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## **Corruption and Openness**

by

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# Corruption and Openness\*

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## Abstract

We consider a neoclassical growth model with endogenous corruption. Corruption and wealth, which are co-determined in equilibrium, are shown to be negatively correlated. Richer countries tend to be less corrupt, and corrupt economies tend to be poorer. This observation gives rise to the following puzzle: If poorer countries do indeed experience higher levels of corruption, and if indeed as suggested by a number of empirical studies corruption hampers growth, then how did rich countries, who were poor once, become rich? Our answer is simple. In the past, economies were mostly “closed” in the sense that it was difficult to transfer illicit money outside of the economy. In contrast, today’s economies are mostly open. In the relatively closed economies of the 19th century, the gains from corruption remained inside the country and became part of the economy’s productive capital. In contrast, in today’s open economies, corrupt agents smuggle stolen money abroad depleting their country’s stock of capital. We confirm this intuitive explanation by testing the hypothesis that the effect of corruption on wealth depends on the economy’s degree of openness using cross-country data.

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# 1 Introduction

Until recently the prevailing view among historians and social scientists was that “corruption, like adolescence, is a phase which countries go through before they reach maturity” (Williams, 2000, p. ix) In “mature” countries, so it was held, social, political, and judicial reforms combined to make corruption very rare. This rather optimistic view has now been replaced with the view that, at least in today’s developing economies, corruption is a serious obstacle to development. The cure to corruption, so it is still believed, is in development, but development may be stalled in a corrupt economy. Poor economies are thus caught in a vicious cycle: high corruption leads to poverty, which generates yet more corruption, and so on.<sup>1</sup>

This pessimism is difficult to reconcile with the observation that many of today’s developed economies experienced widespread corruption during their history. Theobald (1990), for example, describes the widespread corruption of state legislatures and city governments during the “gilded age” of 1860s and 1870s in the U.S. (see also Josephson, 1934, and Callow, 1966). In England, corruption was so severe at times that Wraith and Simkins (1963), for example, write “The settlements of 1660 and 1688 inaugurated the Age of Reason, and substituted a system of patronage, bribery, and corruption for the previous method of blood-letting” (p. 60). Indeed, Bardhan (1997, p. 1328) notes that “Historians [...] point to many cases when a great deal of corruption in dispensing licenses, or loans, or mine and land concessions has been associated with (and may have even helped in) the emergence of an entrepreneurial class.” What is it then that makes present corruption so much more harmful to development than past corruption? Why is corruption said to stall development in many of today’s developing economies, but not in the developing economies of one or more centuries ago?

We present a simple theory that provides an explanation for this puzzle and is consistent with a number of other stylized facts about the relationship between corruption and growth. We consider a neoclassical growth model with endogenous corruption. Corruption is modeled

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<sup>1</sup>Bardhan (1997) for example writes “it is probably correct to say that the process of economic growth ultimately generates enough forces to reduce corruption” (p. 1329). But, as Williams (2000) cautions, because “the ‘take off’ phase of economic growth seen as necessary for [...] development had not materialized. [...] It is no longer legitimate to assume that development would resolve the multiple problems besetting the South (p. ix)

as follows. State officials may steal part of tax revenues which the government is using to finance the provision of a public good. An official that is caught stealing loses his job and with it his income, which is higher in richer countries. Consequently, in richer countries officials are less inclined to steal and corruption is lower. The government anticipates the level of corruption and in every period sets the tax rate to maximize the discounted present value of output. For a large set of parameter values, at least two stable steady-state equilibria are shown to exist, one with a high level of wealth and a low level of corruption, and another with a low level of wealth and a high level of corruption. Wealth and corruption are thus co-determined in equilibrium. Furthermore, the long run behavior of the economy depends on its initial conditions. Wealthy economies grow and converge to a steady-state with a high level of capital and a low level of corruption, while poor economies are trapped in a vicious circle in which high levels of corruption lead to low output, which generates yet more corruption, and so on.

This relationship between wealth and corruption is consistent with the documented negative relationship between countries' wealth and levels of corruption (see, e.g., Hall and Jones, 1999, Kaufmann et al., 1999, and LaPorta et al., 1999).<sup>2</sup> Surprisingly, although a lot of attention has been devoted to the effect of corruption on wealth and growth,<sup>3</sup> and to the causes for corruption,<sup>4</sup> less has been written on the effect of wealth and growth on corruption.<sup>5</sup>

As mentioned above, the negative relationship between corruption and wealth gives rise to the following puzzle: If poorer countries do indeed experience higher levels of corruption, and if indeed as suggested by a number of empirical studies (Mauro, 1995, and others), corruption hampers growth, then how did rich countries, who were poor once, become rich? Our answer

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<sup>2</sup>Of related interest is Paolo Mauro's (1995) study which finds a significant negative correlation between corruption and the investment rate or the rate of growth. See also Tanzi (1998) and Mo (2001).

<sup>3</sup>See, e.g., Ehrlich and Lui (1999), Barreto (2000), Sarte (2001), Tanzi (1998), and Ventelou (2002).

<sup>4</sup>See, e.g., Easterly and Levine (1997), La Porta et al. (1999), and Treisman (2000). Factors that have been found to contribute to corruption include ethnic fragmentation, proximity to the equator, the use of French or socialist laws, and a large number of Catholic or Muslim citizens. Countries with Protestant traditions, histories of British rule, and higher imports, were found to be less corrupt.

<sup>5</sup>La Porta et al. (1999) find that poor countries tend to be more corrupt, and Treisman (2000) reports a negative relationship between economic development and corruption. Bardhan (1997) observes that "Although the requisite time series evidence in terms of hard data is absent, circumstantial evidence suggests that over the last 100 years or so corruption has generally declined with economic growth in most rich countries" (p. 1329).

is very simple. Corruption is disruptive for two main reasons. First, corruption causes inefficient distortion of market activities. Second, resources that were obtained through corrupt activities are diverted outside of the economy, which depletes the economy's stock of capital. We argue that the latter effect is perhaps even more important than the former. In the past, economies were mostly "closed" in the sense that it was difficult to transfer illicit money outside of the economy. In contrast, today's economies are mostly open. In the relatively closed economies of the 19th century, the gains from corruption remained inside the country and became part of its productive capital. In contrast, in today's open economies, corrupt agents, who fear they may be caught and required to return the stolen money, smuggle it abroad depleting their country's stock of capital. Countries that are rich today were poor and corrupt once, but at a time where most of the world was composed of closed economies. Now, of course, the situation is very different. This insight can also help explain the otherwise puzzling flow of capital from poor to rich countries, which conflicts with the predictions of conventional neoclassical growth theories according to which capital should flow from rich economies where the return to capital is relatively low to poor economies where the return to capital is relatively high (see, e.g., Lucas 1990).

We test the hypothesis that the effect of corruption on wealth depends on the economy's degree of openness using cross-country data. To proxy for openness, we use the newly collected classification of countries compiled by Wacziarg and Welch (2002). Like the widely used Sachs-Warner (1995) index, Wacziarg and Welch classify countries as open or closed based on the black market premium, the level of tariffs, whether the country is socialist, and the presence of non-tariff barriers to trade or of an export marketing board. All these measures reflect to some extent the ease with which stolen money can be smuggled outside the country. We find strong empirical support for our principal claim. Our results indicate that in open economies there is a strong adverse effect of corruption on output, whereas in closed economies we do not find any evidence that corruption is harmful at all. These results are robust to various definitions of openness and subsamples, and persist even if one takes into account the possible endogeneity of the corruption variable and estimates the relationship via Instrumental Variables.

Another relevant observation is the recent critique of Rodriguez and Rodrik (2000) of the empirical literature that documents a positive relation between openness and growth. Rodriguez and Rodrik argue that in spite of the almost universal consensus about the benefits

of openness, careful econometric analysis does not indicate any positive relation between openness and growth. The results reported here, namely that openness may aggravate the adverse effects of corruption and therefore hamper growth is consistent with their finding.

The rest of the paper proceeds as follows. In the next section, we present the model. The model's predictions are described in Section 3. In Section 4 we describe our empirical methodology and data. The empirical results are presented in Section 5. Section 6 offers concluding comments.

## 2 The Model

We consider a dynamic one-sector economy with the production function

$$Y_t = A_t K_t^\alpha L^{1-\alpha} \quad 0 < \alpha < 1 \quad (1)$$

where  $A_t$  is a factor of productivity and  $K_t$  is capital at  $t$ , and  $L$  is labor.

Denote the total amount of (pre-tax) capital resources in the economy in period  $t$  by  $Q_t$ . The government taxes these resources and uses the proceeds to produce the common factor of productivity,  $A_t$ . However, corrupt bureaucrats steal part of the tax revenues which implies that less can be used to pay for the production of  $A_t$ .

Letting  $\tau_t$  denote the tax rate,  $c_t$  the total amount of resources stolen by bureaucrats, and  $\phi$  the proportion of stolen resources that are reinvested in the economy in period  $t$ ,  $A_t$  and  $K_t$  are given by the following equations,

$$A_t = (\tau_t Q_t - c_t)^\beta \quad \beta > 0. \quad (2)$$

$$K_t = (1 - \tau_t)Q_t + \phi c_t \quad 0 \leq \phi \leq 1. \quad (3)$$

Namely, in every period the government uses the collected taxes less the amount stolen,  $\tau_t Q_t - c_t$ , to produce the common factor of productivity  $A_t$ ; and the amount of the productive capital in the economy,  $K_t$ , is equal to the amount of after-tax resources,  $(1 - \tau_t)Q_t$ , plus the amount of stolen resources that are reinvested in the economy,  $\phi c_t$ . We assume that the rest of the stolen resources,  $(1 - \phi)c_t$ , are smuggled outside of the economy.

What determines the fraction of stolen resources that are reinvested in the economy,  $\phi$ ? We assume that  $\phi$  is negatively related to the economy's degree of openness. Our assumption is motivated by the following consideration. For a corrupt official, the advantage of smuggling

stolen resources outside the country is that in case he is caught, the authorities would not be able to retrieve the stolen money, whereas he may yet regain access to it after he completes his prison term. Smuggling stolen resources outside the country may also make their consumption less conspicuous, and therefore reduce the likelihood of getting caught. On the other hand, conventional wisdom suggests that investors strongly favor investment in their own country, where they have better information on investment opportunities (French and Poterba, 1991). In a more open country, the cost of smuggling stolen resources outside the economy is lower, and the net return on overseas investment is higher. We therefore expect that in open economies more stolen resources will be smuggled outside the economy than in closed economies; it follows that the proportion of stolen resources that are reinvested in the economy would tend to be higher in closed economies.<sup>6</sup>

To ensure that total return to capital in both the private and public sectors is decreasing, we require that the two parameters  $\alpha$  and  $\beta$  be such that

$$\alpha + \beta < 1.$$

Every period, a measure one of bureaucrats or state officials each choose an amount  $c_t$  of resources to steal that would maximize their expected utilities:

$$(1 - \pi(c_t)) u(w_t + c_t) \tag{4}$$

subject to the constraint

$$c_t \leq \tau_t Q_t. \tag{5}$$

The function  $u(\cdot)$  denotes the state officials' utility function;  $\pi(c_t)$  denotes the probability of getting caught as a function of the amount of resources stolen,  $c_t$ ; and  $w_t$  denotes state officials' wage rate. The utility function  $u(\cdot)$  is assumed to be non negative, increasing, and concave. State officials' utility when they are caught is normalized to zero. The probability of getting caught  $\pi(\cdot)$  is assumed to be increasing, differentiable, and convex on the interval  $[0, \bar{c}]$  for some  $\bar{c} < \infty$ , to be equal to one for all  $c \geq \bar{c}$ , to be equal to zero at zero, and to have a derivative of zero at zero. We assume that officials can only steal from the taxes they themselves have collected, which implies that  $c_t \leq \tau_t Q_t$ . Because all state officials are identical, they each steal the same amount  $c_t$ . The fact that there is a measure one of state

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<sup>6</sup>Indeed, Pastor (1990) finds that exchange controls reduce the extent of capital flight.

officials implies that  $c_t$  is also the total amount of resources stolen in the economy, and that each state official is responsible for the collection of  $\tau_t Q_t$  of tax revenues at  $t$ . For simplicity, we assume that the officials' wage rate in every period is proportional to the amount of resources in the economy in that period, or that  $w_t = \gamma Q_t$  for some fixed  $\gamma > 0$  for every  $t \geq 1$ . We refer to the amount stolen in period  $t$ ,  $c_t$ , as the level of corruption in the economy in period  $t$ .

In every period the government, who anticipates the amount stolen by its officials, sets the tax rate  $\tau_t$  to maximize the discounted value of future output.

Finally, the total amount of resources in the economy in period  $t + 1$  is equal to the amount of savings in period  $t$ . For simplicity we adopt the standard assumption that savings is a fixed proportion  $s \in (0, 1)$  of the total output, or that,

$$Q_{t+1} = sY_t. \tag{6}$$

### 3 Analysis

**Definition.** A sequence  $\{(Y_t, Q_t, A_t, \tau_t, c_t)\}_{t \geq 1}$  is a competitive equilibrium of the economy if it satisfies equations (1)-(3), (6), and is such that for every  $t \geq 1$ ,  $c_t$  is chosen optimally by state officials given  $Q_t$  and  $\tau_t$ , and  $\tau_t$  is chosen optimally by the government given  $Q_t$  and  $c_t$ .

#### 3.1 Analysis of Period $t$

For every level of  $Q_t$  and  $\tau_t$ , denote the state officials' optimal choice of corruption by  $c(Q_t, \tau_t)$ . As shown by Lemma 1 below, the amount of resources stolen in every period, decreases as the economy becomes richer.<sup>7</sup>

**Lemma 1.** *There exists a level of resources  $\underline{Q} > 0$  such that in every period  $t \geq 1$ , for  $Q_t \leq \underline{Q}$ , state officials' optimal choice of corruption is given by  $c(Q_t, \tau_t) = \tau_t Q_t$  for every  $\tau_t \in [0, 1]$ . For  $Q_t > \underline{Q}$ ,  $c(Q_t, \tau_t)$  declines continuously in  $Q_t$  and is independent of the tax rate  $\tau_t$  except in case where it is so small that state officials would want to set  $c_t > \tau_t Q_t$*

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<sup>7</sup>This is consistent with the empirical findings of Van Rijckeghem and Weder (2001) who show that corruption is decreasing in the wage paid to state employees (which, in our model, is assumed to be increasing in  $Q_t$ ).



if they could. In this case, because  $c_t$  is constrained to be smaller than or equal to  $\tau_t Q_t$ ,  $c(Q_t, \tau_t) = \tau_t Q_t$ .

The reason that corruption declines with output is very simple. Higher wages reduce the marginal utility from corruption, and therefore, higher wages reduce the incentive of government bureaucrats to steal. Hence, our assumption that state officials' wages are proportional to output implies that bureaucratic corruption is lower in richer countries. In very poor economies, that is when  $Q \leq \underline{Q}$ , the marginal utility from corruption is so high and tax revenues are so low that all tax revenues are stolen.

As mentioned above, in every period, the government, who anticipates the level of corruption, determines the tax rate  $\tau_t$  so as to maximize the discounted present value of output.

**Lemma 2.** *In equilibrium, if  $Q_t > \underline{Q}$  and the government expects the level of corruption to be equal to  $c_t = c(Q_t, \tau_t)$ , then it sets the tax rate equal to*

$$\tau(Q_t, c_t) = \frac{\beta}{\alpha + \beta} + \frac{(1 + \phi)\alpha}{\alpha + \beta} \cdot \frac{c_t}{Q_t}; \quad (7)$$

*if  $Q_t \leq \underline{Q}$ , then the government is indifferent among all tax rates  $\tau_t \in [0, 1]$ .*

Lemma 2 implies that greater corruption leads to higher tax rates. This is because the government anticipates the loss of revenues caused by corruption and reacts to it by raising the tax rate. However, if the economy is so poor that all the tax revenues will anyway be stolen, then the tax rate becomes immaterial.

Three remarks are in order. First, if  $Q_t > \underline{Q}$ , then the government sets the tax rate  $\tau_t$  in such a way that  $c_t < \tau_t Q_t$ .

Second, by construction, taxes in our model are not distortionary. If they were, as they usually are in practice, then corruption would have caused an additional harm by inducing higher tax rates.

Third, whenever,  $Q_t > \underline{Q}$ , corruption affects output only through its effect on the level of capital flight. In the extreme case in which the economy is completely closed and  $\phi = 1$ , the level of corruption has no effect on equilibrium at all. To see this, suppose that if there was no corruption ( $c = 0$ ), then the government would have set the tax rate optimally at  $\tau^* = \frac{\beta}{\alpha + \beta}$ , with the resulting levels of  $A^* = (\tau^* Q)^\beta$  and  $K^* = (1 - \tau^*)Q$ . If  $\phi = 1$ , then given any corruption level  $c$ , setting  $\tau = \tau^* + c/Q$  generates the same values of  $A^*$  and  $K^*$ , as in the economy without corruption.

## 3.2 The Dynamics

In equilibrium, the state of the economy at date  $t$  is completely determined by the value of  $Q_t$ . In order to study the dynamics of the economy, it is convenient to express  $Q_{t+1}$  in terms of  $Q_t$ . Equations (1)-(3), (6) imply that  $Q_{t+1} = f_\phi(Q_t)$  where  $f_\phi(\cdot)$  is given by:

$$f_\phi(Q_t) = s(\tau_t Q_t - c_t)^\beta ((1 - \tau_t) Q_t + \phi c_t)^\alpha L^{1-\alpha} \quad (8)$$

where  $c_t = c(Q_t, \tau_t)$  and  $\tau_t$  is given by (7). The following lemma describes the properties of  $f_\phi(Q_t)$ .

**Lemma 3.** *The function  $f_\phi(\cdot)$  has the following properties:*

1.  $f_\phi(\cdot)$  is continuous;
2. For  $Q \in [0, \underline{Q}]$ ,  $f_\phi(Q) = 0$ ;  $f_\phi(\cdot)$  is strictly increasing on  $[\underline{Q}, \infty)$ ;
3.  $f_\phi(Q)$  tends to infinity with  $Q$ ;
4. The derivative of  $f_\phi(Q)$  tends to zero as  $Q$  tends to infinity.

The properties of  $f_\phi(\cdot)$  imply that, generically, there are two possibilities. Either the entire graph of  $f_\phi$  lies below the  $45^\circ$  line, in which case there is a unique steady-state equilibrium at  $Q = 0$ ; or  $f_\phi$  crosses the  $45^\circ$  line at least twice in which case there are at least two stable steady-states, one at zero and the other at some  $Q^* > 0$ . In the latter case, the equilibrium to which the economy converges depends on the initial value  $Q_1$ . Note that  $f_\phi(\cdot)$  increases as the probability of getting caught,  $\pi$ , increases. In the extreme case where  $\pi(0) = 1$ , there is no corruption and our model becomes very similar to the standard Solow model. Note also that  $f_\phi(\cdot)$  is increasing in  $\phi$ . This is due to the fact that, for simplicity, we focus our attention only on the negative effects of openness (namely, the facilitation of capital flight) while ignoring its benefits.

## 4 Methodology and Data

### 4.1 Methodology

The theoretical model described in the previous sections generates an easily testable empirical implication. Output per worker should be negatively related to corruption in open economies,

while there should be no such relationship in closed economies. Assume that we have a continuous measure of corruption and a binary indicator of openness, that takes on the value of 1 for open countries, and zero for closed countries. Then, one could run regressions of log GDP per capita on the corruption index, separately for open and closed countries, and test whether the coefficient on the corruption variable is significantly different from zero, and whether it is significantly more negative in the open country sample. A more efficient way of testing the theory is by pooling all countries together, and estimating the following regression:

$$\ln GDP_i = \beta_0 + \beta_1 CORRUPTION_i + \beta_2 OPEN_i + \beta_3 CORRUPTION_i \times OPEN_i + \gamma' X_i + \varepsilon_i, \quad (9)$$

where  $GDP_i$  is GDP per capita in country  $i$ ,  $X_i$  is a vector of other observed determinants of output, and  $\varepsilon_i$  is an error term capturing measurement error and unobserved determinants of output. This regression implies that for closed countries, the relationship between output per capita and corruption is

$$\ln GDP_i = \beta_0 + \beta_1 CORRUPTION_i + \gamma' X_i + \varepsilon_i,$$

whereas for open countries the relationship is

$$\ln GDP_i = (\beta_0 + \beta_2) + (\beta_1 + \beta_3) CORRUPTION_i + \gamma' X_i + \varepsilon_i.$$

Therefore, according to our model,  $\beta_1$  should be indistinguishable from zero, while  $(\beta_1 + \beta_3)$  should be negative and significant.

Several points in our econometric specification deserve special comment. First of all, we focus on levels of income per capita rather than growth rates. This is in accordance with the theoretical model, and also follows recent work by Hall and Jones (1999) and Kaufmann et al. (1999). One can justify this approach by noting that levels, and not growth rates, capture fundamental cross-country differences in consumption, and hence in welfare levels. In addition, the theoretical literature on growth predicts that in the long run all countries should grow at the same rate, so that cross-country differences in growth are by their nature transitory (Mankiw, Romer and Weil, 1992; Barro and Sala-i-Martin, 1992). This prediction is confirmed by the finding in Easterly et al. (1993), who find that growth rates are weakly correlated across decades.

Second, the issue arises as to whether one should include other determinants of output on the right hand side of equation (9). On the one hand, if one views the equation as a true long run relationship, it makes little sense to control for variables (such as stocks of physical and human capital, the size of government, the rate of inflation, etc.) that are themselves the endogenous outcomes of the process of economic development. This is the approach taken by Hall and Jones (1999), who did not include any additional variables to their specification other than in their final table. On the other hand, it may be hard to believe that corruption and openness are the sole determinants of economic outcomes, and one may be interested in whether the relationship postulated in the theoretical section holds up or within a given subset of countries classified by geography or by their initial stocks of capital. Therefore, we present results both with and without additional control variables: in any case, the models with control variables are extremely parsimonious, and include only continent dummies and the stock of human capital measured by the total years of schooling attained by the population aged 25 and over.

We must also address the potential endogeneity of corruption and economic development. In the model, corruption and output are jointly determined, so that one cannot assign a causal interpretation to the OLS estimates of equation (9). Moreover, since corruption is only imperfectly measured, the OLS estimates suffer from attenuation bias as well as simultaneity bias. Both biases can be addressed if we have exogenous instruments that are correlated with corruption but uncorrelated with the error term in equation (9). The existing literature has suggested at least three different sets of instruments for corruption.

Mauro (1995) and Alesina et al. (2003) argue that societies that are more ethnically or linguistically fractionalized have more corrupt governments, as bureaucrats may have larger incentives to steal money to favor members of their own group. Since the degree of ethnic and linguistic fractionalization is to a large extent determined by the arbitrary straight-line borders traced by colonial powers in the past, it seems reasonable to assume that this variable is uncorrelated with the disturbance in today's output equation.

Hall and Jones (1999) and Kaufmann et al. (1999) instrument social infrastructure using the fraction of the population who speaks English and other major European languages as their mother tongue. The underlying idea for these instruments is that countries where the extent of Western European influence was greater were more likely to adopt a social and economic infrastructure that was favorable for economic development: protection of

property rights, a system of checks and balances in government, the free-market ideas of Adam Smith. Moreover, factors that attracted Western European colonizers five centuries ago (an abundance of natural resources, sparse population) seem unlikely to be correlated with unobserved determinants of productivity today.

Finally, LaPorta et al. (1999) show that the quality of government is strongly related to a country's legal origins: countries with a French or socialist legal system tend to have lower quality government, relative to countries with an English common law, and hence, more corruption, less protection of property rights, a higher regulatory burden, and less efficient provision of essential public goods. LaPorta et al. argue that English common law, which developed as a reaction of Parliament and property owners to attempts by the sovereign to expropriate them, is more conducive to good governance; on the other hand, French civil law, which developed as an instrument to build the state and expand the sovereign's power, will by its nature restrict individuals' property rights; socialist law is an extreme case of the State creating institutions that protract the Communist party's hold on power, without much respect for individual's rights and freedoms. Once again, in using the legal origin dummies as instruments, we assume that the only effect of legal origins on present output is through their effect on the quality of government.

We therefore use these three sets of instruments to obtain IV estimates for the parameters of equation (9). Since the endogenous variable, corruption, enters both linearly and interacted with the openness variable, the instruments will also be interacted. We now proceed to the description of our variables.

## 4.2 Data

Our goal in collecting the data is to create as large a sample as possible that includes information on GDP per capita, the level of corruption, and openness. Therefore, we collect data from several sources. The variables and their sources are summarized in Table 1.

Our main measure of economic development is the 1995-1999 average of GDP per capita in current U.S. dollars evaluated at purchasing power parity, and is taken from the 2001 World Bank Development Index CD-Rom. Altogether, GDP per capita is available for 165 countries and dependencies.

As our measure of corruption we use the newly created data set of Kaufmann, Kraay and Zoido-Lobatón (1999, henceforth KKZ). KKZ use a variety of indicators collected by

international organizations, political and business rating agencies, think tanks and non-governmental organizations to construct six broad aggregates that measure governance in the 1990s. One of these aggregates, which KKZ refer to as “graft”, measures perceptions of corruption. Corruption can be easily defined using the conventional definition: the exercise of public power for private gain. The various sources used by KKZ examine somewhat different aspects of corruption, ranging from “corruption of public officials,” “effectiveness of anticorruption initiatives,” “corruption as an obstacle to business,” “frequency of ‘additional payments’ to ‘get things done,’ ” “mentality regarding corruption,” and the “effect of corruption on the attractiveness of a country as a place to do business.” The KKZ index is standardized so as to have mean zero and standard deviation of one in the sample. High values of the index represent good governance, that is, low corruption. We multiply the index by -1 so that, consistent with our terminology throughout the paper, countries with a high value of the *CORRUPTION* variable are indeed more corrupt. Overall, the corruption index is available for 155 countries.

We classify countries based on their openness status in the 1990s using the newly created data set of Wacziarg and Welch (2002, henceforth WW). WW extend the Sachs-Warner index of openness to the 1990s, and also expand the list of countries for which the index is available to include the economies of Central and Eastern Europe and the newly independent states of the former Soviet Union. Countries are classified as open if they satisfy all the following five criteria: (1) the average of unweighted tariffs in the 1990-1999 period is lower than 40%; (2) the average of core non-tariff barriers on capital goods and intermediates is lower than 40%; (3) the average black market premium over the period is lower than 20%; (4) the country does not have an export marketing board; and (5) the country is not socialist. Note that some of the openness criteria capture the extent to which the country is open with respect to trade of physical goods, while others, such as the black market premium, have more to do with the degree of openness of financial markets. In our theoretical model, the openness variable,  $\phi$ , reflects the ease with which corrupt bureaucrats are able to transfer stolen funds abroad, and is therefore related primarily to the openness of financial markets. Therefore, one could argue that the black market premium alone captures more accurately our theoretical concept. In our basic regressions we will use the conventional definition of openness that aggregates all five criteria, but we will present separate results using only the black market premium as the basis for our openness dummy. Altogether, openness status is

available for 141 countries.

We collect data on countries' legal origins from LaPorta et al. (1999), and use the data set in Alesina et al. (2003) to construct the other instruments: percentage English and European language speakers, as well as ethnic and linguistic fractionalization. Data on educational attainment of the population aged 25 and over is taken from Barro and Lee's (1996) data set.

We end up with a sample of 133 countries for which data is available on GDP per capita, corruption and openness. The list of countries, classified by their openness status and their degree of corruption is presented in Table 2. As can be seen, all closed countries with the exception of Estonia are characterized by at least a medium degree of corruption. On the other hand, open economies exhibit a wide range of corruption levels. Most OECD countries are open and are characterized by low corruption. Interestingly, corruption does not seem to be confined to any particular geographic region. Countries with low levels of corruption can be found in Sub-Saharan Africa (Botswana), Central America (Costa Rica, Trinidad and Tobago), East Asia (Hong Kong, Malaysia, Singapore, Taiwan) and among the transition economies of Central and Eastern Europe (Slovenia, Hungary). At the same time, these regions also have worthy representatives among the list of highly corrupt countries.

Summary statistics for all of our variables are presented in Table 3.

## 5 Results

The main point of the paper is best illustrated by Figure 1 below.

In the top panel (Figure 1a) we present a scatter plot of log GDP per capita in the 1995-1999 period on our index of corruption among countries that were classified as open in the 1990s according to Wacziarg and Welch (2002). There is clearly a very strong negative relationship between economic development and corruption among open economies: the simple regression coefficient is  $-0.95$ , its associated t-statistic is  $-14.93$ , and corruption alone explains more than 70 percent of the variance in log income. On the other hand, there is essentially no correlation at all between corruption and GDP per capita in closed economies (Figure 1b): the regression coefficient is statistically indistinguishable from zero, and corruption explains less than one percent of the variance in log income. The graphical contrast between open and closed economies is not simply an artifact of the scales used:

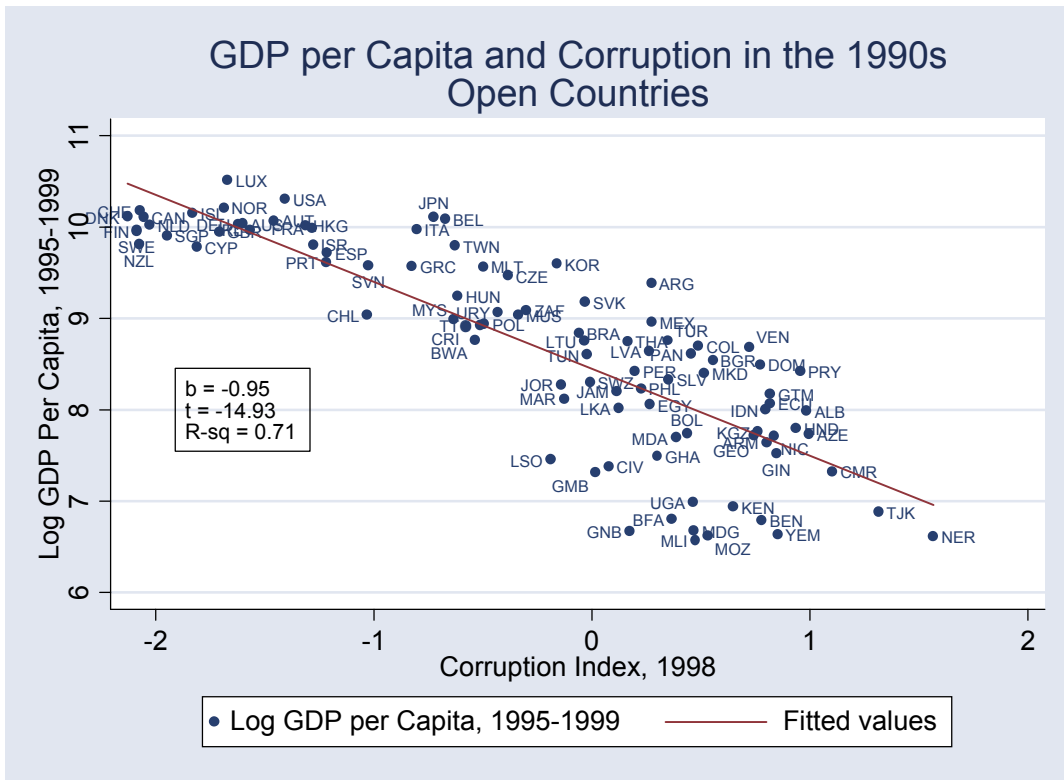


Figure 1a: Corruption and Economic Development – Open Countries

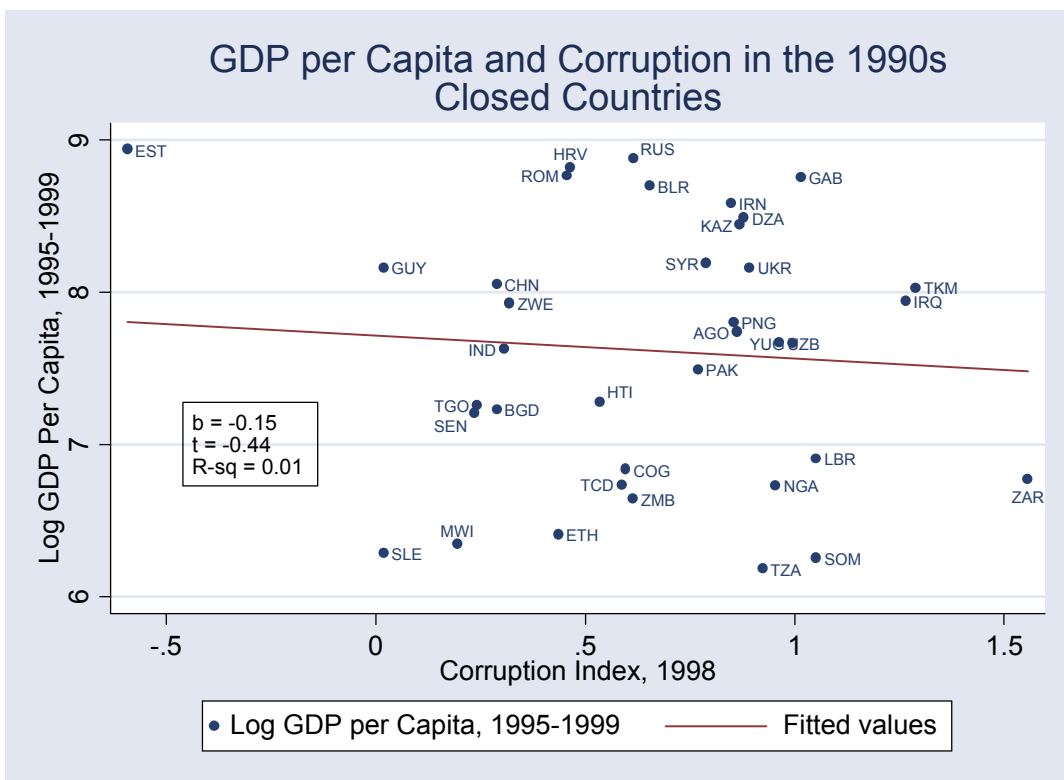


Figure 1b: Corruption and Economic Development – Closed Countries



in fact, had we expanded the scale of the horizontal axis among closed economies to the whole range of corruption values present in open countries, the line would have looked even more flat. Moreover, the very strong relationship between corruption and GDP among open countries does not depend simply on the inclusion of the rich, non-corrupt countries clustered in the top left-hand corner of the graph. If we had restricted the sample to countries with a higher degree of corruption than Estonia (the least corrupt of the closed countries), we still would have obtained a coefficient of  $-0.99$ , a t-statistic of  $-5.70$ , and an R-square of  $0.35$ . Overall, the graphical evidence is strongly supportive of our theory. We now proceed to test whether the simple relationships uncovered in the graphs are robust to a variety of different specifications and estimation techniques.

In Table 4 we present simple OLS estimates of equation (9). Column (1) of the table essentially replicates the regressions presented in Figure 1, but pools all countries together and adjusts standard errors by allowing for potential heteroskedasticity. The coefficient on corruption is small and indistinguishable from zero, whereas the coefficient on the interaction is negative and highly significant. We cannot reject the null hypothesis of no relationship between corruption and GDP among closed countries, but we strongly reject it among open countries. The size of the effect is also economically significant: if we attach to the coefficients a causal interpretation, an open economy with an average degree of corruption like Slovakia (corruption index =  $-0.03$ ) could see its GDP per capita rise by 158 percent if it could achieve the same quality of government as that of Slovenia (corruption index =  $-1.02$ ).

Column(2) of the table controls for regional differences in income per capita by including a set of continent dummies. The results are virtually unchanged: the effect of corruption on GDP is now basically zero in closed economies, while a one standard deviation increase in corruption lowers per capita income by 80 log points if the country is open. Column (3) controls for continent dummies and education in 1990. The sample shrinks to 95 countries, as the Barro-Lee data set does not have information on the newly independent states of Eastern Europe and the former Soviet Union, but the results are virtually unchanged: a one standard deviation in corruption lowers GDP per capita by about 49 log points, even for countries that are otherwise identical in terms of their geographic location and their stock of human capital. Finally, Columns (4) and (5) report the results of separate regressions for the sample of closed and open countries with the inclusion of continent dummies and years of education. We find that in open economies, the coefficient on corruption drops to

-0.45, but it is still highly statistically significant. In closed economies, the coefficient on corruption has the wrong sign, and is indistinguishable from zero.

In Table 5 we try several alternative specifications to test the robustness of the results. One possible concern with our classification of openness is that the Wacziarg-Welch measure is based on the average of the 1990s of its component variables. The 1990s saw a large number of developing countries move towards trade liberalization. If at the beginning of the period mostly rich and non-corrupt countries were open to trade, and during the 1990s poor countries with corrupt governments also liberalized, we would tend to find a negative relationship between GDP and corruption among open countries that has nothing to do with our theory on the joint determination of corruption and output. Therefore, in the first column we classify countries based on whether they were ever open based on the Sachs-Warner criteria between 1990 and 1992. As in Table 4, we find that the coefficient on corruption is essentially zero, while the coefficient on the interaction is negative and significant. In Column (2), we restrict the definition of openness to countries that had an average black market premium below 20 percent. This definition, which focuses on the degree of financial openness, reflects more closely the theoretical construct described in the model: the resulting coefficients are virtually unchanged relative to Table 4. In Column (3) we use data on corruption and openness from the 1970s and 1980s. Specifically, the corruption variable is taken from Mauro (1995), and as our openness variable we take the average between 1975 and 1984 of the Sachs-Warner dummies. The coefficient on corruption is insignificant, while the coefficient on the interaction has a t-statistic of 1.58. However, the hypothesis that the sum of the coefficients is equal to zero is soundly rejected: even in the 1980s, there existed a significant negative relationship between corruption and output, but only among open countries.

The next three columns of the Table restrict the sample along several dimensions. The exclusion of high income countries in column (4) has essentially no effect, neither qualitatively nor quantitatively, on our coefficients. In columns (5) and (6) we estimate the equation for African and Asian countries alone, and we still find either a zero or a positive relationship between corruption and output among closed economies, and a strong and significant negative relationship among open economies.

In Table 6 we address the issue of the potential endogeneity of the corruption variable. The first three columns of the Table present IV estimates of equation (9) where we control for

regional differences in GDP by including continent dummies. The instrument set is made up of legal origin dummies (column 1), the percentage in the population that speaks English and the percentage that speaks a major European language (column 2), and the degree of ethnic and linguistic fractionalization (column 3); in addition, the interaction of these variables with the openness dummy is also included in the instrument set. There is substantial variability in the coefficients on the corruption and the corruption-openness interaction, but this is probably due to the weak power of the instruments in the closed countries sample, which leads to highly imprecise estimates. In fact, in contrast to the wide range of estimates in the individual coefficients, the implied effect of corruption on log GDP in open economies (i.e., the sum of the two coefficients) ranges from  $-0.806$  to  $-1.157$ , a result very much in line with the OLS estimates of Table 4. In all three cases, the F test for the hypothesis that the sum of the coefficients is equal to zero is soundly rejected. The first stage F statistic is large in the first two specifications, whereas in column (3) it exceeds conventional significance values but is somewhat smaller than the “rule of thumb” value of 10, casting some doubts on the validity of the estimates. In all cases, we do not reject the over-identification test for the validity of the instruments. In column (4) we add log years of schooling to the list of control variables, and use the legal origin dummies as instruments.<sup>8</sup> The results are similar to those obtained using OLS: a one standard deviation in corruption lowers GDP per capita by 53 log points, holding constant the stock of human capital and geographic characteristics. Finally, columns (5) and (6) estimate separate IV regressions for open and closed countries, using the legal origin dummies as instruments. The coefficient on corruption for open countries is  $-0.39$ , significant at the 5.3 percent level, while the coefficient for closed countries is large, positive and marginally insignificant. However, this result is questionable given the very low value of the first stage F statistic in the closed countries sample.

Altogether, the IV results confirm the findings of Tables 4 and 5. In open economies, corruption is strongly negatively related to output. In closed economies, there is no such correlation.

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<sup>8</sup>Using the other two instrument sets in the specification with years of schooling yielded very low first stage F statistics, and the results are not reported.

## 6 Conclusions

Although the strong negative correlation between corruption and output suggests that corruption is harmful for growth there is little direct empirical evidence on why this might be the case. Our empirical findings point to one important channel through which corruption affects economic growth. We interpret our finding that corruption appears to have scarcely any effect on output in closed economies, and a strong negative effect on output in open economies, as suggesting that the main damage caused by corruption is due to its effect on capital flight. Rough estimates of the extent of capital flight, or more precisely, the accumulated stream of unreported capital outflows, reach the magnitude of the entire capital stock in many African and Latin American countries (see, Pastor, 1990; Boyce and Ndikumana 2001). The argument and evidence presented in this paper suggest that much of this capital outflow may have been illegally obtained. Our argument also explains the correlation between corruption and investment reported by Mauro (1995).

The argument advanced in this paper also explains why countries such as the United States, Britain, and France, which were riddled with corruption during large parts of their history did not seem to suffer from corruption economically as much as many of today's African and Latin American countries.

Finally, for simplicity, we have abstracted away from consideration of the advantages provided by openness. Since the negative effects which are attributed to openness in this paper are related to corruption, which is more prevalent in poor countries, it may be that openness may indeed be beneficial for richer countries where corruption tends anyway to be low, but not in poor countries. Wacziarg and Welch's (2002) findings that openness had beneficial effects in the 1980s but not in the 1990s, together with the fact that a large number of relatively poor countries opened up in the early 90s, supports this hypothesis.

## Appendix

**Proof of Lemma 1.** Inspection of the necessary and sufficient first-order condition of state officials' optimization problem reveals that  $c(Q_t, \tau_t)$  is implicitly given by the unique solution,  $c_t$ , of the following equation,

$$(1 - \pi(c_t)) u'(\gamma Q_t + c_t) = u(\gamma Q_t + c_t) \pi'(c_t), \quad (10)$$

provided it exists, or by  $\tau_t Q_t$ , whichever is smaller. The properties of  $u(\cdot)$  and  $\pi(\cdot)$  imply that  $c(Q_t, \tau_t)$  is continuous and nonincreasing in  $Q_t$ , and nondecreasing in  $\tau_t$ . The value  $\underline{Q}$  is given by the solution to the equation  $c_t(Q, 1) = Q$ . As  $Q_t$  tends to infinity,  $c(Q_t, \tau_t)$  tends to zero; and  $c(Q_t, \tau_t) = \tau_t Q_t$  for all sufficiently small values of  $Q_t$  and  $\tau_t$ . By (10),  $c(Q_t, \tau_t)$  is independent of  $\tau_t$  except in case where  $\tau_t$  is so small that state officials would want to set  $c_t > \tau_t Q_t$  if they could. In this case, because  $c_t$  is constrained to be smaller than or equal to  $\tau_t Q_t$ ,  $c(Q_t, \tau_t) = \tau_t Q_t$ . ■

**Proof of Lemma 2.** The size of the tax rate  $\tau_t$  has a direct effect on output only through its effect on  $y_t$ . As will become clear below when we specify the dynamics of the model,  $y_t$  is positively related to  $Q_{t+1}$  and so also to  $y_{t+1}$ . Similarly,  $y_{t+1}$ , in turn, is positively related to  $Q_{t+2}$  and so also to  $y_{t+2}$ , and so on. Therefore, choosing the tax rate  $\tau_t$  to maximize  $y_t$  would also maximize the discounted present value of output, regardless of which discount rate is chosen.

The government's objective in every period  $t$  may thus be limited to choosing the tax rate  $\tau_t \leq 1$  that maximizes the level of output  $y_t$  in period  $t$ , which, by (??)-(??) is given by

$$y_t = (\tau_t Q_t - c(Q_t, \tau_t))^\beta ((1 - \tau_t) Q_t + \phi c(Q_t, \tau_t))^\alpha. \quad (11)$$

Obviously, if it is at all possible, or whenever  $Q_t$  is sufficiently large, the government would set  $\tau_t > \frac{c_t}{Q_t}$ . In this case,  $\frac{\partial c(Q_t, \tau_t)}{\partial \tau_t} = 0$ , and so differentiation of (11) with respect to  $\tau_t$  and equating the derivative with zero yields (7). The second order condition for optimization is satisfied in this solution. When  $Q_t$  is not sufficiently large,  $c(Q_t, \tau_t) = \tau_t Q_t$  for every  $\tau_t \leq 1$  and so every  $\tau_t \in [0, 1]$  is optimal. ■

**Proof of Lemma 3.** (1) Continuity is a consequence of the continuity of  $c(Q_t, \tau_t)$  and  $\tau(Q_t, c_t)$ .

(2) By Lemma 1, for  $Q \leq \underline{Q}$ ,  $c(Q, \tau) = \tau Q$  for every tax rate  $\tau \leq 1$ , from which it follows that  $f_\phi(Q) = 0$ . To see that  $f_\phi$  is increasing for  $Q > \underline{Q}$ , note that if  $c$  declines from  $c_1$  to  $c_2$ , then the government can increase output from  $Y_1$  to  $Y_2$  by choosing  $\tau_2 = \tau_1 + \frac{c_1 - c_2}{Q}$ ,

$$\begin{aligned} Y_2 &= (\tau_2 Q_t - c_2)^\beta ((1 - \tau_2) Q_t + \phi c_2)^\alpha \\ &= (\tau_1 Q_t - c_1)^\beta ((1 - \tau_1) Q_t + \phi c_1 + (1 - \phi)(c_1 - c_2))^\alpha \\ &> Y_1. \end{aligned}$$

For  $Q > \underline{Q}$ , by Lemma 1,  $c$  declines with  $Q$  and is unaffected by  $\tau$ . Hence, an increase by  $Q$  reduces  $c$  in which case there exist  $\tau$  for which output increases.

(3) Follows from the fact that  $c(Q, \tau)$  is nonincreasing in  $Q$  and independent of the value of  $\tau$  when  $Q$  is large, and the fact that  $\tau(Q_t, c(Q_t))$  is decreasing in  $Q_t$ . Finally,

(4)  $f_0(Q_t)$  is bounded from above by  $sQ_t^\beta(Q_t + \phi c_t)^\alpha$  which has a derivative that tends to zero as  $Q_t$  tends to infinity. ■

## References

- Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., and Wacziarg, R. (2003). "Fractionalization," *Journal of Economic Growth*, 8(2), June 2003, pp. 155-194.
- Bardhan, P. (1997). "Corruption and Development: A Review of Issues," *Journal of Economic Literature* 35(3), 1320-1346.
- Barro, R. J. and Sala-i-Martin, X. (1992). "Convergence," *Journal of Political Economy* 100(2), 223-251.
- Barro, R. J. and J. W. Lee (1996) "International Measures of Schooling Years and Schooling Quality," *American Economic Review* 86(2), 218-23.
- Barreto, R. A. (2000). "Endogenous Corruption in a Neoclassical Growth Model," *European Economic Review* 44, 35-60.
- Boyce J. K., and Ndikumana L. (2001) "Is Africa a net creditor? New estimates of capital flight from severely indebted sub-Saharan African countries, 1970-96," *Journal of Development Studies* 38(2), 27-56.
- Callow, A. (1966) *The Tweed Ring*, Oxford University Press.
- Easterly, W., M. Kremer, L. Pritchett, and L. H. Summers (1993). "Good policies or good luck? Country growth performance and temporary shocks," *Journal of Monetary Economics*, 32(3) 459-483.
- Easterly, W. and R. Levine (1997) "Africa's growth tragedy: policies and ethnic divisions," *Quarterly Journal of Economics* 112, 1203-1250.
- Ehrlich, I., and F. T. Lui (1999) "Bureaucratic corruption and endogenous economic growth" *Journal of Political Economy* 107, S270-S293.
- French Kenneth R. and Poterba James M. (1991) "Investor diversification and international equity markets" *American Economic Review* 81 (May) 222-226.
- Hall, Robert E. and Jones, Charles I. (1999). "Why Do some Countries Produce so Much More Output per Worker than Others?" *Quarterly Journal of Economics*, 114(1), pp. 83-116.
- Josephson, M. (1934) *The Robber Barons*, Harcourt, Brace and Company, New York.
- Kaufmann, D., Kraay, A. and P. Zoido-Lobaton (1999) "Governance Matters," World Bank Policy Research Working Paper No. 2196 (Washington), [www.worldbank.org/wbi/governance/](http://www.worldbank.org/wbi/governance/).
- La Porta, R. Lopez-De-Silanes, F., Shleifer, A. and R. Vishny (1999) "The Quality of Government," *Journal of Law, Economics, and Organization* 15, 222-79.
- Lucas Robert, (1990), "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review* 80 (May) 92-96.

- Mankiw, G.N., Romer, D. and Weil, D.N. (1992). "A contribution to the empirics of economic growth," *Quarterly Journal of Economics* 107(2), 407-437.
- Mauro, P. (1995) "Corruption and Growth," *Quarterly Journal of Economics* 110, 681-712.
- Mo, P. H. (2001) "Corruption and economic growth," *Journal of Comparative Economics* 29, 66-79.
- Pastor, M., (1990), "Capital Flight from Latin America," *World Development* 18(1) 1-18.
- Rodriguez, F. and D. Rodrik (2000) "Trade policy and economic growth: a skeptic's guide to the cross-national evidence," Manuscript, University of Maryland and KSG, Harvard University.
- Sachs, J. D. and A. Warner (1995). "Economic Reform and the Process of Global Integration," *Brookings Papers on Economic Activity* 1, 1-95.
- Sarte, P. D. G. (2001) "Rent-seeking bureaucracies and oversight in a simple growth model," *Journal of Economic Dynamics and Control* 25, 1345-1365.
- Tanzi, V. (1998) "Corruption around the World – Causes, consequences, scope, and cures," *International Monetary Fund Papers* 45, 559-94.
- Theobald, R. (1990) *Corruption, development, and underdevelopment*. Durham, NC: Duke U. Press.
- Treisman, D. (2000) "The causes of corruption: a cross-national study," *Journal of Public Economics* 76, 399-457.
- Van Rijckeghem, C. and B. Weber (2001) "Bureaucratic corruption and the rate of temptation: do wages in the civil service affect corruption and by how much?" *Journal of Development Economics* 65, 307-31.
- Ventelou, B. (2002) "Corruption in a model of growth: political reputation, competition, and shocks," *Public Choice* 110, 23-40.
- Wacziarg, R. and K. H. Welch (2002). "Trade Liberalization and Growth: New Evidence." Unpublished Manuscript, Stanford University.
- Williams, R. (2000) "Introduction" in *Corruption in the developing world*, eds. R. Williams and R. Theobald, Edward Elgar, Cheltenham, UK.
- Wraith, D. and E. Simkins (1963) *Corruption in developing countries*. London: Allen and Unwin.



**Table 1: Variable Description and Sources**

<b>Variable</b>	<b>Description</b>	<b>Source</b>	<b>Availability</b>
Log GDP per capita, 1995-1999	GDP per capita in current US \$, at purchasing power parity	World Bank Development Index CD Rom, 2001	165 countries
Corruption, 1998	An aggregate of several indicators, collected by international organizations, political and business risk rating agencies, think tanks and non-governmental organizations, measuring “the exercise of public power for private gain.” The index is standardized to have mean 0 and standard deviation 1.	Kaufmann, Kraay and Zoido-Lobatón (1999).	155 countries
Corruption, 1982	An index for “the degree to which business transactions involve corruption or questionable payments,” collected by Business International, a private firm, during the period 1980-1983. The raw index is standardized to have mean 0 and standard deviation 1.	Mauro (1995)	68 countries
Wacziarg-Welch Openness Dummy, 1990-1999	A country is defined as open if all the following criteria are met: 1) the average of unweighted tariffs in the 1990-1999 period is lower than 40%; 2) the average of core non-tariff barriers on capital goods and intermediates is lower than 40%; 3) the average black market premium over the period is lower than 20%; 4) the country does not have an export marketing board; 5) the country is not socialist.	Wacziarg and Welch (2003)	141 countries

<b>Variable</b>	<b>Description</b>	<b>Source</b>	<b>Availability</b>
Sachs-Warner Openness Dummies 1975-1992	A country is defined as open in any given year if it meets all the following criteria: 1) the average of unweighted tariffs is lower than 40%; 2) the average of core non-tariff barriers on capital goods and intermediates is lower than 40%; 3) the black market premium is lower than 20%; 4) it does not have an export marketing board; 5) it is not socialist.	Sachs and Warner (1995)	110 countries
Years of Schooling	Log(1+total years of schooling of population aged 25 and over).	Barro and Lee (2000)	107 countries
Legal Origins	Dummies for whether the origin of the country's legal system is British (common law), French (civil law), German/Scandinavian (civil law) or socialist.	La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998)	207 countries
Percentage English Speakers	Percentage of the population who speaks English as their "mother tongue".	Alesina et al. (2002)	217 countries
Percentage European Language Speakers	Percentage of the population who speaks a major European language (English, French, German, Spanish, Portuguese) as their "mother tongue".	Alesina et al. (2002)	217 countries
Ethnic Fractionalization	A variable measuring the probability that two randomly selected individuals in the population belong to different ethnic groups. Calculated as one minus the Herfindahl index of ethnic group shares.	Alesina et al. (2002)	190 countries
Linguistic Fractionalization	A variable measuring the probability that two randomly selected individuals in the population speak the same "mother tongue". Calculated as one minus the Herfindahl index of language shares.	Alesina et al. (2002)	202 countries

**Table 2: List of Countries by Openness Status and Degree of Corruption**

	Low Corruption	Medium Corruption	High Corruption
Closed	<p>Estonia</p> <p><i>Total: 1 country</i></p>	<p>Bangladesh, China, Croatia, Ethiopia, Guyana, India, Malawi, Romania, Senegal, Sierra Leone, Togo, Zimbabwe.</p> <p><i>Total: 12 countries</i></p>	<p>Algeria, Angola, Belarus, Chad, Congo, Congo Democratic Republic (Zaire), Gabon, Haiti, Iran, Iraq, Kazakhstan, Liberia, Nigeria, Pakistan, Papua New Guinea, Russia, Serbia/Montenegro, Somalia, Syria, Tanzania, Ukraine, Uzbekistan, Zambia.</p> <p><i>Total: 24 countries</i></p>
Open	<p>Australia, Austria, Belgium, Botswana, Canada, Chile, Costa Rica, Cyprus, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Malaysia, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland, Taiwan, Trinidad and Tobago, United Kingdom, United States.</p> <p><i>Total: 35 countries</i></p>	<p>Argentina, Bolivia, Brazil, Burkina Faso, Colombia, Cote d'Ivoire, Czech Republic, Egypt, El Salvador, The Gambia, Ghana, Guinea-Bissau, Jamaica, Jordan, South Korea, Latvia, Lesotho, Lithuania, Madagascar, Mali, Malta, Mauritius, Mexico, Moldova, Morocco, Panama, Peru, Philippines, Poland, Slovak Republic, South Africa, Sri Lanka, Swaziland, Thailand, Tunisia, Turkey, Uganda, Uruguay.</p> <p><i>Total: 38 countries</i></p>	<p>Albania, Armenia, Azerbaijan, Benin, Bulgaria, Cameroon, Dominican Republic, Ecuador, Georgia, Guatemala, Guinea, Honduras, Indonesia, Kenya, Kyrgyzstan, FYR Macedonia, Mozambique, Nicaragua, Niger, Paraguay, Tajikistan, Venezuela, Yemen.</p> <p><i>Total: 23 countries</i></p>

**Notes:** Countries are defined to have low, medium, or high corruption based on the Kaufmann et al. (1999) graft index. Countries with an index smaller than  $-0.5$  are defined as low corruption, countries with an index between  $-0.5$  and  $0.5$  are defined as medium corruption, and countries with an index above  $0.5$  are defined as high corruption. The openness dummy is taken from Wacziarg and Welch (2003).

**Table 3: Summary Statistics**

	N	Mean	Standard Deviation	Minimum	Maximum
Log GDP per capita, 1995-1999	133	8.393	1.147	6.183	10.515
Corruption, 1998	133	-0.003	0.949	-2.129	1.567
Corruption, 1982	65	0.010	1.009	-1.254	2.264
Wacziarg-Welch Openness Dummy, 1990-1999	133	0.722	0.450	0	1
Sachs-Warner Openness Dummy, 1992	132	0.591	0.494	0	1
Sachs-Warner Openness Dummy, 1984	101	0.317	0.468	0	1
Log years of schooling, 1990	95	1.767	0.485	0.436	2.565
Legal Origin – English	133	0.271	0.446	0	1
Legal Origin – French	133	0.444	0.499	0	1
Legal Origin – Socialist	133	0.203	0.404	0	1
Legal Origin – German	133	0.045	0.208	0	1
Legal Origin – Scandinavian	133	0.038	0.191	0	1
Percentage English Speakers	133	0.064	0.226	0	0.984
Percentage European Language Speakers	133	0.250	0.402	0	1
Ethnic Fractionalization	132	0.444	0.262	0.002	0.930
Linguistic Fractionalization	131	0.393	0.296	0.002	0.923

**Note:** The full sample of 133 countries includes all countries with non-missing data on GDP per capita, corruption and openness in the 1990s based on the Wacziarg-Welch indicator.

**Table 4: Corruption, Openness, and Economic Development:  
Basic OLS Results**

	(1) Full Sample	(2) Full Sample	(3) Full Sample *	(4) Open Countries	(5) Closed Countries
Corruption	-0.151 (-0.42)	-0.013 (-0.05)	0.183 (0.76)	-0.450 (-6.02)	0.301 (0.95)
Corruption × Openness	-0.801 (-2.19)	-0.789 (-3.05)	-0.678 (-2.76)	-	-
Openness Dummy	0.732 (2.44)	0.585 (3.00)	0.805 (4.79)	-	-
Log Years of Schooling	-	-	0.836 (5.05)	0.957 (5.42)	0.887 (1.98)
Continent Dummies	No	Yes	Yes	Yes	Yes
F test for $\beta_{corruption} + \beta_{corr \times open} = 0$	342.71 (0.00)	261.53 (0.00)	43.51 (0.00)	-	-
N	133	133	95	74	21
$R^2$	0.6506	0.7989	0.8768	0.8789	0.5124

**Notes:** The dependent variable is the log of average GDP per capita between 1995 and 1999. Robust t-statistics in parentheses.

\* : The sample in column (3) is restricted to countries with non-missing education data.

**Table 5: Robustness Checks**

	(1) Sachs- Warner Openness Dummy	(2) Openness based on BMP alone	(3) 1980s	(4) Excluding High Income Countries	(5) Africa only	(6) Asia only
Corruption	0.032 (0.16)	0.234 (0.92)	-0.094 (0.90)	0.240 (0.93)	0.149 (0.43)	0.635 (2.15)
Corruption × Openness	-0.516 (-2.57)	-0.741 (-2.82)	-0.198 (1.58)	-0.735 (-2.63)	-0.816 (1.86)	-1.285 (-4.00)
Openness Dummy	0.618 (3.51)	0.792 (4.11)	0.119 (0.60)	0.759 (4.07)	0.874 (2.92)	0.632 (2.51)
Log Years of Schooling	0.937 (5.53)	0.881 (5.24)	1.067 (4.71)	0.807 (4.26)	0.977 (4.14)	1.356 (4.42)
Continent Dummies	Yes	Yes	Yes	Yes	No	No
F test for $\beta_{corruption} + \beta_{corr \times open} = 0$	34.82 (0.00)	41.29 (0.00)	9.22 (0.00)	19.18 (0.00)	5.79 (0.03)	26.36 (0.00)
N	94	95	54	66	26	19
$R^2$	0.8715	0.870	0.7752	0.7284	0.6311	0.8820

**Notes:** The dependent variable is the log of average GDP per capita between 1995 and 1999. Robust t-statistics in parentheses.

\*: In all columns, the sample is restricted to countries with non-missing education data.

**Table 6: Instrumental Variables Estimates**

	(1) Full Sample	(2) Full Sample	(3) Full Sample	(4) Full Sample*	(5) Open Countries*	(6) Closed Countries*
Corruption	2.690 (1.22)	0.318 (0.89)	-3.026 (-1.27)	1.152 (1.35)	-0.391 (-1.93)	1.170 (1.60)
Corruption × Openness	-3.557 (-1.59)	-1.124 (-2.95)	1.869 (0.79)	-1.678 (-1.87)	-	-
Openness Dummy	2.280 (1.59)	0.793 (3.92)	-1.404 (-0.92)	1.384 (2.73)	-	-
Log Years of Schooling	-	-	-	0.825 (3.23)	1.040 (3.19)	0.912 (2.10)
Continent Dummies	Yes	Yes	Yes	Yes	Yes	Yes
F test for $\beta_{corruption} + \beta_{corr \times open} = 0$	94.86 (0.00)	90.10 (0.00)	31.93 (0.00)	9.08 (0.00)	-	-
<i>N</i>	133	133	130	95	74	21
List of Instruments	Legal origin dummies, and interactions with openness dummy	Pct. English and European language speakers, and interactions with openness dummy	Ethnic and Linguistic Fractionaliza tion, and interactions with openness dummy	Legal origin dummies, and interactions with openness dummy	Legal origin dummies	Legal origin dummies
First Stage F- test: Corruption	25.36 (0.000)	8.32 (0.000)	4.43 (0.002)	6.44 (0.000)	6.46 (0.001)	1.74 (0.214)
First Stage F- test: Corruption × Openness	27.58 (0.000)	8.69 (0.000)	5.25 (0.001)	6.81 (0.000)	-	-
Overid. Test	1.348 (0.717)	2.529 (0.282)	0.277 (0.871)	6.494 (0.090)	4.580 (0.101)	0.000

**Notes:** The dependent variable is the log of average GDP per capita between 1995 and 1999. Robust t-statistics in parentheses.

\* : The sample in columns (4), (5), and (6) is restricted to countries with non-missing education data.

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