(l_x/\nu)\sqrt{l_g}}_{\text{diverted spending}}. \tag{3}$$

Hourly income in the government sector is equal to average productivity: g/l_g. The hourly income from corruption is: $\sqrt{l_g}/\nu$. At any interior equilibrium, the return from the three possible activities should be equal:

$$a = \frac{\sqrt{l_g}(1 - l_x/\nu)}{l_g} = \sqrt{l_g}/\nu. \tag{4}$$

This relation, which describes the allocation of time by households, acts as a constraint for the donor problem and makes the level of corruption endogenous. Taxes adjust endogenously to balance the budget.

Definition 1 *Given foreign aid z, productivity a and institutional quality ν, an equilibrium with corruption is represented by a level of tax $\{t\}$, a level of gdp per worker $\{a\}$, and a vector of positive labor inputs $\{l_c, l_g, l_x\}$ such that the budget of the government is balanced (Equation (3)), the labor market clears (Equation (1)), the incentive constraint holds (Equation (4)), and productivity depends on government spending (Equation (2)).*

Proposition 1 *Assuming $\bar{a} > 2$, there exists a threshold $\bar{\nu} = \bar{a}^{\frac{-2}{1+\lambda}}$ such that, if $\nu < \bar{\nu} < 1$ (low quality of institutions), there exists a unique equilibrium with corruption where $t = a\nu - z$, and*

$$l_c = 1 - \nu, \qquad l_g = a^2\nu^2, \qquad l_x = \nu(1 - a^2\nu).$$

and gdp per worker is given by

$$a = \bar{a}^{\frac{1}{1-3\lambda}}\nu^{\frac{2\lambda}{1-3\lambda}} \tag{5}$$

Proof. Solving the system of Equations (1) to (4) for the variables t, l_c, l_g and l_x leads to

$$l_c = 1 - \nu, \qquad l_g = a^2\nu^2, \qquad l_x = \nu(1 - a^2\nu).$$

Consumption of both goods is given by:

$$c = al_c - t = a + z - 2a\nu \tag{6}$$
$$g = \sqrt{l_g}(1 - \nu l_x) = a^3\nu^2. \tag{7}$$

Taking into account that productivity a depends on g, we have from Equation (7) $g = \bar{a}^3 g^{3\lambda}\nu^2$, which implies:

$$g = \left(\bar{a}^3\nu^2\right)^{\frac{1}{1-3\lambda}}$$

GDP per worker is given by

$$a = \bar{a}\left(\bar{a}^3\nu^2\right)^{\frac{\lambda}{1-3\lambda}} = \bar{a}^{\frac{1}{1-3\lambda}}\nu^{\frac{2\lambda}{1-3\lambda}}$$

For this to be an equilibrium, we need to show that $l_c, l_g, l_x \in (0,1)$. For l_x to be positive, we need $a^2\nu$ to be less than one. This requires

$$\nu < \bar{a}^{\frac{-2}{1+\lambda}}$$

which is guaranteed for $\nu < \bar{\nu}$. For c to be positive, we also need $\nu < 1/2$. This holds for $\bar{a} > 2$ and $\nu < \bar{\nu}$. $\nu < 1/2$ also implies $l_c > 1$. QED.

Proposition 1 says that there is a unique number of government employees which is compatible with labor market clearing and equality of remunerations across sectors. Any other level of public employment would violate at least one of these conditions and would not be an equilibrium outcome.

We measure the corruption level x by the implicit "tax" rate on the production of the government good:

$$x = l_x/\nu.$$

Proposition 2 *If the elasticity of productivity to public spending is less than* $1/3$*, equilibrium corruption* x *is decreasing in productivity* $\bar{a}$ *and decreasing in the quality of institutions* ν*. GDP per worker is increasing in productivity* $\bar{a}$ *and increasing in the quality of institutions* ν*.*

Proof. Using the value of l_x and a from Proposition 1, we obtain:

$$x = 1 - \bar{a}^{\frac{2}{1-3\lambda}}\nu^{\frac{1+\lambda}{1-3\lambda}}, \tag{8}$$

which is clearly decreasing in $\bar{a}$ and in ν for $\lambda < 1/3$. The result for GDP per worker a are derived from Equation (5) . QED

Higher productivity a makes private activity more rewarded, decreasing the amount of time spent on corruption activities. This makes government spending more productive (the increase in productivity spreads over the public sector *via* the incentive constraint) and it raises the labor input in the government sector. Better institutions ν make corruption less profitable and increase the productivity of the government sector. This holds as long as the effect of government spending on productivity is not so strong to revert the results.

Let us now consider the problem of the donor agency, who has to allocate aid across different countries i. Taking a utilitarist perspective, the donor maximizes

$$\sum_i u(z_i) \text{ subject to } \sum_i z_i = \bar{z},$$

where $\bar{z}$ is the total amount of aid available and $u_i(z_i)$ is the utility of country i associated to aid z_i.[1] It is optimal to equalize the marginal utility of aid across countries. We assume that the utility function of each country is logarithmic and separable in c_i and g_i:

$$u_i = \ln(c_i) + \gamma \ln(g_i),$$

where c_i and g_i are given by (6) and (7) and where γ represents the relative weight of the government good. Optimal aid is obtained by equalizing this marginal utility across countries $u_i' = u_j' = \bar{u}$, $\forall i, j \in I$, where $\bar{u}$ is the marginal utility which can be achieved given the resource constraint.

Proposition 3 *If $\bar{a} > 2$ and $\nu < \bar{\nu}$, optimal aid z is a positive function of the quality of institutions ν and is a negative function of productivity a_i.*

Proof. The marginal utility of aid is given by:

$$u_i'(z_i) = \frac{\partial(\ln(c_i) + \gamma \ln(g_i))}{\partial z} = \frac{1}{c} = \frac{1}{a_i(1-2\nu_i) + z_i} = \frac{1}{(\bar{a}_i \nu_i^{2\lambda})^{\frac{1}{1-3\lambda}}(1-2\nu_i) + z_i}$$

Aid in country i is therefore:

$$z_i = \frac{1}{\bar{u}} + (\bar{a}_i \nu_i^{2\lambda})^{\frac{1}{1-3\lambda}}(2\nu_i - 1) \tag{9}$$

Under the conditions of the proposition, $\nu_i < 1/2$ and optimal aid is a negative function of productivity a_i. QED

[1] Alternatively we can have a formulation where the donor maximizes $\sum(u(z_i) - \rho z_i)$ where ρ is the cost of funds. This would lead to exactly the same results.

Appendix B - Descriptive Statistics

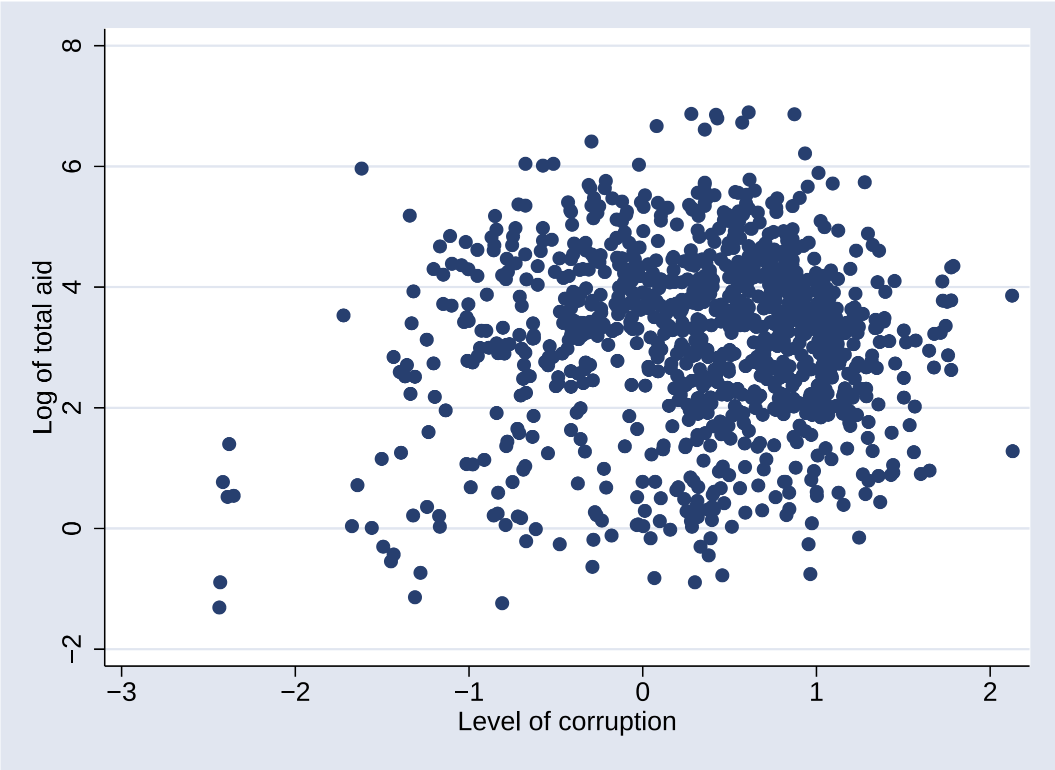

Figure 1: Aid and corruption in 159 countries between 1996 and 2005

Table 1: Descriptive statistics of the main variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Corruption	770	0.328	0.719	-2.437	2.130
Log total aid (in million dollars)	770	2.887	1.323	-1.309	5.965
Log GDP per cap.	770	8.186	1.075	5.144	10.417
Political stability	770	-0.376	0.889	-3.300	1.402
Voice and accountability	770	-0.353	0.807	-2.094	1.337
Rule of law	770	-0.350	0.745	-2.216	2.098
Government effectiveness	770	-0.289	0.731	-2.175	2.569
Regulatory quality	770	-0.200	0.807	-3.875	3.344

Table 2: List of countries studied

Albania	Comoros	India	Micronesia	Solomon Islands
Algeria	Congo	Indonesia	Moldova	Somalia
Angola	Congo, Dem. Rep.	Iran	Mongolia	South Africa
Antigua and Barbuda	Costa Rica	Iraq	morocco	Sri Lanka
Argentina	Croatia	Israel	Mozambique	St. Kitts and Nevis
Armenia	Cuba	Ivory Coast	Namibia	St. Lucia
Azerbaijan	Cyprus	Jamaica	Nepal	St. Vincent and the Grenadines
Bahamas	Czech Rep.	Jordan	Netherlands Antilles	Sudan
Bahrain	Djibouti	Kazakhstan	Nicaragua	Suriname
Bangladesh	Dominica	Kenya	Niger	Swaziland
Barbados	Dominican Rep.	Kiribati	Nigeria	Syria
Belarus	Ecuador	Korea, North	Oman	Tajikistan
Belize	Egypt	Kuwait	Pakistan	Tanzania
Benin	El Salvador	Kyrgyz Rep.	Panama	Thailand
Bermuda	Equatorial Guinea	Laos	Papua New Guinea	Togo
Bhutan	Eritrea	Latvia	Paraguay	Tonga
Bolivia	Estonia	Lebanon	Peru	Trinidad and Tobago
Bosnia-Herzegovina	Ethiopia	Lesotho	Philippines	Tunisia
Botswana	Fiji	Liberia	Poland	Turkey
Brazil	Gabon	Libya	qatar	Turkmenistan
Brunei	Gambia	Lithuania	Romania	Uganda
Bulgaria	Georgia	Macao	Russia	Ukraine
Burkina Faso	Ghana	Macedonia	Rwanda	U. Arab Emirates
Burundi	Grenada	Madagascar	Samoa	Uruguay
Cambodia	Guatemala	Malawi	Sao Tome and Principe	Uzbekistan
Cameroon	Guinea	Malaysia	Saudi Arabia	Vanuatu
Cape Verde	Guinea-Bissau	Maldives	Senegal	Venezuela
Central African Rep.	Guyana	Mali	Seychelles	Vietnam
Chad	Haiti	Malta	Sierra Leone	Yemen
Chile	Honduras	Mauritania	Singapore	Zambia
China	Hong Kong	Mauritius	Slovak Rep.	Zimbabwe
Colombia	Hungary	Mexico	Slovenia	