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**Foreign Aid, Political Instability, and Economic  
Growth**

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# FOREIGN AID, POLITICAL INSTABILITY, AND ECONOMIC GROWTH

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## Abstract

Relying on a simple endogenous growth model, this paper highlights a political instability effect as a potential explanation for why foreign aid is frequently ineffective with respect to economic performance. In the present framework, the role of the state is to fund institutions allowing for ongoing technology adoption and hence long-run growth. However, providing a self-interested government with additional resources to fill a possible "financing gap" may not result in better institutions. More money in the hands of the regime fuels conflict over the distribution of the funds - and decreases the incumbent regime's time horizon in office. With a shorter time horizon, it is less attractive to finance good institutions whose returns mainly accrue in the future. Panel data evidence points indeed to a sizable causal effect of foreign aid on political instability in the 1980s and 1990s.

**JEL classification:** F35; O10

**Keywords:** Foreign aid; Economic growth; Political Instability; Institutions

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# 1 Introduction

After more than three decades of empirical research, it is probably fair to say that we do not find a robust positive impact of foreign aid on economic development.<sup>1</sup> This observation leads to some natural questions: Why do even substantial aid flows frequently fail to push recipient countries on a steeper growth path? Why is it that even in countries with good policies aid does not generate the desired results? Answering these questions will be crucial to the success of future aid efforts; without a better knowledge of why aid did not work in the past, ambitious development targets such as the Millennium Development Goals cannot be reached.

The present paper tries to shed light on the forces undermining aid effectiveness by constructing a political-economy model that captures *frequent characteristics* of poor countries. We focus on an economy that may grow through the adoption of more productive technologies from abroad. The role of the state is to enable an ongoing technology transfer by enforcing contracts between domestic producers and the foreign suppliers of technology; a higher funding of the judiciary translates into better enforcement and, through this channel, allows for faster adoption and growth. The state, however, is taken to be *economically weak* in the sense that it has only limited power to tax so that the government's budget is only small.

With regard to politics, we assume that there are only little checks on executive authority so that the incumbent government - or, synonymously, the "ruler" - has substantial leeway to divert public resources for its own benefit. However, an incumbent ruler's office and power may be challenged from time to time. The citizens can force the incumbent ruler out of office by taking part in an insurrection which allows them to appropriate the current state budget. We say that the executive is *politically weak* if the conditions for a successful insurrection are frequently met so that the ruler is replaced more often along the equilibrium path.

Although highly stylized, these assumptions reflect important aspects of the economic and political systems in aid-depending countries. Many growth theorists (e.g., Parente and Prescott, 1994; Hall and Jones, 1999; Aghion et al., 2005) emphasize the role of productivity in accounting for international GDP per capita differences, and there seems to be a consensus that "good" institutions facilitate the continuous adoption of more productive technologies in low-income countries.<sup>2</sup> Similarly, it is widely held by political scientists (e.g., Herbst, 2000;

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<sup>1</sup>See Rajan and Subramanian (2005) for a comprehensive empirical evaluation of the aid-growth relationship. See also Kraay (2006) for an assessment of the relative importance of international aid in growth regressions.

<sup>2</sup>The view that "bad" institutions are a major obstacle to technology adoption has also a long tradition in development economics. Schultz (1964), for instance, argues that agricultural productivity in poor countries is so low because certain institutional arrangements prevent the use of science-based modern farming methods.

Bates, 2001) that a limited capacity to tax is one of the key characteristics of poor economies. However, while a typical state's ability to generate revenues is rather low, the incumbent governments are barely constrained on how these revenues are spent. Take Sub-Saharan Africa (where most of international aid goes to) as an example. Ever since the early 1960s, a typical Sub-Saharan government has faced only slight limitations on executive authority (Marshall and Jagers, 2005; Polity IV data set).<sup>3</sup> Finally, although only slightly limited in office, the executives tend to be weak in the sense that they are often forced out of power in an unlawful manner. Sub-Saharan Africa serves again as an example. Since the 1960s, the average country has seen 2.5 forced government changes per ten years (Cross-National Time-Series Data Archive). So it appears that a long series of coups and insurrections has continuously brought new regimes into power - without moving the typical African county towards more democracy and better executive control.

The present set-up generates two interesting results. First, as compared to a benchmark democracy-case, the dictatorial regime significantly under-invests into the judicial system so that, without foreign budget assistance, the country largely fails to adopt more productive technologies. With a low ability to raise taxes, the regime can only capture a small fraction of the benefits associated with growth-promoting institutions. Put differently, the self-interested ruler perceives a low return from funding the judicial system and hence consumes a large fraction of the state revenues. The second result is that foreign aid in the form of budget assistance may not induce the ruler to provide substantially better institutions. There are two competing effects of aid. On the one hand, to increase his future revenue base, the ruler has incentives to spend some of the additional resources on growth-promoting institutions; this is the positive *income effect* of budget assistance to which advocates of foreign aid (e.g., Sachs, 2005) may refer to when arguing that foreign aid will fill a "financing gap." On the other hand, as already pointed out by Grossman (1992), there is a negative *political instability effect*. With more resources in the hands of the regime, the citizens' incentives to take part in an insurrection are stronger so that, other things equal, the incumbent government is more often forced out of power along the equilibrium path. Hence, with a higher level of budget assistance, the current ruler faces a lower probability of benefiting from the future returns to today's investment. It turns out that the income effect is stronger at lower aid levels while the instability effect dominates at higher levels so that the relationship between foreign aid and institutional quality or growth is likely to follow an inverted-U pattern. The range in which aid

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<sup>3</sup>During 1960-99 period, the average country's level of executive constraint was slightly below 3, where 3 indicates that there are some real but limited constraints (1 denotes the worst, 7 the best score).

promotes economic performance depends on the government's political and economic strength. The more insurgency is favored through, for instance, rough terrain or foreign logistic support, the stronger the instability effect and hence the more limited the scope for beneficial external assistance; similarly, the higher the ruler's rents in absence of aid (because a strong primary export sector facilitates taxation, for instance), the more damaging even higher, aid-induced political instability and hence the narrower the range in which aid works.

Recent events in Chad, a poor central African country, provide a telling example of such an aid-induced instability effect. Since 2003, when the revenues from an oil pipeline project (which was set-up by the World Bank) started to flow in, political instability has surged. The incumbent president now even faces threats from sub-clans of his own people "who feel they are getting too few of the presidential favours (The Economist, March 2, 2006)." It is clear that this increase in instability induced the regime in December 2005 to abolish agreements on the allocation of oil revenues; the government spends now much more resources without international oversight - which means that the money goes largely to the regime's cronies. Tragically, the quality of the public services has even fallen in recent times. Meanwhile, the dictator has not to worry about future sanctions because, as a Swiss newspaper puts it, "most likely, the regime's time horizon in power is only short (Neue Zürcher Zeitung, December 31, 2005)." While the Chadian example is only an anecdotal illustration, more systematic evidence in favor of an instability effect can be found in the data. Using a panel data model, we find in the 1980s and 1990s a positive causal effect of official development assistance on the frequency of forced government changes.

The present paper may help to explain several puzzling findings in the empirical literature. First, it provides an explanation for why the literature has failed to identify a robust and sizable positive impact of aid on growth. Our model emphasizes that - under relevant conditions - an unintended side effect of large aid inflows, a surge in political instability, prevents the governments from spending a large part of the additional resources productively. So the positive impact of aid is probably too small to be consistently identified across different specifications, estimation methods, or data sets. Second, the model explains the decreasing returns to aid which have been identified in some recent empirical studies. The explanation is that the aid-induced instability effect becomes very strong as the level of lootable government resources rises. Third, the model delivers a rationale for why foreign aid seems not to work better in countries with better economic institutions or policies. In the present framework, the quality of institutions or policies is endogenous, and a large inflow of resources easily destroys a fragile equilibrium in which comparatively good institutions prevail.

Our theory is closely related to work by Grossman (1992) and Acemoglu et al. (2004) who analyze the impact of foreign aid on regime stability. Yet, while these two contributions focus in great detail on the role of the technology of insurrection or the strength of political institutions, the present model centers around the impact of aid-induced instability on long-run economic performance. In this sense, the present paper is part of a small literature that incorporates foreign aid into models of economic growth. Earlier papers in this literature are generally based on Harrod-Domar type models (e.g., Chenery and Strout, 1966) whereas latter contributions rely on the neoclassical framework (e.g., Boone, 1996; Dalgaard and Hansen, 2001) or on the OLG model (e.g., Dalgaard et al., 2004). While the existing models differ in terms of technology, demographic structure or the form of government, they share one common feature: the focus is on the impact of aid on growth via capital accumulation. We deviate from the literature by analyzing how aid might affect institutional quality and, through this channel, the rate of technology adoption. Other related work consists of papers by Svensson (2000a, 2000b) and Collier and Dollar (2004), among others. These papers do not explicitly address economic growth but also explore channels through which foreign aid may deteriorate economic policy. The conjectures are that foreign aid may partially substitute for sound economic policies, or that large aid payments induce wasteful rent-seeking activities. Neither of these authors, however, addresses the issue of aid-induced instability.

The remainder of this paper is organized as follows. Section 2 sets up the basic model. In Section 3, we characterize the equilibrium under personal rule and establish that, as compared to a democracy-benchmark, institutional quality is lower in the former case. Section 4 analyzes the impact of foreign aid on political instability, institutional quality, and growth. Section 5 discusses an interesting variation of the technology of insurrection. In Section 6, we present panel data evidence for aid-induced political instability in poorer developing countries. Section 7 concludes.

## **2 Description of the Model**

### **2.1 Basic Assumptions**

This subsection lays out the basic components of our model. We start by defining the two groups in society, the producers and the ruling elite (Social structure and political power) and then discuss the transition of political power between consecutive regimes (Technology of insurrection). The next step is to specify how output is generated and to characterize the role of the state in promoting economic growth (Production technology and technology adoption).

It follows a description of the state's revenue sources and of how government spending improves the economy's growth potential (Taxes, foreign aid, and public spending). Finally, we lay down the timing of events (Time-line).

**Social structure and political power.** We consider an infinite-horizon economy. Time is discrete and indexed by  $t$ . The economy consists of a continuum  $1 + \gamma$  of individuals, where  $\gamma$  is arbitrarily small but positive number. All individuals' preferences are given by the intertemporal utility function

$$U_{jt} = E \left\{ \sum_{s=0}^{\infty} \beta^s \ln c_{jt+s} \right\}, \quad (1)$$

where  $c_{jt}$  refers to consumption of agent  $j$  at date  $t$  and  $\beta \in (0, 1)$  denotes the discount factor. There are two types of individuals. Agents on the interval  $[0, 1]$  are called "producers;" the remaining individuals belong to a ruling elite. Throughout the paper, the index  $i$  denotes producers while the members of the elite are indexed by  $R$ . Since the members of elite are identical in all relevant aspects, it will be convenient to treat them as one agent; hence we refer to the ruling class simply as the "ruler" or the "dictator."

The ruler is self-interested and decides on economic policies such as taxing output (which is generated by the producers) and investing into growth-promoting institutions. In power, the ruler can ignore the wishes of the remaining population but can instead choose economic policies that maximize his own utility. There are no formal political institutions such as a constitution or electoral rules placing binding constraints on his behavior.

**Technology of insurrection.** However, although the unchallenged ruler may implement the policies he prefers, his rule may be threatened from time to time. At the beginning of each period  $t$ , the producers can force the current ruler out of office by taking part in an insurrection. The individual options are summarized by  $r_{it} \in \{0, 1\}$ , with 1 indicating participation, and we define the probability of taking part,  $u_{it} \in [0, 1]$ , as a producer's relevant choice variable. The insurrection is "successful" if the fraction of participating individuals,  $\pi_t \equiv \int_0^1 r_{it} di$ , exceeds some threshold level  $\pi^{\min} < 1$ . In that case, the current ruler receives zero continuation utility and is replaced by an identical new ruler in the following period,  $t + 1$ . We may think that defeated ruler is forced into exile while the new one, entering the scene from abroad, exploits political turmoil to seize power at home. The important point is that an insurrection does not alter the form of government so that "the new government is very much like the one before (Tullock, 1971, p. 98)" - which seems to match the African experience since the early 1960s. The insurrection threat, however, is only transitory. If  $\pi_t < \pi^{\min}$ , the ruler stays in power and is unchallenged for the rest of the period. In particular, he is free to choose the policies he

prefers most.

In modeling the individual participation decision we assume that the producers' behavior is only influenced by the private benefits and costs of participation. A successful insurrection provides the insurgents with access to the government's revenue sources in period  $t$ . They can appropriate the foreign aid payment and may use the state apparatus to extract taxes to an extent that would have stood open to the unchallenged ruler. It is further maintained that these revenues are equally distributed among the insurgents. Moreover, since in case of a successful insurrection the current government is shut-down and all public resources are appropriated by the revolters, there is no productive investment during the rest of the period. So, in the present set-up, it is less appropriate to think of the insurgents as a well organized opposition movement aiming at bringing a better government into power. Here, the insurgents are rather interested in a (temporary) access to the government's budget and, as in Tullock (1971), the overthrow of the incumbent regime can be seen as a necessary byproduct.

The private cost of participation is assumed to be a factor  $\theta_t$  times the current firm revenue, where  $\theta_t$  is a non-negative i.i.d. random variable with a continuous distribution function  $F$  which satisfies the standard monotone hazard rate condition

$$\frac{d}{dx} \left( \frac{f(x)}{1 - F(x)} \right) \geq 0. \quad (\text{A1})$$

Making the cost proportional to the firm revenue ensures that the former grows *pari passu* with the average income and hence the ruler's resources which is necessary to have a balance growth path. The fact that  $\theta$  fluctuates mirrors the notion that, as in Acemoglu and Robinson (2000), some periods may be more conducive to insurrections than others; moreover, treating  $\theta$  as a random variable allows us to model the idea that, as in the Chadian example, the ruler faces uncertainty with respect to his time-horizon in office. In what follows we say that the ruler is *politically weak* if, for given government revenues, the conditions for a successful insurrection are frequently met; as will become clear below, this is either the case if the probability of "low-cost" realizations is high or if  $\pi^{\min}$  is small.<sup>4</sup>

**Production technology and technology adoption.** Each producer  $i$  has access to a linear production technology that allows to produce  $X_{it}$  units of the unique non-storable final good with one unit of labor. For ease of notation, assume that the producers' labor endowment is normalized to unity so that firm  $i$ 's revenue in period  $t$  is simply given by  $X_{it}$ .

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<sup>4</sup>Implicitly, the present set-up rules out investment into oppression. Yet, allowing the ruler to fund measures of counter-insurgency does not alter the model's main implications as long as the repression technology is sufficiently inefficient. See Grossman (1992) for an analysis of such a model.

After production has taken place, each producer decides on improving the productivity level of his firm. Specifically, there are *foreign firms* offering "technology transfers" at an exogenous price of  $\chi$  per additional unit of future productivity (and per unit of labor). Hence, a producer incurs a cost of  $\chi\Delta X_{it+1}$  when deciding to advance the level of productivity from  $X_{it}$  to  $X_{it} + \Delta X_{it+1} = X_{it+1}$ .<sup>5</sup> So, as in Parente and Prescott (1994) or Aghion et al. (2005), technology adoption is the engine of growth in the present framework, and a country remains economically "underdeveloped" when the firms continuously fail to implement more productive technologies (that are developed abroad). Obviously, independently of other factors or circumstances, the producers will not invest into future technology if either the cost of technology adoption is excessively high or if the weight of future consumption is very low. To avoid this uninteresting case, we impose the parameter restriction

$$\frac{\beta}{2} - (1 - \beta)\chi > 0. \quad (\text{A2})$$

Yet, even if technology adoption is very attractive, the producers may fail to substantially increase productivity between two periods. The reason is an enforcement problem. Each producer  $i$  is free to default on the payment obligation specified in the current technology-adoption contract. The producer's decision to default is denoted by  $d_{it} \in \{0, 1\}$ , with 1 indicating breach of contract. Breaking a contract, however, is not free of charge. Specifically, the cost of default is taken to be a fraction  $\lambda_t$  of the current firm revenue,  $X_{it}$ ; other sanctions - such as exclusion from technology adoption in the future - are ruled out.<sup>6</sup> The level of  $\lambda_t$  - which will be determined by the investment into the judicial system as described further below - mirrors how well the legal system works. If  $\lambda_t$  is "low," the legal system is relatively ineffective since a defaulter can avoid contract enforcement at low cost, and vice versa.

We further assume that each producer  $i$  defaults whenever it is in his interest to do so, i.e., whenever  $d_{it} = 1$  maximizes his net income,  $y_{it} \equiv X_{it} - (1 - d_{it})\chi\Delta X_{it+1} - d_{it}\lambda_t X_{it}$ , given  $\lambda_t$ ,  $X_{it}$ , and  $\Delta X_{it+1}$ . It follows that a contract is *incentive compatible* (and may therefore be implemented) if  $\chi\Delta X_{it+1} \leq \lambda_t X_{it}$ , or, equivalently, if the condition

$$g_{it+1} \leq \frac{\lambda_t}{\chi}, \quad (2)$$

is satisfied, where  $g_{it+1}$  denotes firm  $i$ 's productivity growth rate between  $t$  and  $t + 1$ . The intuition behind equation (2) is straightforward. Other things equal, better contract enforcement (i.e., a higher  $\lambda_t$ ) allows the producers to grow faster since they can credibly commit to

<sup>5</sup>In what follows, we implicitly assume that, in steady state, the productivity levels  $X_{it}$  do not grow faster than the world technology frontier,  $\bar{X}_t$ .

<sup>6</sup>See Kiyotaki and Moore (1997) or Matsuyama (2000) for models of imperfect credit contract enforcement in a similar spirit.

make the substantial payments associated with large productivity increases. A higher  $\chi$ , by contrast, reduces a producer's growth potential because the incentives to default are stronger when the cost of technology adoption is higher, other things equal.

For the rest of this paper we assume that there are no differences in initial productivity levels,  $[X_{i0}]_{i \in [0,1]}$ . Since the producers are equal in all other respects too, the incentives to invest do not differ among producers so that the productivity levels are identical in all future periods as well. Accordingly, we have

$$X_t \equiv \int_0^1 X_{it} di = X_{it}$$

with  $t \geq 0$ , where  $X_t$  denotes aggregate output at date  $t$ .

**Taxes, foreign aid, and public spending.** In each period  $t$ , the incumbent ruler can set a linear tax rate  $\tau_t$  on net income. The state, however, has only a limited capacity to tax. Specifically, we assume that the ruler cannot implement a tax rate higher than  $\bar{\tau}$ ,<sup>7</sup> and we say that the state is *economically weak* if  $\bar{\tau}$  is comparatively low. Though highly stylized, the limited-tax assumption reflects what many political scientists consider to be a central characteristic of poor economies. Moreover, a low ability to generate revenues typically serves as a rationale for external support in the form of budget assistance – which is the second source of state revenues. In each period, the government receives an aid payment worth a fraction  $\alpha$  of the current aggregate output. For expositional convenience, we impose an upper bound on foreign assistance:

$$\alpha \leq 1. \tag{A3}$$

The aid payment is assumed to flow independently of the government's behavior. The justification is that, in practice, donors seem to be reluctant to curb aid flows when conditions are not met. An alternative is to interpret this second revenue source as the recurrent payoff from a large development project that, once set up, continuously generates income. A convenient example would be the Chadian pipeline project that was initiated by the World Bank.

Beside setting the tax rate, the unchallenged ruler has to determine to what extent government revenues are used to finance growth-enhancing institutions. Specifically, the ruler can increase  $\lambda_t$  by funding the judicial system. In explicitly assuming that it is costly to run institutions enforcing private contracts we follow a line of thought that goes back at least to Demsetz' (1967) contribution on property rights. For concreteness, we assume that  $\lambda_t$  rises

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<sup>7</sup>For instance, suppose that the producers can “hide” net income, but lose a fraction  $\bar{\tau}$  when doing so. Then, the relevant tax range is  $[0, \bar{\tau}]$ .

one-to-one in the fraction of the aggregate output devoted to judiciary,  $\sigma_t$ , so that

$$\lambda_t = \sigma_t. \quad (3)$$

Normalizing expenditures by the aggregate output ensures the existence of a balanced growth path. Moreover, such a formulation seems to be reasonable since the number of cases tends to rise in the population size and, in order to maintain a certain quality, wages in the judiciary have to grow *pari passu* with the per capita income.

It remains to discuss the government's budget constraint. We impose that the credit market is inexistent so that the incumbent ruler cannot go into debt (the same applies for the producers). Then, since the unique output good is non-storable, the incumbent ruler has to determine taxes and expenses subject to budget constraint

$$\sigma_t X_t \leq \alpha X_t + \tau_t \int_0^1 y_{it} di. \quad (4)$$

If expression (4) is a strict inequality, the budget surplus is appropriated (and eventually consumed) by the ruler.

**Time-line.** The exact timing of events within each period is as follows: (i) the citizens inherit their productivity level,  $[X_{it}]_{i \in [0,1]}$ , and production takes place; (ii) the producers learn the cost of participating in an insurrection,  $\theta_t$ , and choose the probability of participation,  $[u_{it}]_{i \in [0,1]}$ . In case of a successful insurrection ( $\pi_t \geq \pi^{\min}$ ), the ruler is forced out of office, the maximum tax rate is set, and the insurgents appropriate all state revenues; finally, all producers consume their net incomes, and no further actions are taken within this period. Otherwise, if  $\pi_t < \pi^{\min}$ , the period continues in the following way: (iii) the ruler sets the tax rate,  $\tau_t$ , and determines the funding of the judicial system,  $\sigma_t$ ; (iv) the producers announce to what extent the productivity level is increased,  $[g_{it+1}]_{i \in [0,1]}$ ; (v) the foreign firms decide to transact or not in each case; eventually, the producers decide whether to default or not, consumption takes place, and the period ends.

## 2.2 Equilibrium Concept and Period Payoffs

In order to discuss the possible strategies and payoffs at each date it is convenient to stick to the following convention. In case an insurrection takes place, government spending,  $\sigma_t$ , and the tax rate,  $\tau_t$ , are no longer in the incumbent ruler's choice set; under these circumstances, the two variables are defined to be 0 and  $\bar{\tau}$ , respectively.

**Equilibrium concept.** The focus of the analysis will be on the Markov Perfect Equilibrium (MPE), where strategies depend only on the payoff relevant states and on prior actions within

the same period. The relevant state variables are given by  $(X_{it}, \theta_t)$  in case of the producers and by  $(X_t, \theta_t)$  in case of the ruler. The characterization of the equilibrium below can be simplified by exploiting an important feature of the model. Anticipating that each producer  $i$  will default on the payment obligation if  $g_{it+1} > \lambda_t/\chi$ , the technology suppliers would never agree on such a contract. Knowing this, the producers do not try to advance the productivity level by more than  $\lambda_t/\chi$ , and we can focus on  $g_{it+1} \leq \lambda_t/\chi$  so that the foreign firms always contract and default never occurs. Then, the economy can be represented as a dynamic game between the incumbent ruler and the producers, and the equilibrium is summarized by a set of strategies,

$$\left( [u_{it}(X_{it}, \theta_t)]_{i \in [0,1]}, \tau_t(X_t, \theta_t), \sigma_t(X_t, \theta_t), [g_{it+1}(X_{it}, \theta_t)]_{i \in [0,1]} \right),$$

at each date  $t$ . In order to simplify notation we do not indicate that strategies may depend on actions already taken within the same period.

**Period payoffs.** Since the final good is non-storable and the credit market is absent, all agents just consume period incomes minus expenses. If there has not been a successful insurrection ( $\pi_t < \pi^{\min}$ ), a producer's consumption level equals net income minus taxes (minus the private cost of rioting if  $r_{it} = 1$ ). Using  $\Delta X_{it+1} = g_{it+1} X_{it}$ , we receive

$$c_{it}|_{\pi_t < \pi^{\min}} = ((1 - \chi g_{it+1})(1 - \tau_t) - r_{it} \theta_t) X_{it}, \quad (5)$$

whereas the members of the ruling elite consume an equal share of the current budget surplus,

$$c_{Rt}|_{\pi_t < \pi^{\min}} = \left( \tau_t \int_0^1 (1 - \chi g_{it+1}) X_{it} di + (\alpha - \sigma_t) X_t \right) / \gamma. \quad (6)$$

In case of a successful insurrection ( $\pi_t \geq \pi^{\min}$ ), the revolters set the maximum tax rate and appropriate the tax revenues as well as the aid payment. Since no further decisions are to be taken in this period (and since  $X_{it} = X_t$ ), producer  $i$ 's consumption level is given by

$$c_{it}|_{\pi_t \geq \pi^{\min}} = (1 - \bar{\tau}) X_{it} + r_{it} \left( \frac{\bar{\tau} + \alpha}{\pi_t} - \theta_t \right) X_{it}. \quad (7)$$

The current ruler, by contrast, is no longer part of the game and receives a period utility of zero from  $t$  onwards.

### 3 The Equilibrium

We now characterize the MPE under personal rule (Subsection 3.1) and discuss how equilibrium policies under dictatorship deviate from those chosen under democracy (Subsection 3.2).

### 3.1 The Equilibrium under Personal Rule

Focusing on the MPE, equilibrium strategies within each period can be determined by backward induction. As a first step, guess that the size of the insurrection movement,  $\pi_t$ , is a function of  $\theta_t$  such that  $\pi_t \geq \pi^{\min}$  if  $\theta_t$  lies below some cost level  $\tilde{\theta}$ , and  $\pi_t < \pi^{\min}$  otherwise. Under these circumstances, we have an insurrection with probability  $p = F(\tilde{\theta})$  in each period.

**Equilibrium strategies following  $\pi_t < \pi^{\min}$ .** Suppose now that there has not been an insurrection in the period under consideration, and hence let us start with the producers' investment decision. At the time of the decision, a producer knows the tax rate,  $\tau_t|_{\pi_t < \pi^{\min}}$ , and the level of public spending,  $\sigma_t|_{\pi_t < \pi^{\min}}$ . To determine the optimal level of technology adoption, suppose that producer  $i$ 's value function is of the form

$$V(X_{it}, \theta_t) = \frac{\ln(X_{it})}{1 - \beta} + A(\theta_t), \quad (8)$$

where  $A$  is a constant which depends on the the state variable  $\theta_t$  but not on  $X_{it}$ . Then, remembering  $X_{it+1} = (1 + g_{it+1})X_{it}$ , the recursive formulation of the value function reads

$$V(X_{it}, \theta_t)|_{\pi_t < \pi^{\min}} = \max_{g_{it+1} \in [0, \sigma_t/\chi]} \left\{ \ln(c_{it}|_{\pi_t < \pi^{\min}}) + \beta E \{V((1 + g_{it+1})X_{it}, \theta_{t+1})\} \right\},$$

where  $c_{it}|_{\pi_t < \pi^{\min}}$  is defined in equation (5). Assuming  $r_{it} = 0$  (which turns out to be true if  $\pi_t < \pi^{\min}$ ), the solution to the above maximization problem is given by

$$g_{it+1}|_{\pi_t < \pi^{\min}} = \min \left\{ \frac{\sigma_t}{\chi}, \frac{\beta}{\chi} - (1 - \beta) \right\} \geq 0, \quad (9)$$

where the inequality sign follows from Assumption (A2). The second term in the above equation, i.e., the expression for the unconstrained-optimal level of technology adoption, is quite intuitive. Other things equal, the producers choose a low growth rate if  $\chi$  is high; an increases in cost of technology adoption rises the price of future productivity in terms of current consumption and leads to a corresponding substitution effect. Similarly,  $g_{it+1}|_{\pi_t < \pi^{\min}}$  is small if the individuals attach only a low weight to future consumption. Notice further that  $g_{it+1}|_{\pi_t < \pi^{\min}}$  is not affected by the tax rate. Taxes are on net income (i.e., on income net of adoption costs) and hence do not interfere with the producers' incentives to invest.

When it comes to the decisions on taxes and productive public spending, the incumbent ruler observes the producers' optimal response to his decisions,  $g_{it+1}|_{\pi_t < \pi^{\min}}$ . To solve the regime's optimization problem, assume that the upper bound on  $g_{it+1}|_{\pi_t < \pi^{\min}}$  is never binding in optimum so that, from the ruler's perspective, equation (9) simplifies to  $g_{it+1}|_{\pi_t < \pi^{\min}} = \sigma_t/\chi$ . Further, guess that the *unchallenged* ruler's value function is given by

$$W(X_t) = \frac{\ln(X_t)}{1 - \beta_R} + B, \quad (10)$$

where  $\beta_R \equiv (1 - p)\beta$ . The recursive formulation of  $W(X_t)$  can then be expressed as

$$W(X_t) = \max_{\tau_t \leq \bar{\tau}, \sigma_t \geq 0} \left\{ \ln(c_{Rt} |_{\pi_t < \pi^{\min}}) + \beta_R W((1 + \sigma_t/\chi) X_t) \right\}$$

where  $c_{Rt} |_{\pi_t < \pi^{\min}}$  is defined in equation (6). Since taxes do not distort the producers' adoption decision, we have  $\tau_t |_{\pi_t < \pi^{\min}} = \bar{\tau}$  whereas the equilibrium funding of the judiciary is given by

$$\sigma_t |_{\pi_t < \pi^{\min}} = \max \left\{ 0, \beta_R \frac{\bar{\tau} + \alpha}{1 + \bar{\tau}} - (1 - \beta_R)\chi \right\}. \quad (11)$$

So it turns out that, due to Assumption (A3), reducing equation (9) to  $g_{it+1} |_{\pi_t < \pi^{\min}} = \sigma_t/\chi$  was indeed appropriate.

**The insurrection condition.** It remains to determine under which circumstances an insurrection occurs. To do this, remember that each producer chooses his strategy given the strategies of the other agents. Moreover, recall that a single producer is only of measure zero and hence cannot influence the number of participants. Accordingly, a single producer takes  $\pi_t$  as given when weighing the value of participation against the value of staying away.<sup>8</sup>

With this in mind, we can infer that an insurrection is an equilibrium outcome whenever the condition

$$\frac{\bar{\tau} + \alpha}{\pi^{\min}} X_t \geq \theta_t X_t, \quad (12)$$

holds, i.e., whenever the *maximum* gross private gain of taking part exceeds the private cost. The insurrection must then involve  $\pi_t = \min \{ (\bar{\tau} + \alpha) / \theta_t, 1 \}$  participating producers so that the net benefit from taking part is exactly zero if  $\pi_t < 1$  and only positive if  $\pi_t = 1$ . More formally, with condition (12) satisfied, we have an equilibrium in which each producer  $i$  takes part with probability  $u_{it} = \min \{ (\bar{\tau} + \alpha) / \theta_t, 1 \}$  and, as a result, the incumbent ruler is forced out of office (implying  $\sigma_t = g_{it+1} = 0$ ). Note, however, that even though an insurrection is a possible equilibrium outcome if condition (12) holds, there is a second equilibrium in which no agent participates. In the remainder, we ignore this latter equilibrium and presume that an insurrection takes place whenever the private cost is sufficiently low.

Suppose now that condition (12) is violated. Then, in the only equilibrium, each producer stays away with probability 1 so that  $\pi_t = 0$  and the ruler remains in power. As a consequence, we see a successful uprising with probability

$$p = \Pr \left( \theta_t \leq \frac{\bar{\tau} + \alpha}{\pi^{\min}} \right) = F \left( \frac{\bar{\tau} + \alpha}{\pi^{\min}} \right) \quad (13)$$

in each period. Notice that equation (13) is consistent with our initial guess,  $p = F(\tilde{\theta})$ , where  $\tilde{\theta}$  is defined to be  $(\bar{\tau} + \alpha) / \pi^{\min}$ . Clearly, other things equal, the probability of an insurrection

<sup>8</sup>See Section 5 for a modification of the baseline model in which the insurgents act as a single agent and so take into account that an insurrection induces a period of economic stagnation.

rises in the resources which can be appropriated by the insurgents, and foreign aid contributes one-to-one to this “booty.” Similarly, holding  $\bar{\tau} + \alpha$  fixed, the probability of an uprising is higher if the ruler is politically weak, i.e., if the cost of participating is frequently low or if the minimum number of participation agents is only small.

Equilibrium strategies are now described, and we demonstrate in the appendix that the form of the producers’ and the ruler’s value functions correspond to those assumed in equations (8) and (10), respectively. The following proposition summarizes the main results so far.

**Proposition 1** *There exists a MPE such that for all  $t$ , (i) if  $\theta_t \leq (\bar{\tau} + \alpha)/\pi^{\min}$ , an insurrection takes place (implying that  $\sigma_t = g_{it+1} = 0$  and  $\tau_t = \bar{\tau}$ ); (ii) if  $\theta_t > (\bar{\tau} + \alpha)/\pi^{\min}$ , the ruler remains in power, sets a tax rate of  $\bar{\tau}$ , and chooses public spending,  $\sigma_t$ , according to equation (11); the producers’ investment into future technology,  $g_{it+1}$ , is then given by  $\sigma_t/\chi$ .*

It is the purpose of Section 4 below to analyze how foreign aid affects equilibrium institutional quality and, through this channel, long-run economic performance.

### 3.2 A Democratic Equilibrium

We now briefly determine levels of income taxation and public spending preferred by the producers. Intuitively, these values would materialize in equilibrium if the political system were a *democracy* in which the producers (rather than a ruler) determined economic policies. Below, it will be interesting to compare the democracy-outcome to the equilibrium policies chosen under personal rule.

**The equilibrium under democracy.** Consider an economy that departs from the above assumptions in one important dimension. The policies  $\tau_t$  and  $\sigma_t$  are determined through majoritarian voting and not by a dictator with access to public revenues. We start again by characterizing equilibrium strategies following  $\pi_t < \pi^{\min}$ . Guess that the producers’ value function,  $V^D(X_{it}, \theta_t)$ , is of the form  $\ln(X_{it})(1 - \beta)^{-1} + A^D(\theta_t)$  and thus is qualitatively similar to that assumed in equation (8). Then, it is clear that the producers’ optimal level of technology adoption is also given by equation (9).

The next step is to determine the producers’ optimal policy choice,  $(\tau_t^*, \sigma_t^*)$ . Again assuming that the upper bound on  $g_{it+1}|_{\pi_t < \pi^{\min}}$  is not binding in equilibrium (and hence  $g_{it+1}|_{\pi_t < \pi^{\min}} = \sigma_t/\chi$ ), the recursive formulation of producer  $i$ ’s decision problem reads

$$V^D(X_{it}, \theta_t)|_{\pi_t < \pi^{\min}} = \max_{\tau_t, \sigma_t} \left\{ \ln((1 - \sigma_t)X_{it}(1 - \tau_t)) + \beta E \left\{ V^D((1 + \sigma_t/\chi)X_{it}, \theta_{t+1}) \right\} \right\}$$

subject to the state's budget constraint  $\tau_t(1 - \sigma_t)X_t = \sigma_t X_t$ . Solving this problem yields  $\sigma_t^* = \beta/2 - (1 - \beta)\chi$  and  $\tau_t^* = \sigma_t^*/(1 - \sigma_t^*)$ . It is clear that  $\sigma_t^*$  can only be implemented if  $\bar{\tau}$  is sufficiently large; accordingly, the equilibrium funding of the judiciary,  $\sigma_t^D|_{\pi_t < \pi^{\min}}$ , is given by

$$\sigma_t^D|_{\pi_t < \pi^{\min}} = \min \left\{ \frac{\bar{\tau}}{(1 + \bar{\tau})}, \frac{\beta}{2} - (1 - \beta)\chi \right\}, \quad (14)$$

suggesting that our initial guesses and assumptions were indeed justified (the insurrection condition is unchanged).

**Personal rule vs. democracy.** We now discuss how an incumbent ruler's investment into the judicial system differs from that under democracy. This type of analysis provides us with a coherent explanation for why countries under personal rule (and without external assistance) may fail to achieve the growth rates known from many democracies.

Suppose first that threats of insurrection are absent (and hence  $\beta_R = \beta$ ). Figure 1 shows public spending in this situation as a function of  $\bar{\tau}$  in the dictatorial regime (equation 11) and under democracy (equation 14).

*Figure 1 here*

Apparently, for any value of  $\bar{\tau}$  except 1, the ruler prefers a lower level of productive spending than a representative producer does. The under-investment in the dictatorship-regime is due to the fact that the ruler can only capture a small fraction of the aggregate output while "bearing" the entire cost of higher future output. Compared to democracy-case, a *given increase* in public spending (i.e., a given improvement of productivity) under personal rule induces a larger relative reduction in the decisive agent's consumption level and, as a consequence, leads to a larger reduction in the agent's utility from current consumption. So, when balancing the current utility loss from lower consumption against the future benefits, the ruler chooses a lower level of public spending in absolute terms. More intuitively, a low ability to raise taxes has a larger negative impact on public spending under personal rule since the ruler perceives a low "return" in case he can only appropriate a small fraction of the additional future output.<sup>9</sup> Public investment is even entirely absent for a broad range of lower levels of  $\bar{\tau}$  and starts rising only after the state's economic strength has reached some threshold level. Eventually, if  $\bar{\tau}$  approaches 1,  $\sigma_t|_{\pi_t < \pi^{\min}}$  catches up with the democracy-level because then the full return accrues to the dictator.

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<sup>9</sup>To make this intuition more explicit, note that the ruler's optimization problem can be restated as  $\max_{c_{Rt}, X_{t+1}} \left\{ \ln c_{Rt} + \beta W(\tilde{X}_{t+1}) \right\}$  s.t.  $\tilde{X}_{t+1} = \tilde{X}_t + (\bar{\tau}\tilde{X}_t - c_{Rt}) / (\chi(1 + \bar{\tau}))$ , where  $\tilde{X}_t \equiv X_t/\gamma$ . Using this formulation, we can interpret the term  $\bar{\tau}X_t$  as the ruler's "perceived production function." Obviously then, with a low  $\bar{\tau}$ , the ruler perceives a low return of investing into productivity.

Note further that, as compared to the democracy-case, the ruler's incentives to provide growth-promoting institutions are even lower if the citizens have access to a technology of insurrection. Then, the ruler may not at all benefit from today's investment (which pays-off only tomorrow) because he is forced out of power with a positive probability. Accordingly, he substitutes towards current consumption, other things equal. The producers do not respond in this way since their time-horizon is unaffected by instability.

The model's implication that economically weak states may *strongly fail* to enhance private economic activity through the provision of "good" institutions is consistent with what has been observed by many political scientists. However, as in Acemoglu (2005), the main mechanism through which limited power to tax leads to low levels of public goods provision is more subtle here. It is not that the regime could not finance better institutions. The reason for excessively low productive public spending is that the ruler has only little incentives to provide sound institutions if his ability to squeeze out taxes from the economy is low.

## 4 Foreign Aid, Institutional Quality, and Growth

This section analyzes the impact of foreign aid on the ruler's incentives to invest into growth-promoting institutions (Subsection 4.1) and derives policy implications (Subsection 4.2).

### 4.1 A Non-monotonic Relationship between Aid and Growth

To disentangle the different channels through which aid may affect the ruler's behavior, suppose first that the private cost of rioting is infinitively high in each period so that an impact of foreign assistance on the ruler's time horizon is precluded.

**Aid effectiveness without threats of insurrection.** Without a technology of insurrection,  $\beta_R = \beta$  is simply a constant and it follows directly from equation (11) that the equilibrium spending on the judicial system is weakly increasing in  $\alpha$ .

This policy improvement is due to an *income effect*; with positive aid payments, the ruler perceives a higher period income, and, since both current consumption and the productivity level in the following period are "normal goods", he spends part of the additional resources productively. It may be, though, that small aid flows are ineffective; this is the case if the government's ability to raise taxes is particularly low so that, in absence of foreign aid, the ruler chooses not to fund the judiciary at all because marginal utility from current consumption is high (as compared to the benefit from stimulating growth). Under these circumstances, additional income is fully consumed up to some point; but a positive impact of external assistance

can nonetheless be observed after the aid flow has reached a certain magnitude.

To sum up, if the ruler is highly entrenched from the citizens, sufficiently large amounts of foreign aid induce even a kleptocratic regime to improve institutional quality and hence the economy's growth performance.

**Aid effectiveness with threats of insurrection.** We now turn to the more interesting case in which the incumbent ruler may be forced out of power along the equilibrium path. As a first step, it is convenient to parameterize the distribution function of the private costs of rioting as  $F(x) = \rho H(x\pi^{\min})$ , where  $H(x)$  is a continuous distribution function with a finite density  $h(x)$  for all  $x > 0$ .<sup>10</sup> Hence, the probability of a successful insurrection is given by

$$p(\bar{\tau} + \alpha) = F\left(\frac{\bar{\tau} + \alpha}{\pi^{\min}}\right) = \rho H(\bar{\tau} + \alpha). \quad (12')$$

Note that  $\rho$  is a natural measure for the ruler's political strength. A lower  $\rho$  corresponds to a situation in which the ruler is more entrenched since the cost of replacing him is frequently high or a large fraction of the population is required to force him out of power.

It is now immediately transparent that in case the producers have access to a technology of insurrection there is an additional channel through which foreign aid may affect the ruler's behavior. With more government resources to be appropriated, the private benefit of taking part in an insurrection is higher so that, other things equal, the incumbent regime faces a higher probability of being forced out of office in the following period. Clearly, this *political instability effect* lowers the ruler's incentives to fund growth promoting institutions; with a lower probability of capturing the returns from today's investment, it is optimal to substitute towards current consumption. Hence, while the income effect discussed above has a positive impact on  $\hat{\sigma}_t|_{\pi_t < \pi^{\min}}$ , the political instability effect goes in the opposite direction.

In order to determine the net effect of foreign aid on institutional quality, it is convenient to discuss in a first step some properties of the function

$$\begin{aligned} \vartheta(\alpha) &\equiv \beta_R \frac{\bar{\tau} + \alpha}{1 + \bar{\tau}} - (1 - \beta_R)\chi \\ &= \beta(1 - p(\bar{\tau} + \alpha)) \left( \frac{\bar{\tau} + \alpha}{1 + \bar{\tau}} + \chi \right) - \chi, \end{aligned} \quad (15)$$

which gives  $\sigma_t|_{\pi_t < \pi^{\min}}$  in case of an interior solution (equation 11). The second line in equation (15) can be derived by remembering  $\beta_R = \beta(1 - p(\bar{\tau} + \alpha))$  and rearranging terms.

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<sup>10</sup>More formally, we should write  $\tilde{F}_\rho(x) = \min\{\rho F(x\pi^{\min}), 1\}$ , but the min-operator is omitted for notational convenience.

**Lemma 1** (i) The function  $\vartheta$  has a unique maximum over the domain  $[0, 1]$ . (ii) Define  $\alpha^* \equiv \arg \max_{\alpha \in [0, 1]} \vartheta(\alpha)$ . Then, we have

$$\vartheta(\alpha^*) > 0 \tag{16}$$

if  $\rho$  is sufficiently low, i.e., if the ruler is sufficiently entrenched.

**Proof.** See Appendix. ■

As an immediate corollary of Lemma 1 we see that, given  $\bar{\tau}$  and  $\chi$ , the funding of the judicial system,  $\sigma_t|_{r_t=0}$ , is identical zero if the ruler's political strength is too low (i.e., if  $\rho$  exceeds some threshold level). In this case, foreign aid has no impact whatsoever on the ruler's behavior. The reason is intuitive; under these circumstances, even at low levels of  $\alpha$ , the probability of being replaced is so high (and gets actually higher if  $\alpha$  increases) that it never pays to establish costly "good" institutions. Things are different, however, if it is more difficult to force an incumbent regime out of power.

**Proposition 2** Suppose that the ruler is sufficiently entrenched so that condition (16) holds. Then, as shown in Figure 2, the relationship between foreign aid,  $\alpha$ , and the funding of growth-promoting institutions,  $\sigma_t|_{\pi_t < \pi^{\min}}$ , is hump-shaped.

Formally, we have

$$\frac{d \sigma_t|_{\pi_t < \pi^{\min}}}{d \alpha} \begin{cases} \geq 0 & : \alpha \leq \alpha^* \\ < 0 & : \alpha > \alpha^* \end{cases},$$

where  $\alpha^* \in [0, 1]$ .

**Proof.** The claim follows directly from equation (11) and Lemma 1. ■

The reason for this non-monotonicity is that the political instability effect becomes stronger as  $\alpha$  increases. At lower levels of  $\alpha$ , i.e., if political instability is only moderate, we observe a small impact of higher instability on the ruler's marginal rate of substitution (MRS) between future productivity and current consumption;<sup>11</sup> accordingly, the income effect dominates the instability effect. However, as government revenues (and hence instability) increase, the effect of even higher revenues (and thus even more pronounced instability) on MRS gets larger so that the positive income effect is dominated by the instability effect if  $\alpha$  exceeds some threshold level.

*Figure 2 here*

It is now interesting to analyze how the location of the peak is affected by the parameters  $\rho$ ,  $\bar{\tau}$ , and  $\chi$  which characterize key aspects of the country's political and economic systems.

<sup>11</sup>Formally, for given values of  $c_{Rt}$  and  $\tilde{X}_{t+1}$ , the impact of a higher probability of being replaced on the marginal rate of substitution is given by  $\partial MRS_{c_{Rt}, \tilde{X}_{t+1}} / \partial p = -(\tilde{X}_{t+1}/c_{Rt})/(\beta(1-p)^2)$ .

**Proposition 3** *Suppose that the ruler is sufficiently entrenched so that condition (16) holds. Then, the level beyond which aid is harmful for institutional quality,  $\alpha^*$ , is the higher (i) the more the ruler is entrenched; (ii) the lower the state's capacity to tax; (iii) the less expensive technology adoption.*

*Formally, we have*

$$\frac{\partial \alpha^*(\rho, \bar{\tau}, \chi)}{\partial \rho} \leq 0, \quad \frac{\partial \alpha^*(\rho, \bar{\tau}, \chi)}{\partial \bar{\tau}} \leq 0, \quad \text{and} \quad \frac{\partial \alpha^*(\rho, \bar{\tau}, \chi)}{\partial \chi} \leq 0,$$

*with strict inequality if  $\alpha^* \in (0, 1)$ .*

**Proof.** See Appendix. ■

If the ruler is politically strong (i.e., with a low  $\rho$ ), the probability of an insurrection rises only weakly in  $\alpha$  so that the instability effect, i.e., the adverse impact of instability on the ruler's marginal rate of substitution, becomes influential only at high levels of external assistance. Similarly, if the state is economically weak (i.e., with a low  $\bar{\tau}$ ), the likelihood of an insurrection in absence of aid is low so that the income effect dominates over a broader range. Further, if the cost of technology adoption is low (i.e., with a low  $\chi$ ), the ruler spends a larger fraction of the additional resources productively, other things equal. So, once again, the instability effect starts to dominate only at a high level. The comparative static results with respect to  $\rho$  and  $\bar{\tau}$  are illustrated in Figure 3 below.

*Figure 3 here*

Finally note that the scope for beneficial foreign aid is even smaller if we focus on the economy's long-run growth rate rather than at the funding of the judicial system in absence of an insurrection. With higher aid payments, the insurrection equilibria are more numerous so that the probability of a government shutdown (and hence a complete stagnation) is higher. Formally, the economy's average (long-run) growth rate is given by

$$E\{g_{t+1}\} = (1 - p(\alpha + \bar{\tau})) \frac{\sigma_t|_{\pi_t < \pi^{\min}}}{\chi},$$

and it is immediately clear that the above expression peaks at a lower level of  $\alpha$  than  $\sigma_t|_{\pi_t < \pi^{\min}}$ .

## 4.2 Policy Implications

This model relies on rather strong assumptions, and so it would be unwise to draw ultimate policy conclusions. Nevertheless, the present analysis offers some insights that might be interesting for policy makers.

**More aid may be harmful.** First, more foreign aid may make matters worse. Increasing the level of assistance may actually decrease the funding of growth-promoting institutions and, consequently, may hurt the economy's growth performance. Such a negative correlation is the more likely to emerge the lower the regime's political strength, the stronger the state's ability to extract resources, and the more costly technology adoption. In practice, this could mean that directing aid towards countries in which (more or less exogenous) conditions favor insurgency may be problematic. Such conditions are, for instance, the presence of rough terrain (possibly at a distance to the center of state power) which allows the insurgents to form their movement without being destroyed at an early stage. The governments political strength may also be undermined by the presence of hostile neighboring states which back anti-government movements abroad.<sup>12</sup> Similarly, foreign aid is less likely to achieve its goal in countries with an economic structure that makes it easy to extract resources from the economy. Such a structural factor may be a significant natural resource industry; fuels, minerals or cash crop are usually exported through a few ports which can easily be controlled by the government. Finally, in practice, aid is less likely to work well in countries with unfavorable geographic conditions. It seems reasonable to expect technology adoption costs to rise in a country's remoteness.

Note, however, that the present model does not predict aid ineffectiveness in general. It rather points to the fact that, given some widespread characteristics of recipient countries, the range in which budget assistance is beneficial economic performance may be narrow; it also emphasizes that aid flows beyond this potentially narrow range can be harmful. Hence, in the light of the present theory, it is hardly astonishing that the empirical literature fails to find a clear positive or negative relationship between aid and economic policies or institutions (e.g., Alesina and Dollar, 2000; Knack, 2001) or aid and long-run growth (e.g., Rajan and Subramanian, 2005). Moreover, the paper provides a simple rationale for a hump-shaped relationship between aid and growth; such a pattern has been observed in some recent empirical studies (e.g., Daalgard et al., 2004).

**Selectivity does not guarantee effectiveness.** The second insight concerns aid selectivity. Allocation aid on the basis of the current institutional environment may not be a good thing. Differences in the quality of institutions across recipient countries may simply reflect differences in government revenues and do not necessarily predict whether additional revenues will be used productively (because, for instance, the regime is sufficiently entrenched so that the instability effect is absent). As illustrated by Figure 3, budget assistance, starting from

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<sup>12</sup>See Fearon and Laitin (2003) for a comprehensive discussions of what determines the relative strength of anti-government movements.

zero, may have a positive impact in countries with particularly poor institutions while the effect may be negative in countries with a better working judicial system. Again, the model may help to explain why - at least according to the most recent literature - there seems not to be a robust link between aid effectiveness and good policies or institutions (e.g., Hansen and Tarp, 2001; Easterly et al., 2004).

**Adoption subsidies may work better.** Finally, the model's third interesting insight is that an alternative form of aid, the subsidization of technology adoption contracts, may work better than aid in the form of budget assistance. For concreteness, suppose that the external donor subsidizes an adoption contract with  $\xi \Delta X_{it+1}$  units of the final good, where  $\xi < \chi$ . Hence, producer  $i$ 's net adoption cost is given by  $\chi^{net} \Delta X_{it+1}$ , where  $\chi^{net} \equiv (\chi - \xi)$ . Notice that introducing this additional aid instrument does not alter the structure of the equations derived above; so we can simply replace  $\chi$  by  $\chi^{net}$  in the relevant formulas.

Equations (11) and (9) show that, in a no insurrection equilibrium, subsidizing technology adoption tends to have a positive impact on  $\sigma_t|_{\pi_t < \pi^{min}}$  and on the implied growth rate,  $\sigma_t|_{\pi_t < \pi^{min}} / \chi^{net}$ . The reason is a *substitution effect*. With lower adoption costs, the price of future productivity in terms of current consumption is lower so that the ruler tends to invest more in growth promoting institutions.<sup>13</sup>

In terms of effectiveness, there are two qualitative differences between the two forms of aid. First, in the subsidy case, there always exists a level of assistance so that the incumbent ruler spends a positive amount on contract enforcement. Second, the relationship between  $\sigma_t|_{\pi_t < \pi^{min}}$  and the adoption subsidy is monotonic. The reason behind these two differences lies in the missing instability effect in the subsidy case. In the present framework, making technology adoption cheaper does not provide additional resources that can be appropriated by the revolters; the incentive to take part in an insurrection is unaffected and so is the probability of an insurrection equilibrium. Hence, there is no negative effect of foreign aid on the ruler's discount factor.

## 5 The Insurgents as a Single Actor

In this section, we briefly modify the baseline model regarding the technology of insurrection. Here, we treat the insurgents as a single actor who can decide whether an insurrection takes place or not. In such a setting, the decisive agent has to observe that, in an insurrection

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<sup>13</sup>Thus, the ruler's reaction to lower adoption costs is perfectly consistent with Demsetz' (1967, p. 350) conjecture that "the emergence of ( $\cdot \cdot \cdot$ ) property rights takes place in response to the desires of the interaction persons for adjustment to new benefit-cost possibilities."

period, investment into future productivity is not possible because the current government is shut down (and hence  $\lambda_t = \sigma_t = 0$ ). In the baseline set-up, by contrast, a single agent needs not to take this “stagnation cost” into account because his individual decision is not pivotal. It turns out that - with some qualifications - the baseline model’s main results go through even if the decisive agent internalizes the loss associated with economic stagnation. In particular, aid effectiveness may be low (or even negative) due to an associated instability effect.

Suppose that in each period a group of insurgents of measure  $\pi < \chi$  has the power to force the incumbent ruler out of office and to appropriate current state revenues,  $(\alpha + \bar{\tau})X_t$ . Henceforth, we refer to this group as the “insurgent.” The insurgent’s decision is denoted by  $r_t \in \{0, 1\}$ , with 1 indicating an uprising. For expositional convenience, assume further that  $0 < \alpha + \bar{\tau} \leq 1$  and  $\theta_t \sim U[1, 1/f]$ . All other assumptions remain unchanged.

To characterize the MPE, guess that in equilibrium the probability of an insurrection,  $p$ , is constant over time and that the value functions are of the same form as in the baseline model (which will turn out later on). This implies that the policy functions (9) and (11), i.e., the optimal actions in the no insurrection equilibrium, do not change either. Then, in a given period  $t$ , an insurrection takes place if the insurgent’s net value from such an event,

$$\begin{aligned} \Delta \equiv & \ln \left( \left[ 1 - \bar{\tau} + \frac{\alpha + \bar{\tau}}{\pi} - \theta_t \right] X_{it} \right) + \beta E \left\{ \frac{\ln(X_{it})}{1 - \beta} + C \right\} \\ & - \ln((1 - \chi g_{it+1}|_{r_t=0})(1 - \bar{\tau})X_{it}) + \beta E \left\{ \frac{\ln(1 + g_{it+1}|_{r_t=0} X_{it})}{1 - \beta} + C \right\}, \end{aligned}$$

is positive, i.e., if  $\theta_t$  is sufficiently low so that the net “booty,”  $((\alpha + \bar{\tau})/\pi - \theta_t) X_{it}$ , outweighs the stagnation cost (i.e.,  $g_{it+1}|_{r_t=1} = 0$ ). Assume further that there is constant level of  $\theta$ , denote it by  $\hat{\theta}$ , below which an insurrection is optimal so that  $p = F(\hat{\theta})$ . Then, after rearranging terms in the above equation, we get

$$\begin{aligned} \Delta(\theta_t, \hat{\theta}) &= \ln \left( \frac{1 - \bar{\tau} + \frac{\alpha + \bar{\tau}}{\pi} - \theta_t}{(1 - \chi g_{it+1}|_{r_t=0})(1 - \bar{\tau})} \right) - \frac{\beta}{1 - \beta} \ln(1 + g_{it+1}|_{r_t=0}) \quad (17) \\ &\equiv \Lambda(\theta_t, \hat{\theta}) - \Omega(\hat{\theta}). \end{aligned}$$

Note that  $\Delta$  depends on both the current realization of  $\theta$  but also on the threshold level  $\hat{\theta}$ . The latter arguments feeds in via the growth rate in the no insurrection equilibrium,  $g_{it+1}|_{r_t=0} = \sigma_t|_{r_t=0}/\chi$  which is in turn affected by  $\beta_R = (1 - F(\hat{\theta}))\beta$ . The following proposition relies on equation (17) to characterize the Markov Perfect Equilibrium.

**Proposition 4** *Suppose that in each period an insurgent decides on removing the incumbent ruler from office. Then, there exists a MPE such that for all  $t$ , (i) if  $\theta_t \leq \hat{\theta}$ , an insurrection takes place (implying that  $\sigma_t = g_{it+1} = 0$  and  $\tau_t = \bar{\tau}$ ); (ii) if  $\theta_t > \hat{\theta}$ , the ruler remains in*

power, sets a tax rate of  $\bar{\tau}$ , and chooses public spending,  $\sigma_t$ , according to equation (11); the producers' investment into future technology,  $g_{it+1}$ , is then given by  $\sigma_t/\chi$ .

The threshold level  $\hat{\theta}$  is strictly positive and implicitly determined by  $\Lambda(\hat{\theta}, \hat{\theta}) = \Omega(\hat{\theta})$  if

$$\beta < \frac{1 + \chi}{2 + \chi + \pi}, \quad (18)$$

and a sufficient condition for  $\hat{\theta}$  to be unique is then that  $f$  lies below some threshold level.

**Proof.** See Appendix. ■

Notice that restriction (18) is sufficient but not necessary. The condition is more likely to be satisfied if, other things equal,  $\beta$  or  $\pi$  are relatively low or if  $\chi$  is relatively high. The intuition is as follows. With a low  $\beta$  and a high  $\chi$ , technology adoption is less attractive because additional future income has a low weight or because technology adoption is expensive. Accordingly, provided that the direct cost of an insurrection is small enough, the “booty” is sufficiently large to compensate for the stagnation cost. Similarly, if  $\pi$  is small, the insurgent's benefit per capita is higher which makes an insurrection more rewarding, other things equal.

The next step is now to see how foreign aid affects equilibrium political instability and, eventually, economic performance.

**Proposition 5** *Suppose that in each period an insurgent decides on removing the incumbent ruler from office. Assume further that condition (18) holds and  $\hat{\theta}$  is unique. Then, foreign aid in the form of budget assistance increases  $\hat{\theta}$  and hence rises the probability of an insurrection.*

**Proof.** See Appendix. ■

Proposition 5's basic message is that an increase in foreign budget assistance may be accompanied by a surge in political instability even if the insurgents take into account that the unchallenged ruler would spend part of the additional resources productively. If technology adoption is not too attractive, aid unambiguously increases the incentives for an uprising. The conclusion is that Section 4's main result applies also in this modified set-up. Aid effectiveness may be strongly undermined through an aid-induced instability effect which shortens the ruler's time horizon in office and, through this channel, depletes his incentives to finance sound economic institutions.

## 6 Some Evidence on Foreign Aid and Instability

The purpose of this section is to provide some suggestive evidence supporting the hypothesis that the small or even negative impact of aid on macroeconomic performance may be due to

a political instability effect. Specifically, we assess whether foreign aid shortens an incumbent regime’s time-horizon in office by fueling insurrections and coups.

## 6.1 Specification and Data

To test for an association between political instability and foreign aid, we use a first-difference (fixed-effect) panel data model. Specifically, assume that political instability,  $inst_{it}$ , is determined according to the linear regression equation

$$inst_{it} = a(aid/GNI)_{it} + \mathbf{b}'\mathbf{V}_{it} + \mathbf{c}'\mathbf{W}_i + dt + e_{it},$$

where  $i$  is the country index and  $t$  denotes a particular decade. In total, we observe two decades, the 1980s ( $t = 0$ ) and the 1990s ( $t = 1$ ). The vector  $\mathbf{V}$  contains time-varying determinates of political instability other than the aid-to-GNI ratio while vector  $\mathbf{W}$  is included to capture invariant influences.<sup>14</sup> The linear time-trend is represented by  $dt$ , and the error term,  $e$ , is assumed to satisfy the usual conditions. All time-dependent control variables are calculated as an average over the relevant decade.

As a proxy for the dependent variable,  $inst$ , we use the number of illegal or forced changes in the top governmental elite per ten years. This measure can easily be constructed based on information from the Cross-National Time-Series Data Archive. Moreover, it has the advantage of being highly comparable over time and seems to be appropriate to assess the relevance of our story. That is, it allows to test whether foreign aid shortens a regime’s expected time-span in office by rising the number of successful insurrections and coups. The main independent variable,  $aid/GNI$ , measures net official foreign aid from all donors (i.e., bilateral and multi-lateral) relative to the country’s GNI. The ratio contains all types of foreign assistance since aid tends to be fungible (and hence can at least partially be appropriated by the regime or by insurgents) irrespective of the exact purpose or form. The data comes from the OECD Development Co-operation Directorate.

The set of the additional time-dependent determinants consists of the GDP per capita, a measure for democracy, and the inflation rate. By including these further controls we refer to a large body of empirical literature primarily in political science that tries to identify the determinants of insurrections, revolutions, and civil wars (see MacCulloch, 2004, pp. 830-2, for a short survey). The GDP per capita is often seen to influence the government’s (relative) capability of counterinsurgency. There are two competing hypotheses. Some scholars believe poorer

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<sup>14</sup>As discussed in the previous section, such fixed factors may be the presence (or absence) of rough terrain, hostile neighboring states, or valuable natural resources.

countries to be more vulnerable to insurgency because the regimes in such places - financially weak - are probably restricted to comparatively crude repression technologies; the alternative hypothesis is that a higher GDP per capita rises the insurgents' resources in a disproportionate way so that a successful insurrection become more likely. Accordingly, the literature offers no clear prediction in which direction the influence of income goes. The democracy index is included since democratic institutions may be able to channel (and eventually respond to) grievances of disadvantaged groups. Hence, revolutionary pressure should, other things equal, be lower if institutions allow for broad participation in the political process (as opposed to elite rule). High inflation, by contrast, is expected to foster the taste for revolt. The hypothesis is that the inflation rate is seen as a performance indicator; substantial price-instability is taken to proxy for a low quality of government and hence may erode the regime's legitimacy in the eyes of the many.

*Tables 1 and 2 here*

Exact data definitions and sources for all the relevant variables are provided in Table 1. Table 2 reports summary statistics.

## 6.2 Endogeneity Problems

As extensively discussed in the literature, the aid-to-GNI ratio is likely to be endogenous. The donors' aid allocation is almost certainly affected by political instability in the receiving countries. On the one hand, if aid allocation is merit-based, the donors may find that instable countries do not deserve substantial assistance. In this case, a possible positive impact of foreign aid on political instability would be biased downward. On the other hand, donors may perceive instability to create needs by deteriorating economic performance so that a causal impact of foreign aid would be overstated. To deal with this problem, we have to instrument for the endogenous actual aid-to-GNI ratio. In the regressions below, we use the instrument constructed by Rajan and Subramanian (2005) as an exogenous source of variation in foreign assistance.<sup>15</sup> This instrument gives the *exogenous component* of total assistance as a share of the GDP. To isolate the exogenous part, Rajan and Subramanian exploit the fact that aid flows are often influenced by factors that are rather independent of contemporaneous economic and political events; such factors include common membership in an alliance or colonial ties between the donor and the recipient country, for instance.

Serious concerns of endogeneity arise also with respect to the other explanatory variables.

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<sup>15</sup>We are grateful to Raghuram Rajan and Arvind Subramanian for sharing their data with us.

The GDP per capita needs instrumentation since we may simply observe a negative correlation between political instability and income due to the direct negative impact of conflict on economic activity; the inflation rate may be endogenous for the same reason. Similarly, it may be that frequent insurgencies induce the incumbent government to move towards more democracy to soften revolutionary pressure. To deal with these problems in our first-difference panel data model, we use a procedure originally proposed by Arellano and Bond (1991). That is, we exploit the levels in the second half of the 1970s to instrument for the subsequent changes (from the 1980s to the 1990s) in these additional explanatory variables.<sup>16</sup>

### 6.3 Estimation Results

Our estimation results are shown in Table 3. The first two columns give the baseline specification with the aid-to-GNI ratio and the GDP per capita as independent variables. In column (1), we do not instrument for the two regressors but run a simple OLS-estimation; it turns out that both coefficients are statistically insignificant. Things change, however, when the (potential) endogeneity of the explanatory variables is taken into account. The basic IV-results are presented in column (2). Foreign assistance has now a significant positive impact on political instability. Most likely, this difference reflects the negative feedback effect of instability on the donors' aid allocation which biases the simple OLS-result downwards. The destabilizing effect of foreign aid is quite sizable; increasing official development assistance from 0% to 10% of the GNI (which corresponds to 1 standard deviation in the 1980s) rises the number of illegal or forced government changes (or any attempt at such changes) by 2.3 per 10 years. The influence of the GDP per capita, by contrast, remains insignificant even with appropriate instrumentation. Similarly, we do not observe a significant decade-specific effect.

*Table 3 here*

In column (3) and (4) we introduce step-by-step the two remaining explanatory variables (with appropriate instrumentation). As expected, the democracy index enters the regression equation with a negative sign (column 3). Moreover, the effect of democracy on political stability is marginally significant and quite large; pushing a country from a low standard of democracy (e.g., the Haitian level) to a high level (e.g., the South African level) would reduce

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<sup>16</sup>The levels are by construction correlated with the subsequent changes but political instability in the 1980s and 1990s cannot influence the levels of income, inflation, and democracy in the 1970. Hence, the levels seem to be appropriate instruments for the subsequent changes in these variables. Note that in case of inflation we have to use the average level from 1980 to 1984 since that of the second half of the 1970s is a weak instrument.

the number of revolutionary acts by 3 per 10 years. Finally, again consistent with expectations, the coefficient on inflation (which is taken to reflect the quality of government) is positive and statistically highly significant (column 4). Yet, as compared to the other explanatory variables, the magnitude of the effect is smaller; increasing inflation by 1 standard deviation (i.e., by 220 percentage points) goes together with an additional 0.5 revolutions per 10 years.<sup>17</sup>

Note, finally, that the introduction of these additional explanatory variables does not reduce the impact of foreign assistance on the number of coups and insurrections; the coefficient on the aid-to-GNI ratio becomes even larger. In this sense, the present evidence points to a robust effect of aid on instability.

## 7 Summary and Conclusions

We analyze the impact of foreign aid on economic performance in an economy that may grow through the adoption of more productive technologies. The role of the state is to enforce contracts between foreign technology suppliers and domestic firms; a higher funding of the judiciary translates into better enforcement and, through this channel, allows for faster growth. The self-interested government, however, is weak in the sense that its power is permanently threatened through insurrections; moreover, it has only a limited capacity to tax - a stylized fact that has often been blamed as an important obstacle to economic development.

We find that in such an environment foreign aid may fail to promote better institutions and a higher growth rate. The paper thus provides a possible explanation for the lack of a robust empirical relationship between aid and economic performance. The mechanism highlighted here is that - with insufficient checks on the government's behavior - large revenues are required to make even a perfectly entrenched ruler willing to finance key economic institutions. The dilemma is that providing such resources easily destabilizes the incumbent regime and hence depletes its incentives to invest; large sums of money fuel distributional conflicts and shorten the regime's time-horizon in office.

Besides accounting for low aid effectiveness, the present set-up may add to an explanation for additional empirical findings. First, it turns out that the instability effect gets disproportionately strong as the aid level rises. So the model can account for decreasing returns to

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<sup>17</sup>Without instrumentation, the coefficients on democracy and inflation are given by  $-0.161$  and  $0.0359$ , respectively (results not reported in the table). So, it appears the two variables' endogenous response to political instability biases the causal impact of democracy downward (since threatened regimes democratize to mitigate revolutionary pressure, for instance) and that of inflation upward (because of the direct negative impact of conflict on economic activity).

aid which have been found in some recent studies. Second, the model highlights that current institutional quality does not predict aid effectiveness. An (additional) inflow of resources, by lifting political instability above some critical level, may be harmful in an economy which has performed relatively well. Yet, such an inflow is probably highly effective in a country suffering from low institutional quality. In this light, it is less surprising that the literature does not find a robust empirical link between aid effectiveness and institutional quality.

From a policy perspective, the present model offers three interesting insights. First, increasing transfers may not only be ineffective but may actually hurt a country's long-run performance. According to the model, such a negative impact is more likely to emerge if insurgency is favored through, e.g., rough terrain or hostile neighboring states; if government revenues are already high because a strong natural resource sector facilitates taxation; or if the country's remoteness renders technology adoption expensive. The second insight is that institutional quality reacts endogenously to aid inflows so that current conditions do not necessarily predict whether additional resources will be used effectively. Hence, allocating aid on the basis of current institutions or policies – which lies at the heart of the selectivity concept – may simply pick the “wrong” recipient countries. Finally, the model points to an alternative form of aid which can be expected to work more reliably. Making access to more productive technologies cheaper (by subsidizing licensing fees, for instance) may be a way to spur economic growth even in a bad institutional environment.

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Bank.

## Appendix

**Form of the value functions.** We show that the producers' value function under personal rule,  $V(X_{it})$ , is indeed of the form assume in equation (8). The guesses of all other value functions can be verified in a similar way.

Given the form of the policy functions (9) and (11), and given the fact that an insurrection takes place if  $(\bar{\tau} + \alpha)/\pi^{\min} \geq \theta_t$ , we can write the equilibrium level of technology adoption,  $g_{it+1}$ , as a function of  $\theta_t$  and the parameters of the model,

$$g_{it+1}(\theta_t; \alpha, \beta, \pi^{\min}, \bar{\tau}, \chi).$$

Then, according to equations (5) and (7), the producers' consumption level can be written as a factor  $z$  times the current productivity level,

$$c_{it} = z(\theta_t; \alpha, \beta, \pi^{\min}, \bar{\tau}, \chi)X_{it}.$$

This multiplicative expression can now be used in equation (1) to derive the form of  $V$ . Suppressing the arguments in  $z$  and  $g_{it+1}$  where appropriate, a producer's value function can be expressed as

$$\begin{aligned} V &= E \left\{ \sum_{s=0}^{\infty} \beta^s \ln(z(\theta_{t+s})X_{it+s}) \right\} \\ &= E \left\{ \sum_{s=0}^{\infty} \beta^s \ln(X_{it+s}) \right\} + \ln z(\theta_t) + \beta \frac{E\{z\}}{1-\beta}. \end{aligned}$$

Further, exploiting the fact that  $X_{it+s} = X_{it}(1 + g_{it+1}) \cdots (1 + g_{it+s})$  yields

$$\begin{aligned} V(X_{it}, \theta_t) &= \frac{\ln(X_{it})}{1-\beta} + \ln z(\theta_t) + \beta \frac{\ln(1 + g_{it+1}(\theta_t))}{1-\beta} + \beta \frac{E\{z\}}{1-\beta} \\ &\quad + E \left\{ \beta^2 \ln(1 + g_{it+2}) + \beta^3 \ln((1 + g_{it+2})(1 + g_{it+3})) + \cdots \right\} \\ &\equiv \frac{\ln(X_{it})}{1-\beta} + A(\theta_t), \end{aligned}$$

which corresponds to the assumptions made in equation (8).

**Proof of Lemma 1.** The first claim can immediately be seen by looking at the first derivative,

$$\frac{d\vartheta}{d\alpha} = \frac{\beta}{1+\bar{\tau}} (1 - \rho H(\bar{\tau} + \alpha)) \left( 1 - \frac{\rho h(\bar{\tau} + \alpha)}{1 - \rho H(\bar{\tau} + \alpha)} (\bar{\tau} + \alpha + \chi(1 + \bar{\tau})) \right),$$

which is monotonically decreasing in  $\alpha$  since the monotone hazard rate assumptions imposed on the distribution function  $F$  carriers over to  $\rho H(\bar{\tau} + \alpha)$ .

With respect to the second claim, note that, by Assumption (A2),  $\beta((\bar{\tau} + \alpha)/(1 + \bar{\tau}) + \chi) - \chi$  is strictly positive if  $\alpha$  is sufficiently close to 1; hence we can always find a value of  $\rho$  which is sufficiently close to 0 so that  $\beta_R((\bar{\tau} + \alpha)/(1 + \bar{\tau}) + \chi) - \chi = \vartheta(\alpha)$  is also strictly positive.

**Proof of Proposition 3.** Suppose first that  $\alpha^* \in (0, 1)$ . Then, since the monotone hazard rate condition holds, it follows from the first-order condition

$$\frac{d\vartheta}{d\alpha} = 0 \Leftrightarrow \left( 1 - \frac{\rho h(\bar{\tau} + \alpha^*)}{1 - \rho H(\bar{\tau} + \alpha^*)} ((\bar{\tau} + \alpha^* + \chi(1 + \bar{\tau})) \right) = 0,$$

that the partial derivatives,  $\partial\alpha^*/\partial\rho$ ,  $\partial\alpha^*/\partial\bar{\tau}$  and  $\partial\alpha^*/\partial\chi$ , must be strictly negative.

Consider now the corner solutions. If  $d\vartheta/d\alpha|_{\alpha=1} > 0$  and hence  $\alpha^* = 1$ , a marginal increase in  $\rho$ ,  $\bar{\tau}$ , or  $\chi$  leaves  $\alpha^*$  unaffected since  $\arg \max \vartheta(\alpha) > 1$ . Note, however, that  $\arg \max \vartheta(\alpha)$  falls in  $\rho$ ,  $\bar{\tau}$ , and  $\chi$  so that the case  $\alpha^* \leq 1$  becomes relevant at some point. Similar arguments apply for the case  $\alpha^* = 0$ .

**Proof of Proposition 4.** To prove the first claim, we have to show the existence of a  $\hat{\theta}$  such that  $\Delta(\theta_t, \hat{\theta}) > 0$  if  $\theta_t < \hat{\theta}$  and  $\Delta(\theta_t, \hat{\theta}) \leq 0$  if  $\theta_t \geq \hat{\theta}$  implying that an insurrection takes place with a constant probability  $p = F(\hat{\theta})$  in each period. Then, the guesses of the value functions were correct, and using the policy functions (9) and (11) was appropriate so that the set of strategies described in the proposition is indeed a MPE.

To proceed, notice an important property of  $\Delta(\theta_t, \hat{\theta})$ . We have  $\partial\Delta(\theta_t, \hat{\theta})/\partial\theta_t < 0$  since  $\partial\Lambda(\theta_t, \hat{\theta})/\partial\theta_t < 0$ . Hence, it is clear that the condition

$$\Delta(\hat{\theta}, \hat{\theta}) = \Lambda(\hat{\theta}, \hat{\theta}) - \Omega(\hat{\theta}) = 0$$

implicitly defines possible values of  $\hat{\theta}$ , and it remains to characterize the solution(s) to this condition. It is convenient to treat two different constellations separately. Suppose first that  $\Delta(0, 0) > 0$ . Under this condition, it follows from the properties of the functions  $\Lambda(\hat{\theta}, \hat{\theta})$  and  $\Omega(\hat{\theta})$  that there is at least one solution to  $\Lambda(\hat{\theta}, \hat{\theta}) - \Omega(\hat{\theta}) = 0$  over the range  $(0, 1 - \bar{\tau} + (\alpha + \bar{\tau})/\pi]$ . Suppose now that  $\Delta(0, 0) \leq 0$ . Then, a possible value of  $\hat{\theta}$  is given by 0, and there may be other values satisfying  $\Lambda(\hat{\theta}, \hat{\theta}) - \Omega(\hat{\theta}) = 0$  over the range  $(0, 1 - \bar{\tau} + (\alpha + \bar{\tau})/\pi]$ . Accordingly, there exists at least one  $\hat{\theta}$ , and the first paragraph of the proposition follows.

In order to prove the second claim, we have to show that with  $\theta_t = 0$  the net benefit from an insurrection is strictly positive if condition (18) holds. More formally, we have to show that  $\Delta(0, 0) > 0$  or, equivalently, that  $\Lambda(0, 0) > \Omega(0)$  if  $\beta < (1 + \chi)(2 + \chi + \pi)^{-1}$ . To do this, notice that

$$\Lambda(0, 0) > \tilde{\Lambda} \equiv \ln \left( 1 + \frac{\alpha + \bar{\tau}}{\pi} \right) \quad \text{and} \quad \Omega(0) < \tilde{\Omega} \equiv \frac{\beta}{1 - \beta} \ln \left( 1 + \frac{\alpha + \bar{\tau}}{\chi} \right).$$

It is not easy to see that  $d\tilde{\Lambda}/d(\alpha + \bar{\tau}) > d\tilde{\Omega}/d(\alpha + \bar{\tau})$  if condition (18) is satisfied (and if  $\alpha + \bar{\tau} \leq 1$ ). Accordingly, we have  $\tilde{\Lambda} > \tilde{\Omega}$  and hence  $\Lambda(0, 0) > \Omega(0)$ .

The third claim follows from  $\left|d\Omega/d\hat{\theta}\right| \leq (\beta/(1-\beta))(f/(1-F(\hat{\theta})))$  so that  $\left|d\Omega/d\hat{\theta}\right| < \left|d\Lambda/d\hat{\theta}\right|$  if  $f$  is sufficiently small. Then, since  $\Lambda(0,0) > \Omega(0)$ , there is exactly one intersection of  $\Lambda(\hat{\theta},\hat{\theta})$  and  $\Omega(\hat{\theta})$  over the range  $(0, 1 - \bar{\tau} + (\alpha + \bar{\tau})/\pi]$ .

**Proof of Proposition 5.** Restriction (18) implies that  $\hat{\theta}$  is determined by  $\Lambda(\hat{\theta},\hat{\theta}) = \Omega(\hat{\theta})$ . Implicit differentiation of this latter condition yields

$$\frac{d\hat{\theta}}{d\alpha} = \frac{\frac{\partial\Lambda}{\partial\alpha} - \frac{\partial\Omega}{\partial\alpha}}{-\left(\frac{\partial\Lambda}{\partial\hat{\theta}} - \frac{\partial\Omega}{\partial\hat{\theta}}\right)}.$$

Since restriction (18) holds (and hence  $\Lambda(0,0) > \Omega(0)$ ) and because there is a unique solution to  $\Lambda(\hat{\theta},\hat{\theta}) = \Omega(\hat{\theta})$ , the  $\Lambda$ -curve must intersect the  $\Omega$ -line from above at the equilibrium value of  $\hat{\theta}$ . Hence, the denominator in the above expression is strictly positive. To determine the sign of the numerator, notice that

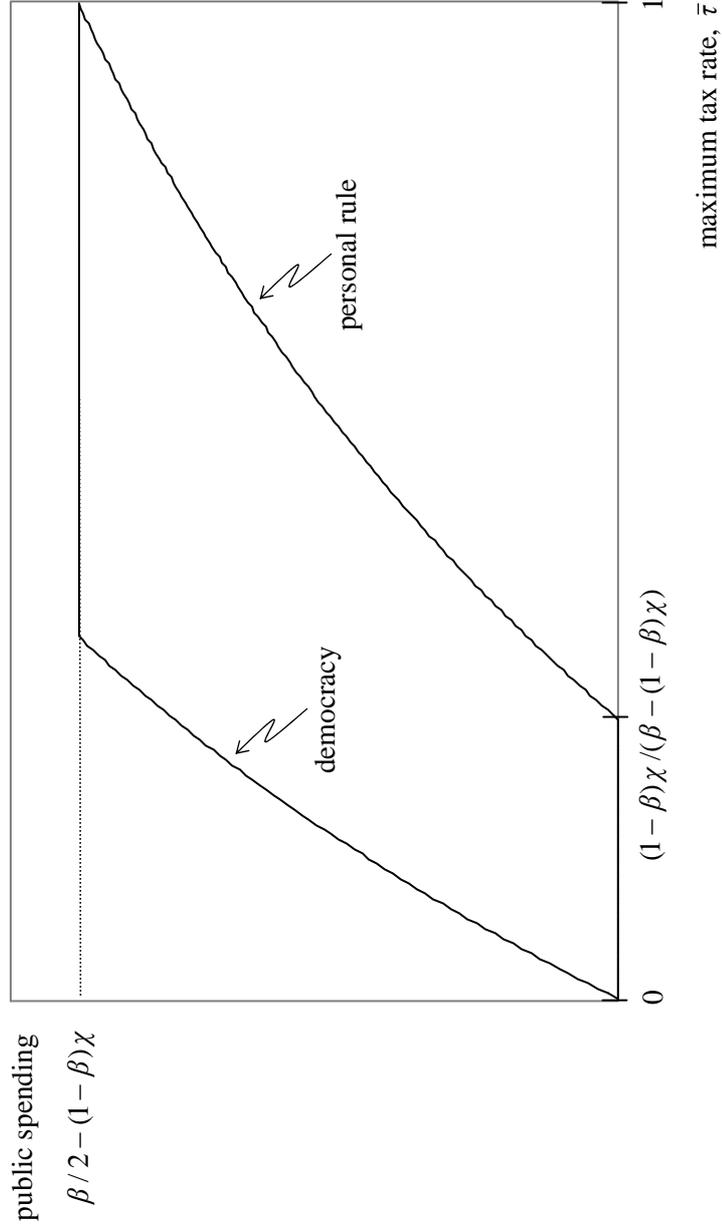
$$\frac{\partial\Lambda}{\partial\alpha} \geq \frac{1}{(1 - \bar{\tau} - \hat{\theta})\pi + \bar{\tau} + \alpha} \quad \text{and} \quad \frac{\partial\Omega}{\partial\alpha} \leq \frac{\beta}{1 - \beta} \frac{1}{(1 + \bar{\tau})\chi + \bar{\tau} + \alpha},$$

which makes it straightforward to verify that restriction (18) is sufficient to ensure  $\partial\Lambda/\partial\alpha > \partial\Omega/\partial\alpha$ . Therefore, we have  $d\hat{\theta}/d\alpha > 0$ .

# Figures

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Figure 1 – Public spending in different political regimes (without threats of insurrection)



**Figure 2 – Aid effectiveness with threats of insurrection**

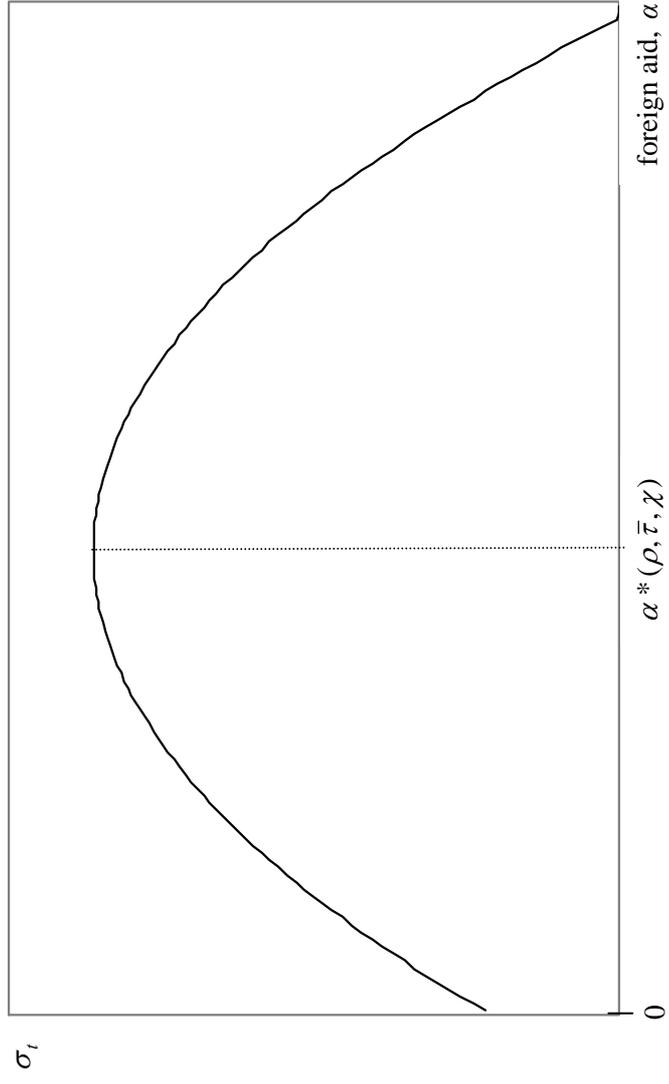
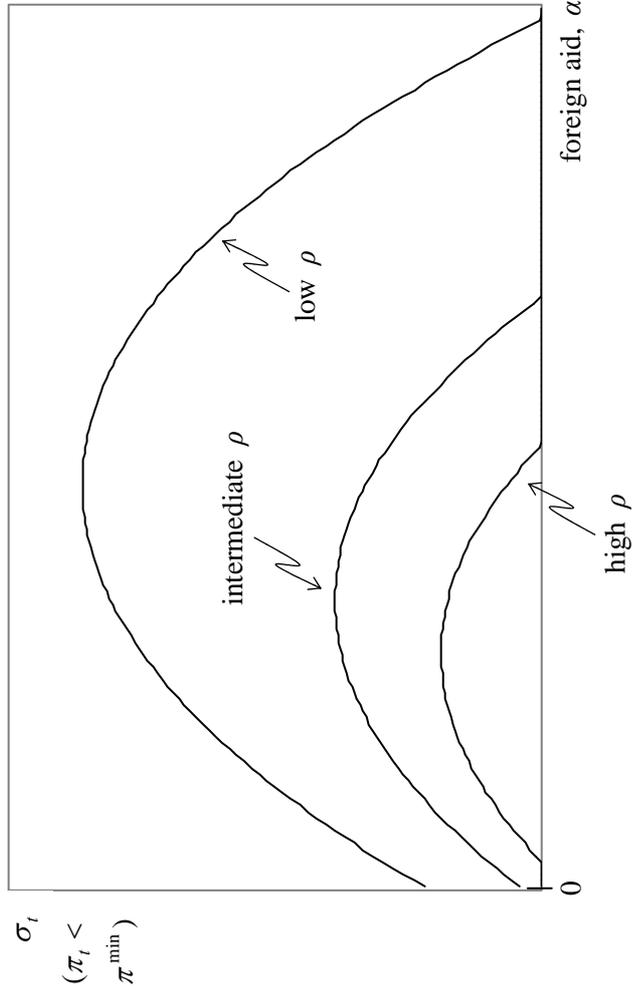
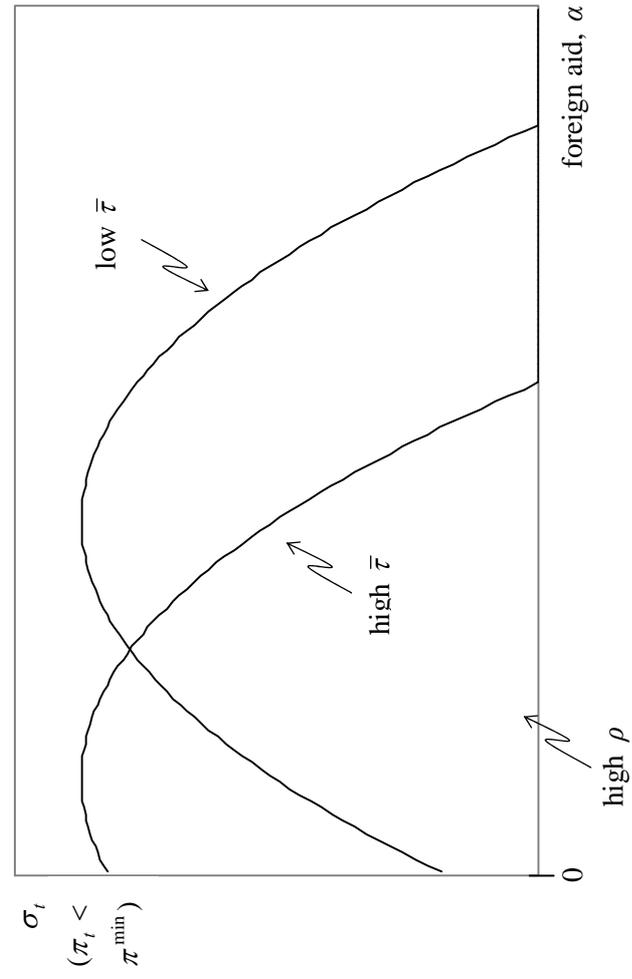


Figure 3 – Aid effectiveness: comparative statics

a. Different degrees of political strength



b. Different degrees of economic strength



## Tables

**Table 1 – Data definitions and sources**

Instability	Number of illegal or forced change in the top governmental elite or any attempt at such a change in a particular decade. <i>Source:</i> Cross-National Time-Series Data Archive, 1815-2003.
Aid-to-GNI ratio	Total net ODA/OA (all types) as a share of recipient's GNI; the data is averaged over the relevant decade. <i>Source:</i> OECD, Development Co-operation Directorate (online database).
Fitted aid-to-GDP ratio	ODA/OA (as a share of recipient's GDP) that is not extended for economic but other, rather time-invariant reasons (e.g., common membership in an alliance). <i>Source:</i> Rajan and Subramanian (2005).
GDP per capita	Level of per capita GDP; the data is PPP-converted (in 1996 IS) and averaged over the relevant decade. <i>Source:</i> Heston, Summers, and Aten (2002; PWT 6.1)
Democracy	An index ranging from -10 (strongly autocratic) to 10 (strongly democratic); the data is averaged over the relevant decade. <i>Source:</i> Marshall and Jaggers (2005; Polity IV Project).
Inflation	Annual percentage change of the consumer price index; the data is averaged over the relevant decade. <i>Source:</i> World Bank (2004; WDI).

**Table 2 – Summary statistics**

	1980s			1990s		
	Number of observations	Mean	Standard Deviation	Number of observations	Mean	Standard Deviation
Revolutions	128	2.02	3.03	148	2.74	4.20
Aid-to-GDP ratio (%)	131	8.42	10.31	164	9.84	14.42
Fitted aid-to-GDP ratio (%)	107*	10.31*	21.88*	107	10.16	20.40
GDP per capita**	105	4.11	3.55	141	5.47	5.22
Democracy	112	-3.16	6.15	134	1.04	6.20
Inflation rate / 100	111	0.60	2.20	137	0.99	3.48

\* Average over the 1980-99-period.

\*\* In 1000 US\$

**Table 3 – Regression results**

	Dependent variable: #Revolutions per 10 years			
	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Aid-to-GNI ratio	0.0015 (0.0268)	0.2298 <sup>b</sup> (0.1077)	0.3111 <sup>a</sup> (0.1226)	0.5360 <sup>b</sup> (0.2680)
GDP per capita	-0.1809 (0.1451)	0.5692 (0.987)	0.2177 (1.1046)	0.9518 (1.2807)
Democracy			-0.4942 <sup>c</sup> (0.2810)	-0.5809 <sup>c</sup> (0.3108)
Inflation (Quality of government)				0.2602 <sup>a</sup> (0.1028)
Time trend	0.7955 (0.5076)	0.2532 (0.6245)	2.4383 (1.5935)	1.9608 (1.5228)
Number of observations	94	83	81	68

Robust standard errors in parentheses.

<sup>a</sup> Significant at the 1 percent level.

<sup>b</sup> Significant at the 5 percent level.

<sup>c</sup> Significant at the 10 percent level.