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ALBERTO DALMAZZO
GUIDO DE BLASIO

Resources and Incentives to Reform

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Abstract - We develop a model that considers the incentives for a self-interested government to implement reforms. Reforms lead to investment and growth, but reduce the government's ability to appropriate national surplus. Abundance of resources, such as primary commodities and foreign aid, is shown to reduce reforms, causing lower investment. These implications are broadly supported by our empirical evidence: in particular, we show that measures of resource abundance help predict poorer institutions and policies. Our theoretical and empirical conclusions point to some main policy implications. Unconditional aid in the form of fungible funds (including debt-cancellations) may reduce the incentives to reform: for this reason, conditional aid and direct provision of infrastructures are to be preferred. Further, windfalls may undo reform plans: in this case, international institutions may manage aid and debt-policies as a discipline device.

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Alberto Dalmazzo, Dipartimento di Economia Politica, Università di Siena
Guido De Blasio, International Monetary Fund and Bank of Italy

1. Introduction

Recent literature has attributed the low rates of investment and growth observed for many developing countries to a combination of poor infrastructure and bad policies and institutions, such as insufficient economic liberalization, unstable macroeconomic environment, and poor political and legal frameworks. At the same time, studies such as Sachs and Warner (1995,1999) have emphasized the adverse effects of natural resources, while other work has questioned the effectiveness of foreign aid to stimulate economic development in poor countries: see Tsikata (1998), Dollar and Easterly (1999). The scope of this paper is to provide a simple unifying explanation for these observations, adding at the same time some new evidence. In particular, we consider the incentives to reform for a self-interested government, showing that the availability of resources, such as foreign aid and natural resources, discourage the adoption of "good policies" and eventually hamper investment and growth. This approach has relevant policy implications concerning aid policy and debt forgiveness.

In the simplest version of the model, we consider an autocratic government that has two alternatives. It can either choose not to reform, concentrating on loot-seeking activities that exploit the country's endowment, or adopt good policies, implementing reforms and public investment in infrastructure to encourage investment and growth. We focus on the incentives of self-interested coercive governments to take actions that can partly be in the interest of society (see McGuire and Olson (1996)). From the government's point of view, the benefits from reforms arise from a *larger* national surplus, which can partly be appropriated. However, good policies are costly to an autocracy. Reforms such as lower taxation, lower tariffs, less state control on the economy, etc., tend to reduce the fraction of national surplus that the ruling elite can extract. Moreover, reforms reduce political support among the government's clienteles, increasing for example the risk of a coup d'ètat.[1] Consequently, a reforming government may have lower chances of political survival. We show that an autocratic government will have less incentive to reform when the country's resources are abundant (see Section 2). This result bears relevant implications for the effects of natural resource shocks and foreign aid, including debt forgiveness, on reform plans. In particular, the ruling elite will react to positive resource shocks by slowing down reforms, so to increase its rents and the odds of remaining in office. Since the basic model hinges on a deep divergence of interests between political leaders and their populations, 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 population). As we show, however, international institutions may sometimes play the role of "large stakeholders," putting pressure on local governments to implement efficient actions.

[1] 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 also argue that reforms tend to increase the contestability of governments and encourage dictators to oppose development: "President Mobutu opposed Zairian development…because development raised the threat of political demise and the loss of his substantial claim on GDP."

The simplest model is expanded in a number of directions. A two-period extension shows that windfalls have negative effects on reform plans. In Section 2.2 we generalize the model to study the case when the government cares to some extent about the welfare of the society. We show that resource abundance has adverse effects only when government's benevolence is sufficiently low. Finally, in Section 2.3 we analyze the implications that international institutions may face when providing aid.

In Section 3 we present some OLS evidence drawn from a sample of 65 developing countries. We first show (Section 3.1) that resource abundance, as measured by foreign aid and proxies for natural resources, has a negative effect on the share of investment over GDP, after controlling for the quality of both institutions and policy. These findings are consistent with other work, such as Sachs and Warner (1995). Yet, they are not conclusive regarding the precise mechanism through which resources hamper investment, since the evidence could be explained by alternative theories as well (Rodriguez and Sachs (1999)). In order to provide some evidence on the mechanism we propose here – resource abundance has a negative effect on investment because it *reduces the incentive to reform* in less developed countries - we use two measures of policy and institutional change as dependent variables. The first one is the change in the country's economic policy index, as defined in Burnside and Dollar (1997). The second one is the change in the country's institutional quality index, as in Knack and Keefer (1995). Consistent with our theoretical predictions, we show that measures of countries' resource abundance have a negative impact on the subsequent changes in institutional quality and policy indicators. We take this evidence as suggestive that governments of countries that are rich in resources have weaker incentives to follow good policies.

Our conclusions are related to the theoretical and empirical results obtained in other works. 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. Baland and Francois (2000) exploit an "allocation of talent" model in which, following a resource boom, individuals may leave productive activities to engage in rent-seeking. These models, however, do not explicitly analyze the incentive for the incumbent government to reform. Svensson (1998) develops a model where insecure property rights discourage private investment. He analyzes the incentives for the government to invest in "legal infrastructure," showing that political instability discourages public investment in the legal system. Although his paper focuses, broadly speaking, on the incentives to reform, it is not concerned with the role of natural resources and international aid on the behavior of non-democratic governments. Acemoglu and Robinson (1998,1999) consider the pressure to democratize put by the threat of a revolution upon the ruling elite. While the approach followed by these authors hinges on the costs of an insurrection for the incumbent ruler, our setup emphasizes the gains that the elite can obtain by implementing reforms that stimulate growth. Wantchekon

(2000) argues that authoritarian governments use resource windfalls to "buy off" potential opponents and strengthen their power. Finally, Robinson (1999) develops a formal model where an autocratic government may avoid to supply public goods, so to reduce the likelihood of "collective actions", such as revolutions, on behalf of the citizens. Although this paper bears some similarities to ours, we explicitly consider the joint role of expenditure in infrastructures (public goods) *and* reforms in boosting economic activity. Moreover, we consider the rate at which the autocracy appropriates national surplus as a function of reforms.

In Section 4, we conclude by discussing some policy implications of the model, which may provide a rationale for the criteria followed by international institutions in aid policy. We argue that (i) international institutions should take into greater account the political regime of the receiving countries; (ii) conditional aid and direct provision of infrastructures should definitely be preferred to unconditional donations in the form of fungible funds; and (iii) when a discipline device is needed, foreign aid should be tailored to the actual evolution of the country's resource availability.

2. The model

2.1. The autocratic government as a benchmark case

We consider a country that possesses a net endowment given by $Z=Q-D+A$, where Q represents natural resources, such as revenues from primary commodities, D represents the amount of repayments on foreign debt, and A the amount of aid received by the country (donations). The country's level of civil and economic liberty, denoted by R, is supposed to be low at the onset: in the absence of reforms, R is equal to zero.[2] We suppose here that the country is ruled by an autocratic government, which is purely self-interested. This assumption, although extreme, helps to clarify the basic mechanisms at work in the model. The government enjoys private benefits from its office, since it can appropriate a fraction N of the national surplus with probability p. The probability p denotes the likelihood that the government remains in office. The government can choose not to reform ("bad policy") or make a reform plan together with investment in infrastructure ("good policy"). Good policies stimulate private investment, thus increasing national surplus. Reforms however can be costly, especially for an authoritarian government. We assume that N and p are both decreasing functions of reforms, which is $N'(R)<0$ and $p'(R)<0$. On the one hand, reforms are generally associated to milder taxation and reduce arbitrary behavior, such as "creeping expropriation," on behalf of the government. Thus, reforms tend to decrease the fraction of national surplus N the ruling elite can appropriate.[3] On the other hand, reforms tend to restrain the deeply-rooted

[2] For instance, property rights and civil rights are not safe, there is a high level of corruption on behalf of the ruling faction, the degree of openness to foreign trade is limited, etc.

[3] In this perspective, reforms may include lower taxes, trade liberalization, lower seigniorage, privatization of state-controlled enterprises, etc. The idea that N is reduced by reforms constitutes a crucial difference from Robinson (1999), where the fraction of surplus appropriation is taken to be constant.

system of privileges enjoyed by the clienteles supporting the government.[4] For example, stabilization programs reduce the expenditure in favor of some groups; trade liberalization hurts protected industries; privatization tends to raise unemployment in the short-run; etc. Thus, reforms are very likely to raise the risk that the incumbent government be thrown out of office.

We also assume that, when countries have poor infrastructures, reforms alone are not sufficient to encourage private investment. (See, e.g., 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. Here, reforms and infrastructures are taken to be complementary. Private investment is unprofitable when either the level of infrastructure, or the extent of reforms, is too low. In what follows, we will suppose that the government needs to spend a fixed amount $I = \bar{I}$ on infrastructure as a precondition for private investment.

Events unfold in two stages. In stage 1, the country receives an endowment equal to *Z*, composed of aid and natural resources. The government decides the policy plan (*R,I*), remaining in power with probability *p(R)*. If the government survives, it carries over the plan, implementing the desired levels of *I* and *R*. In stage 2, private investors observe (*R,I*) and decide the optimal levels of investment and production, equal to *K* and *Y* in the aggregate. The government appropriates a fraction *N(R)* of both *Z* and *Y*.

The government's payoff is given by the following expression:

$$\Theta(R,I) = p(R)\cdot\left[\phi(R)\cdot Z + \phi(R)\cdot Y(R,I) - I\right] \qquad (1)$$

where *Y(R,I)* denotes the surplus from private investment, a function of reforms and public investment. The government enjoys private benefits only if it "survives," which occurs with probability *p*. In equilibrium, it must hold that $\phi(R)\left[Z + Y(R,I)\right] \geq I$.

In what follows, we consider an incumbent government that maximizes payoff (1) by anticipating that the level of private investment depends on its decisions on *R* and *I*.[5] To solve for the government's optimal policy choice, it is convenient to divide the problem into two steps. First, we characterize the production decision on behalf of private investors, taking the government's decisions as given. Second, we solve for the

[4] This aspect is particularly relevant in states where there is widespread corruption among local bureaucrats: see, for example, Ndulu and O'Connell (1999) on Africa. La Ferrara (1996) considers a model (without production) where the decision of a self-interested government to liberalize trade depends upon the possibility to retain 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.

[5] Here we neglect the possibility that the government faces liquidity constraints; this issue is explicitly considered in Appendix 1.2.

policy choice, when the government anticipates private investors' reaction. The government thus acts as a Stakelberg leader.[6]

We first analyze the private investors' problem. Suppose that there is a continuum of investment projects uniformly distributed over the interval [0,1]. Each private investor *i* maximizes the surplus y_i by choosing the level of capital k_i:

$$\max_{\{k_i\}} \quad y_i = D(I) \cdot S(R) \cdot k_i^{\alpha} - r \cdot k_i \qquad (2)$$

where *D(I)=0* for $I < \bar{I}$ and *D(I)=1* for $I \geq \bar{I}$. We also assume that *S'(R)>0, S''(R)<0,* and *S(0)=0.* The objective function (2) postulates that each private investor's revenues are strictly positive only if the government invests up to the amount $\bar{I}$ in infrastructures and implements some reforms ($R>0$).[7]

Investor *i*'s solution to problem (2) yields the following:

$$k_i = \left(\frac{\alpha \cdot D(I) \cdot S(R)}{r} \right)^{\frac{1}{1-\alpha}}$$

Under symmetric equilibrium, it holds that $k_i=K$ for every *i*, where *K* also denotes the equilibrium level of aggregate capital. Thus, in a symmetric equilibrium ($y_i=Y$), the equilibrium level of private net production is given by:

$$Y(R,I) = C \cdot [D(I) \cdot S(R)]^{\frac{1}{1-\alpha}} \qquad (3)$$

where $C = (1-\alpha)\left(\frac{\alpha}{r} \right)^{\frac{\alpha}{1-\alpha}}$. Equation (3) represents private investors' reaction function to the government's choice of *R* and *I*.

6 We deliberately overlook Kydland-Prescott's time-consistency problems, arising from the possibility that once private investment is made, reforms are repealed and private surplus is expropriated by the ruling elite. Indeed, we assume that private capital is very mobile, in the sense that private entrepreneurs can disinvest their capital at no cost when the economic environment of the country is not longer favorable. Even disregarding time-consistency issues, the model generates important interactions between government's decisions and private sector behaviour.

7 The assumption that "good policies" are necessary for private investment to generate output is consistent with evidence in Dollar and Easterly (1999). They argue that private investment depends on the type of policies adopted by the government and find also that private investment generates growth only when combined with reforms and investment in infrastructures.

Anticipating private investors' behavior, summarized by equation (3), the government solves the following problem:

$$\max_{\{R,I\}} \Theta(R,I) = p(R)\left[\phi(R)\cdot Z - I + \phi(R)\cdot Y(R,I)\right] \qquad (4)$$

Two cases may arise: *(i)* the government chooses a level of investment in infrastructure such that $I < \bar{I}$, *(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 (4) reduces to $\Theta = p(R)[\phi(R)\cdot Z - I]$. In this case, the investment in infrastructure is insufficient to stimulate private investment. Thus, the optimal levels of reforms and public investment are equal to zero (recall that *p'(R)<0* and *N'(R)<0).* The government's payoff is thus equal to *1(0,0)=p(0)N(0)Z.*

Case (ii). Suppose that $I \geq \bar{I}$. Given our assumptions on (2), the optimal choice of public investment is equal to $I = \bar{I}$. Hence, the optimal amount of reforms *R** is the solution to the following first-order condition:

$$\frac{\partial\Theta(R,I)}{\partial R} = \left(\frac{p'(R)}{p(R)} + \frac{\phi'(R)}{\phi(R)}\right)\cdot\left[Z - \frac{\bar{I}}{\phi(R)} + Y(R,\bar{I})\right] + \left[\frac{\phi'(R)}{\phi(R)^2}\bar{I} + \frac{\partial Y(R,\bar{I})}{\partial R}\right] = 0 \qquad (5)$$

and yields a payoff equal to $\Theta(R^*,\bar{I})$. From differentiation of (5) it holds that $\frac{dR^*}{dZ} < 0$ whenever the second-order condition for a maximum is respected. Thus, an increase in the country's net resources induces the government to reform less. As a consequence of weaker reforms, the equilibrium level of private investment and production will be lower (see equation (3)). Further, the concavity of (4), the government's objective function, implies that the additional gains from reforms are decreasing in *R.*

A rational, self-interested government will decide to implement good policies if the following condition is respected:

$$\Theta(R^*,\bar{I}) \geq \Theta(0,0) \qquad (6)$$

Figure 1 illustrates a case when condition (6) holds. The level of the resources *Z* has a crucial impact not only on the degree to which good policies are pursued, but also on the opportunity of introducing reforms *at all*.

Svensson (1998) finds that little investment in legal infrastructure generates low levels of domestic investment. Our results

By exploiting the envelope theorem, the effect of a larger level of *Z* on the payoff corresponding to good policies is given by $\frac{d\Theta(R^*,\bar{I})}{dZ} = p(R^*)\cdot\phi(R^*)$. However, a larger *Z* has a stronger effect on the payoff from bad policies, since it holds that $\frac{d\Theta(0,0)}{dZ} = p(0)\cdot\phi(0) > p(R^*)\cdot\phi(R^*)$. Thus, the more abundant are resources, the smaller the chance that condition (6) is respected. We summarize these findings as follows:

Result 1. When the government is purely self-interested, resource abundance (high Z) makes the implementation of good policies less likely. Also, if reforms are undertaken, an increase in net resources will induce more conservatism (lower R) in the government's behavior.*

Result 1 is consistent with the evidence presented by Sachs and Warner (1999), who find an inverse association between natural resource abundance and several measures of institutional quality. In Section 3.2 we provide evidence on the negative association between resources abundance and changes in institutional quality and policy indicators.

The model generates additional implications when it is extended to two periods, in order to investigate the effects of windfalls on reforms. We suppose that, at time t=1, the government chooses investment in infrastructures and the levels of reforms, R_1 and R_2, to be implemented at t=1 and t=2. The country receives an endowment Z_1 at time 1, and an (expected) endowment Z_2 at time 2. The government's probability of survival at time *t*, $p(R_t)$, depends on reforms at time *t* (with t=1,2). Similarly, the fraction of surplus appropriated by the government at time *t* depends on the level of reforms, that is $N(R_t)$. As shown in detail in Appendix 1.1, the following holds:

Result 2. (i) An expected increase in the future level of the endowment, Z_2, induces the government to adopt a more conservative reform plan. Moreover, (ii) reform plans can be undone, when an unexpected windfall occurs at time 2.

The intuition for part *(i)* of the Result is rather immediate. Since the government expects to predate from a greater amount of resources, it prefers to reduce reforms so to maintain higher rates of appropriation *N* in both periods, together with higher probabilities of survival. Consequently, the reform process becomes weaker when additional aid, debt cancellations, or increases in the value of home-produced primary commodities are expected. As for part *(ii)*, when an unexpected windfall occurs during a planned reform process, the government will

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in Section 3 are consistent with these findings.

become more prone to predation, even at the cost of cutting back on reforms and discouraging private accumulation.[8]

Positive endowment shocks may thus generate perverse effects on reform plans. When windfalls arise over time,[9] the government's desire to reform at time t=2 will be lower than the level planned at t=1. In such cases however, international institutions can (in part, at least) safeguard reform plans by using discipline devices such as *reductions* in donations and *reductions* in debt-forgiveness[10]. For opposite reasons, negative endowment shocks that reduce the gains from predatory behavior may induce governments to go for good policies. In this case, even a self-interested government may find it convenient to encourage private investment[11].

The negative implications of net resources on reforms carried by Results 1 and 2 can, to some extent, be mitigated when the government is subject to liquidity constraints. We fully discuss this possibility in Appendix 1.2. In the following section, we remove the extreme assumption that governments are purely self-interested.

2.2. A generalization: government benevolence and welfare

The basic one-period model presented in Section 2.1 postulates that the government is interested only in the benefits it can extract while staying in office. 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 non-negative weight $\exists \geq 0$ on the residual share, 1-N, of surplus left to society. Here, "benevolence" can be thought of as a simple modeling device that captures the influence on the actions of the government of the civil and economic environment of the country (see Putnam (1993)). An important difference from the preceding analysis is the following. When an incumbent government also cares about society, it does so both when it remains in office (prob.=p), and when it loses power (prob.=1-p). We postulate that all the possible types of government that can take power in the economy are characterized by a

[8] This result bears some similarity to the conclusions of Tornell and Lane (1999). According to these authors, when legal and political institutions are weak, windfalls in the production sector will increase the rent-seeking activities of (competing) powerful groups. This "voracity" effect reduces capital accumulation and growth. For this reason, they argue that positive terms-of-trade shocks, foreign aid and natural resources shocks (like the oil shocks in Nigeria, Venezuela and Mexico) tend to have adverse effects on growth in countries ruled by an elite. Differently from theirs, our model puts stronger emphasis on the incentive to undertake reforms for an incumbent government subject to political risks. Since natural resources, or funds from abroad, are easier to appropriate in countries with poor institutions, windfalls will reduce the incentive to reform. In turn, weak reforms will reduce the incentives to invest.

[9] The possibility that reforms are partly reversed after aid has been given is considered by Dollar and Easterly (1999).

[10] Corporate governance theory applied to managerial behavior generates similar implications. Severe inefficiencies may occur when self-interested managers run companies that have excess cash and limited investment opportunities. In those cases, debt can constrain managers' behavior: see Jensen (1986) and Hart and Moore (1995).

[11] These implications do not seem at odds with the Latin American experience of the 1980s. After having being subject to debt overhang and negative terms of trade shocks (see Warner (1992)), many Latin American countries have started a robust program of political and economic reforms. In addition to the evidence we present in Section 3.2, La Ferrara (1996) finds that negative term-of-trade shocks increase the probability of subsequent trade-liberalizations for a sample of sub-Saharian countries .

certain value of care for society, $\exists$. The distribution of $\exists$ is defined over the support [0,4], with an average equal to $\hat{\beta}$.

When the government has some benevolence towards society, its objective function takes the form:

$$\tilde{\Theta} = p\{\phi[Z+Y]-\bar{I}\}+\beta\ \{p(1-\phi)[Z+Y]+(1-p)(1-\hat{\phi})[Z+\hat{Y}]\} \qquad (7)$$

$$\textit{subject to} \quad \phi[Z+Y]\geq\bar{I}$$

where $\hat{\phi}\equiv\varphi(\hat{R})$ and $\hat{Y}\equiv Y(\hat{R},\hat{I})$ denote, respectively, the levels of *N* and *Y* calculated under the expected policy plan $(\hat{R},\hat{I})$ that will be implemented by an *average new government* $(\beta=\hat{\beta})$ coming into office with probability (1-*p*). Note that when the incumbent government has no benevolence towards society ($\exists$=0), expression (7) reduces to expression (1). In what follows, we assume that the analog of condition (6) is always respected: the government finds it always convenient to implement a certain amount of good policies.

The first-order condition relative to the objective function (7) is given by:

$$\frac{\partial\tilde{\Theta}}{\partial R}=\frac{\partial\Theta}{\partial R}+\beta\left\{p'\left[(1-\phi)(Z+Y)-(1-\hat{\phi})(Z+\hat{Y})\right]+p\left[-\phi'(Z+Y)+(1-\phi)\frac{\partial Y}{\partial R}\right]\right\}=0 \qquad (8)$$

where $\frac{\partial\Theta}{\partial R}$ is defined in expression (5). By evaluating (8) for the *average* government type, $\hat{\beta}$, the first term in braces drops, and we obtain an implicit expression for the optimal level of reforms, $\hat{R}^*$, that the *average* government is willing to implement. Hence, expression (8) takes the form:

$$\frac{\partial\tilde{\Theta}}{\partial\hat{R}}=\frac{\partial\Theta}{\partial\hat{R}}+\hat{\beta}\left\{p(\hat{R})\left[-\phi'(\hat{R})[Z+Y(\hat{R},\bar{I})]+(1-\phi(\hat{R}))\frac{\partial Y(\hat{R},\bar{I})}{\partial\hat{R}}\right]\right\}=0 \qquad (8')$$

yielding $\hat{R}^*=\hat{R}(\hat{\beta})$. Note that the term in braces in (8') is positive: consequently, when the second-order condition for a maximum is respected, it holds that $\frac{d\hat{R}^*}{d\hat{\beta}}>0$. Thus, the higher the *average* degree of benevolence of the possible governments in the economy, the higher the average level of reforms. This version of the model encompasses some extreme cases. First, when the average degree of benevolence is very small ($\hat{\beta}\to 0$), governments care only about private benefits from power, as in the benchmark case of Section 2.1. McGuire and Olson (1996) define this as the "autocrat" or "dictatorial ruler" case.

When governments is extremely benevolent on average ($\hat{\beta} \to \infty$), the weight given to private benefits from power becomes negligible, and (7) reduces to:

$$\tilde{\Theta}\Big|_{\hat{\beta}\to\infty} = (1-\hat{\phi})[Z+\hat{Y}] \qquad (9)$$

In this case, the average government is willing to implement the highest attainable level of reforms. In this case, the optimal $\hat{R}^*$ is a corner solution that satisfies the financing constraint $\phi(Z+Y) = \bar{I}$. In other words, the government sets the highest level of reforms (that is, the lowest level of *N*) consistent with the funding of infrastructures, $\bar{I}$ (see McGuire and Olson, 1996, p.81). This result has an interesting implication. Since $\hat{R}^*$ is such that $\phi = \bar{I}/(Z+Y)$ is satisfied, expression (9) becomes:

$$\tilde{\Theta}\Big|_{\hat{\beta}\to\infty} = Z + \hat{Y} - \bar{I} \qquad (10)$$

Thus, the payoff of ultra-benevolent governments ($\hat{\beta} \to \infty$) coincides with the net surplus of the economy. This result replicates the ideal case of the "consensual democracy," as defined by McGuire and Olson (1996). The extent of sub-optimality can be measured as the difference between the socially optimal level of reforms solving $\phi = \bar{I}/(Z+Y)$ and the actual level of reforms implemented by the incumbent government.

Coming back to the general case of $\hat{\beta} \in [0,\infty)$, differentiation of (8') implies that the effect of resources, *Z*, on reforms depends crucially on the average degree of benevolence, $\hat{\beta}$. Since it holds that $\operatorname{sgn}\left(\frac{d\hat{R}^*}{dZ}\right) = \operatorname{sgn}\left\{ p'\phi + p\phi'(1-\hat{\beta}) \right\}$, we obtain the following:

Result 3. When the average government is sufficiently benevolent (i.e., when $\hat{\beta} > 1 + \frac{p'\phi}{p\phi'}$ *holds), an increase in net resources, Z, will stimulate the implementation of reforms. By contrast, when it holds that* $\hat{\beta} \le 1 + \frac{p'\phi}{p\phi'}$ *, the desire to appropriate a larger endowment share will reduce the average government's incentive to reform.*

As a consequence, our model predicts that the effects of resource shocks crucially depend on the (average) government's attitude towards society.[12] This Result may thus explain why different countries, such as Norway and Nigeria, have reacted so differently to similar shocks, such as oil windfalls: see Wantchekon (2000).[13]

In what follows, we extend the discussion of the model to the effects of foreign aid by restraining our attention to the case of pure self-interest ($\exists$=0).

2.3. Self-interested governments and foreign aid

As we argue in what follows, the effects of aid crucially depend on the type of support a country is given. The conclusion that countries rich in endowment have weaker incentives for reform (Result 1) bears important implications for types of aid such as *donations* 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 reforms *R** or, at the extreme, it reinforces the desire to keep bad policies in place. Hence, when governments mainly care about extracting private benefits from the national surplus, donations will make reforms less likely.[14,15] In light of these results, empirical evidence showing that aid flows have an ambiguous, and often negative, impact on investment and growth in less developed countries is not surprising (see, among others, Boone (1996), Burnside and Dollar (1997), and Dollar and Easterly (1999) on African countries[16]).

When other types of aid are enforceable, 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 building some pieces of infrastructure.

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[12] Note that when the average government is ultra-benevolent ($\hat{\beta} \to \infty$), an increase in *Z* allows for a slackening of the financing constraint on infrastructures. As a consequence, the optimal (corner) level of reforms becomes higher.

[13] See also Burnside and Dollar (1997).

[14] This observation is consistent with the view that aid can delay reforms. (See Rodrik (1996) and Tsikata (1998)). By adopting a time-inconsistency approach in a game between donors and recipients, Svensson (2000b) shows that the anticipation of aid may reduce the incentives to introduce costly reform policies.

[15] At most, donations can eliminate the financial constraints faced by a country. As shown in Appendix 1.2, this occurs when the incentive condition (6) holds, but the available resources fall short of the cost of infrastructures, i.e., when condition $\phi(R^*) \cdot Z < \bar{I}$ holds true.

[16] Other recent findings are compatible with our results. 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. Similarly, Svensson (2000a) finds that both aid and resource booms are positively associated to corruption.

Making aid conditional on reforms. Suppose that aid is made conditional on the reforms a government actually implements. The amount of aid, denoted by *H*, will depend upon the observed level of reforms *R*. Hence, *H=H(R)*, with *H'*>0. In this case, the government's objective function (1) takes the form:

$$\hat{\Theta}(R,I) = p(R)\cdot\left[\phi(R)\cdot Z + \phi(R)\cdot H(R) + \phi(R)\cdot Y(R,I) - I\right] \qquad (1')$$

Donors can adopt a reward function *H(R)* such to stimulate more reforms in equilibrium. In particular, the presence of *H(R)* in (1') implies greater incentives to reform, relative to problem (1), when the following condition holds: $p'\cdot\phi\cdot H + p\cdot\phi'\cdot H + \phi\cdot\frac{\partial H}{\partial R} > 0$. Thus, conditional aid may induce self-interested governments to adopt better policies, so to enjoy the promised reward. [17]

We next consider direct provision of infrastructures, a form of aid that aims at eradicating the "funds-fungibility" problem. This kind of aid policy naturally arises as a natural consequence of the approach followed here.

Direct provision of infrastructure. The direct implementation of specific projects by foreign countries or international organizations may avoid the concession of fungible funds to local governments. In addition, this form of aid reduces the cost of infrastructures $\bar{I}$ borne by the local government up to a certain amount *X*. Consequently, this form of aid has effects similar to a reduction in the cost of public investment.

This point can be simply illustrated as follows. Since it holds that $X \in [0,\bar{I}]$, the government's payoff from good policies is given by $\Theta(R^*,\bar{I}-X) = p(R^*)\cdot\left[\phi(R^*)\cdot Z - (\bar{I}-X) + \phi(R^*)\cdot Y(R^*,\bar{I})\right]$. On the other hand, the payoff from keeping bad policies in place remains equal to $\Theta(0,0) = p(0)\phi(0)\cdot Z$. Thus, the government will be willing to start a reform program if the ensuing condition holds:

$$\Theta(R^*,\bar{I}-X) \geq \Theta(0,0), \qquad with \quad X \in [0,\bar{I}] \qquad (6')$$

[17] Our conclusion ignores, however, possible time-consistency problems. For instance, a government might have incentives to undo reforms after receiving the reward for good policies. The ability to enforce types of conditional aid is discussed in Dollar and Easterly (1999) and Svensson (2000b). To this regard however, 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 24th 2000).

It is immediate to show that there exists a value of X in the interval $[0, \bar{I}]$ such that condition (6') holds.[18] Thus, the following holds:

Result 4. When donors can provide infrastructures directly, autocratic governments have the incentive to implement some reforms.

This conclusion crucially depends on the complementarity between reforms and infrastructures. When international aid can provide some infrastructure, the costs of good policies are reduced, while the gains from reforms remain intact. Furthermore, this type of aid can also circumvent the problems associated with financial constraints that prevent governments from borrowing and investing (see Appendix 1.2).

2.4. A summary of the empirical implications of the model

Our model builds on the following idea. Abundance of resources, be them natural resources or foreign aid, modifies the incentives of self-interested governments to reform. The lower the level of political and economic reforms, the lower the level of private investment and production. In conclusion, resources have a negative effect on private investment *through the level of reforms* undertaken by self-interested governments. Thus:

(i) Since *(a)* net resources have negative effects on reforms, and *(b)* poor civil and economic liberties have adverse effects on investment[19], the *reduced-form* of our model predicts that *investment depends negatively on resources*. This reduced-form prediction is observationally equivalent to alternative explanations, such as those based on the "Dutch disease" or externality-effects[20]. Yet, to our knowledge the *joint* effect of aid and natural resources on investment has not been tested so far.

(ii) Since the model predicts that available resources reduce the incentive to implement good policies, we expect that natural resources, as well as foreign aid, have a negative effect on reform indexes.[21] We test this "political" mechanism, which mainly characterizes the present model, by using indexes of both civil and economic liberties.

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[18] To prove this result note that, when $X = \bar{I}$, a positive amount of reforms yields a payoff that dominates the no-reform payoff (*R=0*).

[19] The idea that sound policies and good institutions are positively related to private investment has been heavily highlighted in the literature on economic growth: see, for example, Barro and Sala-I-Martin (1995), Knack and Keefer (1995), and Svensson (1998).

[20] In particular, Sachs and Warner (1995) 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.

As mentioned above, there are two different contexts that present considerable empirical evidence broadly consistent with our results. On the one hand, the literature assessing the role of aid has provided some estimates of the effects of aid on investments. (See Burnside and Dollar (1997) and Dollar and Easterly (1999)). These effects were found to be ambiguous, or even harmful. For a sample of five Asian countries, McGillivray and Ahmed (1994) found a positive effect in only two of them; in a panel of development countries, Boone (1996) found that foreign aid failed to raise the investment rate (see also World Bank (1999)). On the other hand, the literature on terms-of-trade shocks has emphasized the perverse effect of windfalls on growth in several countries. (See Auty (1990), Gelb (1998), and Little and others (1993)). More recently, Sachs and Warner (1995,1999) have provided additional cross-country evidence on the negative effects of natural resources on growth. It must be noted that the studies quoted above analyze one kind of resource endowment at a time (e.g., aid), while neglecting other types (e.g., natural resources). In what follows, we provide some additional evidence consistent with the main predictions of the model.

3. Empirical evidence

Our empirical strategy is comprised of two steps. In Section 3.1, we first estimate an equation for investment (*INV*), showing that the quality of institutions and policies has significant explanatory power.[22] We also analyze the role of resources, as measured by foreign aid and natural resource shocks, finding that resources have a negative effect on investment. Then, in Section 3.2 we estimate a specification to capture the role of resources on reforms, the central feature of our model. We find that our measures of resource abundance have a perverse effect on the change of policy (*)P*) and institution (*)IQ*) indexes.

In what follows, we describe the data used. To minimize the reverse causation problem, all the explanatory variables are measured at the beginning of the sample period (year 1985). The sample of countries, reported in Appendix 2, has been determined on the basis of their availability in all of the four different data-bases used. The list and the definitions of variables is provided in Appendix 3, while Appendix 4 offers summary statistics.

Growth theory variables. A first group of explanatory variables – used here as controls – originates from empirical work in growth theory: see Barro and Sala-I-Martin (1995). This group comprises *Y85*, denoting real GNP per capita (calculated in 1995 US$) to control for convergence; *PI85*, denoting the 1985 PPP value of the price level of investment, used to proxy for the relative return to investments; and *PRIM85*, denoting primary school enrollment rates in the year 1985, used to control for human capital effects on investments.

[21] This conclusion holds provided that liquidity constraints are not binding: see Appendix 1.1.
[22] Our measure of investment includes both private and public investment. This is justified by the fact that, with reference to our model, positive resource shocks reduce the incentive to implement good policies, including investment in infrastructure. However, similar results are obtained when the empirical analysis is restricted to measures of *private* investment.

Policy and institution and variables. The quality of economic policies is approximated by the Burnside and Dollar (1997) policy index *P*, calculated as $P = 1.3 + 5.4 \Delta FB - 1.4 \Delta I + 2.1 \Delta O$, where *FB* is the share of fiscal balance over GDP, *I* is the inflation rate, and *O* is the Sachs and Warner's (1995) openness dummy.

The level of institutional development is proxied by *IQ*, which is a summary measure of indicators from the International Country Risk Guide (see Knack and Keefer (1995)). This is the most widely used measure of institutional quality in the literature. The indicators are the following: *rule of law* (the extent to which institutions provide effectively for the implementation of law, adjudication of disputes, and orderly succession of power); *corruption in government* (related to the frequency of bribes in areas such as international trade, taxation, and police protection); and *quality of bureaucracy* (a measure of autonomy from political pressure and strength and expertise to govern without drastic changes in policy or interruptions in government services). While the relation between economic policy and institution variables has been investigated in some recent literature (see for example Havrylyshyn and van Rooden (2000)), here we leave the issue of their relative importance aside. Our definition of reforms encompasses both economic policy and institution aspects.

Resource variables. We use two kinds of resource variables. The first is *AID*, given by the average amount of aid as a fraction of investment *INV* over the period 1980-1985. The second measure of resources aims at capturing the effect of natural resources. We approximate natural resources through two alternative measures: (i) *TT1* is the 1980-85 growth rate of terms-of-trade, as in Barro and Sala-i- Martin (1995); (ii) *TT2* is given by *TT1* multiplied by the average share of trade on GDP over the period 1980-85. The latter measure, which includes quantities,[23] is more better suited to capture the effects of resource shocks (see Sachs and Warner (1995)).

3.1. The determinants of investment

In Table 1, we start by estimating a benchmark model for investment that includes policy and institutional variables. (See Barro and Sala-i-Martin (1995), Knack and Keefer (1995) and Svensson (1998)). Equation (I.a) delivers results that are in line with previous work on the subject. *PI* is negative and significant, while the coefficient associated with *Y85*, the initial income level, is not significantly different from zero; *PRIM85* has a positive effect on investments and it is highly significant. Turning to the policy and institution variables, included in specifications (I.b) to (I.d), the proxy *P85* is always significant and its estimated impact on investments is considerable. A unit standard deviation increase in the initial level of *P85* would be associated with a rise in the investment share of GDP of about 2.9 percent. The proxy for institutional quality, *IQ85*, has the expected sign, although its significance reaches a level close to 5 percent only when the *P85* is included as well, as done in equation (I.d). Its magnitude seems however remarkable. A unit standard deviation increase in the

[23] Our measures of trade include both primary commodities and manufacturing. According to our notion of "resources," trade measures should ideally include only primary commodities.

initial level of *IQ85* would be associated with a rise in the investment share of GDP of about 1.4 percent. We elect equation (I.d) as our benchmark specification in the following analysis.

Turning to the effects of the resource variables, Table 2 presents the estimates of the impact of *AID*, *TT1*, or *TT2*, on investment *INV*. We control both for *IQ85* and *P85*. Broadly speaking, the results shown in this table support the conclusions of our model. First, the resource variables *AID* and *TT1*, or *TT2*, always have the expected negative sign. Second, the statistical significance of these variables tends to increase when they are jointly included in the regressions. (See equations (II.d) and (II.e)). Note also that the "price by quantity" variable *TT2* dominates in every specification the pure "price" variable *TT1*.

The magnitude of the effects at play is considerable. According to the results in Table 2, a unit standard deviation increase in *AID* would be associated with a decrease of 3.1 percent in the investment share of GDP (equation II.a). This effect is even stronger when we control for the natural resource variables. The decrease in investment would be 3.4 percent when we include *TT1* (equation II.d) and 3.8 percent when we include *TT2* (equation II.e). With regard to our proxies for natural resources, the negative impact of a unit standard deviation increase of *TT2* on investments is always larger than the corresponding one associated with *TT1*. In particular, the reduction in investment associated with a unit standard increase in *TT2* is 1.8 percent when *AID* is not considered (equation II.c), and 2.7 percent when *AID* is included (equation II.e).[24]

3.2. Resources and incentives to reform

The empirical evidence presented in Section 3.1 confirms that healthy policies and good institutions are crucial for investment. Moreover, our results show that when the quality of institutions and policy is controlled for, an increase in resources has a negative effect on investment.

The scope of this section is to provide some evidence of the central mechanism that drives our model, where the negative effect of resource abundance on investment works through the incentive to implement good policies. Consistently with the model proposed, we show that the variables approximating the 1980-85 average levels of natural resources (namely, *TT1* and *TT2*) have a negative and significant effect on reforms, defined as *changes* in the indexes of policy (*)P*) or institutional quality (*)IQ*) between 1985 and 1997. The effect of *AID* on reforms appears to be less important, although this variable has the expected negative sign and is often significant.

Tables 3 and 4 present the specifications for *)P* and *)IQ* respectively. As in Section 3.1, we start by estimating a benchmark equation for our independent variables and then we add the resource variables. It should be noted that the initial level of income, *Y85*, appears to be unimportant, and the human capital proxy *PRIM85* seems to deliver minor effects as well. In contrast, the *initial* levels of both policy and institution variables, *P85* and *IQ85* respectively, matter for *future* reforms. The initial level of *IQ85* has a negative and highly significant

[24] For *TT1*, the corresponding values are respectively 0.93 (see equation II.b) and 1.24 percent (see equation II.d).

effect on *)IQ*. Similarly, *P85* has a negative and significant effect on *)P*. This is consistent with the theory's prediction, since the gains associated with good policies increase at a decreasing rate.[25]

When we consider the impact of our proxies for natural resources, we find that the effects of both *TT1* – as captured by equations (III.c,e) and (IV.d,e) –, and *TT2* – as captured by equations (III.d,f) and (IV.d,f) – are negative and significant. Moreover, the impact of *TT1* and *TT2* on policy reforms (*)P*) is much bigger – on average, 15 times larger – than the corresponding effect on institutional reforms (*)IQ*). Again, the effect of the proxy *TT2* dominates that of *TT1*. By contrast, the evidence on the role of foreign aid is weaker. Although *AID* enters our specifications with the expected negative sign and is strongly significant when *)IQ* is considered, the value of the point estimate is very low.

A number of conclusions can be drawn from our results. First, both economic policy and institutional quality matter for investments. Also, in our sample the impact of policy appears to be larger. Second, an increase in foreign aid and natural resources seems to hinder investments. Third, the specific mechanism driving our theoretical predictions, namely that a rise in resources tends to have negative consequences on reforms, receives empirical support. Although the effect of foreign aid is quite small, abundance of natural resources appears to hinder reforms significantly, in particular when economic policy indicators are considered. Finally, a sound macroeconomic environment (measured here by *P85*) looks promising for future improvements in institution quality (as measured by *)IQ*). By contrast, good institutions (i.e., a high level of *IQ85*) do not seem to be related to future macroeconomic stabilization (measured by *)P*).

4. Concluding remarks and policy implications

Our empirical and theoretical results point to a main conclusion. The incentives of a self-interested government to implement reforms leading to investment and growth are weaker when resources are abundant. This conclusion raises the question of what international institutions can do to encourage the adoption of good policies; that is, how to make foreign aid work.

Three main policy prescriptions can be drawn from this paper. First, the effects of donations crucially depend on the government's attitude towards society. When the government cares about the welfare of its citizens, then foreign aid can indeed stimulate reform implementation, as shown in Section 2.2. A better targeting of foreign aid towards countries where a benevolent government is in office would deliver more

[25] Note that the links between policy and institution variables seem to be asymmetric. The initial level *P85* has a positive and significant effect on *)IQ* (see Table 4). By contrast, the initial level *IQ85* seems to have a negative, although not significant, effect on *)P85* (see Table 3).

effective results.[26] Our analysis thus calls international institutions to take into greater account the political and economic regime of a receiving countries when assessing aid opportunities.

Second, our results strongly argue in favor of making aid conditional on reforms and providing infrastructures directly. These forms of aid dominates unconditional money donations, as shown in Section 2.3. Overall, our model leads to quite optimistic conclusions. When appropriately designed, adequate amounts of foreign aid can induce self-interested governments to undertake reform programs. Our analysis thus provides an economic rationale for the criteria that the IMF and the World Bank try to follow in aid policy.

Third, the two-period extension of the model (Section 2.1 and Appendix 1.1) points out that even *expected* donations may induce governments to adopt more conservative reform plans. This result underscores that caution in aid policy should be extended from current aid disbursements to pledges themselves, and opens up an intriguing policy issue. When windfalls occur over time, reducing the government's desire to implement the planned level of reforms, international institutions can - in part, at least - use disciplinary devices such as reductions in donations, and reductions in debt-forgiveness. Our analysis thus underscores the need to tailor foreign aid to the actual evolution of the country's resource availability.

These policy prescriptions are also relevant from the perspective of debt relief for low-income countries (Boote and Thugge (1999)). Our findings strongly support the fundamental principle of the Highly Indebted Poor Country (HIPC) Initiative launched in 1996: debt relief must come together with an ambitious program of structural reforms and macroeconomic stabilization to provide a permanent exit from the rescheduling process. Accordingly, debt relief should be provided after the debtor country has demonstrated the capacity to use it prudently, by establishing a sound track record of good performance[27]. On this front, the debate on the features of the debt relief Initiative is still underway. In particular, NGOs and civil society representatives are arguing for the option of an upfront debt reduction over the alternative of refinancing with conditionality. (For the respective merits of the two options see Claessen and others (1997)). Moreover, they are also lobbying (a) to increase the number of eligible countries, irrespective of their political regime; (b) to make the delivery of debt relief faster; and (c) to limit the scope of conditionality. Our results point out that such proposals would be a step in the wrong direction. Indeed, this paper rather unpleasantly underlines that - to be effective - debt cancellation should: (i) be targeted only towards countries with a favorable political regime; (ii) be accompanied by some form of conditionality; and (iii) be disbursed over time – on a period-by-period basis while the country policy stance is closely monitored by the IMF and the World Bank – so as to keep the receiving government on a short leash (Williamson (1988)).

[26] This is consistent with the conclusions of Dollar and Easterly (1999), who argue that aid has positive effects on growth only when governments are willing to implement reforms. In fact, when countries do not have conditions conductive to reforms, aid is bound to be unsuccessful.

27 See Andrews and others (1999).

Appendix 1

1.1. The two-period model

The setup of the two-period model is described in Section 2.1 in the text. We still assume that private investment is highly mobile, so that the type of policy implemented has an immediate effect on the level of private investors' accumulation. The government's objective function is now given by:

$$\Theta(R_1, R_2, I) = p(R_1)\left[\left(\phi(R_1)\cdot Z_1 - I\right) + \phi(R_1)\cdot Y(R_1, I)\right] + \\ + \left(\frac{p(R_1)\cdot p(R_2)}{1+\delta}\right)\phi(R_2)\cdot\left[Z_2 + Y(R_2, I)\right] \qquad \text{(A1.1)}$$

where $*$ 0 denotes the government's discount rate. If the government finds it convenient to invest the amount $I = \bar{I}$ in infrastructure at time 1 (i.e., if the analog of condition (6) holds), the optimal reform plan (R_1*, R_2*) is the solution to the following first-order conditions:

$$\frac{\partial\Theta(R_1, R_2, \bar{I})}{\partial R_1} = \tau'(R_1)\cdot\left[Z_1 - \frac{\bar{I}}{\phi(R_1)} + Y(R_1, \bar{I})\right] + \tau(R_1)\cdot\left[\frac{\phi'(R_1)\cdot\bar{I}}{\phi(R_1)^2} + \frac{\partial Y(R_1, \bar{I})}{\partial R_1}\right] + \\ + \frac{p'(R_1)}{1+\delta}\cdot\tau(R_2)\cdot\left[Z_2 + Y(R_2, \bar{I})\right] = 0 \qquad \text{(A1.2)}$$

and

$$\frac{\partial(R_1, R_2, \overline{I})}{\partial R_2} = \tau'(R_2)\left[Z_2 + Y(R_2, \bar{I})\right] + \tau(R_2)\cdot\frac{\partial Y(R_2, \bar{I})}{\partial R_2} = 0 \qquad \text{(A1.3)}$$

where $\tau(R_t) \equiv p(R_t)\cdot\phi(R_t)$. By differentiating, one obtains that –in equilibrium- the following hold:

$$\frac{\partial}{\partial R_2}\left(\frac{\partial\Theta(R_1, R_2, \bar{I})}{\partial R_1}\right) = 0, \quad \frac{\partial}{\partial R_1}\left(\frac{\partial\Theta(R_1, R_2, \bar{I})}{\partial R_2}\right) = 0 \qquad \text{(A1.4)}$$

By exploiting Cramer's Rule, it is immediate to show that:

$$\frac{dR_1^*}{dZ_1} < 0, \quad \frac{dR_1^*}{dZ_2} < 0, \quad \frac{dR_2^*}{dZ_1} = 0, \quad \frac{dR_2^*}{dZ_2} < 0 \qquad \text{(A1.5)}$$

The conclusion that an increase in Z_1 reduces the optimal level of reforms adopted at time 1, R_1*, replicates the conclusion obtained for the one-period model (Result 1). Also, an (expected) increase in Z_2 will reduce the reform plan (lower levels of R_1* and R_2*). The results in (A1.5) also imply that reform plans can be undone by

unexpected windfalls. In fact, at time 2, an (unexpected) increase in Z_2 implies that the incumbent government will have an incentive to reduce reforms to a level $R_2^{**}<R_2^*$, where R_2^* denotes time 1 (*ex-ante*), optimal plan.

1.2. Financial constraints

We analyze the possibility that the government faces financial constraints. When the government *can* access financial markets and issue debt to finance the cost of infrastructure, the debt raised to finance $\bar{I}$ can be repaid as long as the condition $\phi(R)\left[Z+Y(R,\bar{I})\right]\geq\bar{I}$ holds. This condition requires that the fraction of surplus the government can appropriate must not be smaller than the cost of investment.

When borrowing is *not* feasible, a government that is willing to reform up to $R=R^*$ must be able to extract sufficient resources from the available endowment Z to finance infrastructure; thus, the condition $\phi(R^*)\cdot Z\geq\bar{I}$ must hold.

Suppose now that *financial constraints are binding*; that is, condition $\phi(R^*)\cdot Z<\bar{I}$ holds. Note that, the higher the desired level of reforms, the higher the likelihood that this constraint is binding. Two sub-cases may arise. In the first one, the condition $\phi(R)\cdot Z\geq\bar{I}$ is *never* met for any value of R (for instance, the value of Z may be very low relative to $\bar{I}$). Then, even if the government finds it optimal to stimulate private investment (i.e., if condition (6) holds), it does not have the resources to build the infrastructures necessary to create an attractive economic environment. In this case, only foreign aid can overcome financial constraints.

There is a second sub-case to consider. It may occur that the constraint is satisfied for a level of reforms, say $\bar{R}$, lower than R^*. In this case, it will hold that $\phi(\bar{R})\cdot Z=\bar{I}$. However, the fact that $\bar{R}<R^*$ also implies that $\Theta(\bar{R},\bar{I})<\Theta(R^*,\bar{I})$. For this reason, financial constraints may reduce the gains from reforms, thus making the adoption of good policies less likely. Formally, the incentive condition $\Theta(\bar{R},\bar{I})\geq\Theta(0,0)$ is stronger than condition (6).

When financial constraints are considered, the resource level Z may play an ambiguous role in the adoption of good policies. On the one hand, abundance of resources reduces the incentives to reform. On the other hand, the lack of resources may prevent investment in infrastructure when the government is unable to borrow.

Appendix 2. Country list

Algeria	Ghana	Niger	Uruguay
Argentina	Guatemala	Nigeria	Venezuela
Bahamas	Guinea-Bissau	Oman	Vietnam
Bangladesh	Guyana	Pakistan	Zambia
Botswana	Honduras	Panama	Zimbabwe
Brazil	Hungary	Papua New Guinea	
Burkina Faso	India	Paraguay	
Cameroon	Indonesia	Philippines	
Chile	Iran	Poland	
China	Jamaica	Portugal	
Colombia	Kenya	Romania	
Congo, DR	Korea, Republic	Senegal	
Congo, Rep	Malawi	Sierra Leone	
Costa Rica	Malaysia	Sri Lanka	
Cote d'Ivoire	Mali	Sudan	
Dominican Republic	Mexico	Thailand	
Ecuador	Mongolia	Togo	
Egypt	Morocco	Tunisia	
Ethiopia	Mozambique	Turkey	
Gambia	Nicaragua	Uganda	

Appendix 3. List of variables

Variable	Definition	Source
INV	Gross domestic investment (% of GDP) Average 1985-97	WB-WDI
PI85	1985 PPP value of the price level investment	Penn World Table5.6
Y85	GNP per capita (constant 1995 US$)	WB-WDI
PRIM85	School enrollment, primary (% gross)	WB-WDI
P85	1985 Policy Index. P=1.3 + 5.4 FB -1.4 I +2.1 O (FB=fiscal balance as share of GDP; I = inflation; O = Sachs-Warner openness dummy)	Burnside and Dollar (1997)
IQ85	1985 Institutional Quality Index ICRG. Sum of: 1. Rule of law; 2. Corruption in Government; 3. Quality of the Bureaucracy	Knack & Keefer (1995)
AID	Aid (% of gross domestic investment). Average 1980-85	WB-WDI
TT1	Rate of growth 1980-85. Terms of trade, goods & services	WB-WDI
TT2	TT1 weighted with the ratio of Trade over GDP over 1980-85	WB-WDI
)P	Difference in the P Index between 1995 and 1985	Burnside and Dollar (1997)
)IQ	Difference in the IQ Index between 1997 and 1985	Knack & Keefer (1995)

Appendix 4. Summary statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obs.
INV	21.77	21.76	37.95	6.62	6.81	0.15	3.03	65
PI85	83.30	64.88	295.09	31.79	60.03	2.22	7.80	43
Y85	1596.37	898.59	12584.10	90.79	2079.02	2.92	13.98	65
PRIM85	91.31	99.00	147.40	24.50	25.81	-0.78	3.51	65
P85	1.11	0.90	4.50	-1.90	1.27	0.35	3.69	45
IQ85	0.44	0.44	0.78	0.11	0.15	-0.14	2.42	65
AID	32.62	11.11	178.66	-0.08	43.25	1.60	4.79	61
TT1	0.00	0.00	0.29	-0.21	0.10	0.57	3.31	65
TT2	0.28	0.00	24.32	-6.33	3.83	4.23	26.96	61
)P	1.14	0.49	5.16	-1.14	1.45	0.69	2.87	50
)IQ	0.07	0.06	0.39	-0.47	0.15	-0.50	4.30	65

Table 1. Dependent variable: *INV*

	I.a	I.b	I.c	I.d
Constant	15.986**	15.588**	12.020**	11.743**
	(3.579)	*(3.021)*	*(3.859)*	*(3.669)*
PI85	-0.039**	-0.033*	-0.037**	-0.031*
	(0.012)	*(0.012)*	*(0.013)*	*(0.015)*
Y85	-0.001	0.000	-0.001	-0.001
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
PRIM85	0.106**	0.058*	0.110**	0.065*
	(0.038)	*(0.028)*	*(0.037)*	*(0.029)*
P85		2.361*		2.223*
		(1.007)		*(0.872)*
IQ85			9.207	9.527
			(5.890)	*(4.798)*
Adj. R2	0.27	0.41	0.30	0.46
N. Obs.	43	36	43	36

Note: OLS regressions, standard errors in parenthesis. White Heteroskedasticity-Consistent Standard Errors & Covariance.

* (**) denotes significance at the 5 (1) %

Table 2. Dependent variable: *INV*

	II.a	II.b	II.c	II.d	II.e
Constant	13.479**	11.220**	11.825**	13.278**	14.339*
	(4.266)	*(3.658)*	*(3.575)*	*(4.190)*	*(4.312)*
PI85	-0.004	-0.035*	-0.033*	-0.006	-0.001
	(0.018)	*(0.015)*	*(0.015)*	*(0.015)*	*(0.015)*
Y85	-0.001	-0.001	-0.001	-0.002	-0.002
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
PRIM85	0.035	0.075*	0.075*	0.046	0.044
	(0.037)	*(0.029)*	*(0.029)*	*(0.038)*	*(0.039)*
P85	2.111*	2.214*	2.127*	2.087*	1.941*
	(0.829)	*(0.905)*	*(0.877)*	*(0.874)*	*(0.843)*
IQ85	12.335*	9.899	8.499	13.143*	11.449*
	(4.917)	*(4.916)*	*(4.719)*	*(5.282)*	*(4.789)*
AID	-0,071			-0.078*	-0.087*
	(0.035)			*(0.032)*	*(0.032)*
TT1		-8.490		-11.289	
		(7.074)		(7.939)	
TT2			-0.471*		-0.705**
			(0.224)		*(0.252)*
Adj. R2	0.50	0.46	0.46	0.52	0.54
N. Obs.	36	36	36	36	36

Note: OLS regressions, standard errors in parenthesis. White Heteroskedasticity-Consistent Standard Errors & Covariance.

* (**) denotes significance at the 5 (1) %

Table 3. Dependent variable: *)P*

	III.a	III.b	III.c	III.d	III.e	III.f
Constant	1.086	1.025	0.471	0.940	0.661	1.211
	(0.824)	*(0.995)*	*(0.707)*	*(0.774)*	*(0.929)*	*(1.002)*
Y85	0.000	0.000	3.97E-05	8.34E-05	4.28E-05	8.14E-05
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
P85	-0.670**	-0.654**	-0.553**	-0.591**	-0.551**	-0.593**
	(0.163)	*(0.167)*	*(0.168)*	*(0.166)*	*(0.167)*	*(0.163)*
IQ85	-1.555	-1.620	-1.419	-2.086	-1.414	-2.089
	(1.164)	*(1.196)*	*(1.130)*	*(1.185)*	*(1.147)*	*(1.207)*
PRIM85	0.015	0.014	0.019**	0.017*	0.018*	0.015
	(0.008)	*(0.009)*	*(0.006)*	*(0.007)*	*(0.008)*	*(0.008)*
AID		0.000			-0.002	-0.003
		(0.006)			*(0.005)*	*(0.005)*
TT1			-4.397*		-4.453*	
			(1.860)		*(1.961)*	
TT2				-0.268**		-0.273**
				(0.063)		*(0.067)*
Adj. R2	0.41	0.39	0.46	0.48	0.45	0.46
N. Obs.	44	43	44	42	43	41

Note: OLS regressions, standard errors in parenthesis. White Heteroskedasticity-Consistent Standard Errors & Covariance.

* (**) denotes significance at the 5 (1) %

Table 4. Dependent variable: *)IQ*

	IV.a	IV.b	IV.c	IV.d	IV.e	IV.f
Constant	0.341**	0.455**	0.305**	0.302**	0.428**	0.427**
	(0.044)	*(0.055)*	*(0.049)*	*(0.043)*	*(0.058)*	*(0.052)*
Y85	2.02E-05**	1.10E-05	1.70E-05*	1.77E-05**	1.98E-06	6.22E-06
	(7.45E-06)	*(9.66E-06)*	*(7.71E-06)*	*(6.36E-06)*	*(1.03E-05)*	*(8.64E-06)*
P85	0.022*	0.016	0.029**	0.036**	0.024**	0.029**
	(0.011)	*(0.010)*	*(0.010)*	*(0.007)*	*(0.009)*	*(0.007)*
IQ85	-0.793**	-0.769**	-0.785**	-0.784**	-0.753**	-0.772**
	(0.082)	*(0.079)*	*(0.082)*	*(0.084)*	*(0.078)*	*(0.083)*
PRIM85	0.000	-0.000	0.001	0.001	-0.000	-0.000
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
AID		-0.001**			-0.001**	-0.001**
		(0.000)			*(0.000)*	*(0.000)*
TT1			-0.258		-0.336*	
			(0.145)		*(0.147)*	
TT2				-0.016**		-0.019**
				(0.005)		*(0.004)*
Adj. R2	0.58	0.61	0.59	0.60	0.64	0.65
N. Obs.	45	44	45	43	44	42

Note: OLS regressions, standard errors in parenthesis. White Heteroskedasticity-Consistent Standard Errors & Covariance.

* (**) denotes significance at the 5 (1) %

References

Acemoglu D. and J. A. Robinson (1998), "Why did the West extend the franchise? Democracy, inequality and growth in historical perspective", CEPR Discussion Paper No.1797.

Acemoglu D. and J. A. Robinson (1999), "Democratization or repression ?", CEPR Discussion Paper No.2278.

Alesina A. and D. Dollar (2000), "Who gives foreign aid to whom and why?", *Journal of Economic Growth*, 5, 33-64.

Alesina A. and B. Weder (1999), "Do corrupt governments receive less foreign aid?", NBER Working Paper No.7108.

Andrews D. and others (1999), "Debt Relief for Low Income Countries: The Enhanced HIPC Initiative", Pamphlet Series No. 51. Washington. International Monetary Fund.

Auty R. M. (1990), *Resource-Based Industrialization: Sowing the Oil in Eight Developing Countries*. New York: Oxford University Press.

Baland J.-M. and P. Francois (2000), "Rent-seeking and resource booms", *Journal of Development Economics*, 61, 527-542.

Barro R. and X. Sala-I-Martin (1995), *Economic Growth*. New York: McGraw-Hill.

Boone P. (1996), "Politics and the effectiveness of foreign aid", *European Economic Review*, 40, 289-329.

Boote A.R. and Thugge K. (1999), "Debt Relief for Low Income Countries: The HIPC Initiative", Pamphlet Series No. 51. Washington. International Monetary Fund.

Burnside C. and D. Dollar (1997), "Aid, policies and growth", Policy Research Working Paper No.1777, World Bank.

Claessen S. and others (1997), "HIPC Debt: A Review of the Issues," *Journal of African Economies*, 2, 231-254.

Collier P. and J.W. Gunning (1999), "Why has Africa grown slowly?", *Journal of Economic Perspectives*, 13, 3-22.

Dollar D. and W. Easterly (1999), "The search for the key: aid, investment, and policies in Africa", *Journal of African Economies*, 8, 528-545.

Easterly W. (1999), "How did highly indebted poor countries become highly indebted? Reviewing two decades of debt relief", mimeo, The World Bank.

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

Hart O. and J. Moore (1995), "Debt and seniority: an analysis of the role of hard claims in constraining management", *American Economic Review*, 85, 567-585.

Havrylyshyn O. and Van Rooden R. (2000) “Institutions matter in transition, but so do policies”. IMF Working Paper WP/00/70.

Jensen M. (1986), “Agency costs of free cash flow, corporate finance , and takeovers”, *American Economic Review*, 76, 323-329.

Knack S. and P. Keefer (1995), “Institutions and economic performance: cross-country tests using alternative institutional measures”, *Economics and Politics*, 7, 207-227.

La Ferrara E. (1996), “A political equilibrium approach to trade liberalization in developing countries”, *Journal of International Trade & Economic Development*, 5, 287-318.

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

McGillivray M. and Ahmed A. (1994), “Aid, Saving and Investment Re-Explored: The Cases of Bangladesh, India, Nepal, Pakistan and Sri Lanka,” *Asian Economic Review*, 36-3, 737-46.

McGuire M. and M. Olson Jr. (1996), “The economics of autocracy and majority rule: the invisible hand and the use of force”, *Journal of Economic Literature*, 34, 72-96.

Ndulu B. and S. O’Connell (1999), “Governance and growth in Sub-Saharan Africa”, *Journal of Economic Perspectives*, 13, 41-66.

Robinson J. (1999), “When is a state predatory ?”, CES Working Paper No.178, University of Munich.

Rodrìguez F. and J. Sachs (1999), “Why do resource-abundant economies grow more slowly?, *Journal of Economic Growth*, 4, 277-303.

Putnam R.D. (1993), Making democracy work: civic traditions in modern Italy (with Leonardi R. and Nanetti, R.), Princeton N.J., Princeton University Press.

Rodrik D. (1996), “Understanding economic policy reform”, *Journal of Economic Literature*, 34, 9-41.

Sachs J. and A. Warner (1995), “Natural resource abundance and economic growth”, NBER Working Paper No.5398.

Sachs J. and A. Warner (1999), “The big push, natural resource booms and growth”, *Journal of Development Economics*, 59, 43-76.

Svensson J. (1998), “Investment, property rights and political instability: theory and evidence”, *European Economic Review*, 42, 1317-1341.

Svensson J. (2000a), “Foreign aid and rent-seeking”, *Journal of International Economics*, 51, 437-461.

Svensson J. (2000b), “When is foreign aid policy credible? Aid dependence and conditionality”, *Journal of Development Economics*, 61, 61-84.

Shleifer A. and R. Vishny (1997), “A survey of corporate governance”, *Journal of Finance*, 52, 737-783.

Tornell A. and P. Lane (1999), “The voracity effect”, *American Economic Review*, 89, 22-46.

Tsikata T. (1998), “Aid effectiveness: a survey of the recent empirical literature”, IMF Working Paper PPAA/98/1.

Warner A. (1992), “Did the debt crisis cause the investment crisis?”, *Quarterly Journal of Economics*, 107, 1161-1186.

Wantchekon L. (2000), “Why do resource abundant countries have authoritarian governments ?”, mimeo, Yale University.

Williamson J. (1988), “Voluntary Approaches to Debt Relief,” Institute for International Economics, *Policy Analyses in International Economics*, No. 25.

World Bank (1998), *Assessing aid : what works, what doesn't, and why*. New York: Oxford University Press for the World Bank.

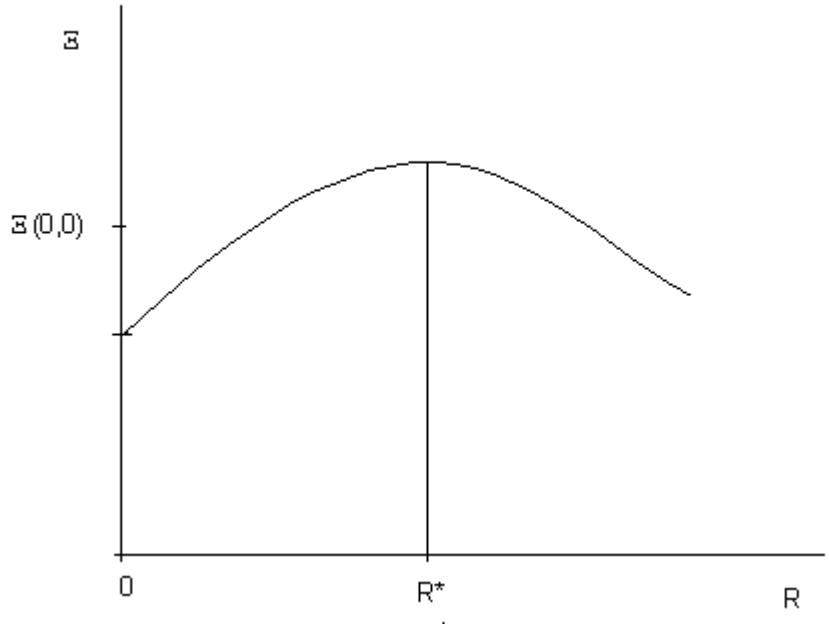

Figure 1. The government's payoff as a function of *R*