IMF Staff Papers
Vol. 50, No. 2

Resources and Incentives to Reform

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This paper models the incentives for a self-interested government to implement "good policies." While good policies lead to investment and growth, they also reduce the government's ability to reward its supporters. The model predicts that resource abundance leads to poor policies and, consequently, to low investment. The implications of the model are broadly supported by existing evidence. In particular, countries that are rich in natural resources tend to have low institutional quality and poor macroeconomic and trade policies. [JEL D72, Q32]

Recent literature has attributed the low rates of investment and growth observed in many African countries to a combination of poor infrastructure and bad policies and institutions, such as insufficient economic liberalization, an unstable macroeconomic environment, and poor political and legal frameworks (see Easterly and Levine, 1997, and Collier and Gunning, 1999). This has been compounded with a view that undemocratic governments might not be inclined to implement reforms and establish public investment programs (see Ndulu and O'Connell, 1999). Some studies (Sachs and Warner, 1997, 1999) have emphasized the adverse effects of natural resources, while others have questioned the effectiveness of foreign aid in stimulating economic development in poor countries (Tsikata, 1998, and Dollar and Easterly, 1999).

The purpose of this paper is to provide a simple unifying explanation for these facts. In particular, we consider a self-interested government's incentives for reform showing that the availability of resources, such as unconditional foreign

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aid and natural resources, discourages the adoption of "good policies" and eventually hampers investment and growth.

We focus on the incentives of self-interested governments to act in ways that are in the interest of society.[1] We consider a dictatorial government that has two alternatives. It can either choose to keep "bad policies," concentrating on loot-seeking activities that exploit the country's resources, or adopt "good policies," conceding some economic liberalization and investing in infrastructure, so as to encourage investment and growth. From the government's point of view, the benefits of reforms are a *larger* national surplus, which can partly be appropriated by those in power. However, good policies are costly to such a government, since lower taxation, lower tariffs, less state control of the economy, etc., tend to reduce the fraction of national surplus that the ruling elite can extract. We show that an autocratic government will have less incentive for reform when the country's resources are abundant. This result has relevant implications for the effects of natural resource shocks and foreign aid on reform plans. In particular, the ruling elite will react to positive resource shocks by implementing bad policies that allow for increased surplus appropriation.[2]

The implications of our model are related to other works. A number of studies concentrate on the impact of aid and natural resources on growth in countries ruled by an elite. Boone (1996) shows that aid is mostly wasted in elitist regimes. Tornell and Lane (1999) argue that windfalls increase the rent-seeking behavior of powerful groups, reducing growth. Under similar assumptions, Svensson (2000a) shows that foreign aid and natural resource shocks tend to reduce the provision of public goods. Unlike ours, these papers do not explicitly analyze the incentive for the incumbent government to implement "good policies." An exception is that of Svensson (1998), who develops a model in which insecure property rights hamper private investment. In examining a government's incentive to invest in "legal infrastructure," Svensson shows that political instability discourages reforms of the legal system. This model has two main differences from ours. First, it crucially builds on "political risk." Second, although it focuses on the incentives for reform, it is not directly concerned with the role of natural resources or international aid on the behavior of governments.

Several papers concentrate on the political effect of reforms. Acemoglu and Robinson (1998, 1999, 2001) consider the pressure to democratize imposed on the ruling elite by the threat of a revolution. By contrast, Robinson (1999) develops a formal model in which an autocratic government may avoid supplying public goods so as to reduce the likelihood of "collective actions," such as revolutions, by citizens. Similar arguments are put forward by La Ferrara (1996) and Wantchekon (2000). In particular, Wantchekon argues that authoritarian governments use resource windfalls to "buy off" potential opponents and strengthen their own power. Those papers rely on different, and often opposite, assumptions about the

[1] See McGuire and Olson (1996).

[2] Since the basic model hinges on a deep divergence of interests between the dominating group and the rest of society, our approach bears some similarities to agency theories of corporate governance: see Shleifer and Vishny (1997). Without pushing the analogy too far, one can think of the incumbent government as self-interested management that faces dispersed shareholders (the society).

relationship between political support and reforms. In contrast, we show that the results of our model hold regardless of whether good policies strengthen or weaken support for the incumbent government.

We also survey the empirical evidence on the relationship between economic performance, quality of policies, and resource abundance. The predictions of the model are widely supported. In particular, the existing evidence suggests that (i) the quality of policies has relevant effects on economic performance and (ii) resource abundance reduces the incentives to implement "good policies."

I. The Model

We start by considering the basic case of a dictatorial government. We then analyze the impact of aid on policies and investigate possible remedies to encourage reform. We also consider some extensions to the basic model.

Dictatorial Government

We consider a country that has a net endowment of $Z = R + A$, where R denotes natural resources, such as revenues from primary commodities, and A the amount of donations received from abroad. Society is composed of $n \geq 2$ equally sized groups. In the simpler version of the model, we suppose that the country is ruled by a government that is only interested in the welfare of its particular group[3] and its objective function is given by

$$U(C_i) = C_i, \tag{1}$$

where C_i denotes the consumption of the government's supporters. In this case, the government places no importance on the welfare of the remaining $(n-1)$ groups in the society, defined as $U(C_r) = C_r$.[4]

The government can appropriate a fraction $\phi \in (0,1)$ of the national surplus—which will be defined later—with a certain probability $p \in (0,1)$. The probability p denotes the likelihood that the government will remain in power and carry out its program. We assume that ϕ and p are both functions of a country's economic liberties, whose level is denoted by Q, with $Q \in [0,\bar{Q}]$. Our notion of "liberalization" includes several factors. On the one hand, it can entail higher institutional quality, such as less corruption and greater "rule of law." On the other, it can be reflected in trade and macroeconomic policies, such as lower tariffs and lower government consumption.

In what follows, we assume that $\phi'(Q) < 0$, and $\phi''(Q) < 0$: the government's ability to appropriate resources decreases as Q increases. In our view, then,

[3] McGuire and Olson (1996) define this as the "autocrat" or "dictatorial ruler" case. This extreme assumption is not at odds with the political experience of sub-Saharan Africa, where most countries have been ruled by nondemocratic governments: see Bratton and van der Walle (1997).

[4] Tornell and Lane (1999) and Acemoglu and Robinson (2001) present opposing groups in society through a fully developed political economy game. Here we restrict our attention to the analysis of the incentives of the incumbent government in order to emphasize the relationship between reforms and resource abundance.

economic liberalization affects the ruling elite by reducing its ability to prey on the national surplus (through taxes and more direct appropriation methods, such as theft, bribery, licensing, etc.). The idea that ϕ is reduced by reforms constitutes a crucial difference from Robinson (1999), where the fraction of surplus appropriation is taken to be constant.

We do not make any assumption on the sign of $p'(Q)$ since, a priori, an increase in economic liberties has an ambiguous impact on a government's survival. Consider for example a reform plan pushing toward more liberalization. On the one hand, since reforms reduce the privileges enjoyed by some who support the government,[5] the risk that the incumbent government will be thrown out of office may rise. On the other hand, reforms may reduce the probability of upheaval in the part of society that is not adequately represented by the ruling government.[6] Whatever the relationship between policies and political survival, the qualitative results we obtain do *not* depend on the sign of $p'(Q)$. However, as a purely "technical" assumption, we will take $p''(Q) \leq 0$.

In our model, the ruling party has two choices. It can either implement a "bad policy" or concede some economic liberties and make some investment in infrastructure ("good policy"). We suppose that economic liberalization alone is not sufficient to encourage private investment when a country has poor infrastructure.[7] Thus, investment in infrastructure and economic liberties are complementary. In particular, we assume that the government needs to spend a fixed amount, $I = \bar{I} > 0$, on infrastructure as a condition for economic liberties to be effective. Good policies thus stimulate private investment, K, and private net production, Y. In what follows, we define the sum of Z, the country's endowment, and Y as the country's national surplus.[8] Obviously, for any *given* level of ϕ, a higher surplus will raise consumption by the ruling elite.

Events unfold in two stages.

- In stage 1, the country has an endowment equal to Z, composed of natural resources and foreign aid. The government decides on a policy plan (Q, I), and it remains in power with probability $p(Q)$. If the government survives, it carries out the plan: the desired level of Q is implemented, and the investment cost I is sunk.

[5]Ndulu and O'Connell (1999) report the example of Zambia during the 1980s, where reforms were fiercely opposed by strong pressure groups that enjoyed the benefits of bad policies. These authors argue that reforms often increase opposition to governments and encourage dictators to resist development: "President Mobutu opposed Zairian development . . . because development raised the threat of political demise and the loss of his substantial claim on GDP."

[6]La Ferrara (1996) considers a model (without production) in which the decision of a self-interested government to liberalize trade depends on its retaining political support. In Robinson (1999), the provision of public goods by an autocratic government may encourage collective actions, such as revolutions, on the part of the citizens.

[7]See McGuire and Olson (1996) and Collier and Gunning (1999). Safe property rights, or a favorable taxation regime, may not be enough when transportation routes are not available, or when the available workforce suffers from analphabetism or cannot migrate. Thus, both reforms and infrastructure are taken to be indispensable for private entrepreneurship in the rest of society.

[8]This is a notion of *gross* national surplus. In fact, the country's *net* surplus is equal to $Z + Y$ *minus* expenditure in infrastructure, I.

- In stage 2, private investors observe (Q,I) and decide the optimal levels of investment and production, equal to K and Y, respectively. The government appropriates a fraction $\phi(Q)$ of both Z and Y.

The ruling party's expected consumption is expressed as[9]

$$E(C_i) = p(Q)\cdot\{\phi(Q)\cdot[Z+Y(Q,I)]-I\}+[1-p(Q)]\cdot\hat{C}_i, \tag{2}$$

where $Y(Q,I)$ denotes the surplus generated by private investment in the rest of society.

According to expression (2), the ruling elite will extract a share ϕ of national surplus with probability p. When the incumbent government is thrown out of office, an event occurring with probability $(1-p)$, the elite will have a consumption level equal to $\hat{C}_i \geq 0$.

Note that the incumbent government will consider whether to implement some public investment only when the surplus it can extract from the economy is not smaller than the cost of infrastructure. Thus, the following inequality always holds in equilibrium:

$$\phi(Q)\cdot[Z+Y(Q,I)] \geq I. \tag{3}$$

The expected level of consumption of the elite when losing power, denoted by $\hat{C}_i$, depends on the actions of the new government. In order to characterize $\hat{C}_i$, we assume that political change implies such *higher* costs in public investment that no new government will ever have an incentive to undertake good policies. Although quite extreme, this assumption is plausible when political change occurs through coups or revolutions that cause severe costs to society, such as destruction of human capital or damage to the existing infrastructure: see, for example, Acemoglu and Robinson (2001).[10]

Since a new government will always undertake bad policies, the expression for $\hat{C}_i$ is given by

$$\hat{C}_i = \left(\frac{1-\phi(0)}{n-1}\right)\cdot Z, \tag{4}$$

where n denotes the number of equally sized groups in the society.

Under the incumbent government, the level of expected consumption for the rest of society is given by

[9] According to equation (2), the government maximizes expected consumption of the group it represents, that is, the incumbent government fully identifies itself with the interests of the supporting group. This is not generally the case. For example, the government might only be interested in the gain for its own members. Suppose that the government retains a fraction $\delta \in [0,1]$ of the surplus it appropriates, while leaving the fraction $(1-\delta)$ to its supporters, and assume that the government's members do not survive political change. Then, the government's objective function will take the form $\delta\cdot\{p\cdot[\phi(Z+Y)-I]\}$. This alternative, however, does not affect the basic conclusions derived from problem (2).

[10] Our model, however, generates similar results under different assumptions, such as the new government will make reforms with some probability.

$$E(C_r) = p(Q)\cdot\{[1-\phi(Q)]\cdot[Z+Y(Q,I)]\}+[1-p(Q)]\cdot\{Z-\hat{C}_i\}, \quad (5)$$

where $\{Z-\hat{C}_i\}$ denotes the aggregate amount of consumption available to the rest of society when the new government takes power.[11]

In what follows we consider a partisan government that maximizes the expected consumption (2) of its supporters. In doing so, the government anticipates that the level of private investment in the rest of society will depend on its decisions about Q and I.[12] We solve the model by backward induction. Given the timing we postulate, we first characterize the production decision of private investors, taking the government's decisions as given. Second, we solve for the policy choice, when the government anticipates private investors' reaction.

Consider first stage 2, when private entrepreneurs have to decide how much to invest and produce. Given the policy stance of the government, summarized by the levels of (Q,I) determined in stage 1, each private investor chooses capital so to maximize consumption, which is equal to the fraction $(1-\phi)$ of production net of capital costs. In order to streamline the model without any loss of generality, it is sufficient to consider the presence of just one entrepreneur who maximizes his consumption from production, given by $(1-\phi)\cdot Y$, by choosing the level of capital K.

Once the government has picked (Q,I) in stage 1, the entrepreneur's problem in stage 2 reduces to:

$$\max_{\{K\}} Y = d(I)\cdot[F(K,Q)-C(K)], \quad (6)$$

with

$$d(I)=\begin{cases}0, & if\ \ I<\bar{I}\\ 1, & if\ \ I\geq\bar{I}\end{cases}$$

The function $d(I)$ emphasizes the complementary roles of infrastructure and reforms. It implies that private investment can be profitable only when there is at least a minimum level of public investment in infrastructure, $\bar{I}$. The functions $F(K,Q)$ and $C(K)$ denote, respectively, the return from production and its cost. These functions have the following properties: $F_K>0$, $F_{KK}<0$, $F(0,Q)=0$; $C'(K)>0$, $C''(K)\geq 0$.

We assume that poor institutional quality destroys output by generating corruption, insecure property rights, etc. In other words, an economic environment plagued by bad policies generates negative externalities in the private sector.[13] Thus, the revenue function $F(K,Q)$ captures the effect of economic liberties on

[11] Expressions (2) and (5) build on the idea that the bulk of entrepreneurial initiative, generating $Y(Q,I)$, does not belong to the elite supporting the incumbent government. This simplification can be easily generalized without any major consequences for our results.

[12] We assume that private capital is fully mobile, in order to avoid time-consistency issues. This problem, however, is discussed in a later section, "Extensions."

[13] A similar assumption is made in Svensson (1998), where poor legal infrastructure is deemed detrimental to production. This notion is supported by Hall and Jones' (1999) evidence on the role of "social infrastructure" on productivity.

private entrepreneurship and has the following properties: $F_Q > 0$, $F_{QQ} < 0$, $F_{QK} > 0$, and $F(K,0) = 0$. Moreover, we assume that

$$\lim_{Q\to 0} F_Q = \infty \text{ and } \lim_{Q\to \bar{Q}} F_Q = 0.$$[14]

To summarize, expression (6) postulates that net returns from private investment are strictly positive only if the government invests up to the amount $\bar{I}$ in infrastructure and implements some economic liberties (i.e., $Q > 0$).[15] If $I < \bar{I}$, private investment is unprofitable, whatever the level of Q. In this case, both the optimal level of K, denoted by K^*, and private surplus Y are equal to zero. By contrast, if $I \geq \bar{I}$, K^* solves the following condition:

$$F_K(K,Q) = C'(K) \tag{7}$$

whenever $Q > 0$. Private investment increases with reforms, since it holds that

$$\frac{dK^*}{dQ} = \frac{F_{KQ}}{-F_{KK}} > 0.$$

The net private surplus is given by

$$Y(Q,I) = F\left(K^*(Q),Q\right) - C\left(K^*(Q)\right). \tag{8}$$

Equation (8) represents the entrepreneur's reaction function to the level of Q when $I \geq \bar{I}$. It implies that $Y(0,I) = 0$, $Y_Q(Q,I) > 0$, $Y_{QQ}(Q,I) \leq 0$ and also that

$$\lim_{Q\to 0} Y_Q(Q,I) = \infty \text{ and } \lim_{Q\to \bar{Q}} Y_Q(Q,I) = 0.$$

In stage 1, the government anticipates private investors' behavior and solves the following problem:

$$\max_{\{Q,I\}} E\left[C_i(Q,I)\right] = p(Q)\cdot\left\{\phi(Q)\cdot\left[Z + Y(Q,I)\right] - \left(I + \hat{C}_i\right)\right\} + \hat{C}_i. \tag{9}$$

Two cases may arise: (i) the government chooses a level of investment in infrastructure such that $I < \bar{I}$ or (ii) expenditure in infrastructure is set equal to $I \geq \bar{I}$.

Case (i). If the government chooses a level of public investment equal to $I < \bar{I}$, the maximand in expression (9) reduces to

$$E\left[C_i(Q,I)\right] = p(Q)\cdot\left[\phi(Q)\cdot Z - I - \hat{C}_i\right] + \hat{C}_i. \tag{10}$$

[14] The following functional forms satisfy the properties stated: $F = Q^{\alpha}K^{\beta}$, with $(\alpha,\beta) \in (0,1)$ and $C = r \cdot K$, with $r > 0$.

[15] The assumption that "good policies" are necessary for private investment to generate output is consistent with evidence reported in Easterly and Levine (1997). Svensson (1998) also finds that lack of investment in legal infrastructure leads to low levels of domestic investment.

Since investment in infrastructure is insufficient to stimulate private investment, the government finds it optimal to set $I = 0$. Thus, the marginal incentive to reform is given by

$$\frac{dE\left[C_i(Q,0)\right]}{dQ} = p'(Q)\cdot\left[\phi(Q)\cdot Z - \hat{C}_i\right] + \phi'(Q)\cdot p(Q)\cdot Z. \tag{11}$$

Without making any assumption on the sign of $p'(Q)$, the marginal incentive to reform is always negative when the condition $p'(Q)\cdot\phi(Q) + \phi'(Q)\cdot p(Q) < 0$ holds true, where $\phi'(Q) < 0$. This condition implies that the elasticity of political survival to reforms is lower than (the absolute value of) the corresponding elasticity relative to the appropriation rate, which is

$$\frac{p'(Q)}{p(Q)/Q} < -\frac{\phi'(Q)}{\phi(Q)/Q}. \tag{12}$$

In what follows, we will assume that condition (12) is always satisfied.[16] Then:

Lemma 1. When $I = 0$ and condition (12) holds, the maximum level of expected consumption for the ruling elite is equal to $E[C_i(0,0)] = p(0)\cdot[\phi(0)\cdot Z - \hat{C}_i] + \hat{C}_i$.

Case (ii). Suppose that $I \geq \bar{I}$. Given our assumptions, the government's optimal choice is to set public investment equal to $\bar{I}$. Hence, the marginal benefit from reforms is given by

$$\frac{\partial E\left[C_i\left(Q,\bar{I}\right)\right]}{\partial Q} = \tag{13}$$
$$\left(p'(Q)\cdot\phi(Q) + \phi'(Q)\cdot p(Q)\right)\cdot\left[Z + Y\left(Q,\bar{I}\right)\right] - p'(Q)\cdot\left[\bar{I} + \hat{C}_i\right] + p(Q)\cdot\phi(Q)\cdot Y_Q\left(Q,\bar{I}\right).$$

Consequently, the existence of an internal maximum for Q^* requires that the following first-order condition holds:

$$\frac{\partial E\left[C_i\left(Q^*,\bar{I}\right)\right]}{\partial Q} = 0. \tag{14}$$

Lemma 2. When $I = \bar{I}$, an internal maximum $Q^* \in (0,\bar{Q})$ exists and is unique. Thus, the level of expected consumption for the ruling elite is equal to

$$E\left[C_i\left(Q^*,\bar{I}\right)\right] = p\left(Q^*\right)\cdot\left\{\phi\left(Q^*\right)\cdot\left[Z + Y\left(Q^*,\bar{I}\right)\right] - \left[\bar{I} + \hat{C}_i\right]\right\} + \hat{C}_i.$$

Proof. See Appendix I.

[16] A sufficient condition for expression (12) to hold is that $p'(Q) \leq 0$, that is, that reforms reduce the probability of political survival.

Note that if $p'(Q) \leq 0$, the government will have lower incentives to implement economic liberties.[17] In other words, when good policies jeopardize political survival, the government takes a more conservative attitude toward liberalization. The reverse is true when better policies buy some support for the government, that is, when $p'(Q) > 0$. In this case, the incentive to pursue weak policies will be reduced.

From Lemmas 1 and 2, the following holds:

Result 1. A rational, dictatorial government will decide to implement some good policies if the following condition holds true:

$$E\left[C_i\left(Q^*, \bar{I}\right)\right] \geq E\left[C_i(0,0)\right]. \tag{15}$$

Condition (15) can be rewritten as follows:

$$\underbrace{\left[p(Q^*)\cdot\phi(Q^*) - p(0)\cdot\phi(0)\right]}_{(-)}\cdot Z \tag{15′}$$
$$+p(Q^*)\cdot\underbrace{\left[\phi(Q^*)\cdot Y\left(Q^*, \bar{I}\right) - \bar{I}\right]}_{(+)} - \left[p(Q^*) - p(0)\right]\cdot\hat{C}_i \geq 0.$$

Expression (15′) clarifies the basic mechanisms at work in our model. Without making any assumption about the sign of p', the impact of $\hat{C}_i$ remains ambiguous. However, good policies tend to be implemented when the loss of the ability to appropriate resources Z (first term in the left-hand side) is outweighed by the net gain arising from private production (second term in the left-hand side). Also, good policies are more likely to be implemented when the need for infrastructure, denoted by $\bar{I}$, is relatively low. Figure 1 illustrates a case in which condition (15) holds.

The level of resources, Z, has a crucial impact both on the opportunity to introduce some economic liberalization and on the degree to which good policies are pursued. We summarize these findings in the following:

Result 2. (i) When the government is solely interested in the welfare of the party it represents, resource abundance (high Z) makes the implementation of good policies less likely. Moreover, (ii) even when some reforms are implemented, a higher level of resources will induce more conservatism (lower Q^*) in the government's behavior.

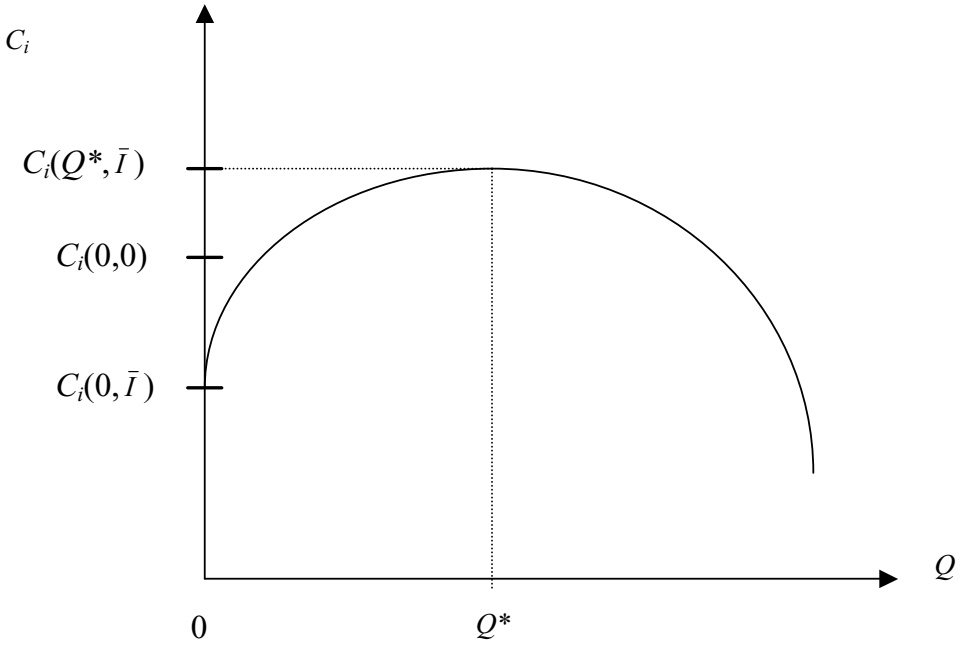
Proof. See Appendix II.

Result 2 underlies the central implication of the model. Governments of countries rich in resources, be they natural resources or fungible donations, have low incentives to implement economic liberalization. In some cases, resource abundance may eliminate the incentive to implement *any* reform. And when some reforms are undertaken, resource abundance pushes the incumbent government to adopt weaker reforms.

The government's ability to appropriate a large share of resources is a measure of the opportunity cost of reforms. In this regard, the incumbent government

[17] The role of $p'(Q)$ can be better emphasized by rewriting the right-hand side of expression (13) as $p' \cdot [\phi(Z+Y) - \bar{I} - \hat{C}_i] + \phi' \cdot p \cdot (Z+Y) + \phi \cdot p \cdot Y_Q$, where it holds that $[\phi(Z+Y) - \bar{I}] > \hat{C}_i$ (the ruling party cannot do worse than giving up power and getting $\hat{C}_i$).

Figure 1. The Optimal Level of *Q*



behaves similarly to a monopolist who, with limited competitive pressure, prefers the "quiet life" to costly effort investment.[18] In the present model, political competition may induce the incumbent to adopt better policies when political survival lies in increasing reforms, i.e., $p'(Q) > 0$.

Result 2's pessimistic connotation for foreign aid must be qualified in a number of ways. We have deliberately neglected the possibility that, in stage 1, the government might be subject to financial constraints when deciding whether to make the up-front investment $\bar{I}$. The presence of financial constraints alone can prevent good policies. This occurs when a government is willing to reform, but it *cannot* borrow to finance the cost of infrastructure $\bar{I}$. In this case, foreign aid can overcome financial constraints and make reforms feasible.[19]

In the next section we consider some forms of conditional aid that may provide the incentive to implement good policies.

Foreign Aid and Conditionality

The incentives from aid crucially depend on the type of support a country receives. The conclusion from Result 2 that countries rich in resources have little incentive to implement good policies has important implications for aid such as *donations*

[18] See Hermalin (1992) and the literature quoted therein. We thank a referee for the suggested analogy.

[19] Burnside and Dollar (2000) and Dollar and Svensson (2000) show that foreign aid can help the success of reform programs only when there are adequate political-economic conditions. As Dollar and Svensson put it, "the role of donors is to identify reformers not to create them" (p. 896).

or *credit extensions*, which are largely administered by local governments. Donations, denoted by A, raise the country's endowment Z. Consequently, our model predicts that this type of aid tends to reduce the optimal level of Q^* or, at the extreme, reinforces the desire to keep bad policies in place.[20]

With other types of aid less pessimistic conclusions can be reached. In what follows, we consider two types of intervention. First, we consider the case of conditional aid as a device to reward reforms. Second, we consider the possibility that aid is directly aimed at providing some pieces of infrastructure.

Making aid conditional on reforms. Suppose that donors condition aid on the level of economic liberties that is actually implemented. The amount of aid, denoted by $H = H(Q)$, will be made dependent upon the level of economic liberties Q according to

$$H(Q) = \begin{cases} \tilde{H} > 0, & \textit{if } Q \geq Q^c \\ 0, & \textit{otherwise} \end{cases}. \tag{16}$$

Thus, donors will concede a positive amount of aid to the country only if the government implements at least a minimum level of reforms Q^c. Under such a scheme, the government has the following options:

(i) Give up aid and keep bad policies, so as to get payoff $E[C_i(0,0)]$ as in Lemma 1;
(ii) Agree to set Q^c *without* investing in infrastructure, so that $I = Y = 0$; or
(iii) Agree to set at least Q^c and invest $I = \bar{I}$.

Under cases (ii)–(iii), the government's payoff (2) takes the form:

$$E(C_i) = p(Q^c) \cdot \left\{ \phi(Q^c) \cdot \left[Z + Y(Q^c, I) + \tilde{H} \right] - I \right\} + \left[1 - p(Q^c) \right] \cdot \hat{C}_i. \tag{17}$$

It is immediately evident that the government will prefer plan (iii) to plan (ii) whenever its participation constraint $\phi(Q^c) \cdot Y(Q^c, \bar{I}) - \bar{I} \geq 0$ is satisfied. In general, this will be the case when donors set Q^c appropriately. Moreover, plan (iii) will be preferred to plan (i) when the level of conditional aid $\tilde{H}$ is sufficiently high. Thus, when properly designed, conditional aid may induce partisan governments to adopt better policies, so as to enjoy the promised reward. This conclusion, however, must be accompanied with great caution, since it ignores obstacles such as the ability of donors to verify the actual quality of reforms.[21, 22]

We next consider direct help with infrastructure, a form of aid that may reduce the "funds fungibility" problem. This kind of aid policy naturally arises out of the approach followed here.

[20] This observation is consistent with the view that aid can delay reforms: see Rodrik (1996) and Tsikata (1998).

[21] Indeed, doubts are often raised about the actual incidence of reforms: "...increasingly, the suspicion must be that the deception is deliberately designed to gain just enough respectability to attract private foreign capital, and to qualify more readily for the public sort, from multilateral bodies such as the IMF and the World Bank" (*The Economist*, "Phoney Democracies," June 24, 2000).

[22] Time-consistency problems may also arise. In a game between donors and recipients, Svensson (2000b) shows that the anticipation of aid may reduce the incentive to introduce costly reforms. The ability to enforce types of conditional aid is also discussed in Dollar and Easterly (1999).

Direct provision of infrastructure aid. Foreign countries or international organizations might invest directly in parts of the infrastructure, such as roads, health care, schools, etc. This form of aid has two desirable properties. First, it limits the flow of fungible funds to local governments. Second, it cuts the cost of infrastructure $\bar{I}$ by the amount of aid, X. Thus, from the point of view of the incumbent government, this particular form of donation reduces the amount of public investment it must make.

This point can be simply illustrated as follows. By denoting direct provision to the infrastructure by $X \in [0, \bar{I}]$, the equilibrium payoff from good policies is now given by

$$E\left[C_i\left(Q^*, \bar{I} - X\right)\right] = p\left(Q^*\right) \cdot \left\{\phi\left(Q^*\right) \cdot \left[Z + Y\left(Q^*, \bar{I}\right)\right] - \left[\left(\bar{I} - X\right) + \hat{C}_i\right]\right\} + \hat{C}_i. \qquad (18)$$

On the other hand, the payoff from keeping bad policies in place remains equal to $E[C_i(0,0)] = p(0) \cdot [\phi(0) \cdot Z - \hat{C}_i] + \hat{C}_i$.

Consequently, the government will be willing to implement some good policies if the analog of condition (15) holds:

$$E\left[C_i\left(Q^*, \bar{I} - X\right)\right] \geq E\left[C_i(0,0)\right], \quad \textit{with} \quad X \in \left[0, \bar{I}\right]. \qquad (19)$$

There exists a value of X in the interval $[0, \bar{I}]$ such that condition (19) is satisfied. To show this, it is sufficient to note that when $X = \bar{I}$, a marginal quantity of good policies yields a payoff that exceeds the "bad policy" payoff ($Q = 0$). Thus, the following holds:

Result 3. When donors can provide an adequate amount of infrastructure aid directly, autocratic governments will have the incentive to implement some reforms.

This conclusion crucially depends on the complementarity between economic liberties and infrastructure. When international aid can provide some help with infrastructure, the costs of good policies are reduced, while their benefits remain intact. Furthermore, this type of aid can also circumvent the problems associated with financial constraints that prevent governments from borrowing and investing.

In the next section we consider some extensions to the basic model presented in the previous section.

Extensions

Government benevolence

The model presented in the first part of Section I postulates that the government is interested only in the welfare of its supporters. In this section we extend the model to consider the possibility that the government may also care, to some extent, about the welfare of the rest of society. In other words, the objective function of the government puts a weight, denoted by β, on the expected level of consumption available to the rest of society, $E(C_r)$. β is defined over the support $[0, 1/2]$. When $\beta = 0$, the government puts no weight on the welfare of the rest of society, as postulated in the first part of Section I above. On the contrary, when $\beta = 1/2$, the government values the welfare of its supporters as much as the welfare of those in the rest of society. "Benevolence" can be thought of as a simple modeling device that

captures the influence exerted by the civil and economic environment of the country on the actions of the government (see Putnam, Leonardi, and Nanetti, 1993).

To simplify the exposition, we assume that political risk is independent of reforms, that is, $p'(Q) = 0$. Also, we suppose that the government always finds it convenient to implement some reforms, that is, we assume that condition (15) is always satisfied.

When $0 < \beta < 1/2$, the government's problem becomes

$$\max_{\{Q\}} \left\{(1-\beta)\cdot E\left(C_i\right) + \beta \cdot E\left(C_r\right)\right\}, \tag{20}$$

where $E(C_i)$ and $E(C_r)$ are defined, respectively, by (2) and (5) for $I = \bar{I}$.

The first-order condition relative to problem (20) can be written as

$$\frac{\partial E\left[C_i\left(Q,\bar{I}\right)\right]}{\partial Q} + \left(\frac{\beta}{1-2\beta}\right)\cdot \underbrace{p\cdot Y_Q\left(Q,\bar{I}\right)}_{(+)} = 0, \tag{21}$$

where, from (13) with $p' = 0$,

$$\frac{\partial E\left[C_i\right]}{\partial Q} = p\left\{\phi'(Q)\cdot\left[Z + Y\left(Q,\bar{I}\right)\right] + \phi(Q)\cdot Y_Q\left(Q,\bar{I}\right)\right\}.$$

The following holds:

Result 4. When the government has some care for the welfare of the rest of society, it will concede more liberties than an autocratic government will. Thus, when $0 < \beta < 1/2$, it holds that $Q^*(\beta) > Q^*(0)$.

Proof. The proof follows immediately from inspection of (21). The presence of some benevolence on behalf of the average government adds a positive term to the left-hand side of (21) whenever condition $0 < \beta < 1/2$ holds. Hence, the greater the care of the typical government for the rest of society, the greater the net marginal benefits from good policies.

From a political-economic perspective, it is plausible to restrict attention to the case in which condition $\beta < 1/2$ holds. Even in democracies, it is quite unlikely that the average government has the same care for the rest of society as it has for its supporters. However, the special case of $\beta = 1/2$ carries an interesting implication. When $\beta = 1/2$, the government will implement the *highest feasible level of economic liberties*.[23] This ideal case is what McGuire and Olson (1996) define as "consensual democracy."

Differences in the government's ability to extract surplus

In the first part of Section I we assumed that the government extracts the fraction ϕ of surplus regardless of its source. However, it is likely that the ruling party finds

[23] When $\beta = 1/2$, the government's objective function (20) reduces to $1/2\{p\cdot[Y(Q,\bar{I}) - \bar{I}] + Z\}$. The net marginal benefit from Q is then equal to $p\cdot Y_Q(Q,\bar{I})$, which is positive over $[0,\bar{Q}]$. Thus, the optimal level of Q for $\beta = 1/2$ is $\bar{Q}$.

it easier to extract rents from natural resources than from private output. In this case, the objective function (9) can be rewritten as[24]

$$E\left[C_i\right] = p(Q)\cdot\left\{\phi(Q)\cdot Z + \rho(Q)\cdot Y\left(Q,\bar{I}\right) - \bar{I}\right\} + \left[1 - p(Q)\right]\cdot\hat{C}_i, \tag{22}$$

where $\phi(Q) > \rho(Q)$ for any given level of Q. Assume that $\rho(Q) = m\cdot\phi(Q)$, with $m < 1$. Then, since it holds true that[25]

$$-\frac{d\log\phi}{d\log Q} < \frac{d\log Y}{d\log Q} + \frac{d\log p}{d\log Q}, \tag{23}$$

it follows that a lower m will decrease the equilibrium level Q^*. Thus, the government will adopt *weaker* policies when its ability to appropriate private surplus is reduced.

Dependence of private sector production function on natural resources

In the first part of Section I, production in the private sector does not depend on natural resources: see equation (6). However, natural resources may affect private surplus, as when $Y = A(Z)\cdot f(K,Q,I)$. Although the effect of Z on Y is a priori ambiguous,[26] we will concentrate on the case of $A'(Z) > 0$.

We first reconsider Result 2(i). When $A'(Z) > 0$, resource abundance makes bad policies more likely if the condition $\Theta - p(Q^*)\phi(Q^*)A'(Z)\cdot f(K(Q^*),Q^*,\bar{I}) > 0$ still holds true, where $\Theta > 0$ (see Appendix II). Thus, Result 2(i) will still hold, *unless* $A'(Z)$ is sufficiently large.

Result 2(ii) predicted that when the government prefers to adopt some good policies (i.e., condition (15) is satisfied), a higher level of resources will lower the desired level of reforms Q^*. Under the present case, it holds that

$$\frac{dQ^*}{dZ} = -\frac{D + \left\{A'(Z)\cdot\frac{p\cdot\phi\cdot Y}{Q}\cdot\left[\frac{d\log p}{d\log Q} + \frac{d\log\phi}{d\log Q} + \frac{d\log Y}{d\log Q}\right]\right\}}{E},$$

where E and D are negative quantities (see Appendix II), while the term in braces is positive (see condition (23)). Thus, when $A'(Z) > 0$ is not too large, resources will still have an adverse, though smaller, effect on reforms.

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[24] We assume condition (15).

[25] Inequality (23) follows from the fact that a strictly positive equilibrium level of liberties ($Q^* > 0$) implies that the term $(p\cdot\phi\cdot Y)$ in expression (9) is increasing (at a decreasing rate) in $Q \in [0, Q^*]$.

[26] On the one hand, abundance of natural resources might generate some "comparative advantage" for the development of industries that use these resources as an input. In this case, it will hold that $A'(Z) > 0$. On the other hand, abundant resources may have negative effects on private production. For example, resources may reduce human capital by discouraging education (see Gylfason, Herbertsson, and Zoega, 1999, and Gylfason, 2001), or by stimulating allocation of talent in unproductive activities (see Baland and Francois, 2000). Also, natural resources may generate negative externalities on traded manufacturing activities (see Sachs and Warner, 1999). Then, it may also hold that $A'(Z) < 0$.

Time inconsistency

In the basic model of the first part of Section I we assumed that private capital is fully mobile. In other words, private entrepreneurs can withdraw their capital at no cost when the economic environment of the country is no longer favorable. In that case, the government will appropriate the fraction ϕ of *net* private surplus, denoted by $Y(K,Q,\bar{I}) = F(K,Q) - C(K)$, and entrepreneurs will choose capital K^* so as to respect the rule $F_K = C_K$. By taking $p' = 0$ for simplicity, the optimal Q^* then satisfies the following condition (see (14)):

$$\phi' \cdot \left[Z + \left(F^* - C^* \right) \right] + \phi \cdot F_Q^* = 0, \tag{24}$$

where $F^* = F(K^*(Q),Q)$ and $C^* = C(K^*(Q))$.

Many contributions, such as those of Grout (1984) and Hart (1995), have shown however that when capital is specific and has to be "sunk" ex ante, opportunistic behavior can arise ex post. This time-consistency problem can apply also to the present context, when a government's opportunism arises from the inability to make a full commitment ex ante. Consider the following sequence of events. First, the government chooses a policy plan (Q,I). Second, entrepreneurs observe the policy plan and choose the optimal level of capital to invest (for simplicity, we assume that in this case the capital is fully immobile). Third, the government appropriates a fraction ϕ of private surplus. Since private capital expenditure $C(K)$ has been sunk, the government may now be able to extract a fraction ϕ of the *gross* private surplus, $F(K,Q)$.[27] In this case, the government's objective function takes the form

$$E\left(C_i\right) = p \cdot \left\{ \phi(Q) \cdot Z + \phi(Q) \cdot F\left(K,Q\right) - \bar{I} \right\} + \left(1 - p\right) \cdot \hat{C}_i, \tag{25}$$

while private entrepreneurs will choose capital K^{**} according to the rule

$$F_K\left(K,Q\right) = \frac{C'(K)}{1 - \phi(Q)} > C'(K). \tag{26}$$

Thus, for any *given* level of Q, the equilibrium level of K^{**} will be lower than K^*, corresponding to the basic case of the first part of Section I. A government's opportunism tends to reduce private investment.

Note, however, that opportunism has ambiguous effects on the optimal policy plan of the government. This can be shown by maximizing (25) subject to (26). When $p' = 0$, one finds that the optimal level of Q^{**} is implicitly given by

$$\phi' \cdot \left[Z + F^{**} \right] + \phi \cdot F_Q^{**} + \phi \cdot F_K^{**} \cdot \frac{dK^{**}}{dQ} = 0, \tag{27}$$

where $F^{**} = F(K^{**}(Q),Q)$.

[27] Similarly to Grout (1984), the argument can be made more formal by considering appropriation as the result of a Nash-bargaining process over $F(K,Q)$ between the government and the entrepreneur. The entrepreneur has indispensable skills in production, while the government has the ability to halt private production, and its bargaining power is equal to ϕ. In this case, the share that goes to the government, $s_i = \phi \cdot F$, is what maximizes the Nash program $(s_i)^{\phi} \cdot (F - s_i)^{1-\phi}$.

Inspection of (24) and (27) shows that the net effect of opportunism on the equilibrium level of policies is ambiguous. In particular, when the indirect effect of Q on the "tax base" F, as captured by $F_K \cdot \frac{dK^{**}}{dQ} > 0$, is sufficiently strong, opportunism tends to generate a Q^{**} *higher than* Q^*. As an example, we compare the left-hand sides of (24) and (27) when $F = Q^{1/2} \cdot K^{1/2}$ and $C = r \cdot K$ (see footnote 14). It turns out that, when the (sufficient) condition $1/4 \leq \phi \leq 1/2$ holds true, opportunism will generate *better* policies.

II. Evidence

Our model builds on the following mechanism:

(i) Poor economic institutions and policies have negative effects on (private) investment and production.

(ii) Abundance of resources reduces the incentive of an elitist government to implement "good policies."

Thus, resources tend to have a negative effect on economic activity *through the quality of economic institutions and policies*. In particular:

(a) When a country is rich in natural resources, the government has a bigger incentive to raid the national surplus by keeping poor institutions and unsound policies in place, as emphasized by Result 2. The model thus predicts that measures of natural resources have a negative impact on the quality of economic institutions and policies.

(b) Since foreign aid raises resources, it will lower the quality of economic policies and institutions. However, if donors manage to condition aid on the implementation of reforms, aid can even have a *positive* effect on policies, as emphasized in the second part of Section I. Thus, the net effect of aid on policies remains ambiguous a priori.

(c) Since resource abundance reduces the incentive to implement good policies, it also makes investment in infrastructure less desirable.

Point (i) is quite undisputed. The first three rows in Table 1 report the correlation coefficients between indicators of "good policy" and a few measures of economic performance, based on 37 sub-Saharan African countries. Good policies are measured by: (i) *IQ*, Knack and Keefer's (1995) summary measure of indicators of institutional quality from the International Country Risk Guide; (ii) *POLICY*, Burnside and Dollar's (2000) measure of quality of macroeconomic and trade policies; and (iii) *LTELPW80*, Easterly and Levine's (1997) proxy for infrastructure.

The idea that sound policies and good institutions are positively related to economic activity has been emphasized in the literature on economic growth: see, for example, Mauro (1995), Barro and Sala-I-Martin (1995), Knack and Keefer (1995), Svensson (1998), Hall and Jones (1999), Burnside and Dollar (2000), and others.[28] In particular, Block (2001) finds that growth in GDP per capita is positively and significantly related both to institutional quality and to proper macroeconomic and trade policies, as measured by low budget deficits and openness to foreign trade.

[28] See also Kaufmann, Kraay, Zoido-Lobatón (1999) and Dollar and Kraay (2000).

Table 1. Economic Performance, Policies, and Resources

	IQ	POLICY	LTELPW80	DLTELPW
GNP per capita	0.37**	0.35	0.45**	
	(0.05)	(0.14)	(0.04)	
GNP per capita growth rate	0.22	0.46**	0.20	
	(0.28)	(0.05)	(0.38)	
Gross domestic investment	0.14	0.53**	0.44**	
	(0.48)	(0.02)	(0.05)	
SNR	–0.20	–0.35*		–0.31
	(0.31)	(0.10)		(0.14)
AID	–0.38*	0.43*		0.37*
	(0.07)	(0.08)		(0.10)

Notes: The *p*-value is in parentheses (2-tailed). ** and * indicate that correlation is significant at the 5 percent and 10 percent level, respectively. Data sources and additional details are provided in Appendix III.

Point (ii) represents the original contribution of our model. Our framework highlights the role of resources as a key factor in determining the quality of a country's economic institutions and policies.

The last two rows of Table 1 report the correlation coefficients between measures of resources[29] and indicators of policies' quality. The variable *SNR* is Sachs and Warner's (1997) measure of natural resource abundance. *AID* quantifies the amount of foreign donations. "Good policies" are measured by *IQ*; *POLICY*; and *DLTELPW*, a proxy for investment in infrastructure.[30] The results provide some hints[31] consistent with our model. Our measure of natural resource abundance, *SNR*, has a negative effect on our measures of good policies, *IQ*, *POLICY*, and *DLTELPW*. The effects of foreign aid on policies are much more varied. While aid seems to have adverse effects on institutional quality, it has a positive effect both on macroeconomic and trade policies and on investment in infrastructure. These opposite effects of aid are compatible with the implications of our model. While it is feasible for a donor to put conditions on macroeconomic and trade policy variables, which are easily verifiable, it is much more difficult to condition aid on the quality of governance, as measured by *IQ*.

Much existing empirical evidence also supports our model. Sachs and Warner (1997, 1999) provide cross-country evidence on the negative effects of natural resources on institutional quality and growth.[32] After confirming the positive

[29]Both measures of resources are backdated with respect to our institutions and policy indicators in order to reduce "reverse causation" problems.

[30]In our sample, the correlation coefficient between *IQ* and *POLICY* is 0.38. The relationship between economic policy and institution variables has been investigated in some recent literature: see, for example, Havrylyshyn and Van Rooden (2000).

[31]Dalmazzo and de Blasio (2001) provide an OLS analysis of the relationship between policies and resources, which adds some robustness to the results reported in Table 1.

[32]Differently from our approach, Sachs and Warner (1999) argue that increases in natural resources can make economies shift away from manufacturing, where externalities necessary for growth are generated. Rodriguez and Sachs (1999) instead use a Ramsey model to show that countries rich in natural resources display negative rates of growth during the transition to the steady state. For an updated survey on the "curse of natural resources" see Sachs and Warner (2001).

relationship between institutional quality and growth, Block (2001) finds that raw material abundance has a negative and significant impact on institutional quality in sub-Saharan African countries. Some literature has also emphasized the perverse effect of resource windfalls on growth in several countries: see Auty (1990), Gelb (1998), and Little and others (1993). According to Tornell and Lane (1999), when legal and political institutions are weak, windfalls in the production sector will increase the rent-seeking activities of (competing) powerful groups, reducing capital accumulation and growth.[33] For the opposite reason, a negative endowment shock may raise the incentive to pursue good policies since, according to our model, even a partisan government may find it convenient to encourage private investment.[34] La Ferrara (1996) finds that negative terms-of-trade shocks increase the probability of subsequent trade liberalization for a sample of sub-Saharan countries.[35]

Several papers have concentrated on the effects of international aid. Boone (1996), Burnside and Dollar (2000), and Dollar and Easterly (1999) on African countries report evidence showing that aid flows have an ambiguous, and often negative, impact on investment and growth (see also World Bank, 1998). Dollar and Svensson (2000) find that domestic political-economic factors are crucial to the success or failure of policy reform programs supported by adjustment loans. Alesina and Dollar (2000) consider the effect of shocks to bilateral aid on democratization and trade liberalization. They conclude that "there is no tendency for shocks to aid to be followed by changes in democracy or openness." Alesina and Weder (1999) find a weak indication that foreign aid creates a "voracity effect": countries that receive higher levels of aid tend to have higher levels of corruption. This evidence is broadly consistent with the conclusion that, when conditionality is absent or ineffective, aid raises resource abundance and favors "bad policies."

The empirical analysis developed in Svensson (2000a) is particularly relevant here. Using a large data set from developing countries, he finds that both aid and natural resource booms are associated with corruption.

III. Concluding Remarks

Our results point to a central conclusion: abundance of resources can have perverse effects on investment and growth. While this conclusion is by no means new, the novelty of our model lies in the political economy mechanism we investigate. Here, the incentive of a self-interested government to implement reforms leading to investment and growth is weaker when resources are abundant. Our explanation may coexist with other arguments. For example, Gylfason (2001) argues that resource abundance has a negative effect on growth because it reduces public investment in education.

[33] Tornell and Lane (1999) report some evidence based on oil shocks in Nigeria, Venezuela, and Mexico.

[34] These implications do not seem at odds with the Latin American experience of the 1980s. In the wake of debt overhang and negative terms-of-trade shocks (see Warner, 1992), many Latin American countries have embarked on robust political and economic reforms.

[35] Barro (1999) also finds that natural resources tend to be associated with lower levels of political freedom. This is consistent with the idea that resource abundance biases governments against liberalization in general.

Our paper gives some suggestions for what donors can do to encourage the adoption of good policies, that is, how to make foreign aid work. Our results strongly argue in favor of making aid conditional on reforms and providing direct infrastructure aid. Theoretically, these forms of aid are superior to unconditional money donations. Donors should, however, pay more attention to the quality of institutions, levels of corruption, safer property rights, etc.

The political economy channel we emphasize implies that reforms involve a trade-off for a self-interested government. On the one hand, by implementing reforms, the government benefits from a *larger* national surplus; on the other hand, the government can extract only a reduced fraction of the national surplus. However, there are some caveats to be made. First, when better policies buy some support for the government, the perverse role of resource abundance on reforms is reduced. There are indeed virtuous cases, the best known being Botswana, in which abundance of natural resources has gone hand in hand with very high rates of growth. Second, there could be impediments to the ability to pursue reforms, even for governments seriously committed to them. Politically unpopular policies typically have low chances of being implemented, in particular in countries without strong civil institutions or with a high level of poverty and unemployment. For these reasons, a promising direction for future research would be to analyze the relation between resource abundance and incentives to reform—emphasized in this paper—within a general model of political transitions, along the lines sketched by Acemoglu and Robinson (2001).

APPENDIX I

Proof of Lemma 2

The objective function $E[C_i(Q,\bar{I})]$ is continuous and differentiable in Q.

Existence. Consider the expression for $\frac{\partial E(C_i)}{\partial Q}$ given in (12). Existence of an internal solution for Q^* follows directly from the fact that both conditions (i) $\lim_{Q\to 0} \frac{\partial E(C_i)}{\partial Q} > 0$ and (ii) $\lim_{Q\to \bar{Q}} \frac{\partial E(C_i)}{\partial Q} < 0$ hold true.

Consider condition (i):

$$\lim_{Q\to 0} \frac{\partial E\left[C_i\left(Q,\bar{I}\right)\right]}{\partial Q} = \lim_{Q\to 0}\left\{\left(p'\cdot\phi+\phi'\cdot p\right)\cdot Z - p'\cdot\left[\bar{I}+\hat{C}_i\right]+p\cdot\phi\cdot Y_Q\right\} > 0 \tag{A1.1}$$

since $Y(0,\bar{I}) = 0$ and $\lim_{Q\to 0} Y_Q(Q,\bar{I}) = \infty$. Concavity of ϕ also ensures that $\lim_{Q\to 0} \phi'(Q) > -\infty$.

Consider condition (ii):

$$\lim_{Q\to \bar{Q}} \frac{\partial E\left[C_i\left(Q,\bar{I}\right)\right]}{\partial Q} = \lim_{Q\to \bar{Q}}\left\{\left(p'\cdot\phi+\phi'\cdot p\right)\cdot[Z+Y] - p'\cdot\left[\bar{I}+\hat{C}_i\right]\right\} < 0 \tag{A1.2}$$

since $\lim_{Q\to \bar{Q}} Y_Q(Q,\bar{I}) = 0$ and, under condition (12), the inequality

$$\{(p'\cdot\phi+\phi'\cdot p)\cdot[Z+Y]-p'\cdot[\bar{I}+\hat{C}_i]\} < 0$$

holds independently of the sign of p'.

Uniqueness. To demonstrate uniqueness of the maximum Q^*, we consider the second-order condition:

$$\frac{\partial^2 E(C_i)}{\partial Q^2} = \left\{p'' \cdot \left[\phi \cdot (Z+Y) - \bar{I} - \hat{C}_i\right] + 2p'\left[\phi' \cdot (Z+Y) + \phi \cdot Y_Q\right]\right\} + p \cdot \left\{\phi'' \cdot (Z+Y) + 2\phi' \cdot Y_Q + \phi \cdot Y_{QQ}\right\}. \tag{A1.3}$$

When the first-order condition $\frac{\partial E(C_i)}{\partial Q} = 0$ is satisfied, the following holds:

$$\left[\phi' \cdot (Z+Y) + \phi \cdot Y_Q\right] = \frac{-p'}{p} \cdot \left[\phi \cdot (Z+Y) - \bar{I} - \hat{C}_i\right]. \tag{A1.4}$$

Then, by calculating (A1.3) under (A1.4), one finds that:

$$\frac{\partial^2 E(C_i)}{\partial Q^2} = \underbrace{\left[\phi \cdot (Z+Y) - \bar{I} - \hat{C}_i\right]}_{(+)} \cdot \underbrace{\left\{p'' - \frac{2 \cdot (p')^2}{p}\right\}}_{(-)} + p \cdot \underbrace{\left\{\phi'' \cdot (Z+Y) + 2\phi' \cdot Y_Q + \phi \cdot Y_{QQ}\right\}}_{(-)} < 0. \tag{A1.5}$$

Thus, since the objective function is continuous and differentiable, there is a unique global maximum.

APPENDIX II

Proof of Result 2

Part (i). Recall that, from (4), $\hat{C}_i$ depends on Z. Using the envelope theorem, the effect of a larger level of Z on the payoff corresponding to "bad policies" is given by

$$\frac{dE\left[C_i(0,0)\right]}{dZ} = p(0) \cdot \phi(0) + \frac{\left[1-p(0)\right]\left[1-\phi(0)\right]}{n-1}. \tag{A2.1}$$

On the other hand, the effect of Z on the government's payoff under "good policies" is equal to

$$\frac{dE\left[C_i\left(Q^*, \bar{I}\right)\right]}{dZ} = p\left(Q^*\right) \cdot \phi\left(Q^*\right) + \frac{\left[1-p\left(Q^*\right)\right]\left[1-\phi(0)\right]}{n-1}. \tag{A2.2}$$

We claim that, under condition (12), a larger Z has a stronger impact on the payoff from bad policies, that is, the following holds:

$$\frac{dE\left[C_i(0,0)\right]}{dZ} > \frac{dE\left[C_i\left(Q^*, \bar{I}\right)\right]}{dZ}. \tag{A2.3}$$

The proof of the claim is immediate when $p'(Q) \geq 0$. When $p'(Q) < 0$, condition (A2.3) can be rewritten as

$$p(0)\left[n\phi(0) - 1\right] - p\left(Q^*\right)\left[(n-1)\phi\left(Q^*\right) + \phi(0) - 1\right] > 0. \tag{A2.4}$$

This inequality is satisfied, since $p' < 0$, $\phi' < 0$, and $n\phi(0) - 1 > 0$ (the dominant elite gets a share ϕ of national surplus that is higher than its weight in society, $1/n$). Consequently, the more abundant the resources, the less likely condition (15) will be met.

Part (ii). When condition (12) holds, differentiation of (14) implies that $\frac{dQ^*}{dZ} < 0$. Thus, an increase in resources will discourage the government from reform and, as a consequence of fewer reforms, the equilibrium level of private production will be lower: see equation (8).

APPENDIX III

List of Countries and Variables Used in Table 1

List of countries: Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Congo, Dem. Rep. of; Congo, Rep. of; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Ivory Coast; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mozambique; Namibia; Niger; Rwanda; Senegal; Sierra Leone; Somalia; Sudan; Swaziland; Tanzania; Togo; Uganda; Zambia; Zimbabwe.

GNP per capita, GNP per capita growth rate, and *Gross domestic investment* (public plus private investment) are calculated as percentage of GNP over the period 1990–1995 (source: World Bank, *World Development Indicators*).

SNR denotes the share of mineral production in GNP in 1971. This variable characterizes the structural relevance of natural resources in a country.

AID is calculated as the average amount of aid per country as a fraction of GNP over the period 1965–1980. This variable aggregates different types of aid (conditional and unconditional aid, bilateral or multilateral aid, donations, and debt relief) from heterogeneous sources (IMF, World Bank, etc.).

IQ summarizes the following indicators: "rule of law"; corruption in government; and "quality of bureaucracy." For each country, *IQ* is calculated as an average of yearly observations from 1982 to 1998.

POLICY is given by $(1.28 + 6.85 \times \textit{Budget surplus} - 1.40 \times \textit{Inflation} + 2.16 \times \textit{Openness})$, where *Budget surplus* is the share of fiscal balance over GDP and *Openness* is Sachs and Warner's openness dummy. For each country, *POLICY* is calculated as an average of yearly observations from 1985 to 1995.

LTELPW80 denotes (the log of) telephones per 1,000 workers in 1980. This variable measures the level of telecommunications and seems to be strongly correlated with other infrastructure variables (see Collier and Gunning, 1999).

DLTELPW is defined as the difference between *LTELPW80* and *LTELPW70* and measures the increment of (the log of) telephones per 1,000 workers between 1980 and 1970.

REFERENCES

Acemoglu, Darron, and James A. Robinson, 1998, "Why Did the West Extend the Franchise? Democracy, Inequality and Growth in Historical Perspective," CEPR Discussion Paper No. 1797 (London: Centre for Economic Policy Research).

———, 1999, "Democratization or Repression?" CEPR Discussion Paper No. 2278 (London: Centre for Economic Policy Research).

———, 2001, "A Theory of Political Transitions," *American Economic Review*, Vol. 91, No. 4 (September), pp. 938–63.

Alesina, Alberto, and David Dollar, 2000, "Who Gives Foreign Aid to Whom and Why?" *Journal of Economic Growth*, Vol. 5, No. 1 (March), pp. 33–64.

Alesina, Alberto, and Beatrice Weder, 1999, "Do Corrupt Governments Receive Less Foreign Aid?" NBER Working Paper No. 7108 (Cambridge, Massachusetts; National Bureau of Economic Research).

Auty, Richard M., 1990, *Resource-Based Industrialization: Sowing the Oil in Eight Developing Countries* (Oxford: Clarendon Press).

Baland, Jean-Marie, and Patrick Francois, 2000, "Rent-Seeking and Resource Booms," *Journal of Development Economics*, Vol. 61, No. 2 (April), pp. 527–42.

Barro, Robert J., 1999, "Determinants of Democracy," *Journal of Political Economy*, Vol. 107, No. 6, Part 2 (December), pp. S158–83.

———, and Xavier Sala-I-Martin, 1995, *Economic Growth* (New York: McGraw-Hill).

Block, Steven, 2001, "Does Africa Grow Differently?" *Journal of Development Economics*, Vol. 65, No. 2 (August), pp. 443–67.

Boone, Peter, 1996, "Politics and the Effectiveness of Foreign Aid," *European Economic Review*, Vol. 40, No. 2 (February), pp. 289–329.

Bratton, Michael, and Nicholas van der Walle, 1997, *Democratic Experiments in Africa: Regime Transitions in Comparative Perspective* (Cambridge: Cambridge University Press).

Burnside, Craig, and David Dollar, 2000, "Aid, Policies, and Growth," *American Economic Review*, Vol. 90, No. 4 (September), pp. 847–68.

Collier, Paul, and Jan Willem Gunning, 1999, "Why Has Africa Grown Slowly?" *Journal of Economic Perspectives*, Vol. 13, No. 3 (Summer), pp. 3–22.

Dalmazzo, Alberto, and Guido de Blasio, 2001, "Resources and Incentives to Reform. A Model and Some Evidence on Sub-Saharan African Countries," IMF Working Paper 01/86 (Washington: International Monetary Fund).

Dollar, David, and William Easterly, 1999, "The Search for the Key: Aid, Investment, and Policies in Africa," *Journal of African Economies*, Vol. 8, No. 4 (December), pp. 546–77.

Dollar, David, and Aart Kraay, 2000, "Property Rights, Political Rights, and the Development of Poor Countries in the Post-Colonial Period" (unpublished; Washington: World Bank). Available via the Internet: *www.worldbank.org/research/growth.*

Dollar, David, and Jakob Svensson, 2000, "What Explains the Success or Failure of Structural Adjustment Programmes?" *Economic Journal*, Vol. 110, No. 466 (October), pp. 894–917.

Easterly, William, and Ross Levine, 1997, "Africa's Growth Tragedy: Policies and Ethnic Divisions," *Quarterly Journal of Economics*, Vol. 112 (November), pp. 1203–50.

Gelb, Alan H., 1998, *Windfall Gains: Blessing or Curse?* (New York: Oxford University Press).

Grout, Paul, 1984, "Investment and Wages in the Absence of Binding Contracts: A Nash Bargaining Approach," *Econometrica*, Vol. 52 (March), pp. 449–60.

Gylfason, Thorvaldur, 2001, "Natural Resources, Education, and Economic Development," *European Economic Review*, Vol. 45, No. 4 (May), pp. 847–59.

———, Tryggvi T. Herbertsson, and Gylfi Zoega, 1999, "A Mixed Blessing: Natural Resources and Economic Growth," *Macroeconomic Dynamics*, Vol. 3, No. 2 (June), pp. 204–25.

Hall, Robert E., and Charles I. Jones, 1999, "Why Do Some Countries Produce So Much More Output per Worker Than Others?" *Quarterly Journal of Economics*, Vol. 114 (February), pp. 83–116.

Hart, Oliver, 1995, *Firms, Contracts, and Financial Structure* (Oxford: Oxford University Press).

Havrylyshyn, Oleh, and Ron Van Rooden, 2000, "Institutions Matter in Transition, but So Do Policies," IMF Working Paper 00/70 (Washington: International Monetary Fund).

Hermalin, Benjamin, 1992, "The Effect of Competition on Executive Behavior," *Rand Journal of Economics*, Vol. 23, pp. 350–65.

Kaufmann, Daniel, Aart Kraay, and Pablo Zoido-Lobatón, 1999, "Governance Matters" (unpublished: World Bank). Available via the Internet: *www.worldbank.org/research/growth*.

Knack, Stephen, and Philip Keefer, 1995, "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures," *Economics and Politics*, Vol. 7, No. 3, pp. 207–27.

La Ferrara, Eliana, 1996, "A Political Equilibrium Approach to Trade Liberalization in Developing Countries," *Journal of International Trade & Economic Development*, Vol. 5 (November), pp. 287–318.

Little, I.M.D., and others, 1993, *Booms, Crisis, and Adjustment: The Macroeconomic Experience of Developing Countries* (New York: Oxford University Press for the World Bank).

Mauro, Paolo, 1995, "Corruption and Growth," *Quarterly Journal of Economics*, Vol. 110 (August), pp. 681–712.

McGuire, Martin C., and Mancur Olson Jr., 1996, "The Economics of Autocracy and Majority Rule: The Invisible Hand and the Use of Force," *Journal of Economic Literature*, Vol. 34 (March), pp. 72–96.

Ndulu, Benne J., and Stephen O'Connell, 1999, "Governance and Growth in Sub-Saharan Africa," *Journal of Economic Perspectives*, Vol. 13, No. 3 (Summer), pp. 41–66.

Putnam, Robert D., R. Leonardi, and R. Nanetti, 1993, *Making Democracy Work: Civic Traditions in Modern Italy* (Princeton, New Jersey: Princeton University Press).

Robinson, James A., 1999, "When Is a State Predatory?" CES Working Paper No. 178 (Munich: University of Munich, Center for Economic Studies).

Rodríguez, Francisco, and Jeffrey D. Sachs, 1999, "Why Do Resource-Abundant Economies Grow More Slowly?" *Journal of Economic Growth*, Vol. 4, No. 3 (September), pp. 277–303.

Rodrik, Dani, 1996, "Understanding Economic Policy Reform," *Journal of Economic Literature*, Vol. 34 (March), pp. 9–41.

Sachs, Jeffrey, and Andrew M. Warner, 1997, "Natural Resource Abundance and Economic Growth" (unpublished; Cambridge, Massachusetts: Harvard University, Center for International Development). Revised version of NBER Working Paper No. 5398, December 1995.

———, 1999, "The Big Push, Natural Resource Booms and Growth," *Journal of Development Economics*, Vol. 59, No. 1 (June), pp. 43–76.

———, 2001, "The Curse of Natural Resources," *European Economic Review*, Vol. 45, No. 4–5 (May), pp. 827–38.

Shleifer, Andrei, and Robert W. Vishny, 1997, "A Survey of Corporate Governance," *Journal of Finance*, Vol. 52 (June), pp. 737–83.

Svensson, Jakob, 1998, "Investment, Property Rights and Political Instability: Theory and Evidence," *European Economic Review*, Vol. 42, No. 7 (July), pp. 1317–41.

———, 2000a, "Foreign Aid and Rent-Seeking," *Journal of International Economics*, Vol. 51, No. 2 (August), pp. 437–61.

———, 2000b, "When Is Foreign Aid Policy Credible? Aid Dependence and Conditionality," *Journal of Development Economics*, Vol. 61, No. 1 (February), pp. 61–84.

Tornell Aaron, and Philip R. Lane, 1999, "The Voracity Effect," *American Economic Review*, Vol. 89 (March), pp. 22–46.

Tsikata, Tsidi M., 1998, "Aid Effectiveness: A Survey of the Recent Empirical Literature," IMF Working Paper 98/1 (Washington: International Monetary Fund).

Wantchekon, Leonard, 2000, "Why Do Resource Abundant Countries Have Authoritarian Governments?" (unpublished; New Haven, Connecticut: Yale University).

Warner, Andrew M., 1992, "Did the Debt Crisis Cause the Investment Crisis?" *Quarterly Journal of Economics*, Vol. 107 (November), pp. 1161–86.

World Bank, 1998, *Assessing Aid: What Works, What Doesn't, and Why* (New York: Oxford University Press for the World Bank).