Corruption and the Resource Curse: The Dictator Model*

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Abstract

We further develop our dynamic discrete choice model of a self-interested and unchecked ruler making decisions regarding the development of a resource rich country. Resource wealth serves as collateral and facilitates the acquisition of loans. The ruler makes the recursive choice of either staying in power to live off the productivity of the country while facing the risk of being ousted, or looting the country's riches by liquefying the natural assets through external lending. The ruler is able to balance risk and return by means of siphoning returns from the economy into an offshore store of value, accessible upon any form of departure. We show in a simple model of looting that 1) unstructured lending from international credit markets can enhance the autocrat's incentives to loot the country's resource wealth; and then demonstrate that 2) an enhanced likelihood of looting within an economy reduces tenures (greater political instability), increases indebtedness, reduces investment, and diminishes growth potential. We test these predictions with the data and find strong empirical evidence that the departure of autocrats is endogenous to external interventions impacting liquidity. We demonstrate in simulations the manner in which a sequence of such endogenous departures will result in accumulated: a) indebtedness; b) instability; and c) nonproductivity. Hence, the curse.

Keywords: Natural Resource Curse; Corruption; Dictatorship; Looting

JEL Classification: O11; O13; O16

1 Introduction: Corruption and the Resource Curse

In a companion paper we demonstrated how the resource curse was related to the availability of liquidity within autocratic countries (Sarr et. al. 2011). We presented empirical evidence that linked liquidity to reduced growth prospects, by reason of induced political instability. Autocratic resource-rich countries were more likely to experience political instability when liquidity was available, and this instability was shown to reduce growth significantly in those countries. This empirical analysis was consistent with much of the literature linking the curse with institutional weaknesses.[1]

In this paper we wish to explain in greater detail the nature of the institutional weaknesses that link autocracies to the curse. We argue that the problem inherent in autocracy (i.e. centralised political control and resource ownership) is that it presents the autocrat with a decision each day on whether to continue in power, or to simply "loot" its own assets

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[1]An extensive literature documents that resource wealth can be a curse rather than a blessing for many countries and that this is closely linked with institutional weaknesses (Sachs and Warner, 1995). There are at least three different explanations for this so-called resource curse. Reduced growth in resource-rich countries has been associated with (i) increased indebtedness (Manzano and Rigobon, 2001), (ii) domestic conflict and political instability (Collier and Hoeffler, 2004), and with (iii) autocratic regimes and poor institutions (Ross, 2001; Isham et al., 2004). Clearly there are political and institutional dimensions to resource-related development problems that need to be unraveled.

and depart the country.[2] We provide a model of this decision making process by the autocrat - *the dictator model* - which demonstrates how this decision is determined in large part by outside factors and forces.

In short, we argue that autocratic leaders who stay and invest in the development of such countries must first make the decision not to engage in immediate looting, and it is the availability of looting that determines that corruption prevails in a country. The hypothetical we suggest to illustrate this point is that of the local goat herder turned air force colonel turned head of state. Why would such a person elect to remain in office for longer than the length of time required to open a foreign bank account and transfer the available liquidity to that account? Surely, the marginal benefits to such a person from having a few hundred million more dollars must pale next to the value of the first hundred million appropriated. When the incentives to stay and invest are inadequate, it would be expected that centralised autocratic regimes afforded the option (liquidity) would translate control into little other than a series of such looting incidents. Thus it is our argument that it is this capacity for looting that turns resource-richness into economic disaster. There are plenty of real-world examples. States evidencing long-standing looting behaviour include countries such as Nigeria, in which long-running disastrous economic and political performance can be easily traced to the ongoing predatory behavior of a series of autocratic regimes.[3]

We see our dictator model as providing the link between the political economy literatures that have examined the phenomenon of corruption (Serra 2006; Treisman 2000) and the resource curse literature that has examined how macro-economic outcomes are linked to resource endowments and institutions (Sachs and Warner 1995; Robinson et. al. 2006; Mehlum et al. 2006). There has been a lot of recent analysis of the sources of corruption, most of it focusing upon historical, social and cultural factors (Serra 2006). We argue here that corruption is primarily an economic phenomenon, and that it should be viewed as a crucial component of the explanation of the resource curse. There is plenty of evidence suggesting that institutional quality is one of the main drivers of economic development in general (Acemoglu et al., 2001; Rodrik et al., 2004), and the fates of resource-rich economies in particular (Robinson et al., 2006; Mehlum et al., 2006). There is also evidence that resource-rich countries are particularly prone to corruption (Treisman 2000; Ades and di Tella 1999). Together these literatures provide substantial evidence that resource-rich economies are driven toward poor macro-economic outcomes through the vehicle of institutional instability.

Our specific objective is to provide the micro-foundations to link these two literatures. We provide the micro-model of the dictator's choice environment that illustrates how outside interventions substantially influence how and when autocrats of resource-rich countries elect to loot their own economies. Specifically we demonstrate here that there is one set of institutional failures that can combine to create irresistible incentives for the looting of nations. These are: a) the existence of relatively undeveloped domestic democratic institutions (an absence of checks on the current ruler); b) the presence of nationally held resource rights (centralised economies); and c) the conferment of liquidity by outside agents upon such rulers (unconditional conferment of liquidity).

As indicated above, the role of outside intervention within these countries is crucial to determining the incentives for looting. External intervention can have a determinative influence on autocrats from any source, when it shapes the choice between current income flows and stocks of wealth (i.e. the rate at which assets are liquefiable). In this paper we will focus on the potential role of the international capital markets in this respect, but any form of intervention can help to frame the incentives of autocrats in this respect. In another paper we focus on the role of various forms of governmental intervention in determining the incentives for looting (Ravetti, Sarr and Swanson 2012).

Here we use the example of commercial lending as a source of corruption and the curse.[4] We demonstrate how excessive resource-based lending by external financial institutions can induce political instability and looting. The

[2] This term refers to the voluntary liquidation - or "looting" - option first modeled by Akerlof and Romer (1994) and discussed in the context of African economies by Bates (2008).

[3] Many economic and political studies list examples of such resource-inspired looting-type behaviour (e.g. Jayachandran and Kremer, 2006; Bates, 2008).

[4] We also are not the first to highlight the roles of international lending and indebtedness in the curse. Manzano and Rigobon (2001) find that the resource curse vanishes when controlling for indebtedness. Their argument is that large credit offered on resource-based collateral in periods of commodity boom resulted in substantial debt overhang when commodity prices fell in the 1980's. We agree with their analysis, and develop

instability is visible in the rate of governmental turnover that exists in such countries. The existence of looting is visible in the indebtedness that results. Such instability-linked indebtedness is the natural consequence of lending that is looted rather than invested. (Bulow, 2002). [5]

In sum, in this paper we develop a model of a resource-rich economy governed by a self-interested ruler with unchecked property rights in national resources who cares only about his own consumption. The crucial and discrete choice made by the ruler is whether to stay and invest, or to exit and loot. In spirit, the model is close to Overland et al. (2005) who explore what determines a dictator to initiate growth or "plunder his country" when he faces a potentially insecure tenure. However, our model differs because our focus is on the role of external agents in liquefying sunk capital, especially in regard to natural resources. To the extent that external agencies facilitate the conversion of sunk capital into liquid capital—enabling the leader to make immediate access to wealth that usually requires time and investment—it affects the tradeoff between staying (re-investing in the economy and consuming by maintaining control) or looting (taking the extant liquidity and exiting). This combination of resource wealth and excessive external lending gives rise over time to endogenous political instability, lack of investment and indebtedness.

Our main results are as follows. We first demonstrate in a simple model how a dictator taking control of a nation's resources might decide between three distinctly different paths: (1) immediate looting of the country's resource wealth; (2) transitory investment in the country's capital base to build up additional liquidity for looting in the medium term; or (3) long term investment in the economy (and possibly in shared consumption or political repression) in an attempt to secure tenure and to consume from the economy. Second, we demonstrate that the choice of looting is endogenous to the problem; in particular, the level of liquidity made available by external agents is fundamental to the determination of the autocrat's choice between the three paths described above. Another important factor determining this choice is the level of indebtedness in the economy, indicating that previous choices of looting contribute to later ones.

We then demonstrate this outcome empirically, by examining the departure decisions of autocrats across a panel data set of such countries. We find that the hazard rate of departure by autocrats is higher for those from resource-rich countries provided with sources of liquidity. We argue that this is evidence of the looting behaviour described in our model.

We then illustrate how such behaviour accumulates over time into the curse. We provide simulations of the path of such an economy over time subjected to a series of autocrats sequentially deciding when to depart. We demonstrate that under the conditions of low productivity and high liquidity the economy is subject to recurrent looting—resulting in political instability, low growth and substantial indebtedness. We demonstrate that the same autocrats afforded less liquidity will pursue a path of optimal investment and high growth—acting more as an owner and less as a looter of the economy. In short, the resource curse is seen to derive from the pathway that is selected by the autocrat, and the election of the autocrat is endogenous to the parameters of the problem.

For this reason we argue here that corruption is not primarily a cultural, sociological, or even historical phenomenon. Instead, corruption is endogenous to the problem of providing autocrats with the correct incentives for efficient governance. When incentives are provided to encourage autocrats to invest and develop their economies, they will do so. When incentives are provided for liquidating and looting their economies, then corruption, non-investment, and indebtedness will be the result. Corruption can be a straightforward result of economic incentives.

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ours to elaborate and expound upon the mechanisms by which resource-based lending goes bad. The most fundamental cause of this problem is moral hazard:This is because lenders see little reason to exercise restraint in lending to resource-rich states, since the resources (and liabilities) remain behind even when the regime changes (Bulow, 2002). This means that lenders have little reason to be concerned about the incentives their loans generate. According to Raffer and Singer (2001: 161), the policy of *"liberal lending by commercial banks opened a bonanza for corrupt regimes. After amassing huge debts and filling their pockets, military juntas (...) simply handed power and the debt problem over to civilians."* We demonstrate in our model precisely how such unstructured lending generates the incentives for the combined events of debt and departure, instability and indebtedness.

[5] The existence of "excessive resource-based lending" is reinforced by the observation that 12 of the world's most mineral-dependent countries and six of the world most oil-dependent countries are currently classified as highly indebted poor countries (Weinthal and Luong, 2006).

The paper is organized as follows. In section 2, we present a stylized model of the looting of a resource-rich nation with an unchecked ruler who has access to foreign lending. In section 3, we provide an empirical estimation of our model, demonstrating how liquidity interacts with resource wealth to generate unscheduled departures by autocrats - which we interpret as looting. In section 4, we simulate the choices of a series of such autocrats over time, and demonstrate the economic outcomes for the nation over a significant range of parameters. In section 5, we conclude.

2 A model of looting

Here we develop a model based on Akerlof and Romer (1994) in which we investigate the effects of natural resource abundance, poor governance and unsound lending on political stability and ultimately on economic performance. Poor governance is present in the form of an unchecked ruler with implicit property rights in the resources of the state. We are interested in how such an autocrat will elect to achieve a payout on these property rights and, in particular, the impact of lending market imperfections upon the dictator's choice between staying and looting. Staying involves the dictator's commitment to acquiring a return through holding power and investing in the economy. Looting involves electing a short term "hit and run" strategy of maximum loan, minimal investment, and immediate departure. Before we examine the model, we will first define the primary actors existing within the framework.

Autocratic Resource-Rich States. The states concerned hold their fixed natural resource stocks directly as sovereign assets; there are no intermediate entities (corporations, individuals) holding rights in these resources. Once in power, the leader of the state has the unchecked authority to mine the resources or to enter into contracts on behalf of the state in regard to the natural resource assets. These natural resources are sunk assets, but are assumed to be capable of providing a constant stream of revenues into the indefinite future. Consider such an autocratic resource-rich state, a small open economy producing output y_t according to the function $y_t = f(k_t) + \varphi(Z)$, where f and φ are two increasing, concave, and continuously differentiable functions of capital k_t and Z. $\varphi(Z)$ is the flow of resource rents deriving from the state's sunk resource wealth Z. We will assume here that the flow of rents from resources remains constant throughout the program, while the productivity of the economy may be enhanced by means of investment in capital. In this economy, investment in capital is given by $i_t = k_{t+1} - (1-\delta)k_t - \sigma_t$, where δ and σ_t represent the depreciation rate and the current amount of public funds diverted by the dictator. As a result, the capital stock k_t evolves according to the transition equation $k_{t+1} = (1-\delta)k_t + i_t + \sigma_t$. Because of the natural resource endowment, this country qualifies for loans l_t from international commercial banks at the beginning of each period so that it faces the following budget constraint: $c_t + i_t + rd_t = y_t + l_t$, where r is the interest rate paid on accumulated debt, d_t. The country's stock of debt evolves according to the following transition equation:

$$d_{t+1} = d_t + l_t$$

The interest on the debt must be paid each period for the banks to accept lending in the next period. So, the cost of servicing the debt rd_t is incurred each period that the state is not in default.

External institutions. Foreign institutions make liquidity available to the resource-rich states in recognition of the expected future flows of value from the resource base. These institutions (assumed here to be the commercial banking sector) recognize the authority of rulers of autocratic resource-rich states to enter into contracts on behalf of the states in regard to these resources, and any contracts entered into by a ruler continue as obligations of that state beyond the individual tenure of that ruler. The commercial banking sector offers liquidity to the current leader contingent upon the state not currently being in default. The amount of liquidity is constrained by an aggregate debt ceiling proportionate to the total resources available.

We are assuming here that international lenders are relying primarily on the anticipated flows from natural resource stocks as implicit collateral for their loans. Natural resources (more specifically the so-called "point source" resources such as oil and minerals) differ from other forms of capital such as physical infrastructure, hospitals, schools or factories in that they can be more readily liquefied by means of bank lending. We capture this notion by assuming that the liquidity parameter θ_z for the natural resource is larger than for other forms of capital, θ_k, i.e. $\theta_z > \theta_k \geq 0$.

Banks recognize that adverse selection can result from price-based lending and so limit lending levels instead (Stiglitz and Weiss, 1981). Credit rationing here is limited by both the immediate and aggregate flows from the resource base available for repayment (Bulow and Rogoff, 1989). This means that, so long as the state is not in default (i.e. prior debt is serviced), the lenders are willing to provide a maximum loan amount in any given period in proportion to the total amount of longer term resources available. The first point indicates that there is a certain proportion of resource-based capital and physical capital that is liquefiable in any given period, i.e. $\theta_z Z + \theta_k k_t$ ($l_t \leq \theta_z Z + \theta_k k_t$). The second point captures the idea of a credit ceiling (Eaton and Gersovitz, 1981). We assume that the aggregate debt level is limited to the amount serviceable by the present value of the stream of liquidity derivable from all capital stocks.

$$d_{t+1} \leq \frac{(1+r)}{r}\left(\theta_z Z + \theta_k k_t\right) \tag{1}$$

The Dictator. The ruler of the state concerned is a dictator in that he has unchecked power over the resource wealth and other assets of the state for the duration of his tenure. His problem is to determine how best to appropriate maximum utility from his period of tenure over these resources. These resources are sunk, in that there is only a fixed proportion of the resources realizable in any given period of his tenure. These flows may then be consumed immediately or invested in the productive capacity of the economy which makes them available for future consumption. The ruler can affect the length of his tenure by means of investments in societal betterment (shared consumption) but there remains uncertainty in each period concerning whether the regime will end at that time. With international lending, the ruler has the option of liquefying some additional proportion of the state's resource wealth in any given period, at the cost of an increase in the state's debt at the beginning of the next period.

The Dictator's Problem. These three assumptions are sufficient for establishing the structure of our autocrat's choice problem, which is built upon the premise that the ruler is pursuing his own agenda after assuming control of the state (Acemoglu et al., 2004). We assume that the self-interested dictator is faced with the problem of maximizing his own life-time utility largely by means of making the decision concerning his optimal length of tenure.

$$\begin{aligned} V(k_t, d_t, \varepsilon_t) \quad = \quad & \max_{\chi_t \in \{stay, loot\}} E_t \left[\sum_{j=0}^{\infty} \beta^j U(k_{t+j}, d_{t+j}, \varepsilon_{t+j}, \chi_{t+j}) \right] \\ & \text{s.t. } \chi_t \geq \chi_{t-1} \end{aligned} \tag{2}$$

where χ_t is the dictator's binary choice between staying ($\chi_t = 0$) and looting ($\chi_t = 1$); and ε_t is an unobservable state variable for the analyst.[6] Time is discrete and the dictator faces an infinite time horizon.

In each period, the incumbent dictator decides whether to stay in power or to loot the country and leave immediately. His choice resembles that of the manager of a firm who is strategically choosing the point in time of the liquidation of a limited liability corporation (Mason and Swanson, 1996). The basic decision comes down to whether to abscond with maximum liquidity today, or whether to stay and invest in tenure and productivity in order acquire a return from holding control over the productive capacities of the enterprise in the future.

Here we model the problem recursively. If the dictator decides to stay, he captures part of the benefits from production, and then faces the decision regarding looting again in the next period. By staying, the dictator faces the possibility that

[6] The state variables k_t and d_t are observable unlike ε_t.

he will be ousted, and lose everything along with his loss of control. The decision whether to stay one more period or to loot is a recursive discrete choice problem described by the following equation:

$$V(k_t, d_t, \varepsilon_t) = \max_{\chi_t \in \{stay, loot\}} [v^{\chi}(k_t, d_t) + \varepsilon_t(\chi_t)] \tag{3}$$

This equation relies on the assumption of additive separability (AS) of the utility function between observed and unobserved state variables. We will also assume that 1) ε_t follows an extreme value distribution; and 2) ε_{t+1} and ε_t are independent conditional on the observed state variables k_t and d_t. These assumptions follow Rust (1987 and 1994) and greatly simplify this complex problem.

The Decision to Retain Control. Given a decision to stay and maintain control, the dictator will choose current period consumption c_t, capital level k_{t+1}, debt level d_{t+1}, accumulated diverted funds w_{t+1} and repression level s_t to secure his rule. He enjoys an instantaneous utility $u(c_t)$ where $u > 0$, $u' > 0$ and $u'' < 0$, and expected stream of future utilities should he remain in power. He decides the level of funds placed abroad w_{t+1} as well as the investment level in productive capital each period by choosing k_{t+1} according to the following law of motions:

$$w_{t+1} = w_t + \sigma_t \tag{4}$$

$$k_{t+1} = f(k_t) + \varphi(Z) + (1-\delta)k_t - c_t - rd_t + l_t + \sigma_t - cost(s_t) \tag{5}$$

where s_t measures the repression level chosen by the dictator (e.g. expenditures on secret services, police and army) and $cost(s_t)$ are the associated costs.

Within each period t, the dictator experiences the realization of a discrete random variable $\xi_t = \{0,1\}$, where $\xi_t = 1$ indicates that the dictator is toppled, and $\xi_t = 0$ indicates that the dictator remains in power. We assume that the realization of the shock depends both on the choice of next period's capital stock and repression level. This specification captures the idea that both investing in future consumption and military-spending are strategies for maintaining control over the economy. Let $\rho(k_{t+1}, s_t) = \rho(\xi_t = 1 \mid k_{t+1}, s_t)$ denote the probability of the dictator being deposed next period given he was in power this period; $\rho(k_{t+1}, s_t)$ is assumed to be strictly decreasing and strictly convex in both arguments—see Overland et al. (2005) for a similar idea. That is, increased k_{t+1} and s_t decrease the probability of being toppled at a decreasing rate. The idea here is that the dictator may invest in repression to secure his tenure and may also attempt to buy off peace by sharing some of the output with the population (k_{t+1}). This dilemma has also been analyzed by Azam (1995).

The recursive problem faced by the dictator does not depend on time *per se*, so that the programme is written as:

$$v^{stay}(k, d, w) = \max_{c, k', d', s, \sigma \in \Gamma(k,d,w)} \left(1 - \rho(k', s)\right) \left[u(c) + \beta E_{\varepsilon'} V(k', d', w')\right] \tag{6}$$

$$\text{s.t. } \Gamma(k,d,w) = \begin{cases} k' = f(k) + \varphi(Z) + (1-\delta)k - c - (1+r)d + d' + w' - w - cost(s) \\ d' = d + l \\ w' = w + \sigma \\ c \geq 0;\ \sigma \geq 0;\ s \geq 0 \\ k \geq 0;\ d \geq 0;\ w \geq 0 \\ k(0) = k_0;\ d(0) = d_0;\ w(0) = w_0 \end{cases} \tag{7}$$

where β is the discount factor, and k', d', w' and ε' represent next period's state variables.

The Decision to Exit. The dictator also has the choice to loot the economy's riches and exit. Conditional on looting, the dictator leaves with the maximum loan amount he can contract and the share of non-sunk capital $\theta_z Z + \theta_k k$ representing the current value of the liquefied natural and physical capital assets. It is assumed that the dictator absconds with this maximum amount of liquidity, without making any effort at retaining power, paying debts or investing in the economy. On departure, he invests the looted sum to live off a constant flow of consumption c^{exit}. The value of looting is then given by:

$$v^{exit}(k,d,w) = \frac{u(c^{exit})}{1-\beta} \quad \text{where } c^{exit} = \frac{rW_0}{1+r} = \frac{r}{1+r}(w+\theta_z Z+\theta_k k) \tag{8}$$

Figure 1 illustrates the dictator's decision tree.

Results. Obviously the dictator compares the payoffs from the two distinct options and chooses the strategy with the highest payoff. Hence, the optimal solution solves:

$$\chi^*(k,d,w,\varepsilon) = argmax\left[v^{stay}(k,d,w)+\varepsilon(0),\ v^{exit}(k,d,w)+\varepsilon(1)\right] \tag{9}$$

where the value of staying $v^{stay}(k,d,w)$ and the value of exiting $v^{exit}(k,d,w)$ are defined above. This amounts to an optimal stopping problem, where the decision to exit is an absorbing state.

As mentioned, if the decision is to depart, the optimal choice for the dictator is to set the level of loan at its maximum, invest nothing in the retention of tenure, and to depart immediately in pursuit of a lifetime of consumption (from looted funds). Given the decision to stay, however, the dictator's optimal choice for the next period's capital k', consumption c^{stay}, next period wealth placed abroad w', next period's debt d' and investment in security is given by the following first order conditions:

$$\begin{aligned}\left(1-\rho(k',s)\right)u'(c^{stay}) &= \beta\left(1-\rho(k',s)\right)\left[\left(1-\rho(k'',s')\right)\left(f'(k')+(1-\delta)\right)u'(c'^{stay})Pr(\chi=0|k',d')\right.\\ &+ \left.\frac{r(\theta_k+\alpha)}{1+r}\frac{u'(c'^{exit})}{1-\beta}Pr(\chi=1|k',d')\right] - \frac{\partial\rho}{\partial k'}\left(u(c^{stay})+\beta EV(k',d')\right)\end{aligned} \tag{10}$$

$$u'(c^{stay}) = \beta\left[\left(1-\rho(k'',s')\right)u'(c'^{stay})Pr(\chi=0|k',d',w') - \frac{r}{1+r}\frac{u'(c'^{exit})}{1-\beta}Pr(\chi=1|k',d',w')\right] \tag{11}$$

$$u'(c^{stay}) = \beta\left(1-\rho(k'',s')\right)(1+r)u'(c'^{stay})Pr(\chi=0|k',d') \tag{12}$$

$$\left(1-\rho(k',s)\right)cost'(s)\,u'(c^{stay}) = -\frac{\partial\rho}{\partial s}\left(u(c^{stay})+\beta EV(k',d')\right) \tag{13}$$

Equation (10) says that the dictator faces a trade-off when increasing capital stock: decreased consumption today versus an increased probability of remaining in power next period together with increased consumption tomorrow if power is retained or increased liquidity from capital in case of exit. Equation (11) suggests that the dictator faces a trade-off when increasing wealth stolen and placed in a Swiss bank account: he faces a decreased consumption today in return for an increase in the value in the event of departure tomorrow. The next condition (12) conveys the idea that the dictator chooses d' in order to balance increased consumption today against decreased consumption tomorrow due to debt servicing (if he stays the following period). Finally, equation (13) reflects the fact that by choosing s the dictator will trade-off the utility loss from expending resources on retaining power against the benefit from an enhanced security of tenure.

Lemma 1: .

1) The value function $V(k,d,w)$ is increasing in k, Z, θ_z and θ_k, and is decreasing in d.

2) There is a unique w^* such that (i) for $w < w^*$, the value function $V(k,d,w)$ is decreasing in w; and (ii) for $w > w^*$, the value function $V(k,d,w)$ is increasing in w.

Proposition 1: *Define $\Delta V(k,d,w) \equiv v^{stay}(k,d,w) - v^{exit}(k,d,w)$ to be the net gain from staying relative to looting in any given period. For any given pair (k,d), the dictator's optimal choice is to stay if $\Delta V(k,d,w) > 0$ and to exit if $\Delta V(k,d,w) < 0$.*

1) The gain from staying ΔV is decreasing in w, d, θ_z and θ_k.

2) If $-\frac{f''(k)}{f'(k)+(1-\delta)} - \left(f'(k)+(1-\delta)\right)\frac{u''(c^{stay})}{u'(c^{stay})} > -\frac{r\theta_k}{1+r}\frac{u''(c^{exit})}{u'(c^{exitt})}$ *then the gain from staying ΔV is non-monotonic with respect to k*

3) If $-\frac{\varphi''(Z)}{\varphi'(Z)} - \varphi'(Z)\frac{u''(c^{stay})+\beta u''(c'^{stay})D}{u'(c^{stay})+\beta u'(c'^{stay})D} > -\frac{r\theta_z}{1+r}\frac{u''\left(c^{exit}\right)}{u'\left(c^{exit}\right)}$*, then the gain from staying ΔV is non-monotonic with respect to Z*

4) The negative effect of θ_z on the gain from staying ΔV increases with Z, i.e. $\frac{\partial^2 \Delta V}{\partial \theta_z \partial Z} < 0$*, if* $-\frac{u''\left(c^{exit}\right)}{u'\left(c^{exit}\right)} < \frac{1+r}{r\theta_z Z}$.

These results are derived formally in Appendix A.1. The intuition for most of the findings is straightforward. Affording higher liquidity to the dictator (increasing parameters θ_z and θ_k) increases the opportunity cost of retaining power. The level of indebtedness reduces the relative returns to staying, since payment (by the dictator) is not required after looting. Increased security of tenure (reduced hazards) increases the relative returns to staying.

The non-monotonicity of ΔV with respect to k and Z results from the condition that v^{stay} is more concave than v^{exit} with respect to k and Z. Finally, we establish that the impact of liquidity supplied by the banks on the likelihood of looting increases with resource wealth when the dictator is not too risk-averse.

As indicated in Proposition 1, the sign of ΔV , that is whether v^{stay} is above or below v^{exit}, depends on many of the parameters in the model (debt, liquidity, security). We wish to focus here on how the level of resource-based liquidity afforded to the dictator (θ_z) affects the autocrat's incentives to loot or to stay and invest in the economy. We commence by defining the critical values of collateral-based liquidity (θ_z) in terms of their impacts upon the dictator's incentives.

Definition:

1) For a given θ_k, define $\overline{\theta}_z$: $v^{exit}(\overline{\theta}_z) = \frac{u\left(\frac{r(\overline{\theta}_z Z+\theta_k k)}{1+r}\right)}{1-\beta}$*, represented by the curve tangent to v^{stay} at k^* in Figure 2 such that* $(1-\rho(k',s))\left(f'(k^*)+(1-\delta)\right)u'(c^{stay}) = \frac{r\theta_k}{1+r}\frac{u'(c^{exit})}{1-\beta}$ *and $v^{exit}(k^*,d) = v^{stay}(k^*,d)$.*

2) For a given θ_k, define $\underline{\theta}_z$: $v^{exit}(\underline{\theta}_z) = \frac{u\left(\frac{r(\underline{\theta}_z Z+\theta_k k)}{1+r}\right)}{1-\beta}$*, represented by the curve parallel to $v^{exit}(\overline{\theta}_z)$ in Figure 2 such that $v^{exit}(k=0,d;\underline{\theta}_z) = v^{stay}(k=0,d)$, with $\underline{\theta}_z < \overline{\theta}_z$.*

Note that $v^{exit}(\overline{\theta}_z)$ is the curve passing the point at which the marginal product of capital and the marginal liquidity of capital are equal for a given θ_k. Also, $v^{exit}(\underline{\theta}_z)$ is parallel to $v^{exit}(\overline{\theta}_z)$ and passes through the minimum of v^{stay}

at $k = 0$. In effect, the v^{exit} iso-cline shifts upwards with increasing θ_z and the critical values define where it lies in relation to the v^{stay} curve. This definition allows us to state our main result.

Proposition 2: Value of looting as a function of liquidity

1) If $\theta_z > \overline{\theta}_z$, then the dictator always loots irrespective of the level of k.

2) If $\underline{\theta}_z < \theta_z < \overline{\theta}_z$, there are two capital levels $\tilde{k}_1$ and $\tilde{k}_2$ (with $\tilde{k}_1 < \tilde{k}_2$) such that the dictator stays for any $k \in (\tilde{k}_1, \tilde{k}_2)$ and loots otherwise.

3) If $\theta_z < \underline{\theta}_z$, then there is a capital level $\tilde{k}_3$ such that $v^{stay}(\tilde{k}_3, d, w) = v^{exit}(\tilde{k}_3, d, w)$. The dictator loots for any capital level above $\tilde{k}_3$ and stays otherwise.

Proof: see Appendix A.2.

In Figure 2 we illustrate the results stated in Proposition 2. For a given set of parameters (debt level, funds already siphoned and capital-based liquidity), the level of resource-based liquidity will determine the incentives of the dictator to stay and invest, or to loot the economy.[7] Specifically, the level of resource-based liquidity afforded must be such that the dictator finds itself in the region where the v^{stay} curve lies above the v^{exit} curve in order to have any incentives to stay and invest in the economy; otherwise, the optimal choice is to take any proffered liquidity and "to loot" the economy. Our main result is that increased liquidity will unambiguously increase the prospects for political instability and looting in a given state. That is, increases in the value of the parameter for resource-based liquidity (θ_z) raises the value of looting (shifts the v^{exit} curve upwards).[8]

If the two curves potentially intersect, then the two values $\overline{\theta}_z$ and $\underline{\theta}_z$ separate the space into three regions: 1) Region I, for values of θ_z located above $\overline{\theta}_z$ where looting is always optimal; 2) Region II for values of θ_z between $\overline{\theta}_z$ and $\underline{\theta}_z$ where staying and investing is optimal within a specified (intermediate) range of capital levels; and 3) Region III for values of θ_z below $\underline{\theta}_z$ where looting is optimal only for the highest values of k.

The ill-gotten wealth variable, w, enables the dictator to accumulate capital (when choosing to stay) outside of the country by means of accumulating stocks of wealth w in some store of value (e.g. gold bars). The advantage to the dictator to doing so is in terms of relative liquidity. We assume that the entire stock of wealth that is accumulated outside of the country is liquid in the event of "looting", but only that amount θ_k of k is liquefiable. The dictator receives a better return to capital when investing in the country - the return to w is r (assumed to be small than the return to investment in the country) while it is in the process of being accumulated - but at the cost of losing immediate access in the event of departure.

Now the dictator has a portfolio choice problem, balancing its assets across a) the national economy (k) with a rate of return of approximately $f(k)$ but with risk ρ; b) the store of value (w) with a rate of return r but with no risk (since unplanned departure enables access to this part of the portfolio).[9] Looting accompanied with the dictator's departure occurs when there no longer is a relative return from the economy that compensates for this risk.

In this decision making framework, the impact of increasing the amount of siphoning (w) within the autocratic economy is to advance in time the date of optimal departure when looting will occur. In Figure **??**, the impact of increasing

[7] Of course, the other parameters also play a role. Reductions in the values for the parameters for debt (d) and security of tenure (ρ) increases the value of staying (shifts the v^{stay} curve upwards). We investigate this further in the simulation in section 4.

[8] It is of course possible that, for particular parameter values, the two curves do not intersect anywhere in (v,k) space. This would be the case if either debt levels or security levels were so extreme as to render financial contracting unimportant. In this instance we term the issue of financial contracting non-critical, and we leave this case aside. Examples of such states might be the highly indebted states of sub-Saharan Africa or the extremely secure states of Arabia.

[9] The assumption of three different rates of return on assets is necessary to provide for three distinct choices (investing in economy, investing outside of the economy, or looting the economy).

w is to *both* shift up the v^{exit} function and also to shift down the v^{stay} function - resulting in a lower level of capital (k) at which state the choice of looting becomes optimal. This means that the dictator who elects to stay (and bear the risk of removal) in order to secure a return from the economy may balance these two objectives better (in line with its own risk preferences) simply by siphoning off some amount of the economy's wealth into this store.

We have two basic points we would like to use this model to illustrate.

The Endogeneity of Corruption. The first point is that this model demonstrates that the corruption of the autocrat - in terms of the level and incidence of looting of the economy - is a function of the parameters of the model and not the preferences of the autocrat (or the social or cultural mores of the society). A relatively corrupt autocratic regime results when: a) the returns from investment in the economy is relatively poor; b) the risk of removal is high (or the ability to retain control is low); and c) the proportion of liquefiable assets in the economy is relatively high. When these factors are present, the incentives within the economy are for quick and complete corruption (looting). When these factors are not present, the optimal strategy for an autocrat may be to become relatively benevolent in the sense of investing in its own length of tenure and in the economy's growth. The latter is similar to a situation in which a mine-owner's best option is simply to develop the mine it currently holds, and to invest in the protection of its own property rights. Those who work in and with the mine will benefit from the level of investment, and the rate of flows that are generated. On other hand, when these conditions do not inhere (in terms of returns, risks and liquidation), then the incentives are for the autocrat to simply liquidate as much of the mine as possible and as soon as possible. In this situation the populace associated with that mine will not experience any benefits from investment or growth.

The Impact of External Agencies - Liquidity. The second point we wish to illustrate is that externally determined parameters will, in part, determine the framework of options facing the autocrat, and hence the choices that the dictator will make. One of the most obvious ways that external agents will impact upon an autocrat's choices is the determination of the amount of liquidity available at any particular point in time (and in reference to any given resource). This is one of the three fundamental parameters affecting autocratic choice in this framework, and it is a wholly external affair. We will focus on this factor in the next sections - as an illustration of how it is that external choice can determine dictatorial outcome in this framework.

Together these points demonstrate that it is possible for external actors to shape the decision making environment of autocratic regimes in order to move them toward greater levels of stability and investment, and that the resource curse is best-explained by the failure of external actors to respond to these resources in a measured manner. Such resources enhance the opportunities for looting and sharpen the impact of outside interventions. It is even more important under these conditions that the options available to autocrats are carefully considered when outside options are presented.

In the next section of the paper we examine the empirical record on how liquidity has related to political outcomes and then ultimately to economic growth.

3 Determinants of Dictators' duration

3.1 Hypothesis Testing

The purpose of this empirical section is to test the major prediction of the model that lending to resource rich dictators tends to increase the hazard of remaining in power.

Second, we have hypothesized that productive investment as well as investment in repressive devices are two instruments that enable the dictator to remain in power longer. Such outcome relies on two types of considerations: 1) the dictator can buy peace by keeping the population happy namely by investing in the productive capacity of the country; and 2) the dictator relies on some form of repression effect to deter any challenge that would upset the *status quo*.

Third, the hazard of losing power is non-monotonic in the level of resources. It may fall, then rise, with the physical capital or natural resource stock. Departing from power after looting the country's riches should be less profitable at low values of these variables.[10]

3.2 Empirical strategy and Data

Since we have data regarding the year of leaders' departure, survival models provide a perfect framework for modeling departure probabilities. More specifically, we will estimate the probability that the dictator departs in time t conditional on being in power in time $t-1$.

Let X be a vector of relevant observed explanatory variables and β be a vector of coefficients. Let the random variable T be the dictator's length in power with a cumulative distribution function, $F(t|X_{it},\beta) = Prob(T \leq t|X_{it},\beta)$, and probability density function, $f(t|X_{it},\beta)$. Duration models allow us to estimate the hazard rate $\theta(t|X_{it},\beta)$ defined as the probability that the dictator i departs in time t conditional on being in power in time $t-1$, that is:

$$\theta(t|X_{it},\beta) = \frac{f(t|X_{it},\beta)}{1-F(t|X_{it},\beta)}$$

However, there is no single specification for the hazard rate. In our main estimation, we will examine two functional models frequently used in the literature: the Gompertz model (parametric) and the Cox model (semi-parametric). The Gompertz model is a particular case of the proportional hazard models family which is characterized by the separability assumption:

$$\theta(t|X_{it},\beta) = \lambda(t)\exp(\beta X_{it})$$

where the baseline hazard function $\lambda(t)$ is the probability of irregular failure assumed common to all leaders and reflects the pattern of duration dependence. For instance, if there is positive duration dependence, it means that the probability of being ousted increases the longer the dictator is in power. The dictator's specific scaling factor $\exp(\beta X_{it})$ depends on the vector of covariates X and varies with the survival time. Thus, two different dictators have probabilities of irregular turnover that are proportional for all t. The estimation of a parametric survival model requires the functional specification of the baseline hazard distribution $\lambda(t)$. In particular, the Gompertz model assumes that $\lambda(t) = \exp(\gamma t)$ where the shape parameter γ indicates the pattern of duration dependence. If $\gamma > 0$, then the hazard is monotonically increasing; if $\gamma = 0$, it is constant; and if $\gamma < 0$, the hazard declines monotonically.

Given the nature of our data (panel data) we capture omitted explanatory variables by including unobserved heterogeneity. We will estimate the *frailty* model

$$\theta(t|X_{it},v,\beta) = \lambda(t)\exp(\beta X_{it})v$$

where v is an unobserved individual-specic effect following a Gamma distribution and assumed independent of X with $\mathbb{E}(v) = 1$ and variance σ^2.[11] Given we can rarely observe the wealth siphoned by dictators among other unobservable characteristics, it is important to include frailty or unobserved heterogeneity in the model.

[10] Diminishing marginal utility implies large gains from staying one more period to consume in the future. Similarly, the present discounted value of departing from power depends positively on resource abundance. This also incentivizes staying slightly longer particularly at low values. Beyond some threshold of natural resources wealth, looting and departing should become more likely.

[11] This is the most commonly used specification in the literature.

To test our main prediction, we use a sample of 54 autocracies between 1970 and 2000. Data on lending, political and economic characteristics, natural resource wealth and other control variables are included from various sources described below.

The hazard function of losing power is based on a binary variable, irregular regime change, that takes on the value 0 or 1. When it is equal to 1, it proxies for a scenario when the net benefit of staying $\Delta V(k,d)$ is negative and departure is optimal. Such event takes place when a ruler or regime has been deposed or forced from power in a non-constitutional manner.[12]

Throughout, we restrict attention to only those states classified as an autocracy by Cheibub and Gandhi (2004). The regime change data come from Bueno de Mesquita, et al. (2003). Complementary data is available from Archigos, a database of political leaders developed by Gleditsch and Chiozza (2006, version July 2006). Archigos is particularly comprehensive and detailed so that we relied on it whenever there was a discrepancy with Bueno de Mesquita et al.

The key determinants of the hazard of losing power are resource stocks and foreign lending. The resource stock comes from K. Hamilton and G. Ruta (World Bank, Environment Department). Squared resource stocks are included to help test the non-monotonic effect of resources on the outcome. Lending (i.e., disbursements) by private creditors and indebtedness come from the World Bank Global Development Finance (GDF, 2006).[13] The interaction between these two variables is particularly important. If a positive coefficient is found here, and the marginal impact of lending turns out to be positive at a given level of resource abundance, this would substantiate our hypothesis that lending in the presence of resources may induce instability.

To test our third hypothesis that investment and repression change the time horizons of the government by reducing the probability of being deposed in any period we introduce per capita investment, military spending as well as binary variables indicating whether a country is under military rule, and whether the country is ruled under a single party regime. In addition, we control for external interventions by including the fraction of people speaking a European language at birth introduced by Hall and Jones (1999),[14] and the colonial past in particular whether a country was under French domination.[15] Finally, time dummies and regional dummies for Sub-Saharan Africa, Middle East/North Africa and Latin America.

3.3 Estimation Results

The main objective of this section is to make explicit the determinants of the duration of the tenure of dictators in resource rich countries using a panel of 54 countries for the period 1970-2000. We argue that greater lending afforded by financial institutions to resource rich dictators leads to instability as it provides them with the incentive to siphon the country's wealth and departs when the situation becomes too risky. In addition, we would like to test our hypotheses regarding dictators' strategies to remain in power. We use a parametric Gompertz model and a semi-parametric Cox model to ensure the robustness of our results.[16] Our findings are presented in Table 2.

To test our first prediction, that more loans to highly rich dictators increases the conditional likelihood of departure, we introduce an interaction term between liquidity (lending) and resources. The model predicts that under some condition, $\frac{\partial^2 \Delta V}{\partial \theta_z \partial Z} < 0$, i.e. the marginal impact of lending at higher levels of resource wealth leads to a greater hazard

[12] We are assuming that the political instability induced through looting-type behavior is manifested in terms of enhanced levels of unscheduled departures. We control for other potential sources of such observed irregular regime change, see below.

[13] The main limitation of this dataset is that the major Gulf countries are not available because they do not report such borrowing.

[14] This is used as a proxy for Western influence and external intervention

[15] After decolonization, unlike the British, the French foreign policy has been extremely active in its interventions in its former colonies.

[16] We tried first to estimate a Weibull model. However, since the likelihood function in the Weibull model did not converge, we specified the baseline hazard function as a Gompertz distribution.

of losing power. In other words, our empirical model predicts that the sum of the direct effect of lending and indirect effect through resource wealth must be positive. We find that the direct effect of private lending is negative and statistically significant suggesting that lending does contribute to a longer duration.[17] This finding however contradicts our theoretical result that the net value of staying is decreasing in liquidity, i.e. $\frac{\partial \Delta V}{\partial \theta_z} < 0$. However, the interaction effect is systematically positive and statistically significant at 5% across all specifications, suggesting that resource wealth combined with lending to dictators may constitute a toxic mix. Thus, when the level of resource stock is large enough and exceeds a range varying from 480% to 550% of GDP (around 88 to 90th percentile) depending on the specification, the marginal effect of lending becomes positive. This threshold range is well below the average resource stock for resource abundant countries like Nigeria (645%). At the level of the Nigerian mean resource stock, i.e. at 645%, the marginal effect of lending is positive in all four specifications suggesting that our main prediction is validated by the data.

Two strategies are typically assumed useful instruments for dictators to retain power: The dictator can undertake productive investments in an effort to buy peace, thus averting possible discontent.[18] An alternative, albeit illegitimate, instrument in the hand of the dictator is the use of repression. We control for per capita investment and repressive devices such as military spending, the presence of a military regime and the existence of single party system. We find that as hypothesized that both strategies reduce the hazard of losing power.

The findings regarding investment in "repression" are somewhat surprising. First we find that military spending are negatively related with dictators' duration although statistically insignificant. This is probably due to the fact that spending on secret police or on some security forces such as the presidential guards (Iraq, Libya, etc.) are more likely to explain rulers' duration. Such data is not available. However, these unobserved characteristics are taken care of by using a frailty model and controlling for unobserved heterogeneity. The presence of military regimes tends to be an important factor of instability since such regimes usually come to power and lose power by means of *coups d'etat*. Interestingly the existence of a single party regime seems to guarantee of stability or dictators' duration in power. This result suggests that a single party system trumps the other forms of repressive devices. By banning and repressing opposition parties, leaders in single party systems are able to withstand irregular change of power. In those regimes, change of leadership is often organized so that power is handed over following due, although undemocratic, processes. Similar results have been found by Wright (2008) in the political science literature.

We also test for the non-monotonicity of natural resources with respect to incentive to stay by including the square resources. Our results indicate that resources tend to increase the hazard of departure at a decreasing rate but this is not statistically significant. Our prediction that the hazard of failure would be lower for low levels of resources and increase with resource wealth is therefore not substantiated. For these reasons, we prefer specifications (3) and (4) which omit the square terms.

To ensure that our main findings are robust, we replace the resource stock by resource rent[19] using the same parametric and semi-parametric models. We find very similar results to those discussed above. See Table 3.

Overall, these findings essentially support the fact that it is not resource abundance *per se* that provides corrupt dictators with perverse incentives for looting and political instability. Rather, it is through the combination of resource wealth and the possibility afforded by external forces (here financial markets) to liquidate their loot that dictators participate in such corruptive behavior.

[17] This may be through some *"income effect"*, i.e. more lending flows might help the dictator buy peace.

[18] In the aftermath of the Arab Spring in 2011, oil rich Saudi Arabia successfully adopted such strategy to prevent a revolution as in Tunisia and Egypt. In February 2011, King Abdallah announced that an amount of 36 billions dollars will be invested to the benefit of the population. The main objective was to improve the country's education and health system, and build infrastructure. In March, another financial package amounting to 94 billions dollars was announced that aimed at raising salaries, education allowances, building housing, etc.

[19] Resource rent is defined as Quantity $*$ (Commodity price – Unit extraction cost)$/GDP$.

4 Simulations: Institutions, Corruption and the Curse

The previous section provided empirical evidence on how the offer of resource-based liquidity provides an incentive system for the dictator, determining whether he will choose to loot, or invest in, the economy. The results of Proposition 2 indicate that the incentives are dependent upon the level of capital stock available within the economy (k), since this will determine both the expected productivity of additional increments to the capital stock as well as the capital for liquidation. For this reason, the system of incentives for looting may evolve along a particular development path, given a particular level of proffered liquidity. In particular, an economy commencing within Region II will initially commence with incentives for investment, but may evolve into a situation where the incentives are for looting. In these circumstances the time of departure is endogenous, and a function of both liquidity and capital stock within the economy.

The fundamental trade-off from the perspective of the dictator concerns the amounts currently appropriable from the economy (via liquidity and looting) and the amounts potentially producible (via investment and security of tenure). Any new dictator must turn down proffered liquidity in order to decide to stay and invest in the economy. This points to the fact that almost any resource-rich country can be rendered politically unstable by affording sufficient levels of liquidity.

In this section we simulate the evolution of such an economy, given both low liquidity and high liquidity, to illustrate how a dictator will choose its date of departure by reference to the evolving system of incentives to loot. Initially the dictator will perceive high returns to initial investments in capital, and so stay and invest, but as successive increments to the capital stock reduce returns, the relative returns to looting may come to dominate.

Specification of the Model. To illustrate the dynamics of a resource-rich economy with optional liquidity-based looting, we simulate the model using the following functional forms: utility is specified as a CES function $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, and the probability of losing power is an exponential function of the form $\rho(k') = \exp(-\lambda k')$, where λ represents the dictator's effectiveness in preventing his demise. The production function takes the form $f(k) = Y_s - \frac{Y_s}{1+k}$, where $f' < 0$ and $f'' < 0$. In the limit, output will tend to Y_s. For purposes of demonstration, we are assuming in these simulations that the dictator's sole options are to loot or to invest in the economy, removing the store of value option.

The value of staying and looting are then given by:[20]

$$v^{stay}(k,d) = \max_{c,k',d' \in \Gamma(k,d)} \left(1-\exp(-\lambda k')\right) \left[\frac{c^{1-\sigma}}{1-\sigma} + \beta E_{\varepsilon'} V(k',d')\right] \tag{14}$$

$$\text{s.t. } \Gamma(k,d) = \begin{cases} k' = f(k) + Z^{\varphi} + (1-\delta)k - c - (1+r)d + d' \\ d' = d + l \\ d' \leq \frac{(1+r)}{r}(\theta_z Z + \theta_k k) \\ l \leq \theta_z Z + \theta_k k \\ c \geq 0; \\ k \geq 0;\ d \geq 0 \\ k(0) = k_0;\ d(0) = d_0 \end{cases} \tag{15}$$

$$v^{loot}(k,d) = \frac{u(c^{loot})}{1-\beta} \quad \text{where } c^{loot} = \frac{r}{1+r}(\theta_z Z + \theta_k k) \tag{16}$$

[20]For the sake of simplicity, we omit the role of repression s in the simulation.

Parametrisation of the Model. The following parameters are established as baselines, and will remain constant throughout all of the simulations: $\beta = 0.95$; $\sigma = 0.9$; $\delta = 0.1$; $r = 0.12$.

Simulation of Growth. In Figure 3 and Figure 4 we illustrate the impact of incentives for looting generated by first low liquidity and then high liquidity in resource-based lending. Figure 3 demonstrates how, for low enough values of θ_z, the incentives for investment inhere. Here the dictator views the productivity of the economy as his primary asset. Debt is exercised to its limit, but the dictator uses it for investment and in-place consumption. The regime does not change and capital levels reach the steady state optimum. In effect, the autocrat is acting as "owner" of the entire economy, and lending simply serves its purpose as a mechanism for shifting consumption across time. However, when θ_z is high enough (doubled to $0.6\,Z$ as in Figure 4), the dictator uses debt to pursue a "hit and run" strategy with regard to the economy. He accumulates capital to a point, but then loots as much of the capital and liquidity as is possible. This decision to loot is based on the dictator's comparison of the relative returns to further capital investments versus liquidity-based looting, which flip the incentives for the autocrat in the third period. This change in incentives for the dictator makes a big difference for the economy concerned. A comparison of the two simulations reveals that capital in the looted economy moves to levels approximately 15% below that which occurs under the investment scenario (comparing Figure 3 and Figure 4 at period 3).

More importantly, the dynamics of the simulation reveal that the second economy never recovers from this initial looting. The fact that the new dictator (in period 4) takes over an economy with higher debt levels means that the value of staying commences at a much reduced level. Looting becomes the optimal choice for this economy from then on. A series of incoming autocrats immediately loot the country's riches until debt reaches the ceiling, at which point banks are no longer willing to provide further liquidity. (see Figure 4 in periods 4–13) This economy is now caught in a "debt trap" of political instability and low growth, with its origins in the level of resource-based liquidity proffered to the incoming autocrats.

These simulations demonstrate that an incoming autocrat may act as an "owner" or as a "thief" in regard to the economy, depending upon the level of liquidity on offer. Low levels of liquidity maintain the incentives to stay and to invest as the owner of the economy. The returns from control are secured by staying on the scene, maintaining control and securing the flow of returns from earlier investments. On the other hand, high levels of liquidity act as a prize to the winner of the contest for control, and create incentives for an ongoing system of hit and runs. The returns from control in this case are secured simply by winning the contest for control of the economy—then the banks pay the prize and the contest winner exits the stage. This may be illustrated by comparing the incentives of a relatively secure dictator (low hazard of displacement) in Figure 3 with those inhering under the conditions of an insecure ruler (high hazard rate) in Figure 5. What is the impact of "security of tenure" on the incentive system facing the dictator?[21] If the dictator is able to secure his tenure (relatively high λ in Figure 3) then he has incentives to stay and invest in productive capital as "owner". By contrast, if he is unable to secure his tenure (low λ in Figure 5), then the incentives are to loot. Since insecurity and lending have the same impact on incentives, it is apparent that both have the capacity to turn an owner-ruler into a thief.

These simulations translate our basic model of autocratic choice into empirically observable outcomes regarding lending, political instability, and economic growth. We have demonstrated that excessive resource-based lending may be seen to induce political instability and result in poorly performing economies. In this way, the choice environment of the dictator translates into corruption (looting), and ultimately poor economic performance (the curse).

[21] Comparing Figures 3 and 5 demonstrates the point of McGuire & Olson (1996). Their argument is that when an autocrat is secure about his tenure, he will stop behaving as a bandit leader and instead act as a ruler whose interest is aligned with the people's. When the probability of survival is high and the autocrat values the future, an "invisible hand" makes his interest consistent with the interests of society at large.

5 Conclusion: Corruption and the Curse

This paper attempts to set out a mechanism through which the much-discussed resource curse operates. Our main contribution is to show how external interventions impact upon the choices of dictators in resource-rich countries, which in turn leads to instability and slow growth. In our model, a dictator makes a choice between staying and looting.The incentives for staying result from the opportunity for taking advantage of the country's potential productivity while remaining in power. Looting involves the immediate translation of political control into maximum appropriable gain. It is the essence of the sort of corruption that renders resource-rich countries subject to the curse.

Our model suggests that the dictator will be fundamentally influenced in this choice by the level of liquidity afforded by external agents. The opportunity cost to staying and investing in the economy increases directly with any increase in the liquidity being afforded. In this way the decision making environment of the autocrat is highly-influenced by external operators.

When external agents intervene in this way, the predictable result is observed political instability from looting. We can see this in our analysis of the hazard rate afflicting autocrats of resource-rich countries. Resources and lending together result in enhanced rates of instability. We argue that this is likely to be a consequence of an increased rate of looting.

The problem with such political instability and looting is that it is dynamically attractive. Once a choice to loot is implemented, the incentives to loot are enhanced for every succeeding administration. This is a consequence of the autocrats ability to commit all of the state's resources - during the length of its tenure - and the fact that this commitment will outlive the autocrat's tenure. This means that succeeding administrations start from an initial condition that is more indebted, and hence more prone to looting than previous ones.

Although we do not include any modelling for external motivations in our paper, it is apparent that moral hazard is the least of many concerns in this context. External agents at the very least can remain oblivious to the effects of affording liquidity to autocrats, since their assuror is the state's resources not the autocrat. Even more troublesome is the fact that endogenous corruption may be viewed as a positive benefit to external agents looking to transfer a state's wealth to its own balance sheet. Enhanced levels of corruption may enhance the potential for future revenue streams from resources and, in any event, are unlikely to redound to the detriment of the outsider. They may be viewed as the means for transferring the long-term revenues from resources from the state concerned to the external operators balance sheets - by means of placing ever-increasing debt obligations on the state's.

In this way, it is possible to see corruption as the essential link between resources, institutions and economic performance. It is crucial to view corruption not as a social or cultural phenomenon, but as an economic one. Corruption may be seen as the vehicle by which resources are shifted (implicitly) from a state's balance sheets onto those of external agents, and it is both more likely to inhere in resource-rich countries and more likely to be associated with the prevalence of the resource curse in those countries. The dictator model argues that this is because corruption is an important vehicle for transferring the wealth of resource-rich countries to others, at the price of minor transfers to temporary autocrats.

Figure 1: Dictator's decision tree

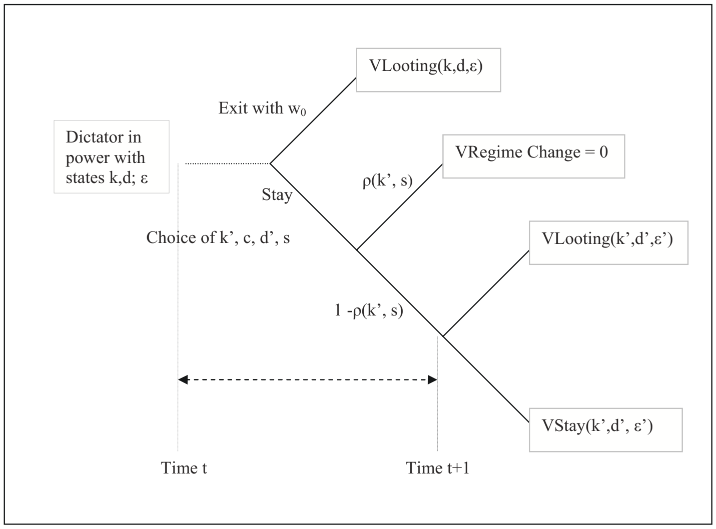


Figure 2: Looting and staying regions as function of θ_z

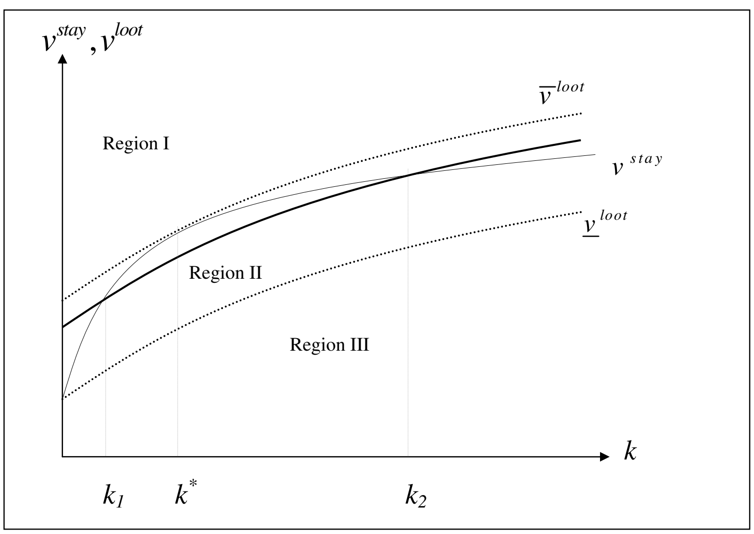


Table 1: Definitions of Variables and Source

Variables	Definition	Data Source
Resource Rent (% GDP)	$\text{Quantity} * (\text{Commodity price} - \text{Unit extraction cost})/GDP$	World Bank, Environment Dept
Resource Stock (% GDP)	Ratio of the stock of resource over GDP	World Bank, Environment Dept
Private Lending (% GDP)	Ratio of lending from private creditors over GDP	Global Development Finance 2006
Private Debt (% GNI)	Ratio of the debt from private creditors over GNI	Global Development Finance 2006
Log per capita Investment	Log of the ratio of investment per capita	Penn World Tables 6.2
Single party regime	Dummy indicating a single party regime	Wright 2008
Military regime	Dummy indicating a military party regime	Wright 2008
Military Spending (% GDP)	Ratio of military spending over GDP	Calculation from WDI 2006
Native European Language (%)	Share of the population speaking a European language at birth	Hall and Jones 1999
French Colonization	Dummy indicating former French colonies	

Table 2: Determinants of Dictators' Durability (Resource Stock)

	Gompertz Model (1)		Semi-parametric Cox Model (2)		Gompertz Model (3)		Semi-parametric Cox Model (4)	
	Coef.	Std Error	Coef.	Std Error	Coef.	Std Error	Coef.	Std Error
Resource Stock (% GDP)	0.0035*	(0.0019)	0.0030	(0.0024)	-0.0000	(0.0008)	-0.0000	(0.0008)
Resource Stock^2 (% GDP)	-0.0000	(0.0000)	-0.0000	(0.0000)				
Private Lending (% GDP)	-0.3038**	(0.1247)	-0.2885**	(0.1303)	-0.2165**	(0.1027)	-0.2187**	(0.1093)
Resource Stock×Lending	0.0006**	(0.0002)	0.0006**	(0.0003)	0.0004**	(0.0002)	0.0004**	(0.0002)
Private Debt (% GNI)	0.0065	(0.0128)	0.0068	(0.0107)	0.0058	(0.0113)	0.0063	(0.0108)
Log Investment per capita	-0.3729**	(0.1879)	-0.3797**	(0.1711)	-0.2868**	(0.1426)	-0.3167**	(0.1481)
Single party regime	-0.9537**	(0.4859)	-0.9533**	(0.4724)	-0.9680**	(0.4836)	-0.9655**	(0.4646)
Military regime	1.4760***	(0.4044)	1.3930***	(0.3860)	1.4053***	(0.3820)	1.3347***	(0.3746)
Military Spending (% GDP)	-0.0147	(0.0518)	-0.0169	(0.0472)	-0.0232	(0.0620)	-0.0278	(0.0565)
European Languages	0.6762	(1.1244)	0.7514	(1.2540)	0.4173	(1.1555)	0.5398	(1.3138)
French Colonization	0.1063	(0.4620)	0.2398	(0.5149)	0.1568	(0.4646)	0.2701	(0.5446)
Sub-Saharan Africa	-0.7593	(0.5535)	-0.8851	(0.5486)	-0.6667	(0.5396)	-0.8327	(0.5487)
Middle East North Africa	-1.0263	(0.6427)	-1.0210	(0.6590)	-1.0783	(0.7002)	-1.0303	(0.7008)
Latin America	0.1246	(1.0219)	-0.0478	(1.0644)	0.1793	(1.0340)	0.0203	(1.1092)
Constant	-0.2386	(1.3912)			-0.5583	(1.4029)		
gamma								
_cons	0.0175	(0.0185)			0.0152	(0.0194)		
ln_the								
_cons	-3.6872	(3.4634)			-14.5174	(44.7723)		
N	1158		1158		1158		1158	
Number of Countries	54.0000		54.0000		54.0000		54.0000	
Log Pseudo-Likelihood	-124.0972		-245.0310		-126.7790		-247.0759	
PH test Chi2(1)								

Robust Standard errors in parentheses are clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In all equations, we control for year dummies and unobserved heterogeneity.

Table 3: Determinants of Dictators' Durability (Resource Rent)

	Gompertz Model (1)		Semi-parametric Cox Model (2)		Gompertz Model (3)		Semi-parametric Cox Model (4)	
	Coef.	Std Error	Coef.	Std Error	Coef.	Std Error	Coef.	Std Error
Resource Rent (% GDP)	0.0345	(0.0261)	0.0389	(0.0287)	0.0083	(0.0123)	0.0072	(0.0107)
Resource Rent^2 (% GDP)	-0.0007	(0.0006)	-0.0009	(0.0007)				
Private Lending (% GDP)	-0.1540*	(0.0832)	-0.1561*	(0.0909)	-0.1419*	(0.0815)	-0.1475	(0.0899)
Resource Rent×Lending	0.0046**	(0.0021)	0.0048**	(0.0022)	0.0039*	(0.0020)	0.0043*	(0.0023)
Private Debt (% GNI)	-0.0015	(0.0117)	0.0004	(0.0107)	-0.0008	(0.0118)	0.0014	(0.0111)
Log Investment per capita	-0.4065***	(0.1280)	-0.4849***	(0.1382)	-0.3995***	(0.1294)	-0.4637***	(0.1420)
Single party regime	-0.9979**	(0.4645)	-0.9691**	(0.4554)	-0.9785**	(0.4632)	-0.9488**	(0.4516)
Military regime	1.3376***	(0.2801)	1.2527***	(0.2673)	1.3314***	(0.2795)	1.2440***	(0.2692)
Military Spending (% GDP)	0.0077	(0.0456)	0.0047	(0.0407)	0.0070	(0.0471)	0.0046	(0.0422)
European Languages	0.7851	(0.6610)	1.0318	(0.8075)	0.7559	(0.6934)	0.9618	(0.8539)
French Colonization	0.2437	(0.2616)	0.3917	(0.2909)	0.2651	(0.2656)	0.4106	(0.2993)
Sub-Saharan Africa	-0.7153	(0.4864)	-0.9275**	(0.4529)	-0.7532	(0.4715)	-0.9468**	(0.4462)
Middle East North Africa	-1.2015*	(0.6167)	-1.2167**	(0.5893)	-1.2243*	(0.6469)	-1.2176**	(0.6140)
Latin America	-0.0456	(0.6751)	-0.3220	(0.7179)	-0.0662	(0.6774)	-0.3043	(0.7381)
Constant	-0.2669	(1.2299)			-0.2621	(1.2251)		
gamma								
_cons	0.0146	(0.0174)			0.0150	(0.0174)		
ln_the								
_cons	-15.8819***	(2.2858)			-15.4739***	(2.1448)		
N	1369		1369		1369		1369	
Number of Countries	62.0000		62.0000		62.0000		62.0000	
Log Pseudo-Likelihood	-158.5150		-325.7437		-158.9771		-326.2812	
PH test Chi2(1)								

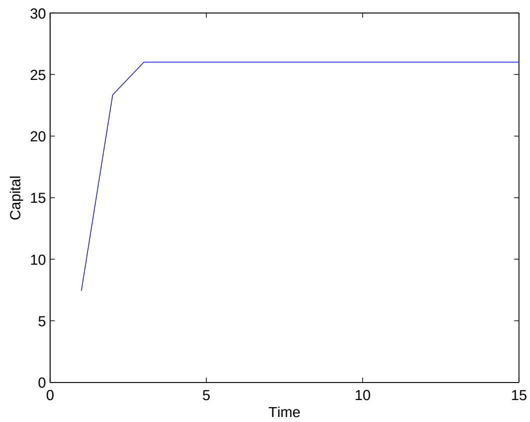
Robust Standard errors in parentheses are clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

In all equations, we control for year dummies and unobserved heterogeneity.

Simulation of the Model

Case of low liquidity

$\beta = 0.95$; $\sigma = 0.9$; $r = 0.12$; $\delta = 0.1$; $\theta_z = 0.3$; $\theta_k = 0.1$; $\lambda = 0.15$; $\varphi = 0.5$; $NR = 5$; $Y_s = 13$; $d_{max} = 37$

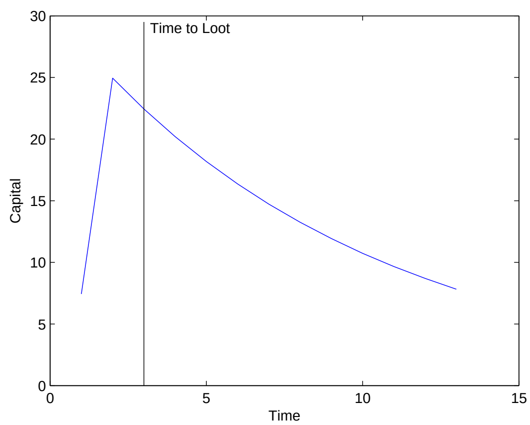


Period	Capital	Output	Debt	Consumption	Number Regimes
1	7.4	11.5	1.5	0.9	1
2	23.3	12.5	6.0	13.0	1
3	26.0	12.5	10.6	14.9	1
4	26.0	12.5	15.1	14.3	1
5	26.0	12.5	19.6	13.8	1
6	26.0	12.5	24.2	13.3	1
7	26.0	12.5	28.7	12.7	1
8	26.0	12.5	33.2	11.9	1
9	26.0	12.5	37.0	7.7	1
10	26.0	12.5	37.0	7.7	1
11	26.0	12.5	37.0	7.7	1
12	26.0	12.5	37.0	7.7	1
13	26.0	12.5	37.0	7.7	1
14	26.0	12.5	37.0	7.7	1
15	26.0	12.5	37.0	7.7	1

Figure 3: Optimal capital over time with low θ_z

Case of high liquidity

$\beta = 0.95$; $\sigma = 0.9$; $r = 0.12$; $\delta = 0.1$; $\theta_z = 0.6$; $\theta_k = 0.1$; $\lambda = 0.15$; $\varphi = 0.5$; $NR = 5$; $Y_s = 13$; $d_{max} = 56$

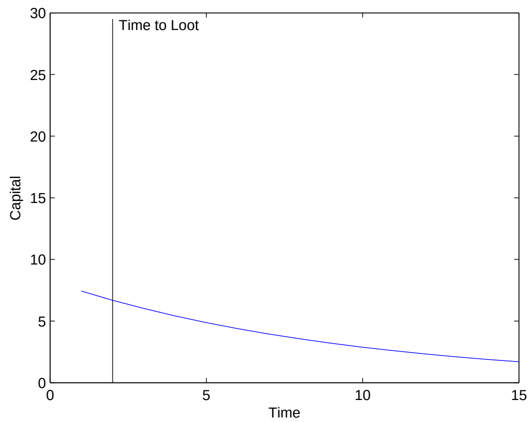


Period	Capital	Output	Debt	Consumption	VLoot	Number Regimes
1	7.4	11.5	2.3	1.2		1
2	24.9	12.5	9.1	16.1		1
3	22.4	12.4	14.1		184.8	1
4	20.2	12.4	19.1		183.8	2
5	18.2	12.3	24.1		182.9	3
6	16.4	12.3	29.1		182.0	4
7	14.7	12.2	34.1		181.2	5
8	13.3	12.1	38.1		180.4	6
9	11.9	12.0	42.1		179.7	7
10	10.7	11.9	46.1		179.0	8
11	9.7	11.8	50.1		178.3	9
12	8.7	11.7	54.1		177.7	10
13	7.8	11.5	56.0		177.2	11

Figure 4: Optimal capital over time with high θ_z

Case of high hazard

$\beta = 0.95$; $\sigma = 0.9$; $r = 0.12$; $\delta = 0.1$; $\theta_z = 0.3$; $\theta_k = 0.1$; $\lambda = 0.13$; $\varphi = 0.5$; $NR = 5$; $Y_s = 13$; $d_{max} = 37$



Period	Capital	Output	Debt	Consumption	ConsoLoot	VLoot	Number Regimes
1	7.4	11.5	1.5	0.85			1
2	6.7	11.3	3.5		0.18	168.37	1
3	6.0	11.1	5.5		0.17	167.68	2
4	5.4	11.0	7.5		0.17	167.04	3
5	4.9	10.8	9.5		0.16	166.44	4
6	4.4	10.6	11.5		0.15	165.89	5
7	3.9	10.4	13.5		0.15	165.38	6
8	3.6	10.1	15.5		0.15	164.90	7
9	3.2	9.9	17.5		0.14	164.47	8
10	2.9	9.6	19.5		0.14	164.06	9
11	2.6	9.4	21.5		0.13	163.69	10
12	2.3	9.1	23.5		0.13	163.35	11
13	2.1	8.8	25.5		0.13	163.04	12
14	1.9	8.5	27.5		0.13	162.76	13
15	1.7	8.2	29.5		0.13	162.50	14

Figure 5: Optimal Capital over time with High Hazard (low λ)

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6 Appendix A.1: Proof of Proposition 1 - Comparative Statics

Comparative Statics $V(k,d,w)$

From the Envelope Theorem we can derive the marginal changes of v^{stay} and v^{exit} with respect to k, d and w:

$V(k,d,w)$ is strictly increasing in k as:

$\frac{\partial v^{stay}(k,d,w)}{\partial k} = \left(1-\rho(k',s)\right)\left(f'(k)+(1-\delta)\right)u'(c^{stay}) > 0$; and $\frac{\partial v^{exit}(k,d,w)}{\partial k} = \frac{r\theta_k}{1+r}\frac{u'(c^{loot})}{1-\beta} > 0$

$V(k,d,w)$ is decreasing in d as:

$\frac{\partial v^{stay}(k,d,w)}{\partial d} = -(1+r)\left(1-\rho(k',s)\right)u'(c^{stay}) < 0$; and $\frac{\partial v^{exit}(k,d,w)}{\partial d} = 0$

Monotonicity of $V(k,d,w)$ with respect to w:

$\frac{\partial v^{stay}(k,d,w)}{\partial w} = -\left(1-\rho(k',s)\right)u'(c^{stay}) < 0$; and $\frac{\partial v^{exit}(k,d,w)}{\partial w} = \frac{r}{1+r}\frac{u'(c^{loot})}{1-\beta} > 0.$

Case 1: For some w_0, $v^{stay}(k,d,w_0) > v^{exit}(k,d,w_0)$

Since v^{stay} is decreasing in w while v^{exit} is increasing in w, then there must exist a single w^* such for $w = w^*$, $v^{stay}(k,d,w^*) = v^{exit}(k,d,w^*)$.

(i) For any $w < w^*$, $v^{stay}(k,d,w) > v^{exit}(k,d,w)$ and therefore $V(k,d,w) = v^{stay}(k,d,w)$ is decreasing in w

(ii) For any $w > w^*$, $v^{stay}(k,d,w) < v^{exit}(k,d,w)$ and therefore $V(k,d,w) = v^{exit}(k,d,w)$ is increasing in w

Case 2: For some w_0, $v^{stay}(k,d,w_0) < v^{exit}(k,d,w_0)$

Since v^{stay} is decreasing in w while v^{exit} is increasing in w, the two values will diverge as w increases. As a result for any w, $V(k,d,w) = v^{exit}(k,d,w)$ increases.

Monotonicity of $V(k,d,w)$ with respect to θ_z, θ_k and Z

$\frac{\partial v^{exit}(k,d,w)}{\partial \theta_z} = \frac{rZ}{1+r}\frac{u'(c^{exit})}{1-\beta} > 0$; and $\frac{\partial v^{stay}(k,d,w)}{\partial \theta_z} = \beta\left(1-\rho(k',s)\right)\frac{\partial EV}{\partial \theta_z}(k',d',w')$

$\frac{\partial v^{exit}(k,d,w)}{\partial \theta_k} = \frac{rk}{1+r}\frac{u'(c^{exit})}{1-\beta} > 0$; and $\frac{\partial v^{stay}(k,d.w)}{\partial \theta_k} = \beta\left(1-\rho(k',s)\right)\frac{\partial EV}{\partial \theta_k}(k',d',w')$

$\frac{\partial v^{exit}(k,d,w)}{\partial Z} = \frac{r\theta_z}{1+r}\frac{u'\left(c^{exit}\right)}{1-\beta} > 0$; and $\frac{\partial v^{stay}(k,d,w)}{\partial Z} = \left(1-\rho(k',s)\right)\left[\varphi'(Z)u'\left(c^{stay}\right)+\beta\frac{\partial EV(k',d',w')}{\partial Z}\right]$

We now need to determine the sign of $\frac{\partial EV}{\partial \theta_z}$, $\frac{\partial EV}{\partial \theta_k}$ and $\frac{\partial EV}{\partial Z}$. We know that $EV(k',d',w')$ is the unique fixed point of a contraction mapping Λ (see Rust 1988 and 1994) such that when ε has an extreme value distribution, we have:

$EV = \Lambda(EV) = \log\left[\exp\left(v^{stay}(k',d',w')\right)+\exp\left(v^{exit}(k',d',w')\right)\right]$

So we have $H(EV;\theta_z,Z) \equiv EV - \Lambda(EV) = (I-\Lambda)(EV) = 0$. By the implicit function theorem:

$$\frac{\partial EV}{\partial \theta_z} = \left(I - \Lambda'(EV)\right)^{-1} \frac{\partial \Lambda(EV)}{\partial \theta_z}$$

Now by differentiating Λ with respect to EV, we obtain $\Lambda'(EV) = \beta\,(1-\rho(k'',s'))\,Pr\,(\chi = 0|k',d',w')$ so that:

$$(I-\Lambda)'\,(EV) = 1 - \beta\left(1-\rho(k'',s')\right)Pr\left(\chi = 0|k',d',w'\right)$$

In addition we can show that:

$$\frac{\partial \Lambda(EV)}{\partial \theta_z} = \frac{rZ}{1+r}\frac{u'\left(c'^{exit}\right)}{1-\beta}Pr\left(\chi = 1|k',d',w'\right)$$

Hence we obtain:

$$\frac{\partial EV}{\partial \theta_z} = \frac{Pr\,(\chi = 1|k',d',w')}{1-\beta\,(1-\rho(k'',s'))\,Pr\,(\chi = 0|k',d',w')}\frac{rZ}{1+r}\frac{u'\left(c'^{exit}\right)}{1-\beta} > 0$$

Similarly we determine:

$$\frac{\partial EV}{\partial \theta_k} = \frac{Pr\,(\chi = 1|k',d',w')}{1-\beta\,(1-\rho(k'',s'))\,Pr\,(\chi = 0|k',d',w')}\frac{rk}{1+r}\frac{u'\left(c'^{exit}\right)}{1-\beta} > 0$$

$$\frac{\partial EV}{\partial Z}(k',d',w') = \frac{\varphi'(Z)u'(c'^{stay})Pr\,(\chi = 0|k',d',w') + \frac{r\theta_z}{1+r}\frac{u'\left(c'^{exit}\right)}{1-\beta}Pr\,(\chi = 1|k',d',w')}{1-\beta\,(1-\rho(k'',s'))\,Pr\,(\chi = 0|k',d',w')} > 0$$

Given that $\frac{\partial EV}{\partial \theta_z}$, $\frac{\partial EV}{\partial \theta_k}$ and $\frac{\partial EV}{\partial Z}$ are all strictly positive, it follows that V is strictly increasing in θ_z, θ_k and Z.■

Comparative statics: Monotonicity of $\Delta V(k,d,w)$

Comparative statics of $\Delta V(k,d,w)$ with respect to d, w, θ_z and θ_k

First let us analyze the partial effect of d on $\Delta V(k,d,w)$.

$$\frac{\partial \Delta V(k,d,w)}{\partial d} = -(1+r)\left(1-\rho(k',s)\right)u'(c^{stay}) < 0$$

It follows that ΔV is decreasing with respect to d.

Second, we analyst the partial effect of w on $\Delta V(k,d,w)$.

$$\frac{\partial \Delta V(k,d,w)}{\partial w} = -\left(1-\rho(k',s)\right)u'(c^{stay}) - \frac{r}{1+r}\frac{u'(c^{exit})}{1-\beta} < 0$$

Therefore ΔV is decreasing in w.

We are now interested in the effect of θ_z on $\Delta V(k,d,w)$.

$$\frac{\partial \Delta V(k,d,w)}{\partial \theta_z} = \beta\left(1-\rho(k',s)\right)\frac{\partial EV}{\partial \theta_z}(k',d',w') - \frac{rZ}{1+r}\frac{u'(c^{exit})}{1-\beta}$$

Replacing $\frac{\partial EV}{\partial \theta_z}$ by its expression and given c^{loot} is constant by assumption, $u'\left(c^{exit}\right) = u'\left(c'^{exit}\right)$, we obtain:

$$\frac{\partial \Delta V(k,d,w)}{\partial \theta_z} = \frac{rZ}{1+r}\frac{u'\left(c^{exit}\right)}{1-\beta}Q \tag{17}$$

where $Q \equiv \frac{\beta\left(1-\rho(k',s)\right)Pr\left(\chi=1|k',d',w'\right)+\beta\left(1-\rho(k'',s')\right)Pr\left(\chi=0|k',d',w'\right)-1}{1-\beta\left(1-\rho(k'',s')\right)Pr\left(\chi=0|k',d',w'\right)}$.

Now, it is clear that the numerator $\beta\left(1-\rho(k',s)\right)Pr\left(\chi=1|k',d',w'\right)+\beta\left(1-\rho(k'',s')\right)Pr\left(\chi=0|k',d',w'\right) < 1$. It follows that the $\frac{\partial \Delta V(k,d,w)}{\partial \theta_z} < 0$. That is the return to staying decreases as θ_z increases.

Similarly, we determine the monotonicity with respect to θ_k:

$$\frac{\partial \Delta V(k,d,w)}{\partial \theta_k} = \frac{rk}{1+r}\frac{u'\left(c^{exit}\right)}{1-\beta}Q < 0 \tag{18}$$

That is the return to staying decreases as θ_k increases.

Non-monotonicity of $\Delta V(k,d,w)$ with respect to k and Z

Let us first consider the case of k:

$$\frac{\partial \Delta V(k,d,w)}{\partial k} = \left(1-\rho(k',s)\right)\left(f'(k)+(1-\delta)\right)u'(c^{stay}) - \frac{r\theta_k}{1+r}\frac{u'(c^{exit})}{1-\beta} \tag{19}$$

To determine the non-monotonicity of ΔV with respect to k, we will apply the idea of relative concavity[22] to $v^{stay}(k,d,w)$ and $v^{loot}(k,d,w)$. As $u(c^{stay})$ is a composite of two increasing and concave functions, there is a presumption that it is more concave in k than $u(c^{exit})$, which implies that $v^{stay}(k,d,w)$ would be more concave than $v^{exit}(k,d,w)$. We want to determine the condition under which this is true, i.e. $-\frac{\partial^2 v^{stay}/\partial k^2}{\partial v^{stay}/\partial k} > -\frac{\partial^2 v^{loot}/\partial k^2}{\partial v^{loot}/\partial k}$.

We can show that $v^{stay}(k,d,w)$ is more concave than $v^{exit}(k,d,w)$ with respect to k if the following condition is satisfied:

$$-\frac{f''(k)}{f'(k)+(1-\delta)} - \left(f'(k)+(1-\delta)\right)\frac{u''(c^{stay})}{u'(c^{stay})} \quad > \quad -\frac{r\theta_k}{1+r}\frac{u''(c^{exit})}{u'(c^{exit})} \tag{20}$$

Under this condition, v^{stay} exhibits faster diminishing returns to capital than v^{exit}. This implies that the gains from staying will increase for sufficiently low capital levels, for which the first term in equation (19) is larger that the second term. For large enough capital levels, the second becomes greater than the first term. This results in the non-monotonicity of ΔV with respect to k.

Let us now look at the non-monotonicity with respect to Z.

[22] Assume h and g are twice differentiable on (a,b), h is concave with respect to g (or h is more concave than g) if for h and g increasing we have: $-\frac{h''(x)}{h'(x)} > -\frac{g''(x)}{g'(x)}$ for any $x \in (a,b)$

$$\frac{\partial \Delta V(k,d,w)}{\partial Z} = \left(1-\rho(k',s)\right)\left[\varphi'(Z)u'\left(c^{stay}\right)+\beta\frac{\partial EV(k',d',w')}{\partial Z}\right] - \frac{r\theta_z}{1+r}\frac{u'(c^{exit})}{1-\beta}$$

$$\frac{\partial \Delta V(k,d)}{\partial Z} \quad = \quad \left(1-\rho(k',s)\right)\varphi'(Z)\left[u'(c^{stay})+\beta u'(c'^{stay})D\right] + \frac{r\theta_z}{1+r}\frac{u'\left(c^{exit}\right)}{1-\beta}Q \tag{21}$$

where $D \equiv \dfrac{Pr\left(\chi=0|k',d',w'\right)}{1-\beta\left(1-\rho(k'',s')\right)Pr\left(\chi=0|k',d',w'\right)}$, and $Q<0$ was defined above.

Applying the same method, we show that $v^{stay}(k,d,w)$ is more concave than $v^{loot}(k,d,w)$ with respect to Z if:

$$-\frac{\varphi''(Z)}{\varphi'(Z)} - \varphi'(Z)\frac{u''(c^{stay})+\beta u''(c'^{stay})D}{u'(c^{stay})+\beta u'(c'^{stay})D} > -\frac{r\theta_z}{1+r}\frac{u''\left(c^{exit}\right)}{u'\left(c^{exit}\right)} \tag{22}$$

Then under condition (22), ΔV is non-monotonic with respect to Z. v^{stay} exhibits faster diminishing returns to resources than v^{exit}. This implies that the gains from staying will increase for sufficiently low resource levels, for which the first term in equation (21) is larger that the second term. For large enough resource levels, the second becomes greater than the first term.

Effect of Z on $\dfrac{\partial \Delta V(k,d,w)}{\partial \theta_z}$

The cross-partial derivative of ΔV with respect to θ_z and Z is given by:

$$\frac{\partial^2 \Delta V(k,d,w)}{\partial Z \partial \theta_z} \quad = \quad \left(u'\left(c^{exit}\right)+\frac{r\theta_z Z}{1+r}u''\left(c^{exit}\right)\right)\frac{rQ}{(1+r)(1-\beta)} \tag{23}$$

We know that the Q is negative so that $\dfrac{\partial^2 \Delta V(k,d,w)}{\partial \theta_z \partial Z} < 0$ if and only if $u'\left(c^{exit}\right)+\dfrac{r\theta_z Z}{1+r}u''\left(c^{exit}\right)>0$. That is:

$$-\frac{u''\left(c^{exit}\right)}{u'\left(c^{exitt}\right)} < \frac{1+r}{r\theta_z Z} \tag{24}$$

The LHS of the inequality is the Arrow-Pratt measure of risk aversion. If the dictator is not too risk averse then the negative effect of liquidity supplied by banks on the likelihood of looting increases with resource wealth Z. ■

7 Appendix A.2: Proof of Proposition 2

Case 1: $v^{exit}(k,d,w) > v^{exit}(\overline{\theta}_z)$ ***for a given*** d ***and*** θ_k

By definition of $v^{exit}(\overline{\theta}_z)$, $v^{exit}(k,d,w) > v^{exit}(\overline{\theta}_z)$ implies that for any value of capital k, $v^{stay}(k,d,w) < v^{exit}(k,d,w)$. Looting is always optimal independently of k.

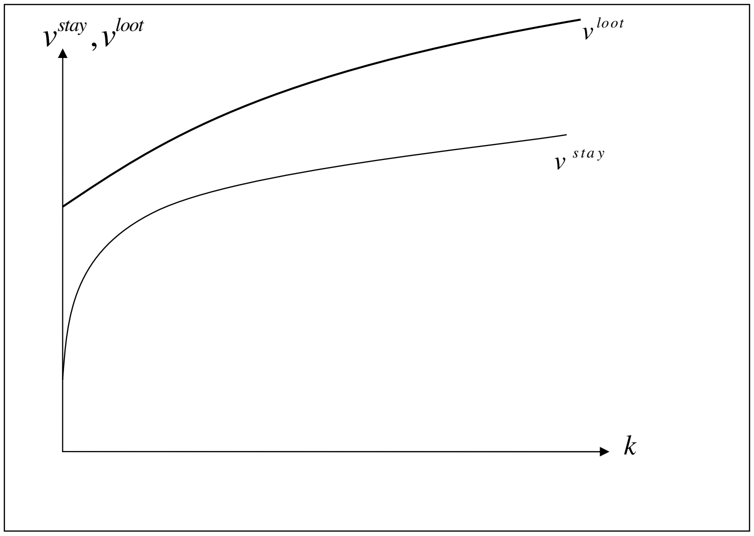

Figure 6: Case 1: Dictator Always Loots

Case 2: $v^{exit}(\underline{\theta}_z) < v^{exit}(k,d,w) < v^{exit}(\overline{\theta}_z)$ ***for a given*** d ***and*** θ_k

Given that 1) $v^{exit}(\underline{\theta}_z) < v^{exit}(k,d,w) < v^{exit}(\overline{\theta}_z)$ for some d and θ_k; 2) both v^{exit} and v^{stay} are continuous in k and strictly increasing; and 3) the value of staying is more concave than the value of looting under condition (20), there exist two points of intersection between v^{stay} and v^{exit}. The value v^{stay} increases fast enough (for low k, v^{stay} increases faster than v^{exit}) to intersect v^{exit} from below at $\tilde{k}_1$. As k increases the combination of point 2 and 3 results in v^{stay} intersecting v^{exit} from above at $\tilde{k}_2$. Formally, there exist two capital levels $\tilde{k}_1$ and $\tilde{k}_2$ such that for $\tilde{k}_1 < \tilde{k}_2$:

1. $v^{stay}(\tilde{k}_1,d,w) = v^{exit}(\tilde{k}_1,d,w)$ and $\dfrac{\partial v^{stay}}{\partial k}(\tilde{k}_1,d,w) > \dfrac{\partial v^{exit}}{\partial k}(\tilde{k}_1,d,w)$
2. $v^{stay}(\tilde{k}_2,d,w) = v^{exit}(\tilde{k}_2,d,w)$ and $\dfrac{\partial v^{stay}}{\partial k}(\tilde{k}_2,d,w) < \dfrac{\partial v^{exit}}{\partial k}(\tilde{k}_2,d,w)$
3. $v^{stay}(k,d,w) < v^{exit}(k,d,w)$ for $k < \tilde{k}_1$ and $k > \tilde{k}_2$; and $v^{stay}(k,d,w) > v^{exit}(k,d,w)$ for $\tilde{k}_1 < k < \tilde{k}_2$

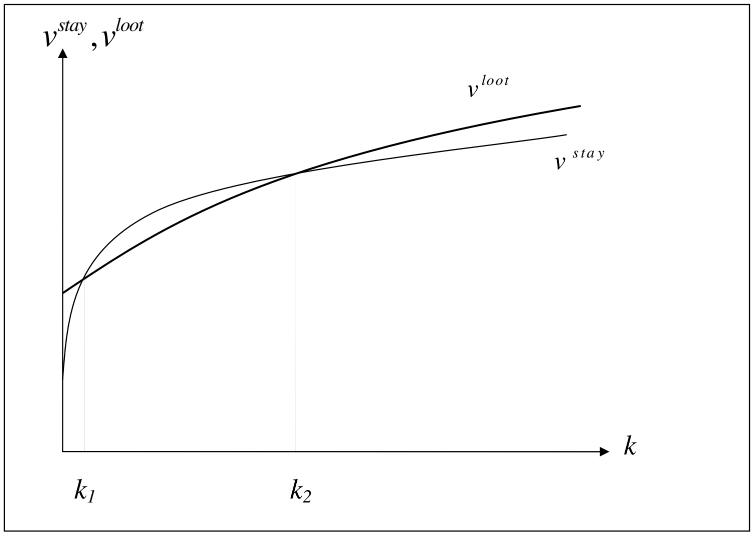

Figure 7: Case 2: Dictator Loots for Low and High k

Case 3: $v^{exit}(k,d,w) < v^{exit}(\underline{\theta}_z)$ ***for a given*** d ***and*** θ_k

Given that 1) $v^{exit}(k,d,w) < v^{exit}(\underline{\theta}_z)$ for some debt level d; 2) both v^{exit} and v^{stay} are continuous in k and strictly increasing; and 3) the value of staying is more concave than the value of looting under condition (20), it follows that there exists a capital level $\tilde{k}_3$ such that

$$v^{stay}(\tilde{k}_3,d,w) = v^{exit}(\tilde{k}_3,d,w) \text{ and } \frac{\partial v^{stay}}{\partial k}(\tilde{k}_3,d,w) < \frac{\partial v^{exit}}{\partial k}(\tilde{k}_3,d,w) \text{ for some } d \text{ and } w$$

The inequality is necessary because as v^{exit} is initially below v^{stay}, it has to grow faster than v^{stay} to catch up. For any $k < \tilde{k}_3$, $v^{stay}(k,dw) > v^{exit}(k,d,w)$. For any $k > \tilde{k}_3$, $v^{stay}(k,d,w) < v^{exit}(k,d,w)$.

To summarize, if $v^{exit}(k,d,w) < v^{exit}(\underline{\theta}_z)$ for some debt level d, and diverted funds w then there exists a capital level $\tilde{k}_3$ such that $v^{stay}(\tilde{k}_3,d,w) = v^{exit}(\tilde{k}_3,d,w)$ and $\left(1-\rho(k',s)\right)\left(f'(\tilde{k}_3)+(1-\delta)\right)u'(c^{stay}) < \frac{r\theta_k}{1+r}\frac{u'(c^{exit})}{1-\beta}$. The dictator loots for any capital level above $\tilde{k}_3$ and stays otherwise.

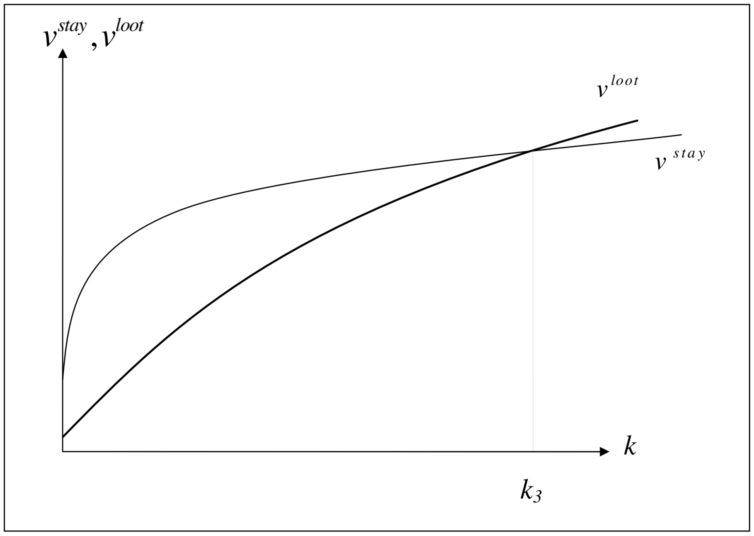

Figure 8: Case 3: Dictator Loots only for High k

Comparative static of $\tilde{k}_i$ ($i = 1,2,3$) with respect to θ_z and θ_k

Using $\dfrac{\partial EV}{\partial \theta_k}$ and $\dfrac{\partial EV}{\partial \theta_z}$ determined in Appendix A.1 and the implicit function theorem, we obtain:

$$\frac{\partial \tilde{k}_i}{\partial \theta_k} = \frac{\frac{rk}{1+r}\frac{u'(c^{exit})}{1-\beta}Q}{(1-\rho(k',s))\,(f'(k)+(1-\delta))\,u'(c^{stay}) - \frac{r\theta_k}{1+r}\frac{u'(c^{exit})}{1-\beta}}$$

$$\frac{\partial \tilde{k}_i}{\partial \theta_z} = \frac{\frac{rZ}{1+r}\frac{u'(c^{exit})}{1-\beta}Q}{(1-\rho(k',s))\,(f'(k)+(1-\delta))\,u'(c^{stay}) - \frac{r\theta_k}{1+r}\frac{u'(c^{exit})}{1-\beta}}$$

We established in Appendix A.1 that Q is negative so that the signs of these ratios depend on the sign of the denominator. When the marginal liquidity of capital is larger than the marginal product of capital, then the denominator is negative and $\tilde{k}_i$ increases with both θ_k and θ_z. In particular, we infer that the denominator is negative at $\tilde{k}_2$ and $\tilde{k}_3$ (see Case 2 and Case 3) and positive at $\tilde{k}_1$ (see Case 2). Therefore, it follows that $\tilde{k}_1$ is decreasing in θ_k and θ_z while $\tilde{k}_2$ and $\tilde{k}_3$ are increasing with these parameters.■