

Autocracy, Democratization and the Resource curse*

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Abstract

Some autocracies are economically successful; others stagnate at low levels of production. Paradoxically, stagnating autocracies often possess more natural resources and are more resistant to political change. This paper addresses a dynamic relation between capital accumulation and political regime in presence of resource rents. It argues that private capital accumulation increases an unfettered autocrat's temptation to expropriate. Therefore, private investment in an autocracy would only take place if the ruler is willing to eventually relinquish some power, which, in turn, is affected by the benefits of control (such as natural resource rents). The model finds that if autocrat's resource rents are low, the country develops under maintained autocracy and becomes democratic only after a period of growth. If rents are medium-sized, the country becomes less autocratic early and grows in a democracy. Finally, if rents are high, the country stagnates under the autocratic rule, thereby suffering from a resource curse.

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1 Introduction

Nowadays, most economists agree that economic and political changes are intertwined. For example, it is commonly argued both that protection of property rights from governmental abuse creates economic growth, and that economic growth gives rise to political freedom, constraining the discretion of the executive. Still, the relationship between limited government and economic outcomes is not very well understood. Notably, autocracies are found to be both the best and worst performers in terms of growth rates.¹ Moreover, the most economically successful autocracies tend to eventually be replaced by more democratic institutions, whereas poorly performing autocracies often prevail for a very long time.

In this paper, we study the dynamics of the relationship between the private capital accumulation and political restraints on the executive in presence of resource rents. We argue that the scope for capital accumulation and growth in an autocracy is largely determined by the ruler's incentive to cling to power, which, in turn, is shaped by her benefits of political control. One of the main results of the model is that there can be private capital accumulation only if the autocrat's control benefits are not too large. The reason is that eventually, as capital accumulates and growth rates decline, an unfettered autocrat's temptation to expropriate capital becomes irresistible. Therefore, capital accumulation proceeds beyond this point only after the autocrat has relinquished some power. While autocrats with small benefits of political control are willing to relinquish power once it becomes necessary in order to sustain future capital accumulation, autocrats with large benefits of control are not. In the latter case, capitalists, looking ahead, realize that they will eventually be expropriated and never start accumulating.

Natural resource availability might be the most obvious determinant of an autocrat's incentive to cling to power. If a country is sufficiently rich in natural resources, an autocratic ruler will always resist political change, because of the lost stream of revenues. In a resource poor country, on the other hand, the autocrat may prefer sustaining private capital accumulation to preserving her resource rents. The model can therefore account both for the observed negative relationship between natural resource rents and economic growth and the great heterogeneity in economic outcomes under autocracy. It also suggests why resistance to political change may be greater in autocracies that never experienced capital accumulation than in economically more successful autocracies.

Specifically, we assume that a country is facing an exogenous opportunity for multi-period investment that is only exploitable by the private sector. This investment is characterized by decreasing returns to scale. An autocratic ruler can tax the private sector or

¹E.g. Almeida and Ferreira (2002).

expropriate it, but is unable to invest and thus support growth after expropriation. The ruler can also choose to relinquish some of her power. Such partial democratization deprives the ruler of the right to expropriate and reduces her tax payoff. Also, while being in power, the ruler enjoys private benefits of control, (part of) which are no longer available to her after democratization.²

The private sector has an option to avoid taxation and expropriation by diverting resources to a less efficient alternative use. Due to decreasing returns to scale, the growth rate in this economy declines over time. As a result, at the early stages of growth, when the growth rate is high, an autocrat has no incentive to seize assets, because delayed expropriation significantly increases the value at stake. As growth slows down, immediate expropriation (“getting the entire pie”) becomes increasingly attractive, as compared to the option of postponing it to increase the size of the pie. The private sector recognizes these incentives of the ruler, and diverts resources once the ruler is tempted to expropriate. If the ruler’s private benefit of control is relatively low, she commits to non-expropriation via democratization and thereby keeps the private sector investing. If the private benefits of control are high, the ruler does not want to ever lose them through democratization. Realizing that capital will eventually be expropriated, the private sector thus never starts to invest. Therefore, the model generates a variety of development trajectories that are non-monotonically related to the resource rents: With low resources the country grows under maintained autocracy and experiences delayed democratization. With intermediate resource rents, the country faces an early limitation of the ruler’s power and grows in a non-autocratic regime. Finally, with high resource rents, the country stagnates under autocratic rule with neither democratization nor growth ever taking place.

The model predicts that these stagnating economies are characterized by high private benefits of control, e.g. are abundant with appropriable natural resources. This finding parallels the “resource curse” literature, arguing that the natural resource wealth can be detrimental to countries’ economic development. The early work on the “resource curse” attributes the underperformance of resource-rich countries to economic factors such as “Dutch disease” or deteriorating terms of trade for the primary commodities. Empirically, this effect is documented e.g. by Sachs and Warner (1995) and Gylfason (2001). More recent literature emphasizes the political and institutional determinants of the resource curse (see e.g. Robinson et al. (2006), Mehlum et al. (2006) and Ross (1999) for a review of both approaches), which again finds empirical support (Mehlum et al. (2006) and Boschini et al. (2007)). Finally, there are studies addressing

²That is, the ruler cannot “fine tune” the decision to relinquish power so as to keep every possible fraction of current economic privileges.

the reverse effect – the impact of the resources on institutions. The effect is found to be negative and is attributed to reduced government accountability, a better ability to repress opposition and increasing corruption and rent-seeking (see e.g. Ross (2001), Sala-i-Martin and Subramanian (2003), Collier and Hoeffler (2005) and Egorov et al. (2009)). We propose an alternative link, suggesting that the abundant resources undermine the autocrat’s incentives to liberalize and hence, hamper capital accumulation.

The paper is also closely related to the literature analyzing the connection between economic growth and political restraints. This connection has been (and still is) a topic of an extensive debate. It is well recognized that prospects of expropriation or other property rights violations by political rulers destroy the investment incentives and are detrimental for growth. However, there is no consensus on whether the respective protection of investors has to be institutionalized. According to one view (North and Thomas (1970), North and Weingast (1989)), the abuse of political power can only be effectively prevented through explicit legal limitations on rulers’ authority. This view is also associated with the presumption that democratic societies should be economically more successful than the autocracies.

However, it has been shown that democratic electoral institutions do not necessarily result in investor protection and subsequent growth. For example, Collier (2007, pp. 44-49)) argues that it is the checks and balances on the ruling party, and not the electoral competition *per se*, that determine the incentives for private investment. Further, the empirical evidence on the relative performance of autocracies vs. democracies is mixed. For example, Besley and Kudamatsu (2008) demonstrate that while democracies perform better than autocracies on average, the incidence of extreme (both high and low) growth rates is higher for autocracies than for democracies; Almeida and Ferreira (2002) find that the most remarkable growth episodes were almost always observed in autocratic regimes. These findings are consistent with the alternative view - namely, that (a period of) sustained growth can be in the interest of an unconstrained and selfish dictator, who chooses to rationally refrain from expropriation.³ The literature offers a number of mechanisms behind such a decision of the ruler. Olson’s (1993) “stationary bandit” argument suggests that a patient and entrenched ruler may choose to abstain from expropriation in order to increase tax revenues. Azam et al. (2009) argue that ruler’s incentive to show restraints may be due to incomplete information. In their model, an opportunistic government may decide to postpone expropriation to pretend that it is benevolent in order to stimulate private investment and increase the appropriable assets in the future.

³There could also alternative reasons for these findings, see e.g. Papaioannou and Siourounis (2008) for the review.

However, these mechanisms do not offer an explanation of why most of the well-performing autocracies eventually limit the dictator's power, e.g. through partial or full democratization. This paper shows that a self-interested opportunistic dictator may choose to democratize in a phase of declining growth. It suggests a compromise between the two views above, arguing that whereas checks and balances on the selfish ruler are indeed crucial for private investment and associated growth, their introduction does not need to precede the take-off of growth phase. What matters for growth is not the initial restraints on the executive power, but a possibility for the ruler to self-impose these restraints at an appropriate moment in time, for example, via (partial) democratization. To stress this logic, the paper concentrates on the checks and balances brought about by democratization while neglecting its other features, in line with the aforementioned Collier's (2007) argument.

The view that democratization is a credible commitment against expropriation has previously been articulated by Acemoglu (2003). However, his model yields either eternal autocracy or immediate democratization. That is, it does not explain why some countries experience sustained economic growth before eventual democratization. Furthermore, Acemoglu (2003) does not address the relationship between growth, political change and natural resource wealth, which is the key question of the current paper.⁴

In a closely related paper Myerson (2010) connects the resource curse literature to the literature on investment and political restraints. In his model, the ruler can expropriate private capital, which limits the capitalists' incentives to invest. The ruler can also choose to liberalize, which improves the investment outcomes, thereby increasing the ruler's tax revenue. However, the liberalization decision is associated with higher risks of the ruler losing power both in case and in the absence of expropriation. Myerson (2010) analyses the optimal level of liberalization and its relation to the ruler's resource endowments. Like the present paper he finds that the liberalization is non-monotonically related to the endowments, with larger resource levels being detrimental for investment and growth (i.e., a resource curse), and intermediate resource level leading to the highest degrees of liberalization. However, Myerson (2010) addresses the steady-state relationship between growth, regime and natural resources, focusing on the optimal degree of liberalization. We, instead, study the dynamics of this relation and concentrate on the timing of the institutional change as determined by the resource endowments, while taking the extent of liberalization (which we refer to as democratization) as given. Thus, the two papers are complementary to each other.

⁴For the mechanisms of democratic transition that do not involve predatory rulers see e.g. Acemoglu and Robinson (2000, 2001) and Gradstein (2004), who treat democratization (through franchise extension) as a commitment to redistribution.

Our model is consistent with a range of empirical findings. It predicts that autocratic economies would be characterized by either relatively high or relatively low growth rates, while the democratic regimes fall into an intermediate range, which is in line with Almeida and Ferreira (2002). It also provides new insight into the relationship between income and democratization. While many cross-country studies find that richer countries democratize earlier, the more recent panel data analysis documents no effect of income on democracy (e.g. Acemoglu et al. (2008)) or on the hazard rate out of autocracy (Persson and Tabellini (2009)) once the regressions include country fixed effects. The model suggests an explanation for the absence of simple relation between country's income and democratization. Indeed, income in the model can be decomposed into the product of total factor productivity and some function of capital. These different components of income are predicted to have different effect on timing of democratization: Higher initial capital leads to earlier democratization, while higher total factor productivity delays democratization. Hence, if this effect of decomposition of income is not accounted for (which is the case in empirical studies), one would expect to find no clear relation between income and democratization. Furthermore, the model also suggests a new explanation to why many empirical studies (e.g. Barro (1999), Alvarez et al. (2000), Boix and Stokes (2003)) find that growth causes democratization. In our model, democratization is preceded by a more or less extensive period of growth. Thus, if the data were to be generated according to our model, it might seem as if growth Granger-causes democratization. Nevertheless, this conclusion is misleading: in the model, institutions of limited government and growth are determined simultaneously and endogenously. Indeed, in the absence of a possibility to credibly relinquish power, growth would slow down if not completely stop. Similarly, in the absence of growth opportunities, the institutions of limited government would never be introduced. Therefore, by means of the model, we illustrate why the observed time pattern between growth and democratization does not reflect a causal relation. This is in line with the literature (Acemoglu et al.(2005), Przeworski (2004)) that emphasizes the endogenous determination of institutions and growth.

The paper proceeds as follows. Section 2 describes the setup of the model. Section 3 presents the model's solution. Section 4 addresses the predictions of the model and its comparative statics. The assumptions of the model are discussed in Section 5. Section 6 deals with relevant case studies. Finally, Section 7 concludes and suggests some directions for further research.

2 The Model

An infinite horizon economy ruled by an autocrat is populated by identical infinitesimal citizens of mass one. The instantaneous utility of a citizen is logarithmic, and each citizen maximizes the net present value of her future utilities

$$V_t = \sum_{j=1}^{\infty} \beta^j v(c_{t+j}) = \sum_{j=1}^{\infty} \beta^j \ln c_{t+j},$$

where c_t is consumption and β is the discount factor.

The initial capital of each citizen is given by K_0 . At date $t = 0$, due to an exogenous shock, each citizen is being exposed to a technology allowing for growth based on capital accumulation. In each period t , output is produced from capital according to the Cobb-Douglas production function

$$y_t = A(K_t)^\alpha,$$

where K_t stands for the capital stock and y_t - for the output at time t . The output can be used for immediate consumption or investment into tomorrow's capital. We assume that capital depreciates completely in each period.

Each period, a citizen can stay in the market or leave the market and divert the capital to an alternative activity. If the citizen stays in the market, her capital/output is within the Ruler's reach. Specifically, if any citizens stay, the Ruler has the power to tax these citizens through an economy-wide consumption tax τ_t , or to expropriate the entire capital (we assume technological indivisibility of the capital stock) from the citizens. In case of expropriation, each citizen receives zero payoff from the moment of expropriation and onwards.⁵

If a citizen leaves, she receives a payoff with the net present value of L , which is non-taxable and non-expropriable by the Ruler. We assume that

$$L < \sum_{i=0}^{\infty} \beta^i \ln \frac{(1 - \alpha\beta) AK_0^\alpha}{(1 + \tau_A)}, \quad \mathbf{A1}$$

where τ_A solves $1 - \phi'(\tau_i)(1 + \tau_i) + \phi(\tau_i) = 0$ and $\phi(\cdot)$ is per unit cost of taxation,

⁵As stressed by Besley and Ghatak (2009) one of the key difference between the taxation and expropriation is that under the latter the producer cannot withdraw the assets from production. This argument parallels our construction with two instruments for the ruler (consumption tax and complete expropriation of capital).

The consumption tax was chosen to keep the analysis tractable. As will be shown below, in our setting, consumption tax does not influence the capital accumulation path. This, together with the cost of taxation, allows us to avoid the time inconsistency problem, standard in infinite-horizon taxation models. We believe that the argument of the model will not be destroyed by replacing the proposed tax scheme by one distortive (capital) tax and classifying expropriation as unappropriately high level of taxes. However, we are not able to solve for the resulting equilibrium.

$\phi'(\cdot) > 0, \phi''(\cdot) < 0, \phi(0) = \phi'(0) = 0$. As we shall see, τ_A is the Ruler's preferred tax rate in autocracy, and assumption **A1** implies that Citizen's alternative activity is less efficient than the market activity. That is, the citizen's payoff of leaving is less than the payoff she would get by staying in the market, were the Ruler able to commit to never expropriate from her. We also assume that the decision to leave is irreversible: if diverted, capital cannot be returned to the market sector.

The payoff function of the Ruler is given by

$$U_t = \sum_{j=1}^{\infty} \beta^j d_{t+j},$$

where d_{t+j} is the payoff received by the Ruler in period $t + j$. More precisely, if the Ruler chooses to tax the citizens in period t , then her payoff is given by the tax revenue $\tau_t c_t$ less the cost of tax collection which is assumed to be proportional to the tax base

$$\Phi(\tau_t c_t) = \phi(\tau_t) c_t.$$

Additionally, the Ruler receives private benefits of control of b units each period. In the later point in the paper we will interpret these benefits as natural resource rents. So, the Ruler's payoff in period t is given by

$$d_t = \tau_t c_t - \phi(\tau_t) c_t + b$$

If the Ruler chooses to expropriate the capital in period t , she can still employ the Cobb-Douglas production function and enjoy the value of the entire output. However, unlike the citizens, she is unable to accumulate capital. Thus, due to complete depreciation, she can only use the expropriated capital stock in one period.⁶ For the same reason, the private benefits of control can be only used for consumption. That is, if she expropriates at period t , her payoffs from that period on become

$$d_t = y_t + b, \quad d_{t+j} = b \text{ for } j = 1, 2, \dots$$

The Ruler can also choose to relinquish some of her power through (partial) democratization. We assume that this decision is equivalent to completely renouncing the right to expropriate, limiting the Ruler's power to set taxes and restricting her access to the benefits of control; that is, as outlined in the introduction, we concentrate on the checks and balances induced by democratization, while taking the associated electoral institutes as a black box. We also assume that democratization is partial, that is that the Ruler retains some power; however, we assume that the Ruler cannot "fine tune" the democ-

⁶The introduction of a cost of expropriation does not affect the qualitative predictions of the model as long as the assumption of indivisibility of capital holds.

ratization decision to keep all current economic privileges.⁷ More precisely, we assume that after democratization, the Ruler cannot set a consumption tax above some upper bound τ_D , where

$$\tau_D < \tau_A. \quad \mathbf{A2}$$

Also, the control benefits b are no longer available to the Ruler. Thereby the Ruler's post-democratization per-period payoff becomes

$$d_t = \tau_t^D c_t - \phi(\tau_t^D) c_t, \text{ such that } \tau_t^D \leq \tau^D.$$

Note that we do not argue that democratization deprives the Ruler of all benefits. Instead, b reflects those benefits of control that are lost upon the (partial) democratization. We also assume that if the economy reaches full development, the industrial sector is sufficiently more productive than the natural resource sector, so the steady-state post-democratization payoff of the Ruler exceeds the value of the flow of private benefits. Further, we assume that the democratization decision is irreversible, i.e., if the Ruler democratizes she cannot return, and no other dictatorial ruler can take over.

The timing of the game is as follows: The citizens and the Ruler meet at discrete time periods $t = 0, 1, \dots, \infty$. Each period has three stages. If there was no democratization in the past, at stage 1 of period t , the Ruler decides whether to democratize (D) or abstain from democratization (ND). At stage 2, each citizen decides whether to stay in the market sector (S) or leave (L). At stage 3 of period t , in case some citizens stay in the market sector, the Ruler chooses whether or not to expropriate (E) the capital of some citizens. Expropriated capital is used for production only in period t and then it depreciates completely, as the Ruler cannot invest. If no expropriation (NE) occurs, production, consumption and investment take place and taxes are paid. Then, the game proceeds to the period $t + 1$. The timing of the game is presented at Figure 1.

As in any other multi-stage game, the history of the game is a collection of all actions played up to stage t . A (behavior) pure strategy of the ruler/citizen is a function $\sigma(h^t)/\rho(h^t)$ prescribing an action in each of the ruler's/citizens' controlled game tree nodes for a given history of the game h^t . For example, conditional on the history h^t , at the first stage of each period, a pure strategy of the ruler determines a choice between D_t and ND_t . At the second stage, the strategy of each citizen determines S_t or L_t taking into account all the past actions including those just played at stage 1 of period t . At the third stage, the ruler's strategy defines a choice of whether and whom to expropriate, again, conditional on all actions played up to stage 3 of period t and, if some capital is not expropriated, τ_t ; the non-expropriated citizen's strategy prescribes the investment

⁷In Section 5 we discuss the implications of relaxing this assumption.

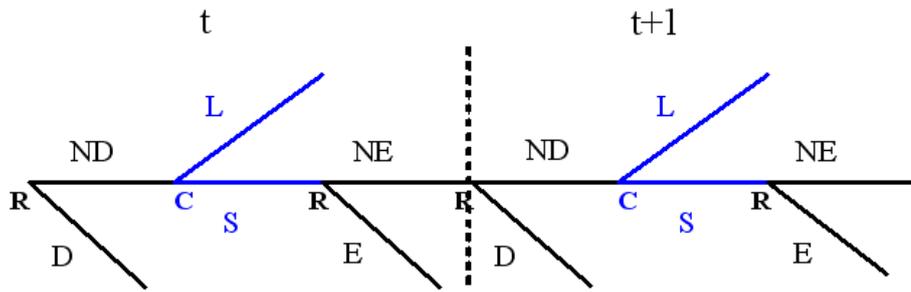


Figure 1. Timing of the game

choice for the next period.

In what follows we seek a symmetric (as regards the citizens) pure-strategy subgame-perfect Nash equilibrium of this game. In addition, we assume that the equilibrium actions of the player are constant on the histories that only differ in the behavior of the sets of agents of measure zero (like in Gul, Sonnenschein and Wilson (1986)).⁸ This implies that the strategies of Ruler and each citizen cannot be conditioned on the actions of any single citizen, or in other words, that unilateral deviation of a single citizen does not affect choices of the Ruler and the other citizens. With this assumption, each citizen takes taxes and the timing of democratization as given. One can also show that in the symmetric equilibrium the Ruler would not have incentive to behave differently with respect to different groups of citizens. These consideration allow us to take a short-cut and discuss this game as a game between a Ruler and the representative tax-taking Citizen.

3 Analysis of the Game

In this section we solve for symmetric subgame-perfect equilibria of the game. We start by analyzing the development path of this economy in the absence of Ruler's intervention, that is, without taxation, expropriation or democratization. Then we turn to the analysis of the subgame-perfect equilibria of our game. To do so, we first describe the optimal taxation choice of the Ruler, were she not able to expropriate, and the choices of the Ruler and the Citizen along the non-expropriation path. Then we show that for sufficiently high capital level the Ruler always prefers expropriation to any other continuation strategy. This allows us to treat this non-stationary infinite-horizon game as a finite-horizon one and use backwards induction to find its SPNE. We proceed by solving the game backwards and discussing equilibria that arise for different sets of parameter values. The proofs of all the results are to be found in the appendix unless stated otherwise.

⁸This assumption may require some technical restrictions, e.g. to insure that the set of citizens taking each given action is measurable. We assume them to hold.

3.1 The benchmark case: no government intervention

We start by describing the evolution of this economy in the absence of any governmental intervention. As staying in the market sector is more productive than leaving it, the efficient outcome is for production to occur in the market sector and for the citizen to maximize her utility

$$\max \sum_{j=1}^{\infty} \beta^j \ln c_{t+j},$$

subject to the dynamic budget constraint

$$K_{t+1} = A(K_t)^\alpha - c_t.$$

This problem is identical to the standard Ramsey growth model and the solution is⁹

$$\begin{aligned} c_t &= (1 - \alpha\beta) AK_t^\alpha, \\ K_{t+1} &= \alpha\beta AK_t^\alpha. \end{aligned} \tag{1}$$

The dynamic equilibrium of this economy is characterized by the capital and the output monotonically converging to the steady state values K^* and y^* , respectively:¹⁰

$$\begin{aligned} K^* &= (\alpha\beta A)^{\frac{1}{1-\alpha}}, \\ y^* &= A^{\frac{1}{1-\alpha}} (\alpha\beta)^{\frac{\alpha}{1-\alpha}}. \end{aligned}$$

Note that along the transition path, both the capital growth rate and the growth rate of output are decreasing in t .

3.2 Subgame-perfect Nash equilibrium

Now we analyze the game between the Ruler and the Citizen and characterize its pure-strategy subgame-perfect Nash equilibria.

3.2.1 Taxation along the non-expropriation path

First, we study the Ruler's taxation decisions in a SPNE of the game. In order to do so we start by examining the Ruler's taxation incentives, assuming that she cannot expropriate and the Citizen does not have any diversion opportunity.

Lemma 1 *In the considered setting consumption taxation does not influence the capital accumulation path and, thus, the output path.*

This lemma follows from the special properties of the logarithmic utility function with the income effect being exactly offset by the substitution effect. Consequently, the

⁹It can be confirmed by the usual guess-and-verify method.

¹⁰We concentrate on studying the increasing branch of the saddle path.

consumption and the capital accumulation path in this economy are given by

$$\begin{aligned} c_t &= \frac{(1 - \alpha\beta) AK_t^\alpha}{(1 + \tau_t)}, \\ K_{t+1} &= \alpha\beta AK_t^\alpha. \end{aligned} \quad (2)$$

This result conveniently allows us to avoid the problem of the dynamic tax inconsistency. It implies that the today's tax only has an impact on today's consumption. Thus, Ruler's consumption taxation decisions can be taken separately for each period. In our specification the before-tax consumption always constitutes a fixed share of output and the output path is not affected by the taxation. Therefore the Ruler's decision each period amounts to choosing the optimal tax rate given the direct cost of taxation and the indirect cost coming from the proportional decrease in Citizen's consumption resulting from a higher tax rate. As a result, the Ruler's choice yields the same tax every period. This finding is summarized in the following lemma.

Lemma 2 *If the Ruler were not able to expropriate and the Citizen were not able to leave the market, the Ruler would choose the same tax rate τ_A each period, such that*

$$1 - \phi'(\tau_A)(1 + \tau_A) + \phi(\tau_A) = 0.$$

Lemma 2 explains why we imposed assumption **A1**. The assumption ensures that, if the Citizen leaves the market, she receives less than she would under Ruler's full discretion to tax (but not to expropriate). Notice that the Ruler in this case does not receive any payoff on top of the private benefit of control, hence, the outcome with the Citizen leaving the market is inefficient.

This result would also help us describe the post-democratization behavior of the Ruler and the Citizen (where the Ruler no longer can expropriate the Citizen).

Lemma 3 *In any SPNE in all subgames following democratization, the Ruler sets the highest possible tax rate τ_D in each period and the Citizen stays in the market.*

The intuition behind this lemma is as follows. As shown above, a consumption tax does not influence the capital accumulation path. Indeed, the citizens ignore the effect of their decisions to stay or leave on the Ruler's choice of the tax rates and the timing of democratization, and take them as given. Hence, in each period after democratization, the Ruler and the Citizen "share a pie" of a predetermined size, unless the Citizen diverts the capital to the non-market sector. No expropriation is possible after democratization. Therefore, by our assumption **A1** the Citizen would prefer being in the market sector to leaving the market. The Ruler, in turn, will exert maximal tax revenue by setting the highest possible tax.

Now we are ready to characterize the taxation decisions of the Ruler in the original game, i.e., when she has the power to expropriate before democratization. An important property of any (symmetric) subgame-perfect equilibrium of this game is that no SPNE can have expropriation on the game path. Indeed, expropriation cannot occur in equilibrium, as the Citizen would gain by deviating to the shadow sector just before the Ruler expropriates. It implies that along the game path of any subgame-perfect Nash equilibrium each citizen, being a tax-taker, invests a fixed share $\alpha\beta$ of current output and this choice is independent of actual tax rates (see Lemma 2). That is, the capital accumulation path always follows rule (2). Therefore, in establishing the game path of SPNE we can limit ourselves to analyzing capital accumulation trajectories that correspond to this rule. This observation together with Lemma 3 yields a useful corollary.

Corollary 1 *Along the non-expropriation (sub)game path, the Citizen never leaves the market. The Ruler chooses τ_A while in power and τ_D after democratization.*

Intuitively, if there is no expropriation along the game path, the maximum tax the Ruler would set is τ_A . Then the Citizen's payoff from leaving is always below the payoff from staying. As a result, along the non-expropriation game path, the Ruler can always choose his preferred tax levels, that is, τ_A while in power and τ_D after democratization.

3.2.2 Dynamics of the Ruler's incentive to expropriate

Now we analyze how the Ruler's incentive to expropriate evolves over time. We show that, if the capital is sufficiently high and the growth rate is sufficiently low, the Ruler's temptation to expropriate becomes irresistible (as mentioned above this happens off-equilibrium). We will then interpret the expropriation moment as the end-of-the-game period, which will allow us to convert the original infinite-horizon non-stationary game into a finite-horizon one, solvable by backward induction.

Denote the share of output the Ruler receives while being in power by

$$\varepsilon_A = \frac{\tau_A - \phi(\tau_A)}{(1 + \tau_A)}(1 - \alpha\beta),$$

and the one she gets after democratization by

$$\varepsilon_D = \frac{\tau_D - \phi(\tau_D)}{(1 + \tau_D)}(1 - \alpha\beta).$$

Note that as the tax in autocracy is higher than after democratization, $\tau_A > \tau_D$, the same is true about the Ruler's output shares:

$$\varepsilon_A > \varepsilon_D.$$

Lemma 4 *If $\frac{\varepsilon_A}{1-\beta} < 1$, then in any SPNE along all the paths where the Citizen invests a fixed share $\alpha\beta$ of current output, there exists a finite time period T such that the Ruler prefers expropriation at stage 3 of period T over any other continuation strategy.*

Proof. We start with some introductory observations. There are three types of “exits” in this game. First, the Ruler can expropriate the capital from the Citizen. If this occurs, the Citizen is left with zero capital and cannot restart production, so that the continuation of the game is fully predetermined. Second, the Citizen can divert the capital to the shadow sector, which makes the continuation game independent of the players’ actions. Finally, the Ruler can democratize. Since this decision is irreversible, and after democratization the continuation game has a unique subgame-perfect Nash Equilibrium, the value of the remaining game is also clear at the time of democratization.

Observe that after the capital has reached a sufficiently high level, no SPNE can have exits of the first two types along the game path. Indeed, in case of expropriation, the Citizen gets zero, while if she diverts the capital at the preceding stage, she is guaranteed a positive payoff. Similarly, if the Citizen diverts the capital, the Ruler is left with the private benefits of control only. As we assume that the steady-state post-democratization payoff of the Ruler is higher than the value of the flow of private benefits, by continuity, the same holds if democratization occurs sufficiently close to the steady state. Thus, the Ruler prefers democratizing at the preceding stage rather than clinging to power and only receiving the benefits of control.

This implies that in the subgame starting at stage 3 of some period t the Ruler is choosing between immediate expropriation, set of continuation paths where the game “ends” by democratization at some future period $t + \tilde{t}$ and a path where the game “continues” forever. The assumption of the Lemma ensures that in the steady state the net present value of tax returns is not high enough to prevent the Ruler from expropriating. By continuity, the same result holds around the steady state. ■

This Lemma states that if the agents are not very patient, the non-market activity is not very inefficient, and/or the share of capital in production α is high, expropriation always takes place if the economy is sufficiently close to the steady state. Note that if the Ruler’s value of expropriating at T is higher than the value of any alternative continuation strategy at time T , the same is true for any $t > T$, as output monotonically converges to the steady-state value y^* .

Corollary 2 *If $\frac{\varepsilon_A}{1-\beta} < 1$, and T is the time period found in Lemma 4, then in any SPNE the Ruler chooses to expropriate at stage 3 of every period $T, T+1, T+2, \dots, \infty$ along all the paths where the Citizen invests a fixed share $\alpha\beta$, and the Citizen leaves the market to avoid expropriation.*

Throughout the paper, we assume that the conditions of Lemma 4 hold; that is, the parameters of the model are such that in the steady state, the Ruler always prefers expropriation over any other strategy. Corollary 2 thus allows us to treat period T as a “final” period and solve the game backwards from there.

3.2.3 Backward induction characterization of SPNE

As shown in Corollary 2, at stage 3 of period T , the Ruler expropriates. At stage 2 of period T , the Citizen leaves the market sector to get a positive payoff, as compared to the zero payoff in case of staying and being expropriated at the next stage. As a result, at stage 1 of period T , the Ruler has to choose between democratizing, in which case she receives a payoff

$$U(D_T) \equiv \tau_D \sum_{i=0}^{\infty} \beta^i c_{T+i} = \varepsilon_D \sum_{i=0}^{\infty} \beta^i y_{T+i},$$

and not democratizing, which gives her a flow of future benefits of control

$$U(ND_T) \equiv \sum_{i=0}^{\infty} \beta^i b = \frac{b}{1-\beta},$$

as the Citizen leaves the market at the next stage.

Suppose that the Ruler’s democratization payoff at T is lower than the flow of the benefits of control

$$U(D_T) < U(ND_T).$$

In this case expropriation in stage 3 of period $T - 1$ yields the Ruler the entire today’s output and the flow of the control benefits from today on

$$U(E_{T-1}) = y_{T-1} + \frac{b}{1-\beta}.$$

Alternative option, non-expropriation accompanied by taxation, only gives her a share of the $T - 1$ ’s output, accompanied by the same flow of control benefits

$$U(NE_{T-1}, \tau_A, ND_T) = \varepsilon_A y_{T-1} + b + \beta U(ND_T) = \varepsilon_A y_{T-1} + \frac{b}{1-\beta}.$$

Thereby, the Ruler will always expropriate in stage 3 of period $T - 1$ and the backward induction reasoning in period $T - 1$ will exactly follow the one for period T .

If instead the Ruler’s democratization payoff exceeds the net present value of the flow of the benefits of control

$$U(D_T) > U(ND_T),$$

then in stage 3 of period $T - 1$ the Ruler compares the payoff of expropriating $U(E_{T-1})$

to the payoff of taxing in period $T - 1$ followed by democratization in period T

$$\begin{aligned} U (NE_{T-1}, \tau_A, D_T) &= \varepsilon_A y_{T-1} + b + \beta U (D_T) \\ &= \varepsilon_A y_{T-1} + b + \beta \left[\varepsilon_D \sum_{i=0}^{\infty} \beta^i y_{i+T} \right]. \end{aligned}$$

If she chooses expropriation, i.e., if

$$U (NE_{T-1}, \tau_A, D_T) < U (E_{T-1}),$$

then, similarly to above, at stage 2 of period $T - 1$ the citizen prefers to leave the market, and the period T 's reasoning repeats for period $T - 1$.

Applying the same argument further up the game tree we can state the necessary condition for the Citizen to stay in the market: There exists a t , $0 < t \leq T$, such that at stage 1 of period t the Ruler prefers democratization to keeping power with control benefits only and no market production, and at stage 3 of period $t - 1$ the Ruler prefers non-expropriation followed by democratization to expropriation¹¹

$$U (D_t) > U (ND_t), \quad (3)$$

$$U (NE_{t-1}, \tau_A, D_t) > U (E_{t-1}). \quad (4)$$

When are these two conditions satisfied? First, note that condition (4) implies condition (3), so we only need to be concerned about the former one. Indeed, the Ruler gets the today's private benefits of control both in the case of taxation and expropriation. Thus, if she prefers taxing today and democratizing tomorrow, as compared to immediate expropriation, it means that the flow of control benefits from tomorrow on is not as appealing as the democratization payoff. Indeed, condition ((4) is equivalent to

$$\varepsilon_A y_{T-1} + b + \beta U (D_T) > y_{T-1} + \frac{b}{1 - \beta} = y_{T-1} + b + \beta U (ND_T), \quad (5)$$

which immediately implies condition (3), as $\varepsilon_A < 1$. Second, the following Lemma establishes that the relative difference of the payoff of expropriation vs. payoff of non-expropriation followed by democratization first monotonically increases and then monotonically decreases in t .

Lemma 5 *For a given set of parameters, the difference $U (NE_{t-1}, \tau_A, D_t) - U (E_{t-1})$ is single-peaked with a peak at some finite $\tilde{t} > 0$.*

¹¹In principle, it is not obvious that this condition is sufficient for the Citizen to stay in the market in period $t - 1$ on equilibrium path. It only guaranties that the Citizen stays *if she gets to make this choice*, i.e. if she is not expropriated/did not leave the market in any previous period. However, we show below that this condition is also sufficient.

Lemma 5 and the fact that the Ruler prefers expropriation to non-expropriation followed by democratization at the steady state, i.e., when $t \rightarrow \infty$, implies that

- (i) either there exists a time period t^d , $\tilde{t} \leq t^d \leq T$, such that the Ruler prefers non-expropriation followed by democratization to expropriation in period $t^d - 1$,

$$U(NE_{t^d-1}, \tau_A, D_{t^d}) > U(E_{t^d-1}),$$

but the reverse is true in all periods $t \geq t^d$, or

- (ii) in each period $t > 0$, expropriation is preferred over non-expropriation.

In the latter case the inequality (4) does not hold and the Citizen never chooses to stay in the market in stage 2 of some period t . So, the only situation when the Citizen can potentially stay in the market in this game is when condition (i) is satisfied. We analyze these two situations separately.

Case (i): Assume that condition (i) is satisfied. We show that in this case the country will experience a delayed democratization.

By definition of t^d , in stage 3 of all periods $t \geq t^d$ the Ruler chooses to expropriate, so in stage 2 the Citizen leaves the market. Consider now stage 1 of period t^d . By definition of t^d and in line with the argument used in (5), the Ruler democratizes at stage 1 of period t^d . Proceed backwards to period $t^d - 1$. Again, by definition of t^d no expropriation takes place at stage 3 of period $t^d - 1$. Thus, by Corollary 1, the Ruler sets $\tau_{\hat{t}} = \tau_A$, and the Citizen chooses to stay in the market at stage 2. Foreseeing it the Ruler does not democratize at stage 1 of period $t^d - 1$, as the taxes under autocracy are higher than after democratization, $\varepsilon_A > \varepsilon_D$ and she can also collect private benefits $b \geq 0$ this period.

$$\begin{aligned} U(ND_{t^d-1}, NE_{t^d-1}, \tau_A, D_{t^d}) &= \varepsilon_A AK_{t^d-1}^\alpha + b + \varepsilon_D \sum_{i=1}^{\infty} \beta^i AK_{i+t^d-1}^\alpha \\ &> U(D_{t^d-1}) = \varepsilon_D \sum_{i=0}^{\infty} \beta^i AK_{i+t^d-1}^\alpha. \end{aligned}$$

Before proceeding backwards to period $t^d - 2$, we need to establish an intermediate result. Consider the Ruler's net payoff.

Lemma 6 *As time passes, the Ruler's payoff from expropriation net of private benefits of control becomes more attractive relative to the payoff from democratization net of private benefits of control.*

Intuitively, the further away is the economy from the steady state, the longer is the growth horizon and the more appealing it is to get a share of future increasing profits (through democratization), as compared to grabbing the entire pie today.

Now, we are ready to discuss the choice of Ruler in the period $t^d - 2$. Remember that at stage 3 of period $t^d - 1$, the Ruler prefers non-expropriation, followed by democratization, to expropriation, by definition of t^d . The Ruler's choice between non-expropriation and expropriation is determined by two factors: the growth rate of output and the private benefits of control that are lost upon democratization. Now consider period $t^d - 2$. By choosing not to expropriate in period $t^d - 2$, the Ruler retains the benefits of control for period $t^d - 1$, as she does not democratize in that period. Therefore, the gain in the private benefits of control resulting from choosing expropriation over non-expropriation in period $t^d - 2$ is smaller than in period $t^d - 1$. In addition, the growth rate of output in period $t^d - 2$ is higher than at $t^d - 1$, thereby providing the Ruler with additional incentive to refrain from expropriation. As the Ruler chooses not to expropriate in period $t^d - 1$, she also chooses not to expropriate in period $t^d - 2$

$$U(NE_{t^d-2}, \tau_A, ND_{t^d-1}, NE_{t^d-1}, \tau_A, D_{t^d}) > U(E_{t^d-2}).$$

Lemma 7 *At stage 3 of period $t^d - 2$, the Ruler prefers non-expropriation over expropriation.*

For exactly same reason as above, the Citizen decides to stay at stage 2 of period $t^d - 2$, and the Ruler does not democratize at stage 1 of period $t^d - 2$. At stage 3 of period $t^d - 3$, we repeat the argument of Lemma 7 to conclude that the Ruler again prefers not to expropriate and continue solving the model backwards along the same lines until we reach period $t = 0$. In all these steps, the optimal strategy for the Ruler is to tax the citizen without democratization or expropriation. The optimal strategy for the Citizen is to stay in the market sector. The tax rate chosen by the Ruler is set to $\tau_t = \tau_A$ in each period $t = 1, 2, \dots, t^d - 1$.

Thus, we can conclude that there is a unique symmetric pure strategy SPNE where along the game path the Ruler taxes the Citizen while retaining autocratic power and not expropriating up to period $t^d - 1$, and democratizes in period t^d ; that is

$$\sigma(h^t) = \left(\begin{array}{l} (ND_t, NE_t), t = 0, \dots, t^d - 1, \quad D_{t^d}; \\ \tau_t = \begin{cases} \tau_A, t = 0, \dots, t^d - 1; \\ \tau_D, i = t^d, \dots, \infty \end{cases} \end{array} \right).$$

The citizen always stays in the market along the game path:

$$\rho(h^t) = (S_t, t = 0, \dots, \infty).$$

That is, for each set of parameters such that condition (i) holds, the Ruler chooses to delay democratization. Denote this set by Ω_{DD} and notice that it is non-empty. Indeed, assume the private benefits of control are very small. If the initial capital is sufficiently low, the growth rate in the period $t = 0$ (and subsequent periods) is very high. Therefore, already in the initial period the Ruler would choose to democratize and get a flow of shares of quickly expanding “pie”, as opposed to grabbing the entire small pie today. By Lemma 5 the same would hold in period $\tilde{t} > 0$, so condition (i) is satisfied. The formal proof of the non-emptiness is in Appendix. We summarize our findings in the following proposition:

Proposition 1 *There exists a non-empty set of model parameters Ω_{DD} , such that the Ruler prefers to democratize rather than expropriate in at least one time period. If the parameters belong to the set Ω_{DD} , then along the game path of the unique symmetric pure strategy SPNE, the Ruler delays democratization until period t^d , where $t^d - 1$ is the latest period in which the Ruler can credibly choose non-expropriation followed by democratization over expropriation. In this case the Citizen always stays in the market and the economy exhibits private capital accumulation and growth.*

Case (ii): What if condition (i) is not met? As argued above, it implies that in each time period the Citizen leaves the market. In particular, this also holds in the initial period $t = 0$. Then there could be two possible situations depending on the relation between the Ruler’s payoff to democratization and the value of the future flow of private benefits of control at $t = 0$. In the first one, the Ruler democratizes in the very initial period; in the second one, the country stagnates in an autocratic regime.

More precisely, suppose that the parameter values are such that in period $t = 0$, the Ruler’s valuation of immediate democratization exceeds the valuation of the flow of control benefits:

$$U(D_0) = \varepsilon_D \sum_{i=0}^{\infty} \beta^i AK_i^\alpha > \frac{b}{1-\beta} = U(ND_0). \quad (6)$$

Then democratization occurs immediately, before any growth in this economy takes place. Here, the Ruler values growth after democratization more than stagnation in an autocratic regime. To achieve any growth, she must democratize in the very first period, otherwise the citizen immediately switches to a non-market activity.

In this case, in the unique symmetric pure strategy SPNE, the ruler democratizes in the initial period $t = 0$, that is

$$\sigma(h^t) = \left(\begin{array}{c} D_0; \\ \tau_t = \tau_D, t = 0, \dots, \infty \end{array} \right).$$

The citizen again never leaves the market sector along the game path:

$$\rho(h^t) = (S_t, t = 0, \dots, \infty).$$

Condition (6) suggests that such an equilibrium can take place in economies where e.g. the initial capital is relatively high, the private benefits of control are moderate, or the Ruler's power to tax after democratization is relatively large. Denote the set of parameters supporting this equilibrium by Ω_{ID} , where ID stays for immediate democratization. This set is non-empty. For example, this outcome can be observed in economies that start up very close to the steady state. As shown above, the Ruler always prefers to expropriate; the efficiency assumption ensures that the flow of private benefits of control falls short of democratization payoff in the steady state which, by continuity, also holds in a neighborhood of the steady state.

Proposition 2 *There exists a non-empty set of model parameters Ω_{ID} , such that the Ruler's payoff from expropriation is always higher than the payoff from non-expropriation followed by democratization in the next period, but the payoff from democratization in $t = 0$ exceeds the value of the flow of private benefits of control. If the parameters belong to the set Ω_{ID} , democratization occurs in the very first period and the economy fully realizes its growth potential.*

Finally, consider the situation where, in period $t = 0$, the Ruler's payoff of immediate democratization is lower than the net present value of the flow of control benefits:

$$U(D_0) = \varepsilon_D \sum_{i=0}^{\infty} \beta^i AK_i^\alpha < \frac{b}{1-\beta} = U(ND_0). \quad (7)$$

Now the Ruler chooses not to democratize in the initial period $t = 0$. The Citizen leaves the market immediately thereafter to avoid expropriation, and such an economy becomes locked in an underdevelopment trap: At the beginning of growth, the post-democratization future does not look sufficiently tempting to the Ruler. Thus, she prefers to retain all her political power to receive the private benefits of control, even at the cost of forgoing capital accumulation. As a result, growth in this economy never occurs.

Formally, in the unique symmetric pure strategy SPNE along the game path, the ruler does not democratize in period $t = 0$:

$$\sigma(h^t) = (ND_0),$$

and the citizen leaves the market sector in the very initial period:

$$\rho(h^t) = (L_0).$$

Condition (7) suggests that this equilibrium outcome is observed in economies with low initial capital, high benefits of control and relatively limited Ruler's power to tax after democratization. Denote the respective set of parameters by Ω_U . Again, this set is non-empty: if the private benefits of control are sufficiently high, the Ruler may never choose to lose them through democratization.

Proposition 3 *There exists a non-empty set of model parameters Ω_U such that the Ruler's payoff from expropriation is always higher than the payoff from democratization in the next period, and the value of the flow of private benefits of control exceeds the payoff from democratization at $t = 0$. If the parameters belong to the set Ω_U , the economy is caught in an underdevelopment trap: no growth or democratization ever occurs.*

4 Predictions of the model

Now we are ready to discuss the model's predictions and comparative statics.

Proposition 4 *In an economy that is growing under autocratic rule, a higher level of initial capital entails earlier democratization. In an economy locked in an underdevelopment trap, an increase in initial capital may entail early democratization and growth.*

The formal proof can be found in the Appendix. Informally, consider two economies, one starting with the initial capital K_0 and another - with the capital that the first economy would reach in period $t = 1$,

$$K'_0 = K_1 > K_0.$$

The backward induction procedure described above implies that the choices made by the agents in the first economy in period t are identical to the choices made by the agents in the second economy in period $t - 1$. Thus, if in the former economy democratization occurs at date \hat{t} , in the latter economy it occurs at date $\hat{t} - 1$. Intuitively, an increase in the initial capital, other things equal, implies that the economy starts closer to the steady state and experiences lower growth rates throughout its development path. As a result, the future does not look that tempting for the Ruler and her incentive to grab at each point in time increases. Thus, in order to persuade the citizens to remain in the market, the Ruler needs to democratize power earlier.

Alternatively, assume that the former economy is in the "underdevelopment trap". That is, in any period $t > 0$, the Ruler prefers expropriation at stage 3 of period t to democratization at stage 1 of period $t + 1$ and her democratization payoff in period $t = 0$ is less than the flow of private benefits of control. Then, an increase in initial capital to

$K'_0 = K_1$ does not influence the relative attractiveness of expropriation, as compared to democratization in the next period. Indeed, as mentioned above, the decisions made in the latter economy at time t replicate the decisions made in the former at time $t + 1$, so the Ruler of the economy starting with K'_0 still prefers expropriation at any $t' > 0$. Therefore, the institutions are fully determined by the Ruler's democratization decision in period $t = 0$. Note that the Ruler's democratization payoff is increasing in the level of the initial capital, while the flow of private benefits of control is constant. As $K'_0 = K_1 > K_0$, democratization in period $t = 0$ in the latter economy brings the Ruler as much as democratization in period $t = 1$ in the former economy, which is higher than the payoff to democratization in the initial period in the former economy:

$$U(D_0|K'_0) = U(D_1|K_0) > U(D_0|K_0).$$

Hence, it may be the case that the democratization payoff at K'_0 exceeds the flow of private benefits of control and thus, in the latter economy, democratization occurs in the very initial period $t' = 0$.

The above discussion implies the following corollary.

Corollary 3 *Economies with lower level of initial capital are more likely to be locked in an underdevelopment trap.*

An underdevelopment trap equilibrium outcome can only arise in an economy where the set parameters $(\alpha, A, \beta, \tau_D, \tau_A, b) \in \Omega_U$, so that the Ruler never prefers democratization over expropriation. As shown above, among these economies, higher initial capital leads to early democratization and growth, while lower capital blocks the economic and institutional development.

Now consider a technological change – an increase in the total factor productivity parameter A . Intuitively, a country with a higher total factor productivity has a higher growth rate in each period and steady-state capital. So, at each point in time, this country's future growth potential weakens the incentives to expropriate. As a result, we expect democratization to be delayed. On the other hand, the value of democratization relative to the value of expropriation increases with TFP (e.g. due to a higher growth rate in each period). Thus, higher total factor productivity may improve the chances for eventual democratization in economies in an underdevelopment trap.

Proposition 5 *If an economy is in the underdevelopment trap, higher total factor productivity may create democratization and growth. For two growing economies, an economy with higher total factor productivity, other things equal, experiences later democratization.*

Other things equal, higher total factor productivity translates into a higher growth rate. Hence, we have an immediate Corollary:

Corollary 4 *Among growing economies, autocracies are more likely to experience higher growth rates than are less autocratic regimes.*

An increase in labor intensity α or in discount factor β has an ambiguous effect.

Comparing the results of Propositions 4 and 5 we see that different components of initial income have opposite effects on the timing of democratization - higher initial capital causes earlier democratization while higher total factor productivity delays it. This may explain why recent panel-data studies find no effect of income on democracy (e.g. Acemoglu et al. (2008)) or on the hazard rate out of autocracy (Persson and Tabellini (2009)) once they control for country fixed effects. Indeed, the model predicts a non-linear effect of the two components of income, to capture which one would need to include an interaction term between income and an indicator for high TFP into a democracy regression. This interaction term would have a negative predicted sign. On the other hand, a long-run effect between the income and growth that arises in the Acemoglu et al. (2005)'s regression (and produces the well-known cross-country correlation between income and democracy) reflects different development paths for different countries. In our model it would be captured by the set of the exogenous (including institutional) factors, such as the existence of democratization mechanism, private benefits of control etc.

Next, let us address the impact of private benefits of control on democratization. The Ruler retains the benefits of control only while being in power, whereas these benefits are no longer available to her after democratization. Thus, private benefits do not influence the Ruler's trade-off between early and late expropriation. Instead, they only have an impact on the Ruler's incentive to democratize. If the benefits are low, the Ruler can delay democratization for a long time, because the Citizen realizes that the Ruler will not cling to power the day she needs to commit not to expropriate to avoid losing investment. On the contrary, if private benefits of control are very high, the Ruler will not be willing to ever give up power, no matter how much capital accumulation is lost. Recognizing this, the Citizen never invests in the market sector and there is neither democratization nor growth. Thus, an abundance of natural resources has a detrimental effect on growth. In the intermediate range, as the private benefit of control increases, the Ruler's relative incentive to expropriate, as opposed to democratization, increases too. As a result, in order to keep capital accumulation going, the Ruler needs to democratize earlier since, at later stages, she always prefers to stay in power, and no commitment is possible. Thus, in this range, an increase in private benefits speeds up

democratization. Therefore, the model predicts a non-linear effect of the private benefits of control on democratization. This prediction of the model parallels the arguments of the resource curse literature – that abundant natural resources may hinder growth¹² and capital accumulation.¹³ Moreover, it suggests that the resource curse should also be non-linear: an increase in resource size does not have any impact on growth, until the resource rents become sufficiently large to completely kill growth.¹⁴ We summarize our findings in the following Proposition.

Proposition 6 *If the Ruler’s private benefits of control are sufficiently small, an increase in the private benefits causes earlier democratization. Eventually, a further increase in the private benefits of control locks an economy in an underdevelopment trap with neither growth nor democratization.*

Note that the maximum post-democratization tax τ_D available to the Ruler and the private benefits of control are two sides of the same coin. That is, both of them reflect the Ruler’s loss associated with giving up power. Thus, the effect of τ_D should be similar to that of the benefit of control. Indeed, a higher post-democratization tax rate makes democratization option more attractive relative to the expropriation. Thus, the Ruler can credibly postpone democratization without jeopardizing industrialization. On the other hand, if the Ruler’s payoff after democratization is very low (or very uncertain), she has no incentive to democratize and the economy is in the underdevelopment trap.¹⁵ For such an economy, a sufficient increase in τ_D will cause an eventual democratization.

Proposition 7 *If the post-democratization tax rate τ_D is sufficiently low, the economy is locked in the underdevelopment trap. An increase in the post-democratization tax rate first causes democratization to occur and then delays it.*

Similarly, a change in the cost of taxation $\phi(\cdot)$ inducing an increase in τ_A and Ruler’s tax revenues received under autocracy has the same impact on the timing of democratization as an increase in τ_D . (Here we only consider an increase in τ_A which does not change the Ruler’s incentive to expropriate in the steady state, and the incentive of the citizen to stay in the market as long as there is no expropriation, so that the assumption of Lemma 4 and condition (18) continue to hold). This result has a very simple explanation. When the Ruler decides whether or not to expropriate, she weights the

¹²E.g. see Sachs and Warner(1995) and Gylfason (2001)

¹³See Gylfason and Zoega (2001)

¹⁴A non-linear (negative) effect of the resource curse on growth is found by e.g. Sala-i-Martin and Subramanian (2003)

¹⁵E.g. consider an extreme case when the Ruler cannot be credibly guaranteed any post-democratization payment from the citizen.

expropriation payoff against the payoff from non-expropriation today and democratization next period. If she chooses to democratize, she retains the today's autocratic tax revenue and receives the democratization payoff from tomorrow onwards. Therefore, by expropriating at period t , she foregoes the tax revenue $\varepsilon_A y_t$. The higher is this revenue, the weaker are her incentives to expropriate and the longer she can stay in power without using the commitment device. On the other hand, if the economy is locked in an underdevelopment trap, the tax revenues from capital accumulation under autocratic regime are too low to persuade the Ruler to forgo the private benefits of control. In this case an increase in τ_A may bring about an eventual democratization.

Proposition 8 *If the autocratic tax rate τ_A is sufficiently low, the economy is locked in the underdevelopment trap. In this case a change in the cost of taxation $\phi(\cdot)$ inducing an increase in τ_A causes eventual democratization. In a growing economy an increase in τ_A delays democratization.*

To illustrate our findings, we consider numerical simulations with parameters $A = 1$, $\alpha = 0.4$, $\tau_D = 0.25$, $\tau_A = 0.4$ and $\beta = 0.7$.¹⁶ In figure 2, we graph the set of

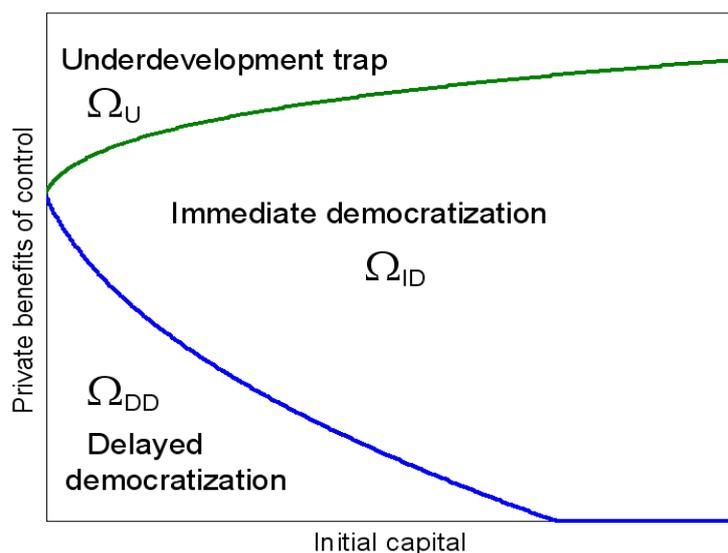


Figure 2. Development trajectories

equilibria in our economy as a function of the initial capital and the private benefits of control. We see that low values of initial capital and private benefits of control result in an equilibrium with delayed democratization. An increase in either initial capital or

¹⁶The values of A and a are standard for numerical simulations of the Ramsey model. The value of the time discount β captures the fact that in our model we have complete depreciation over one period.

the benefit of control brings the economy into the area of immediate democratization. A further increase in the private benefit of control leads to the “underdevelopment trap” equilibria with neither growth nor democratization.

What are the predictions on the relationship between growth and the political regime? In our model, depending on the parameter values, there are two possible regimes: Either an economy is locked in the underdevelopment trap and neither growth nor democratization occurs, or the economy sustains an autocratic regime at higher growth rates and democratizes as growth slows down. Thus, we see that the dictatorships are characterized either by no growth or by high growth rates, while less autocratic regimes fall in an intermediate range. The source of this cross-sectional variation may be different initial conditions, different stages of development (that is, the time of acquiring the technology) or a difference in technology per se. This prediction is consistent with the finding of Almeida and Ferreira (2002), who show that the cross-country variability of growth rates is higher among autocracies, and that autocracies are likely to be the best and the worst performers in terms of growth.

Second, according to the model, democratization is often preceded by several periods of growth. Therefore, it may look as if, in line with the results of Barro (1999) and others, the model establishes a causal relationship from growth to democratization, at least in the Granger-sense. But this conclusion is misleading: in the model, institutions of limited government and growth are determined simultaneously and endogenously. Indeed, if the institutions facilitating partial democratization are missing in an economy, so that the power cannot be credibly relinquished, growth will not occur. On the other hand, in the absence of growth opportunities, the government would never self-impose any checks and balances. Therefore, the observed time pattern between growth and democratization does not necessarily reflect a causal relation.

5 Discussion

In this section, we discuss the key assumptions of our model and their implication for the results. In the model, we abstract from open conflict. That is, the only threat that the Citizen can make to the Ruler is that of exit. Introducing the possibility of conflict into the model would not change the nature of its predictions, but might bring some additional insights. Assume that the Citizen can struggle with the Ruler in order to force her to relinquish the power. Then, as growth declines and the Ruler is prepared to give up power in the near future, we may expect both the Ruler and the Citizen to fight less intensively. Thus, unlike in a stationary setting where the intensity of struggle would typically be constant, we may find that as growth slows down, uproars become less violent. This extension could be helpful in relating the model to the evidence, which

suggests that even peaceful democratizations are normally preceded by some pressure on the ruler.

Another key assumption is that the institutional structure in the economy allows the ruler to commit to partial democratization. The formation of these institutions is beyond the scope of our analysis. Clearly, if such institutions are lacking, the Ruler cannot credibly commit not to expropriate. Similarly, we assume that the citizens can, in turn, guarantee the ruler a “safe haven” after she democratizes. If such an institution is missing, the autocrat has no incentive to democratize. Therefore, in the absence of either of these institutions, the model would predict any economy to be locked in an underdevelopment trap.

What happens if we allow the Ruler to “fine tune” the democratization decision? That is, suppose the Ruler may choose the post-democratization tax level (while keeping the assumption that democratization is associated with the absence of expropriation). Under this relaxed assumption, the Ruler does not impose any restrictions on the post-democratization tax return. Democratization occurs in any period between $t = 0$ and the period when the payoff of expropriation is just below the payoff of eternal taxation. Indeed, the Ruler can now make democratization as profitable as taxation and is thus indifferent concerning the timing of democratization, as long as the Citizen does not leave the market. For example, if the Citizen has a weak preference for democratization, the Ruler is ready to democratize in the very initial period. That is, such “fine tuning” prevents us from predicting the precise timing of democratization. However, as long as the “fine tuning” implies post-democratization loss in private benefits of control, the inefficient “underdevelopment trap” equilibrium outcome continues to exist.

Some of the less realistic predictions of the model are artifacts of simplification. For example, along the equilibrium path, no expropriation occurs in the model, while we do observe examples of the government’s predatory behavior in real life. Lack of expropriation in the model is due to the fact that we have assumed perfect information and no uncertainty. If we instead assume that the Citizen is imperfectly informed, or there are random shocks to the production function, we extend the set of SPNE by including equilibria involving expropriation of capital along the equilibrium path. Similarly, uncertainty can yield “revolutionary” equilibria, that is, equilibria with conflict-driven democratization.

In our pure-strategy SPNE, no autocracy can survive in the long run, while we do observe non-collapsing autocracies in the real world (e.g. consider China). However, this does not imply that the model contradicts the evidence. The growth prospects might be sufficiently good, so that democratization stage has not yet been reached. Also, we have deliberately confined the attention to a set of parameters under which expropriation

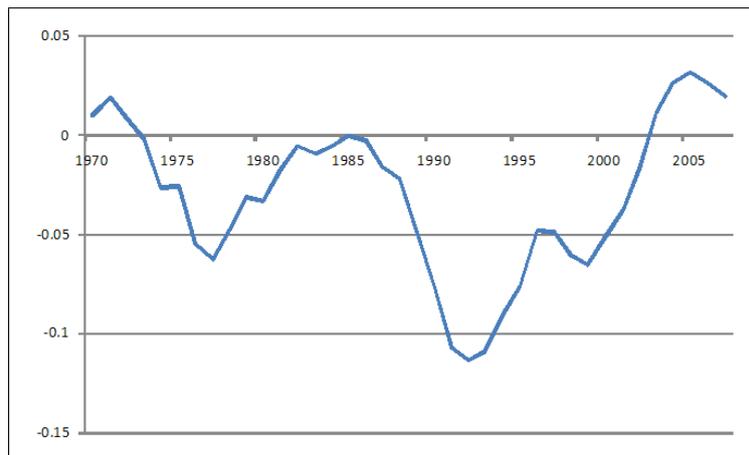


Figure 3. Congo: GDP/capita growth rate, 5-year moving average
Source: Maddison (2009)

is preferred in the steady state. Relaxing this assumption can produce equilibria with an eternal growing autocracy.

Finally, the model predicts that the growth rate declines after democratization. Note that in our model, democratization is, in fact, represented by an improvement in property rights protection. Most empirical studies record the opposite effect – better property right protection spurs growth. This effect can easily be incorporated in the basic framework. For example, we might extend the model to allow for more sectors. If some sectors do not have a diversion opportunity, these sectors will start to accumulate only in the absence of the expropriation threat. That is, democratization will give rise to an additional wave of investment and growth, not attainable under autocracy.

6 Some case studies

The model generates two general classes of development trajectories: either the economy stagnates under an autocratic rule, or it starts growing. In the latter case, the economy may experience early or late democratization. In this section, while not aiming at systematic empirical analysis, we discuss two cases providing support to the patterns predicted by the model: one of stagnation under an autocratic rule, and another - of delayed partial democratization.

There are numerous examples of countries stagnating under a kleptocratic autocracy. Consider, for example, the Democratic Republic of the Congo (former Zaire). This country, abundant in natural resources such as diamonds, uranium, copper and cobalt, until very recently was suffering from extreme inequality and poverty, having an average per capita GDP growth of -2.8% over the last 30 years (see Figure 3). For 32 years (1965-1997), it was under the dictatorship of Joseph Mobutu-Sese Seko. He started his rule by nationalizing foreign-owned firms and handing their management to

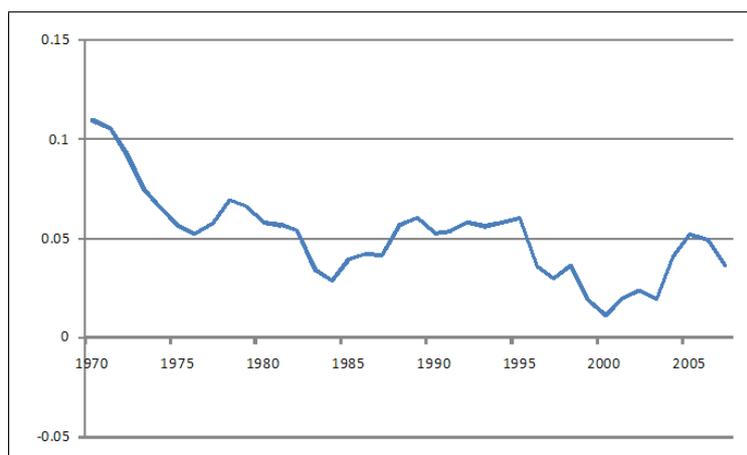


Figure 4. Singapore: GDP/capita growth rate, 5-year moving average.
Source: Maddison (2009)

relatives and close associates who stole the companies' assets. He captured the control over the resource sector and heavily exploited it. By the early 1980s, his personal wealth was estimated at \$5 billion (Leslie 1987), while the rest of the country was basically a subsistence economy (only five per cent of the population were estimated to work in the formal sector during the 1990's). Why was this stagnant path chosen? We propose a two-fold answer: The private benefits of being in control of such a resource-rich economy were high. In addition, there was no institutional way in Congo to guarantee Mobutu a sufficient part of the returns (including the natural sector rents) in case he were to limit his expropriative power.¹⁷ Therefore, Mobutu was willing to forgo the potential future gains from capital accumulation for the immediate benefits of the resource extraction.

Let us now turn to an example illustrating democratization mechanism in practice. Consider the case of Singapore. Being a one-party state with Prime Minister Lee Kuan Yew holding his position for more than 30 years (from 1959 to 1990). Singapore is believed to have relatively authoritarian regime (the Polity IV database measures the constraints on executive power by 3 out of 7). However, as documented by Yap (2003), there are several episodes in the recent history of Singapore when the government creates commitment mechanisms to avoid private sector divestment. Consider, in particular, the period 1985-1986. As can be seen from Figure 4, the per capita GDP growth rates in Singapore were declining from the early 1970 towards the mid-1980s. In 1985, after a period of growth rate decline, the government introduced several policy changes aimed at increasing the private sector's monitoring of and participation in policy setting. To name just a few, the government replaced the Finance Minister with a former pri-

¹⁷In this sense, Congo differed markedly from Botswana where, as argued by Acemoglu et al. (2003), the institutional reforms were not challenging the stability of the elite.

vate sector leader, while returning budgetary policy-making to the Finance Ministry. It pursued a policy of divestment of state ownership in the public-private joint-ownership enterprises. It created an Economic Review Committee, comprising six business representatives and six government representatives to reexamine the government's ten-year Economic Development Plan. While these measures did not change the actual political regime in Singapore, they clearly imposed additional constraints on the government's authority, demonstrating its commitment to non-expropriative policies. Moreover, the attempts to improve the credibility were not a regular practice of the Singaporean government (Yap (2003)), but rather a peculiar characteristic of some historical episodes. This piece of evidence, and especially its timing, illustrates the delayed democratization trajectory.

7 Conclusions and Extensions

We have built a model that addresses the interplay between democratization and economic growth. The model suggests that if there are decreasing returns to capital accumulation, the ruler will be tempted to expropriate at high levels of capital and lower levels of growth. Foreseeing this, the investors cease to invest unless the ruler credibly commits not to expropriate. If being in power is not associated with high private benefits, the ruler self-imposes institutional checks and balances to protect entrepreneurs' property rights. In this case, democratization occurs after a period of sustained growth, unless the initial capital is so high that the ruler is tempted to expropriate even before growth starts. In the latter case, democratization precedes growth. If instead the benefits of control are high, the autocrat sacrifices capital accumulation to keep these benefits. Such an economy never develops.

The model can be extended in several directions. One extension is to study how competition between rulers influences the incentives to cling to power. The threat of being overthrown tomorrow increases the relative value of current payoff and strengthens the incentive to expropriate which, in turn, is recognized by the private sector. This leads to earlier democratization. At the same time, the prospects of future democratization weaken the incentives to cling to power. Therefore, in our setting, competition for power is expected to yield earlier democratization in growing economies. The intensity of the power struggle would also depend on the development path – stagnating economies are expected to face more violent power conflicts, while growing economies would experience less violent conflicts as the time of democratization approaches. Alternatively, one can study oscillating regimes, allowing for a conflict technology so that citizens can replace the ruler and the ruler can mount a coup to return to power.

Another extension is to consider different types of growth. If growth is driven by

improvement in the quality of products, each of the products is on the market only for a limited period of time. Thus, the incentive to grab for a ruler increases as the product may not be around tomorrow. This would lead to earlier democratization. One important prediction of this extension would be as follows: Acemoglu, Aghion and Zilibotti (2006) suggest the growth strategy of less developed countries is investment-based, while more developed economies switch to innovation-based growth. Thus, we may expect earlier democratization in more technologically advanced countries.

References

- [1] D. Acemoglu, Why not a political Coase theorem? Social conflict, commitment, and politics, *Journal of Comparative Economics* 31 (4) (2003) 620–652.
- [2] D. Acemoglu, P. Aghion, F. Zilibotti, Distance to frontier, selection, and economic growth, *Journal of the European Economic Association* 4 (1) (2006) 37–74.
- [3] D. Acemoglu, S. Johnson, J. Robinson, Institutions as the fundamental cause of long-run growth, in: P. Aghion, S. Durlauf (eds.), *Handbook of Economic Growth*, vol. 1, Part A, 1st ed., chap. 06, Elsevier, 2005, pp. 385–472.
- [4] D. Acemoglu, S. Johnson, J. Robinson, P. Yared, Income and democracy, *American Economic Review* 98 (3) (2008) 808–842.
- [5] D. Acemoglu, S. Johnson, J. A. Robinson, Reversal of fortune: Geography and institutions in the making of the modern world income distribution, *Quarterly Journal of Economics* 118 (2002) 1231–1294.
- [6] D. Acemoglu, S. Johnson, J. A. Robinson, *An African Success Story: Botswana*, Princeton University Press, 2003.
- [7] D. Acemoglu, S. Johnson, J. A. Robinson, The rise of Europe: Atlantic trade, institutional change and economic growth, *American Economic Review* 95 (3) (2005) 546–579.
- [8] D. Acemoglu, J. A. Robinson, Why did the West extend the franchise? Democracy, inequality, and growth in historical perspective, *The Quarterly Journal of Economics* 115 (4) (2000) 1167–1199.
- [9] D. Acemoglu, J. A. Robinson, A theory of political transitions, *American Economic Review* 91 (4) (2001) 938–963.
- [10] H. Almeida, D. Ferreira, Democracy and the variability of economic performance, *Economics and Politics* 14 (3) (2002) 225–257.
- [11] M. E. Alvarez, A. Przeworski, J. A. Cheibub, F. Limongi, *Democracy and Development: Political Institutions and Well-Being in the World, 1950-1990*, Cambridge: Cambridge University Press, 2000.

- [12] J.-P. Azam, R. H. Bates, B. Biaï, Political predation and economic development, *Economics and Politics* 21 (2) (2009) 255–277.
- [13] R. J. Barro, Determinants of democracy, *Journal of Political Economy* 107 (S6) (1999) 158–183.
- [14] T. Besley, Monopsony and time-consistency: Sustainable pricing policies for perennial crops, *Review of Development Economics* 1 (1) (1997) 57–70.
- [15] T. J. Besley, M. Ghatak, Property rights and economic development, CEPR Discussion Papers 7243, C.E.P.R. Discussion Papers (2009).
- [16] T. J. Besley, M. Kudamatsu, Making autocracy work, in: E. Helpman (ed.), *Institutions and Economic Performance*, chap. 11, Harvard University Press, 2008, pp. 452–510.
- [17] C. Boix, S. Stokes, Endogenous democratisation, *World Politics* 55 (4) (2003) 517–549.
- [18] A. Boschini, J. Pettersson, J. Roine, Resource curse or not: A question of appropriability, *Scandinavian Journal of Economics* 109 (3) (2007) 593–617.
- [19] P. Collier, *The bottom billion: Why are the poorest countries failing and what can be done about it*, Oxford University Press, Oxford, England, 2007.
- [20] P. Collier, A. Hoeffler, *Democracy and resource rents*, GPRG Working Papers 016, Global Poverty Research Group, Oxford, UK (2005).
- [21] S. Djankov, E. L. Glaeser, R. L. Porta, F. L. de Silanes, A. Shleifer, The new comparative economics, *Journal of Comparative Economics* 31 (4) (2003) 595–619.
- [22] G. Egorov, S. M. Guriev, K. Sonin, Why resource-poor dictators allow freer media: A theory and evidence from panel data, *American Political Science Review* 103 (4) (2009) 645–668.
- [23] M. Gradstein, Inequality, democracy and the emergence of institutions, CEPR Discussion Papers 4187, C.E.P.R. (2004).
- [24] F. Gul, H. Sonnenschein, R. Wilson, Foundations of dynamic monopoly and the Coase conjecture, *Journal of Economic Theory* 39 (1) (1986) 155–190.
- [25] T. Gylfason, Natural resources, education, and economic development, *European Economic Review* 45 (4-6) (2001) 847–859.
- [26] T. Gylfason, G. Zoega, Natural resources and economic growth: The role of investment, *The World Economy* 29 (8) (2006) 1091–1115.
- [27] A. Maddison, *Statistics on world population, GDP and per capita GDP, 1-2008 ad*, <http://www.ggdc.net/MADDISON/oriindex.htm> (2009).
- [28] M. C. McGuire, M. O. Jr., The economics of autocracy and majority rule: The

- invisible hand and the use of force, *Journal of Economic Literature* 34 (1) (1996) 72–96.
- [29] H. Mehlum, K. Moene, R. Torvik, Institutions and the resource curse, *Economic Journal* 116 (508) (2006) 1–20.
- [30] R. B. Myerson, Capitalist investment and political liberalization, *Theoretical Economics* 5 (1) (2010) 73–91.
- [31] D. C. North, R. P. Thomas, An economic theory of the growth of the western world, *The Economic History Review* XXIII (1) (1970) 1–17.
- [32] D. C. North, B. R. Weingast, Constitutions and commitment: Evolution of institutions governing public choice in seventeenth century england, *Journal of Economic History* 49 (1989) 803–832.
- [33] M. Olson, Dictatorship, democracy, and development, *The American Political Science Review* 87 (3) (1993) 567–576.
- [34] E. Papaioannou, G. Siourounis, Democratisation and growth, *Economic Journal* 118 (532) (2008) 1520–1551.
- [35] T. Persson, Forms of democracy, policy and economic development, NBER Working Papers 11171, National Bureau of Economic Research (2005).
- [36] T. Persson, G. Tabellini, Democracy and development: The devil in the details, *American Economic Review* 96 (2) (2006) 319–324.
- [37] T. Persson, G. Tabellini, Democratic capital: The nexus of political and economic change, *American Economic Journal: Macroeconomics* 1 (2) (2009) 88–126.
- [38] A. Przeworski, The last instance: Are institutions the primary cause of economic development?, *European Journal of Sociology* 45 (2) (2004) 165–188.
- [39] A. Przeworski, F. Limongi, Political regimes and economic growth, *Journal of Economic Perspectives* 7 (3) (1993) 51–69.
- [40] J. A. Robinson, R. Torvik, T. Verdier, Political foundations of the resource curse, *Journal of Development Economics* 79 (2) (2006) 447–468.
- [41] M. M. Ross, The political economy of the resource curse, *World Politics* 51 (1999) 297–322.
- [42] M. M. Ross, Does oil hinder democracy?, *World Politics* 53 (2001) 325–361.
- [43] J. D. Sachs, A. M. Warner, Natural resource abundance and economic growth, NBER Working Papers 5398, National Bureau of Economic Research (1995).
- [44] X. Sala-i-Martin, A. Subramanian, Addressing the natural resource curse: An illustration from Nigeria, NBER Working Papers 9804, National Bureau of Economic Research (Jun. 2003).

A Appendix

A.1 Proof of Lemma 1

Assume that the Citizen is facing a flow of taxes $\{\tau_t\}$, $t = 1, \dots, \infty$. In the equilibrium in consideration each citizen takes taxes as given. Indeed, her unilateral deviation has no impact on the choices of the Ruler and thus her investment decision could not affect taxes. Citizen's problem then becomes

$$\begin{aligned} \max \sum_{t=0}^{\infty} \beta^t \ln c_t \\ \text{s.t. } K_{t+1} = AK_t^\alpha - (1 + \tau_t)c_t, \end{aligned}$$

and the solution is

$$\begin{aligned} c_t &= \frac{(1 - \alpha\beta) AK_t^\alpha}{(1 + \tau_t)}, \\ K_{t+1} &= \alpha\beta AK_t^\alpha. \end{aligned}$$

Thus, it is only the consumption profile $\{c_t\}$ that changes as compared to the benchmark case (1), while capital accumulation is unaffected by τ_t .

A.2 Proof of Lemma 2

As follows from Lemma 1, at each point in time t , the Ruler solves the problem

$$\max_{\{\tau_i\}} \sum_{i=t}^{\infty} \beta^{i-t} (\tau_i c_i - \Phi(\tau_i c_i)) = \max_{\{\tau_i\}} \sum_{i=t}^{\infty} \beta^{i-t} (\tau_i - \phi(\tau_i)) \left(\frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_i)} \right). \quad (8)$$

In the absence of the Citizen's diversion opportunity, the solution of (8) does not depend on past taxes, i.e. the Ruler can set each period's tax separately. The respective FOC are

$$1 - \phi'(\tau_i)(1 + \tau_i) + \phi(\tau_i) = 0. \quad (9)$$

As $\phi' > 0$, the RHS of (9) decreases in τ_i . Moreover, it is positive at $\tau_i = 0$ and negative at $\tau_i \rightarrow \infty$. Thus, there is a unique $\tau_i \equiv \tau_A$ satisfying FOC and, as SOC are met, τ_A is the maximum point.

A.3 Proof of Lemma 3

Consider a symmetric SPNE of this subgame. First, note that given assumption **(A2)**, the Citizen chooses to stay in the market for any tax schedule. Indeed, at any point in time t , the Citizen's payoff from staying in the market is at least as high as her payoff

when the Ruler taxes at the rate τ_D :

$$V^S(\tau_t, \tau_{t+1}, \tau_{t+2}, \dots) \geq \sum_{i=t}^{\infty} \beta^{i-t} \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_D)},$$

while her payoff from leaving the market is $V^L = L$. The latter one is below the post-democratization payoff by **(A1)**, **(A2)**, and the fact that K_t increases over time¹⁸

$$\sum_{i=t}^{\infty} \beta^{i-t} \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_D)} \geq \sum_{i=0}^{\infty} \beta^i \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_D)} \geq \sum_{i=0}^{\infty} \beta^i \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_A)} \geq L,$$

That is, after democratization, the Citizen always prefers staying in the market to leaving for the alternative sector:

$$V^S(\tau_t, \tau_{t+1}, \tau_{t+2}, \dots) > V^L.$$

Thus, in any SPNE, the Ruler can choose the tax schedule that brings her the maximal payoff given the post-democratization tax restrictions. As $\tau_D < \tau_A$, the Ruler's payoff increases with each period's tax. So in every post-democratization period $\tau_t = \tau_D$.

A.4 Proof of Corollary 1

If there is no expropriation along the game path, the maximum tax the Ruler would set is τ_A . Thus, the Citizen's payoff from staying will never be below

$$\underline{V} = \sum_{i=t}^{\infty} \beta^{i-t} \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_A)}.$$

But, as capital accumulates, the latter is always above the payoff from leaving:

$$V^S(\tau_t, \tau_{t+1}, \tau_{t+2}, \dots) \geq \underline{V} = \sum_{i=t}^{\infty} \beta^{i-t} \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_A)} \geq \sum_{i=0}^{\infty} \beta^i \ln \frac{(1 - \alpha\beta) AK_i^\alpha}{(1 + \tau_A)} > L.$$

So, along the non-expropriation game path, the Ruler always chooses τ_A while in power and τ_D after democratization.

A.5 Proof of Lemma 4

Consider a subgame starting at stage 3 of some period t . At this stage, the Ruler chooses between immediate expropriation and possible continuation options. For the reasons mentioned in informal proof, the continuation games to be taken into consideration are those where the game "ends" by democratization at some future period $t + \tilde{t}$ or continues forever. More precisely, all continuation strategies consistent with SPNE belong to the

¹⁸Here we assume that the capital level at which the Ruler chooses to democratize is at least as high as K_0 . We will see below that this assumption will always hold along the game path of the SPNE.

set:

$$S_t \equiv \left\{ \left\{ s_t^{D_{t+\tilde{t}}} \right\}_{\tilde{t}=1,2,\dots}, s_t^{ND} \right\} \quad (10)$$

where

$$s_t^{D_{t+\tilde{t}}} \equiv (\tau_t, ND_{t+i}, NE_{t+i}, \tau_{t+i} \quad i = 1, \dots, \tilde{t} - 1, D_{t+\tilde{t}}), \tilde{t} = 1, 2, \dots;$$

are all continuation strategies where taxation is followed by democratization in period \tilde{t} , and

$$s_t^{ND} \equiv (\tau_t, ND_{t+i}, NE_{t+i}, \tau_{t+i}, \quad i = 1, \dots, \infty)$$

denotes a strategy, where democratization never occurs and taxation is continued forever.

Start by finding the maximum payoff the Ruler gets if she taxes forever. As the Citizen has the option of leaving the market, the Ruler's payoff cannot exceed the payoff characterized in Lemma 2¹⁹

$$U(s_t^{ND}) \leq \sum_{i=t}^{\infty} \beta^{i-t} \varepsilon_A A K_i^\alpha + \frac{b}{1-\beta} \equiv \bar{U}_t.$$

Now find the maximum payoff the Ruler can achieve in continuation games where she eventually democratizes. This problem differs from the problem faced by the Ruler under eternal taxation by an additional constraint on post-democratization taxes; after democratization, the tax rate is no higher than τ_D . Thus, the maximum payoff achieved by the Ruler in such a continuation game cannot be greater than that under eternal taxation

$$U(s_t^{D_{t+\tilde{t}}}) \leq \bar{U}_t \quad \tilde{t} = 1, 2, \dots$$

Consider the choice of the Ruler at stage 3 of period t . Let us show that for sufficiently large t , the Ruler prefers expropriation over any other continuation strategy (which, as shown above, yields no more than \bar{U}_t). The value of expropriating at t is

$$U(E_t) = AK_t^\alpha + \sum_{i=t}^{\infty} \beta^{i-t} b = y_t + \frac{b}{1-\beta}.$$

The difference between the Ruler's expropriation payoff and the maximal Ruler's payoff in any continuation game is

$$U(E_t) - \bar{U}_t = y_t - \sum_{i=t}^{\infty} \beta^{i-t} \varepsilon_A A K_i^\alpha > y_t - \sum_{i=t}^{\infty} \beta^{i-t} \varepsilon_A y^* = y_t - y^* + \left(1 - \frac{\varepsilon_A}{1-\beta}\right) y^*.$$

It is positive as long as y_{t+1} is sufficiently close to y^* (i.e., $\Delta y_{t+1} = y^* - y_{t+1}$ is

¹⁹Including Citizen's participation constraints into the Ruler's optimization problem can only add some additional restrictions and decrease the Ruler's maximum utility.

sufficiently small), as $1 - \frac{\varepsilon_A}{(1-\beta)} > 0$. That is, there exists such a time period T that in any SPNE, the Ruler chooses to expropriate at date T .

A.6 Proof of Lemma 5

The difference between the payoff from non-expropriation and the payoff from expropriation in period $t - 1$ is given by

$$U(NE_{t-1}, \tau_A, D_t) - U(E_{t-1}) = \varepsilon_D \sum_{i=1}^{\infty} \beta^i y_{t-1+i} - (1 - \varepsilon_A) y_{t-1} - B, \quad (11)$$

where B denotes the flow of the private benefits of control as of tomorrow, $B = b\beta / (1 - \beta)$.

As the taxation in our model does not influence the capital development path, a capital level in each time period $t + i$ is given by

$$K_{t+i} = (\alpha\beta A)^{\frac{1-\alpha^i}{1-\alpha}} (K_t)^{\alpha^i} \quad (12)$$

and the output is

$$y_{t+i} = AK_{t+i}^\alpha = A(\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (K_t)^{\alpha^{i+1}}. \quad (13)$$

Thus, equation (11) is equivalent to

$$U(NE_{t-1}, \tau_A, D_t) - U(E_{t-1}) = \varepsilon_D A \sum_{i=1}^{\infty} \beta^i (\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (K_{t-1})^{\alpha^{i+1}} - (1 - \varepsilon_A) AK_{t-1}^\alpha - B.$$

Let us introduce an auxiliary continuous function of the capital

$$F(k) = \varepsilon_D A \sum_{i=1}^{\infty} \beta^i (\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} k^{\alpha^{i+1}} - (1 - \varepsilon_A) Ak^\alpha - B.$$

$F(K_{t-1})$ represents the difference between the Ruler's value of non-expropriation in period $t - 1$, followed by democratization in period t , and expropriation at stage 3 of period $t - 1$ as a function of the capital K_{t-1} . The derivative of $F(k)$ declines over time, with $F'(0) > 0$ and $F'(K^*) < 0$. Indeed,

$$\begin{aligned} \partial F(k) / \partial k &= \alpha/k \left[\varepsilon_D A \sum_{i=1}^{\infty} \beta^i \alpha^i (\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (k)^{\alpha^{i+1}} - (1 - \varepsilon_A) Ak^\alpha \right] \\ &= \alpha Ak^{\alpha-1} \left[\varepsilon_D \sum_{i=1}^{\infty} \beta^i \alpha^i (\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (k)^{\alpha(\alpha^i-1)} - (1 - \varepsilon_A) \right]. \end{aligned}$$

As $k \rightarrow 0$, the expression in square brackets becomes infinitely large. On the other hand, at $k = K^*$, the expression in brackets equals

$$\varepsilon_D \frac{\alpha\beta}{1 - \alpha\beta} - (1 - \varepsilon_A) < \varepsilon_A \frac{1}{1 - \alpha\beta} - 1 = \frac{\tau_A - \phi(\tau_A)}{1 + \tau_A} - 1 < 0.$$

As $F'(k)$ is also continuous, there exists a threshold value \tilde{k} , such that

$$\begin{aligned}\frac{\partial F(k)}{\partial k} &\geq 0, k \leq \tilde{k} \\ \frac{\partial F(k)}{\partial k} &\leq 0, k > \tilde{k}\end{aligned}$$

and, consequently, $F(k)$ increases for $k \leq \tilde{k}$, reaches its maximum at \tilde{k} and decreases for $k > \tilde{k}$. Note that $F(0) = -B \leq 0$ and

$$F(K^*) = A(K^*)^\alpha \left(\frac{\varepsilon_D}{(1-\beta)} - 1 \right) - B < 0.$$

Therefore, if in the economy in consideration $K_0 > \tilde{k}$, the peak of the expression $U(NE_{t-1}, \tau_A, D_t) - U(E_{t-1})$ corresponds to period $\tilde{t} = 1$. If instead $K_0 < \tilde{k}$, the maximum of $U(NE_{t-1}, \tau_A, D_t) - U(E_{t-1})$ is achieved in period \tilde{t} , such that

$$\left| K_{\tilde{t}-1} - \tilde{k} \right| = \min_t \left| K_{t-1} - \tilde{k} \right|.^{20}$$

A.7 Proof of Lemma 6

Consider the difference between the ratio of democratization payoff to the payoff to expropriation, both net of private benefits of control, for two subsequent periods

$$\frac{U(NE_{t-1}, \tau_A, D_t) - b}{y_{t-1}} - \frac{U(NE_{t-2}, \tau_A, D_{t-1}) - b}{y_{t-2}} = \varepsilon_D \sum_{i=0}^{\infty} \beta^{i+1} \left[\frac{y_{i+t}}{y_{t-1}} - \frac{y_{i+t-1}}{y_{t-2}} \right].$$

As the growth rate of output is decreasing,

$$\frac{y_t}{y_{t-1}} > \frac{y_{i+t}}{y_{i+t-1}} \Leftrightarrow \frac{y_{i+t}}{y_t} - \frac{y_{i+t-1}}{y_{t-1}} < 0.$$

The latter condition is equivalent to

$$\frac{U(NE_{t-1}, \tau_A, D_t) - b}{y_{t-1}} - \frac{U(NE_{t-2}, \tau_A, D_{t-1}) - b}{y_{t-2}} < 0.$$

A.8 Proof of Lemma 7

The Ruler's expropriation payoff at the period $t^d - 2$ is

$$U(E_{t^d-2}) = y_{t^d-2} + \frac{b}{1-\beta}.$$

If she does not expropriate, she sets tax τ_A and receives private benefits for periods $t^d - 2$ and $t^d - 1$, and democratizes at stage 1 of period t^d

$$U(NE_{t^d-2}, \tau_A, ND_{t^d-1}, NE_{t^d-1}, \tau_A, D_{t^d}) = \varepsilon_A y_{t^d-2} + b + \beta [U(NE_{t^d-1}, \tau_A, D_{t^d})].$$

By definition of t^d , at stage 3 of period $t^d - 1$, the Ruler prefers non-expropriation followed by democratization to the expropriation

$$U(NE_{t^d-1}, \tau_A, D_{t^d}) > U(E_{t^d-1}) = y_{t^d-1} + \frac{b}{1-\beta}. \quad (14)$$

Using inequality (14), we see that the payoff from taxing at $t^d - 2$ and $t^d - 1$ and democratizing at t^d is higher than that from taxing at $t^d - 2$ and expropriating at $t^d - 1$

$$\begin{aligned} U(NE_{t^d-2}, \tau_A, ND_{t^d-1}, NE_{t^d-1}, \tau_A, D_{t^d}) &> \varepsilon_A y_{t^d-2} + b + \beta U(E_{t^d-1}) \\ &= \varepsilon_A y_{t^d-2} + \beta y_{t^d-1} + \frac{b}{1-\beta}. \end{aligned}$$

If we can now show that in period $t^d - 2$, the growth rate is sufficiently high, so that the Ruler gains by taxing and postponing expropriation by one period

$$\varepsilon_A y_{t^d-2} + \beta y_{t^d-1} > y_{t^d-2}, \quad (15)$$

we can conclude that

$$U(NE_{t^d-2}, \tau_A, ND_{t^d-1}, NE_{t^d-1}, \tau_A, D_{t^d}) > U(E_{t^d-2}).$$

We prove that inequality (15) holds by contradiction. Suppose it does not hold, or, equivalently, that

$$\frac{y_{t^d}}{y_{t^d-1}} < \frac{1-\varepsilon_A}{\beta}. \quad (16)$$

Inequality (14) implies that

$$\begin{aligned} U(NE_{t^d-1}, \tau_A, D_{t^d}) - b &> y_{t^d-1} \Leftrightarrow \\ \varepsilon_A y_{t^d-1} + \varepsilon_D \sum_{i=0}^{\infty} \beta^{i+1} y_{i+t^d-1} &> y_{t^d-1}. \end{aligned}$$

From Lemma 6, it follows that the same holds at stage 3 of period $t^d - 2$,

$$\varepsilon_A y_{t^d-2} + \varepsilon_D \sum_{i=0}^{\infty} \beta^{i+1} y_{i+t^d-2} > y_{t^d-2},$$

or equivalently,

$$\sum_{i=0}^{\infty} \beta^i \varepsilon_D \frac{y_{i+t^d-1}}{y_{t^d-2}} > 1 - \varepsilon_A. \quad (17)$$

The output in our model is growing at a decreasing rate. Using inequality (16), we have

$$\frac{y_{t^d-1+i}}{y_{t^d-2}} = \frac{y_{t^d-1+i}}{y_{t^d-1+i-1}} \frac{y_{t^d-1+i-1}}{y_{t^d-1+i-2}} \dots \frac{y_{t^d-1}}{y_{t^d-2}} < \left(\frac{1-\varepsilon_A}{\beta} \right)^{i+1}.$$

As a result, at stage 3 of period $t^d - 2$, the ratio of tomorrow's democratization payoff net private benefits of control to the expropriated output must be below $1 - \varepsilon_A$. Indeed,

$$\sum_{i=0}^{\infty} \beta^{i+1} \varepsilon_D \frac{y_{i+t^d-1}}{y_{t^d-2}} < \sum_{i=0}^{\infty} \beta^{i+1} \varepsilon_D \left(\frac{1-\varepsilon_A}{\beta} \right)^{i+1} = (1-\varepsilon_A) \frac{\varepsilon_D}{\varepsilon_A}.$$

As $\varepsilon_D < \varepsilon_A$, we conclude that

$$\sum_{i=0}^{\infty} \beta^i \varepsilon_D \frac{y_{i+t^d-1}}{y_{t^d-2}} < 1 - \varepsilon_A,$$

contradicting inequality (17).

A.9 Proof of non-emptiness of the sets Ω_{DD} , Ω_{ID} and Ω_U .

Assume that $b = 0$, and consider the difference between the payoffs from expropriation and non-expropriation (followed by democratization) in the initial period $t = 0$. As output is increasing over time,

$$\begin{aligned} U(NE_0, \tau_A, D_1) - U(E_0) &= \varepsilon_D \sum_{t=1}^{\infty} \beta^t y_t - (1 - \varepsilon_A) y_0 > \varepsilon_D \sum_{t=1}^{\infty} \beta^t y_1 - (1 - \varepsilon_A) y_0 \\ &= y_0 \left[\frac{\varepsilon_D \beta}{1 - \beta} \frac{y_1}{y_0} - (1 - \varepsilon_A) \right]. \end{aligned} \quad (18)$$

For given values of $(\varepsilon_A, \varepsilon_D, \beta, A)$, if the initial capital is sufficiently low, the growth rate in the first period

$$\frac{y_1}{y_0} = \left(\alpha \beta A K_0^{(\alpha-1)} \right)^\alpha$$

is sufficiently high for expression (18) to be positive. Continuity ensures that the same holds for small positive b . By Lemma 5

$$U(NE_{\tilde{t}}, \tau_A, D_{\tilde{t}+1}) - U(E_{\tilde{t}}) \geq U(NE_0, \tau_A, D_1) - U(E_0) > 0,$$

which proves the non-emptiness of the set Ω_{DD} .

Alternatively, consider the peak period \tilde{t} . As output increases towards the steady-state value y^* ,

$$\begin{aligned} U(NE_{\tilde{t}}, \tau_A, D_{\tilde{t}+1}) - U(E_{\tilde{t}}) &= \varepsilon_D \sum_{i=1}^{\infty} \beta^i y_{\tilde{t}+i} - (1 - \varepsilon_A) y_{\tilde{t}} - \frac{\beta b}{1 - \beta} \\ &< \varepsilon_D \sum_{i=1}^{\infty} \beta^i y^* - (1 - \varepsilon_A) y_{\tilde{t}} - \frac{\beta b}{1 - \beta}. \end{aligned} \quad (19)$$

Due to the separability of the payoff function, \tilde{t} is independent of b . Given $(\varepsilon_A, \varepsilon_D, \beta, A, K_0)$, choose a sufficiently high b so that

$$\varepsilon_D \sum_{i=1}^{\infty} \beta^i y^* - \frac{\beta b}{1 - \beta} < (1 - \varepsilon_A) y_{\tilde{t}}.$$

Hence, expression (19) is negative and condition (ii) holds. If, for example, the econ-

omy is close to the steady state, $y_0 \approx y^*$, one can choose an intermediate level of b so that

$$0 < \varepsilon_D \sum_{i=1}^{\infty} \beta^i y_i - \frac{\beta b}{1-\beta} = U(D_0) - U(ND_0) \approx \varepsilon_D \sum_{i=1}^{\infty} \beta^i y^* - \frac{\beta b}{1-\beta} < (1 - \varepsilon_A) y_{\hat{t}}.$$

which means that the resulting set of parameters belongs to Ω_{ID} . If instead b is set to be very high, then

$$U(D_0) - U(ND_0) < \varepsilon_D \sum_{i=1}^{\infty} \beta^i y^* - \frac{\beta b}{1-\beta} < 0$$

i.e., the considered parameters belong to the set Ω_U .

A.10 Proof of Proposition 4

Consider an economy with the initial capital K_0 where democratization occurs at date $\hat{t} > 0$, i.e. where

$$U(NE_{\hat{t}-1}, \tau_A, D_{\hat{t}})(K_0) - U(E_{\hat{t}-1})(K_0) > 0, \quad (20)$$

$$U(NE_{\hat{t}+j-1}, \tau_A, D_{\hat{t}+j})(K_0) - U(E_{\hat{t}+j-1})(K_0) < 0, j = 1, \dots, \infty, \quad (21)$$

or, with the use of the auxiliary function $F(k)$ introduced in the proof of Lemma 5

$$F(K_{\hat{t}-1}) > 0, \quad (22)$$

$$F(K_{\hat{t}+j}) < 0, j = 0, \dots, \infty. \quad (23)$$

There are two possibilities depending of the parameters of the model:

Case A. There exists a capital level $k > 0$, such that $F(k) > 0$. Then the discussion in the proof of Lemma 5 implies that $F(\tilde{k}) > 0$, and there exist \underline{k}, \bar{k} , such that $\underline{k} \leq \tilde{k} \leq \bar{k}$, and

$$F(\underline{k}) = F(\bar{k}) = 0. \quad (24)$$

In such an economy, if the initial capital is sufficiently low ($K_0 < \bar{k}$), democratization occurs in period t such that

$$\underline{k} \leq K_{t-1} \leq \bar{k}, \quad (25)$$

$$K_{t+j} > \bar{k}, j = 0, \dots, \infty, \quad (26)$$

which is equivalent to inequalities (22),(23). Further, non-expropriation condition (22) holds at the capital level K_{t-1} , so the Ruler prefers democratization to keeping power only with control benefits and no market production at the capital level K_t (or, in other words, at stage 1 of period t)

$$U(D_t) > U(ND_t), \quad (27)$$

as shown in condition (5). Following this argument, if the initial capital K_0 exceeds \bar{k} , the ruler democratizes in period $t = 0$.

Now consider two economies, one starting with the initial capital K_0 , and another with the initial capital $K'_0 > K_0$, all other things equal. As $K'_0 > K_0$, it implies that

$$K'_j > K_j, j = 1, \dots, \infty. \quad (28)$$

First, assume that the initial capital $K_0 > \bar{k}$, so that democratization in this economy occurs in the initial period $t = 0$. Then in the second economy with $K'_0 > K_0 > \bar{k}$ democratization also occurs at $t = 0$. Indeed, the democratization payoff at $t = 0$

$$U(D_0)(k) = \varepsilon_D A \sum_{i=0}^{\infty} \beta^i (\alpha \beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (k)^{\alpha^{i+1}}$$

is increasing in k , while the payoff of sustaining the autocratic regime with no market production $U(ND_0) = b/(1 - \beta)$ is constant. Thus, if inequality (27) holds for K_0 , it also holds for $K'_0 > K_0$.

Assume instead that K_0 is not very high so that democratization in the first economy occurs at date $t > 0$, i.e., the system (25)-(26) holds. From (28) we conclude that in the economy with the initial capital K'_0 democratization cannot occur after period t , as

$$K'_{t+j} > K_{t+j} > \bar{k}, j = 0, \dots, \infty.$$

Moreover, if the difference between K'_0 and K_0 is sufficiently large, it may be the case that $K'_t > \bar{k}$, or, equivalently, that $F(K'_t) < 0$, which implies that democratization in the second economy occurs strictly before period t .

There is a subtle point in this argument: if the set of parameter values is such that the "democratization segment" $[\underline{k}, \bar{k}]$ where $F(k)$ is positive (i.e. the Ruler prefers democratization over expropriation), is too small, it may be the case that a particular capital accumulation path $(K'_0, K'_1, \dots, K'_t, \dots)$ "misses" it. That is, there exists a t' , such that

$$K'_0 < K'_1 < \dots < K'_{t'} < \underline{k} \leq \bar{k} < K'_{t'+1} < \dots$$

In such an economy, democratization either occurs in the very initial period (if K'_0 is sufficiently high) or never takes place. In this case, an increase in initial capital is not necessarily associated with the (weakly) earlier democratization. For example, it may be the case that in the economy with initial capital K_0 , democratization occurs at some period $t > 0$ where

$$\underline{k} \leq K_{t-1} \leq \bar{k} < K_t,$$

while in the economy with initial capital $K'_0 > K_0$, democratization never occurs. Such a situation is purely an artefact of the discrete nature of our game. One simple way

of avoiding it is to assume that the adoption of technology requires a minimum initial capital/savings $K_{0\min}$, so that for any initial capital below $K_{0\min}$ the country cannot accumulate capital.

Let $K_{0\min}$ be chosen as follows: Consider an equation $F(k) = C$, where C is a (possibly negative) constant. As argued above, for sufficiently low values of C this equation has two roots. Choose the level of C to ensure that the roots of this equation $\underline{k}^C < \overline{k}^C$ satisfy

$$\overline{k}^C = \alpha\beta A (\underline{k}^C)^\alpha, \quad (29)$$

or, in other words, that \overline{k}^C is obtained from \underline{k}^C via the capital accumulation path (1). Set $K_{0\min}$ equal to the larger root \overline{k}^C .

Our case A then naturally transforms into an assumption that there exists a $k \geq K_{0\min}$ with

$$F(k) > 0. \quad (30)$$

For any initial capital below $K_{0\min}$ the country cannot accumulate capital and get growth going (and thus, no democratization ever occurs). If $K_0 \geq K_{0\min}$, then an increase in initial capital results in a (weakly) earlier democratization. To see this, note that condition (30) and the definition of $K_{0\min}$ imply that $F(K_{0\min}) > 0$. Thereby, if $F(K_0) > 0$, a small increase in K_0 means that the economy is getting closer to the “democratization frontier” \overline{k} . Further, if the initial capital is above \overline{k} (i.e. $F(K_0) < 0$) then the country faces an immediate democratization. This follows from the observation that for all capital levels above $K_{0\min}$ the Ruler prefers democratization to staying in power only with control benefits and no market production. Indeed, the definitions of \underline{k}_C , \overline{k}^C and $K_{0\min}$ imply that

$$F(\underline{k}_C) = F(\overline{k}^C) \equiv F(K_{0\min}) > 0. \quad (31)$$

From (29), (31) and (5) it follows that at the capital level $K_{0\min} = \overline{k}^C$ democratization payoff exceeds the value of control benefit flow

$$U(D | K_{0\min}) > U(ND | K_{0\min}) = b/(1 - \beta). \quad (32)$$

As the democratization payoff increases in k , inequality (32) also holds for any $k \geq K_{0\min}$.

To sum up, with this restriction on the minimum productive capital, an increase in K_0 always results in a (weakly) earlier democratization. In our analysis, we will only consider economies with initial capital above $K_{0\min}$.²¹

²¹We believe that this assumption is not very restrictive. For example, the numerical simulation for an economy with parameters $A = 1$, $\alpha = 0.4$, $\tau_d = 0.25$, $\tau_a = 0.4$, $\beta = 0.7$ shows that it takes app. 14

Case B. Alternatively, assume that $F(k) < 0$ for all k (or, more weakly, $F(K_t) < 0$ for any $t = 0, \dots, \infty$). Then the Ruler always prefers expropriation over taxation followed by democratization.

In this case, there is a threshold level of capital $k_{UD}(b)$, such that the value of democratization at k_{UD} is exactly equal to the value of the flow of private benefits:

$$U(D_0|k_{UD}) = \varepsilon_D A \sum_{i=0}^{\infty} \beta^i (\alpha\beta A)^{\alpha \frac{1-\alpha^i}{1-\alpha}} (k_{UD})^{\alpha^{i+1}} = \frac{b}{1-\beta}.$$

As the democratization payoff increases with capital at the point of democratization, for any $K_0 < k_{UD}$, the economy is in the “underdevelopment trap” – the capital is not accumulated and the power is never relinquished. If $K_0 > k_{UD}$, democratization occurs in the initial period $t = 0$.

An increase in initial capital can affect the timing of democratization in only situation when $K_0 < k_{UD} < K'_0$. In this case, in the economy with K_0 , democratization never occurs, while the economy with K'_0 faces an immediate democratization. If both K_0 and K'_0 are below (or above) k_{UD} , a increase from K_0 to K'_0 does not have any impact on democratization.

So, an increase in initial capital leads to a (weakly) earlier democratization.

A.11 Proof of Proposition 5

The Ruler democratizes at the last point in time such that the democratization payoff exceeds the expropriation payoff (see conditions (20)-(21)). This can be rewritten as

$$\varepsilon_D \sum_{i=0}^{\infty} \beta^i \frac{(\alpha\beta A)^{\frac{1-\alpha^{\hat{t}+i+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{\hat{t}+i+1}} > \frac{(\alpha\beta A)^{\frac{1-\alpha^{\hat{t}+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{\hat{t}+1}} + B,$$

$$\varepsilon_D \sum_{i=j}^{\infty} \beta^{i-j} \frac{(\alpha\beta A)^{\frac{1-\alpha^{\hat{t}+i+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{\hat{t}+i+1}} < \frac{(\alpha\beta A)^{\alpha \frac{1-\alpha^{\hat{t}+j+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{\hat{t}+j+1}} + B, \quad j = 1.. \infty,$$

where K_0 is initial capital.

Consider the ratio of the Ruler’s democratization payoff less the private benefit of

periods to (almost) reach the steady state capital $0.9999K^*$, if the economy starts from $K_{0 \min}$. Note that in our model, we have complete depreciation over one period, so a period should be at least 10-15 years, which is also reflected in the value of the discount factor used in simulations.

control to the value of expropriated output in period t :

$$\frac{U(NE_{t-1}, \tau_A, D_t)(K_0) - B}{y_t(K_0)} = \frac{\varepsilon_D \sum_{i=0}^{\infty} \beta^i \frac{(\alpha\beta A)^{\frac{1-\alpha^{t+i+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{t+i+1}} - B}{\frac{(\alpha\beta A)^{\frac{1-\alpha^{t+1}}{1-\alpha}}}{\alpha\beta} (K_0)^{\alpha^{t+1}}}. \quad (33)$$

Democratization occurs at the very last moment when this ratio is above 1. Note that

$$\frac{\partial}{\partial A} \left(\frac{U(NE_{t-1}, \tau_A, D_t)(K_0) - B}{y_t(K_0)} \right) > 0. \quad (34)$$

Consider two economies facing technologies with total factor productivity A and $A' > A$, respectively, and assume that democratization in the former economy occurs at some period \hat{t} . Inequality (34) implies that in all periods t when democratization is preferred under productivity A , it is also preferred under productivity A' . Thus, democratization in the economy with A' cannot occur earlier than in \hat{t} .

On the other hand, assume that an economy with productivity A is in an underdevelopment trap, so that the ratio (33) is always below 1. By (34) $A' > A$ implies higher ratios (33) for all periods t and may, in fact, result in some of these ratios increasing above 1. In this case, higher productivity may cause democratization and growth.

A.12 Proof of Proposition 6

At the upper bound of the “democratization segment” \bar{k} $\partial F(k)/\partial k < 0$ and $\partial F(k)/\partial B < 0$, implying that as B increases, \bar{k} declines. As the capital accumulation path is not affected by B , democratization occurs at (weakly) lower levels of capital or, equivalently, at earlier periods in time. For even higher levels of B , $F(k) < 0$ for any k , the “democratization segment” disappears and the economy falls into the “underdevelopment trap”.

A.13 Proof of Proposition 7

If τ_D (and thus ε_D) is very low, $F(k) < 0$ for any k , and the economy is in the “underdevelopment trap”. If instead the “democratization segment” exists, $\partial F(k)/\partial \tau_D < 0$ and $\partial F(k)/\partial \tau_D > 0$ at the upper bound of the “democratization segment” \bar{k} , implying $\partial \bar{k}/\partial \tau_D > 0$. Therefore, as the capital accumulation path is not affected by τ_D , democratization occurs at (weakly) higher levels of capital or, equivalently, at later periods in time.

A.14 Proof of Proposition 8

Completely analogous to the proof of Proposition 7.