Formal Models of the Political Resource Curse

Desiree A. Desierto*

March 19, 2018

Abstract

By surveying formal models, I demonstrate that the political resource curse is the misallocation of revenues from natural resources and other windfall gains by political agents. I show that the curse always exists if political agents are rent-seeking, since mechanisms of government accountability, e.g. electoral competition, the presence of political challengers, and even the threat of violent conflict, are inherently imperfect. However, the scope for rent-seeking becomes more limited as the competition over political power that threatens the incumbent government becomes more intense.

keywords: resource curse, political rent-seeking

JEL: D72, D73, D74, H41, O5

*WSD Handa Center for Human Rights and International Justice, Stanford University, and Department of Political Science, University of Wisconsin-Madison; desierto@wisc.edu

1 Introduction

When the term 'resource curse' was first coined by Richard Auty (1993), it referred to the apparent negative association between natural resources and economic growth. Sachs and Warner (1995) were among the first who tested and verified this association using cross-country data. This has since spawned a vast empirical literature that have employed various statistical techniques to macro and micro-level data to establish or refute any causal link between proxies for natural resources and economic indicators. Eventually, political variables like governance, institutions, regime-type and conflict have been added to the list of outcomes on which natural resources have a negative impact. The *political* resource curse literature was born.

Does the political resource curse warrant a separate analytical framework that is different from the typical, economic curse? The implicit distinction is that the curse is deemed political if the outcome is political. In surveying the empirical literature, Ross (2015) shows that natural resources, especially oil and petroleum, are robustly associated with lower quality of governance. In particular, they make authoritarian regimes more durable, increase corruption, and raise the likelihood of armed conflict.

The formal political resource curse literature, however, is scant and fragmented. Deacon (2011) and Deacon and Rode (2015) provide a survey of models that generate a resource curse, but they distinguish a political from an economic resource curse purely in terms of outcome.

In this paper, I focus on political resource curse models and propose a definition that encompasses all kinds of political outcomes. Simply put, the political resource curse is the misallocation of revenues from natural resources and other windfall gains by rent-seeking political agents.

In other words, what makes the curse political is that the rent-seeking is done by political agents, as opposed to the private sector. This distinction is key. When the private sector allocates their endowments toward rent-seeking efforts, any deadweight losses from the latter may be offset if rents are sufficiently large. That is, rents may not be fully or more-than-fully dissipated, which implies that aggregate social welfare does not decrease. In contrast, a rent-seeking political agent always allocates resource rents in a socially inefficient manner since her utility function assigns more weight to her own income and/or her patrons' and is thus different from the representative citizen's utility function.

Thus, natural resources and other sources of rents always generate a curse whenever political agents desire rents. Their ability to actually obtain those rents, however, depends on the extent to which such agents can be made accountable to citizens. With greater accountability, the curse is less severe. I formally derive this result in each of the models presented here, in which various mechanisms of government accountability are used, from electoral competition, coalition formation, and the outright threat of violent conflict. The political resource curse is mitigated when the mechanism induces intense competition or contest over political power. In this case, the threat of being replaced is stronger, which constrains the incumbent from too much rent-seeking, thereby limiting the misallocation of revenues.

The next section argues for and provides a more analytically distinct definition of the political resource curse that is based on the identity of rent-seekers, and not on the particular outcome of rent-seeking. In section 3, I present an example of a resource curse model in which all rent-seeking is done by the private sector. This contrasts sharply with various political resource models in section 4 in which political agents capture rents. Section 5 concludes with a summary.

2 The *Political* Resource Curse

The standard definition of the political resource curse as the pernicious effect of natural resources on political outcomes appears to be so commonplace that it is seldom articulated. Since the political resource curse is the "the claim that that natural resource wealth tends to adversely affect a country's governance", Ross naturally organizes his survey of the literature according to specific outcomes that capture the quality of governance. He shows that the most robust empirical findings to date are on the durability of authoritarian regimes and/or fragility of democracies, increased corruption, and greater likelihood of violent conflict.

A widely acknowledged causal mechanism by which natural resources affect political outcomes is the 'rentier effect', which posits that states that have access to natural resource revenues and other types of windfall gains are less reliant on tax revenues, which makes them less responsive to citizens' demands.

Wiens, Post and Clark (2014) provide more nuance by distinguishing between demand-side and supply-side explanations of the political resource curse. From a demand-side perspective, "resource revenues preempt the emergence of demands for governments to democratize." The argument is rooted in Bates and Lien (1985), North and Weingast (1989), and Tilly (1992), in which leaders make commitments to citizens in exchange for taxes and loans. Since natural-resource revenues decrease the government's reliance on tax revenues, this alleviates demands for accountability. Supply-side explanations refer to ways in which natural-resource rents allow authoritarian leaders to suppress the opposition and consolidate their hold, by using the additional revenues to build coercive power and/or selectively distributing them as patronage.

The rentier effect, however, is less satisfying in the case of conflict, as it focuses on the state, and neglects the motivations of insurgent groups who are accountable only to their own group, and not the entire citizenry. Indeed, other explanations that are unique to conflict phenomena have been put forth. Most cited are Fearon and Laitin (2003) and Collier and Hoeffler (2004) which provide evidence to suggest that revenues from natural resources increase the capacity, viability, and economic opportunity of rebel groups.

What is common among all such political outcomes is that political actors - the state and political and/or insurgent groups, desire control over the revenues from natural resources and other windfall gains. That is, they are rent-seeking. I argue, then, that the necessary condition for a resource curse to occur is that individuals and/or groups want to capture rents.

Deacon, and Deacon and Rode, similarly point to rent-seeking behavior as the source of the resource curse. However, in their survey of formal models, they distinguish between the political and economic curse in terms of outcomes. In contrast, I propose that the key distinction ought to be the identity of rent-seekers. That is, a resource curse is political if the rent-seeking is done by political agents, as opposed to private actors. More precisely, a political resource curse is a misallocation of revenues from natural resources and other kinds of unearned income or windfall gains by (rent-seeking) political agents. Such misallocation can manifest in, but are not dependent on, the particular outcomes, such as lower public goods provision, increased patronage and/or corruption, regime instability, and conflict.

This is analogous to rent-seeking by the private sector, which induces an allocation of endowments towards efforts to capture rents rather than to produce goods. The voracity models of Lane and Tornell (1996) and Tornell and Lane (1999), for instance, show how capital is allocated towards the high-rent lower-productivity resource sector, away from a low-rent high-productivity manufacturing sector, while Torvik (2002) and Mehlum et al (2006) show the effect of resource rents on the allocation of entrepreneural skills. Hodler (2006) generalizes to any type of input, e.g. labor, capital.

Note, however, that in these non-political resource curse models, there are two assumptions needed in order for the allocation towards resource-rent capture to actually be a *mis*allocation. One is that the resource sector is inefficient relatively to other sectors, and/or rent-seeking efforts produce deadweight losses that cannot be offset by the additional utility from the rents. The other is that there are no institutions that are effective in enforcing against rent-seeking behavior. When these two conditions are met, then rents are more-than-fully dissipated, and social welfare decreases with rent-seeking.

In contrast, these conditions are not necessary to produce a political resource curse, or a misallocation by political agents. As long as the latter desire rents, such that they effectively have a different utility function from that of the principal or representative citizen, then they will choose an allocation of public revenues that does not perfectly satisfy citizens' demands.

It is also not possible to effectively enforce against a rent-seeking political agent, since any punishment or reward by the principal is inherently imperfect. Citizens cannot replace rent-seeking incumbents with more benign political challengers, since the latter themselves cannot credibly commit to future performance. Once in office, they will also seek rents if they desire rents. Neither can citizens use the incumbent's past performance to predict future policy or perfectly screen election candidates to limit the candidate pool to only non-rent-seeking types because such information is incomplete. Lastly, political turnover is likely to impose social costs such that the incumbent typically enjoys an advantage over political challengers.

Thus, there is always scope for rent-seeking as long as political agents desire to do so. Nevertheless, as long as there is some competition among political challengers or contest over political power that can threaten to replace the incumbent, the latter is constrained, and the misallocation and, hence, the political resource curse, is mitigated. The stronger the threat, or the more intense the competition or contest over political power, the more limited is the rent-seeking and the less severe is the curse.

3 Rent-seeking By The Private Sector

The following model by Hodler produces a resource curse, but not a *political* one in that there is no active role for any political agent. That is, all rent-seeking is done by the private sector.[1]

[1]This is not to say that the model is devoid of any political activity. On the contrary, as is subsequently shown, groups from the private sector erode property rights by fighting over rents. What makes the model an economic resource curse model is that such activities are undertaken by private actors who, unlike political

A country is endowed with windfall gains Ω (which includes natural resources and unconditional aid inflows), and aggregate inputs X (labor, capital, or human capital). It has k groups of equal sizes, and where each group $i = 1, 2, ...k$ has inputs $x_i = X/k$ which it allocates between 'productive' activities l_i and 'fighting' activities or rent-seeking f_i, $x_i = f_i + l_i$, in order to maximize its income/consumption

$$c_i = py_i + r_i. \tag{1}$$

The variable y_i is output produced by the group according to a linear technology:

$$y_i = al_i, \tag{2}$$

of which only fraction $p \in [0, 1]$ can be kept secure, that is, over which the group has property rights. Groups then fight over the unprotected output and the windfall gains, which comprise the common pool of rents

$$R = (1 - p) \sum_{j=1}^{k} y_j + \Omega. \tag{3}$$

The group's share of the total rents, r_i, is determined by the Tullock (1980) contest function

$$r_i = \frac{f_i}{\sum_{j=1}^{k} f_j} R, \tag{4}$$

(unless $f_j = 0 \; \forall j = 1, ...k$, in which case $r_i = \frac{1}{k} R$), which is increasing in the group's own efforts and decreasing in others'. Lastly, fighting over rents is assumed to erode property rights:

$$p = 1 - \frac{1}{X} \sum_{j=1}^{k} f_j. \tag{5}$$

agents whose principals are citizens/political constituents, cannot be made accountable by the latter through mechanisms of political turnover, e.g. elections, political coalitions, violent conflict.

A one-shot Cournot game is played in which groups maximize their own income simultaneously. This yields k reaction functions, which intersect at the Nash equilibrium. Specifically (substituting equations (2) to (5) into (1)), each group i solves:

$$\max_{f_i, l_i} \Big(1 - \frac{1}{X}\sum_{j=1}^{k} f_j\Big) a l_i + \frac{1}{X} f_i a \sum_{j=1}^{k} l_j + \frac{f_i}{\sum_{j=1}^{k} f_j}\Omega, \tag{6}$$

from which equilibrium values f^*, p^*, and c^* can be obtained. Conducting comparative statics on f^* and p^* with respect to Ω generates the following result:

Proposition 3.1 *Windfall gains, e.g. natural resource revenues and aid, generate a resource curse whereby the private sector allocates more inputs toward rent-seeking than output production, which erodes property rights. The curse is mitigated when the marginal productivity of inputs (a) is high.*

(**All proofs are in the Appendix.**)

In other words, a resource curse is simply manifested in the reallocation of inputs/endowments towards rent-seeking, and is thus weaker when such reallocation is constrained which, in this case, depends on the marginal gains to output production relative to rent-seeking.

This reallocation, however, increases incomes/consumption when Ω is sufficiently large. Specifically, when $\Omega > \frac{(k-1)[2aX+aX(a+1)]-aX}{2(k-1)^2(a+1)}$, then c^* increases with Ω.[2] Note that everyone equally benefits from the rents since all groups are identical and obtain an equal share. That is, there is no actor in the model who has the political power to assign and enforce different weights to particular groups, allowing them to capture more rents.

What is thus different in a *political* resource curse is that rent-seeking is done through, or by, the group who holds political power. This almost always leads to a

[2] Differentiating c^* with respect to Ω gives $\frac{\partial c^*}{\partial \Omega} = \frac{2(k-1)^2(a+1)\Omega - 2[aX(k-1)] + aX[1-(k-1)(a+1)]}{aXk}$, which is positive if $\Omega > \frac{(k-1)[2aX+aX(a+1)]-aX}{2(k-1)^2(a+1)}$.

socially inefficient allocation since the leader would want to maximize her own utility by channelling more rents towards herself and/or her own group of supporters. Being in power allows her to do. However, the leader is also constrained by the fact that in order to stay in power and keep getting rents, she has to satisfy the citizenry's demand for a more efficient allocation. This constraint is stronger when the underlying competition between potential leaders is intense. Rent-seeking by the incumbent leader is thus limited, otherwise she is replaced by a political challenger who offers a more efficient allocation.

4 Rent-seeking By Political Agents

Political resource curse models are simply different ways to show that rent-seeking by political actors generate a (mis)allocation of total revenues, which is mitigated by the strength of the underlying political competition or contest over political power. I explicitly derive this result for each of the models presented here, in order to demonstrate its robustness to various specifications of the political environment.

I first illustrate the case when there are stable political institutions that prescribe clear rules that govern political turnover, e.g. elections in democracies, coalition formation in autocracies. I then look at the stability of (democratic) institutions when there is a possibility of violent conflict in which groups fight instead of compete in the political arena. Lastly, I focus on a conflict environment in which all groups invest in some level of violence in order to capture rents.

4.1 Stable Political Institutions

I first present models whereby rent-seeking by the incumbent government is constrained by the threat of a turnover of power to a political opposition, but which does not involve violent conflict. The existing political institutions are thus preserved. Ahmed (2012) and Abdih et al. (2012) abstract from the precise form of such political competition by including a parameter that captures the extent of government accountability which limits the amount of rent-seeking by the incumbent. Bulte and Damania (2008) assume some cost that the opposition incurs if it replaces the incumbent, which can exogenously vary between democracies and autocracies. Bueno de Mesquita et al. (2003, 2010) and Smith (2008) explicitly consider autocratic political institutions in which the incumbent shares the rents with a coalition of individuals whose political support is necessary for the incumbent to remain in power. Robinson et al. (2006) and Brollo et al. (2013) both model democracies in which political competition occurs through elections. In Robinson et al., some amount of rent-seeking by the incumbent is possible because leaders cannot contract their future performance with voters - even the opposition cannot commit *not* to seek rents once they are in power. In Brollo et al., voters have incomplete information about the candidates, which induces rent-seeking types to run.

Thus, the contest over rents coincides with a political contest that determines which group or party obtains control over resource rents. Within a given set of political institutions, one can specify the mechanism, e.g. elections in democratic institutions or coalition formation in autocracies, rather than simply adopt a (Tullock) contest function.[3]

With the exception of Bulte and Damania, rent-seeking by political agents is assumed to take the form of (mis)appropriation of government revenues away from public goods towards private transfers, patronage, and/or the incumbent's own consumption. Natural resources, foreign aid, and other types of unearned income or windfall gains increase government revenues, which allows greater misappropriation. The political resource curse in this case, then, is almost a tautology, since misappropriation of (resource) revenues implies inefficient public good provision, and vice-versa.

[3] More general forms of the contest function have been studied. See, for instance, Skaperdas (1996) and Hirshleifer (1989). In the political science literature, the contest function is typically used to describe investments in conflict and the relative coercive/military power of groups, whether in the domestic arena (see sections 4.2- 4.3) or interstate wars (see, e.g., Kydd (2015) for a summary.)

Thus, it is no surprise that such curse exists irrespective of the type of political institutions. It may be mitigated depending on the strength of the constraining effect of the specific political contest, but as long as political agents are assumed to misappropriate government revenues once they are in power, then government spending is, by definition, socially inefficient.

Bulte and Damania, however, make rent-seeking by political agents contingent on the participation of private firms. Instead of unilaterally appropriating some portion of government revenues, the incumbent accepts bribes from firms in exchange for using revenues to provide public goods that the firms use as inputs to production. Since higher public good provision comes at the expense of greater corruption, the net social effect of resource revenues - the extent of the political resource curse - is ambiguous, and is indeterminate unless the social welfare function explicitly includes both the utility from public goods and (dis)utility from corruption.[4]

I thus delay discussion of Bulte and Damania, in order to demonstrate that within any stable political environment, an increase in natural-resource revenues and other windfall gains like foreign aid, remittance incomes, and federal transfers to local government is predicted to unambiguously lower public good provision and increase patronage and/or corruption. I begin with Ahmed (2012) and Abdih et al. (2012), in which the political contest is modeled in the most reduced form.

The government receives total revenues $\tau y + R_1$, where τ is the tax rate, y is total income, and R_1 is what Ahmed calls "unearned government income", citing foreign aid as an example. (Abdih et al. omits R_1 and only considers τy as total government revenues.) Revenues are spent either on public goods g (with price 1) or rents r which could be distributed to political supporters as patronage goods, as in Ahmed, or kept by the government for its own consumption, as in Abdih et al. The government derives utility from rents and from satisfying households' utility. Thus, it chooses an allocation that maximises

[4] To my knowledge, there are no resource-curse models that incorporate any social costs of bribery.

$$U_g(s, U_h) = \alpha \log(r) + (1-\alpha)U_h, \tag{7}$$

where $\alpha \in (0,1)$ and U_h is households' utility function (to be defined below), subject to the government budget constraint

$$\tau y + R_1 = g + r. \tag{8}$$

The parameter $1-\alpha$ captures the strength of the implicit political competition to which the government is accountable since, in effect, it is the weight that the incumbent government must assign to the utility of its citizens to remain in power.

Households derive utility from consumption good c and public good g, but are assumed to be able to substitute private good z for g. Their net income is $(1-\tau)y+R_2$, where R_2 are remittances. Note that the latter are also a form of unearned income in that it is assumed untaxable, and goes directly to households rather than government revenues.

After observing g, households choose c and z that maximise their utility

$$U_h = \lambda \log(c) + (1-\lambda)\log(z+g), \tag{9}$$

subject to their budget constraint

$$(1-\tau)y + R_2 = c + z. \tag{10}$$

By backward induction, equilibrium values z^*, c^*, g^* and the share $\frac{r^*}{y}$ of income that the incumbent appropriates as rents. Conducting comparative statics on $\frac{r^*}{y}$ and g^* obtains the following result:

Proposition 4.1 *Unearned income like foreign aid and remittances generate a political resource curse whereby private rents increase and public goods decrease. The* *curse is mitigated by the intensity of the (implicit) political competition, as captured by parameter* $1 - \alpha$.

4.1.1 Autocracies

There are several ways to explicitly model the political competition between the incumbent government and potential challengers. One can use the selectorate framework of Bueno de Mesquita (2003, 2010) and Smith (2008) in which the selection of leaders depends on a coalition of individuals whose political support is 'bought' through private transfers from government revenues. When this coalition does not comprise a majority of the population, the model is thus applicable to rent-seeking within autocratic institutions.

The intensity of the political competition through which the incumbent government is made accountable is essentially captured by the size of this coalition. When the coalition is large, the probability that any one member will be included in the coalition formed by a future leader is high, which makes them less loyal to the incumbent and the latter more vulnerable to challengers. At the same time, when total private transfers are to be shared with a large coalition, its value to an individual member diminishes relative to the value of (non-rivalrous and non-excludable) public goods, which implies that government spending would be socially efficient if revenues are allocated towards more public goods provision and less private transfers. Thus, while larger revenues (e.g. from natural resources) increase the ability of the incumbent to buy supporters through large private transfers, her incentive to do so is dampened when the size of the coalition is large. One expects a result that is similar to Ahmed and Abdih et al. - a political resource curse exists but is mitigated by the strength of the political contest, which in this case is captured by the size of the coalition.

I explicitly derive this result from the following model by Smith. Let there be a population of N individuals whose income can be taxed by the government, but only a subset $S \leq N$, called the 'selectorate', are eligible to choose the latter. In particular, the government needs the political support of a coalition of selectors of size $W \leq \frac{S}{2}$ to maintain power.

To get this support, an incumbent leader L offers policy vector (g, r) to her coalition, where g denotes public goods and r private goods that are transferred to each coalition member (or patronage goods, as in Ahmed). Public goods generate the following spillover effects. First, unlike private goods that are given only to the coalition, public goods benefit the entire population. Second, they increase labor productivity. Third, they are assumed to enable citizens to organize politically.

Any member of the incumbent's coalition can reject L's policy offer and defect to a challenger C, in which case L is deposed and C becomes the new leader. In addition, non-members of L's coalition can revolt.[5] If the revolution is successful, a revolutionary activist A becomes the new leader.

The following game is played at each time period $t = 0, 1, 2, ...\infty$.

1. The incumbent leader L forms a coalition of size W, composed of selectors for whom L has the highest affinity. Challenger C nominates her own coalition, also of size W, which includes at least one member of L's. Revolutionary activist A also nominates her coalition, but of larger size $\frac{N}{2}$ and which excludes members of L's coalition.[6] L, C, and A each choose the level of public goods g and transfers r that they offer to their coalition members.

2. Members of A's coalition decide whether or not to rebel. If they do, the revolution succeeds and A becomes the new leader with probability $\rho(g)$.

3. If L survives the revolution in 2, selectors choose between L and C. If any selector in L's coalition chooses C, L is deposed and C becomes the new leader.

4. The policy of the selected leader is implemented, and her affinity among selectors

[5] This revolution option is only in Smith, and not included in Bueno de Mesquita et al.

[6] Thus, a revolution, if successful, effectively changes institutions to a more democratic one in that the new leader now needs the support of half of the population. Although political institutions can change in this manner, I treat them as stable environments in that the institutional change does not explicitly involve violent conflict.

is revealed.

Focusing on stationary strategies in which the same strategies are played in every time period, one can derive a subgame perfect Nash equilibrium (SPNE) in which the incumbent leader L maintains power in every t. In this equilibrium, it must be that the latter offers a policy vector (g, r) that survives the threat of revolution and competition from the challenger. That is, L chooses the policy that maximises her utility subject to a 'revolution' constraint and a 'challenger' constraint.

Let L's utility be the amount of discretionary resources (total revenues less expenditures):

$$R + N\tau\phi(g) - pg - Wr, \tag{11}$$

where R are non-tax revenues or unearned income, e.g. natural-resource revenues and foreign aid, τ is the tax rate, $\phi(g)$ is output per capita (with $\phi_g(g) > 0$), p is the price of public goods, and Wr the total amount of private goods or rents transferred to L's coalition.

To survive competition from the challenger C, L has to give to her coalition a policy that is at least as good as what C would give to her own coalition. Let selectors have utility $v(g) + u(r)$ (with derivatives $v_g, u_r > 0$ and $v_{gg}, u_{rr} < 0$). The best that C could offer to her own coalition is $(g_C, r_C) = \arg\max_{g_C, r_C} v(g) + u(r)$ subject to $pg + Wr = R + N\tau\phi(g)$ or, rearranging, $r = \frac{R+N\tau\phi(g)-pg}{W}$. This implies that

$$r_C = \frac{R + N\tau\phi(g_C) - pg_C}{W}, \tag{12}$$

while g_C is the value that solves the first-order condition (FOC)

$$v_g(g_C) + \frac{N\tau\phi_g(g_C) - p}{W} u_r\left(\frac{R + N\tau\phi(g_C) - pg_C}{W}\right) = 0. \tag{13}$$

Note, however, that while C can give (g_C, r_C) initially, nothing commits her to future policy. Once she becomes the incumbent, she chooses some future policy (g^*, r^*) and forms a coalition of W selectors for whom she has the highest affinity ordering (which may or may not include the selectors she initially nominated).[7] Assuming that all possible affinity orderings are equally likely, the probability of being included in the new coalition is thus $\frac{W}{S}$. Since only coalition members get rents r, then with probability $\frac{W}{S}$, r^* is obtained, and with probability $1 - \frac{W}{S}$ no rents are obtained. (Public goods g^* are obtained with probability 1, since all benefit from it.) Thus, members of C's initial coalition expect to obtain utility $v(g_C) + u(g_C)$ in the initial period, and an infinite stream of utility $v(g^*) + \frac{W}{S}u(r^*)$ thereafter. Denoting the discount rate as δ, the expected value of the best offer C can credibly make is thus $v(g_C) + u(r_C) + \frac{\delta}{1-\delta}\Big(v(g^*) + \frac{W}{S}u(r^*)\Big)$.

It is this latter value that the incumbent will try to match. L's supporters will not defect if the expected utility of remaining in L's coalition is at least as large as the expected utility from joining C's coalition, that is, if L chooses (g, r) such that $v(g) + u(r) + \frac{\delta}{1-\delta}\Big(v(g^*) + u(r^*)\Big) \geq v(g_C) + u(r_C) + \frac{\delta}{1-\delta}\Big(v(g^*) + \frac{W}{S}u(r^*)\Big)$. Setting the inequality equal to zero and re-arranging gives the constraint which L has to satisfy in order to survive competition from C:

$$v(g) + u(r) - v(g_C) - u(r_C) + \frac{\delta}{1-\delta}\Big(1 - \frac{W}{S}\Big)u(r^*) = 0. \qquad (14)$$

In a similar way, one can get the constraint from the threat of a revolution. The best offer of activist A to her supporters is $(g_A, r_A) = \arg\max_{g_A, r_A} v(g) + u(r)$ subject to $pg + \frac{N}{2}r = R + N\tau\phi(g)$ (where the difference from C's optimization problem is the larger size of the coalition - $\frac{N}{2}$ - that gets the private goods). Thus, (g_A, r_A) are analogous to (12) and (13):

[7] Recall that for L to be deposed, at least one of L's coalition members has to defect to C. Thus, C has to nominate a coalition that includes a member of L's, even though C has little affinity for that individual. She can then subsequently drop that individual from her coalition in the next period.

$$r_A = \frac{R + N\tau\phi(g_A) - pg_A}{W} \tag{15}$$

and g_A is the value that solves the following FOC

$$v_g(g_A) + \frac{N\tau\phi_g(g_A) - p}{N/2} u_r\Big(\frac{R + N\tau\phi(g_A) - pg_A}{N/2}\Big) = 0. \tag{16}$$

Assume that following a successful revolution, institutions change to $W = N/2$ and $S = N$. Thus, if the revolution is successful and A assumes power, the probability of being in the future coalition of A is $\frac{1}{2}$. Let k be the cost of rebelling, and ω the cost of a failed revolution. Then if the revolution is successful, a member of A's coalition expects to get the following utility from the best offer that A can credibly make (a): $-k + v(g) + u(r) + \frac{\delta}{1-\delta}\Big(v(g^*) + \frac{1}{2}u(r^*)\Big)$. If the revolution fails, the expected utility is (b): $-k - \omega + v(g_A) + u(r_A) + \frac{\delta}{1-\delta}\Big(v(g^*)\Big)$. Thus, the expected value from rebelling is the weighted average of (a) and (b), with (a) weighted by the probability of successful revolution $\rho(g)$ and (b) by $1-\rho(g)$.[8] Finally, if they do not rebel, they expect to receive (from the incumbent) $v(g) + \frac{\delta}{1-\delta}v(g^*)$. Thus, a revolution does *not* occur if L's chosen policy vector is such that the expected value from not rebelling is at least as large as the expected value from rebelling, that is:

$$k + \omega + \rho(g^*)\Big(\frac{1}{1-\delta}v(g^*) - \omega - v(g_A) - u(r_A) - \frac{\delta}{1-\delta}\big(v(g^*) + \frac{1}{2}u(r^*)\big)\Big) \geq 0. \tag{17}$$

Thus, in a stationary equilibrium where incumbent L remains in power for all time periods, it must be that L chooses policy vector (g, r) that maximizes L's utility $R + N\tau\phi(g) - pg - Wr$ subject to (14) and (17). Consider the case when condition (17) holds. Then revolutions do not occur, implying that the revolution constraint does not bind. In this case, one can then form the Lagrangian, $L = R + N\tau\phi(g) - pg -$

[8]The success of revolution depends on the ease with which citizens can organize, which is assumed to increase with the amount of public goods.

$Wr + \lambda[v(g) + u(r) - v(g_C) - u(r_C) + \frac{\delta}{1-\delta}\left(1 - \frac{W}{S}\right)u(r^*)]$, whose FOCs are given by the following system of three equations

$$L_g = N\tau\phi_g(g) - p + \lambda v_g(g) = 0, \tag{18}$$

$$L_r = -W + \lambda u_r(r) = 0, \tag{19}$$

and (14), which can be solved for equilibrium values of g, r, and λ.[9] Conducting comparative statics on g and r obtains the following result that is similar to Ahmed and Abdih et al.:

Proposition 4.2 *Unearned income like natural resource revenues and foreign aid generate a resource curse whereby patronage increases while public good provision decreases. The curse is mitigated by the intensity of the political competition which, in this case, is captured by the size of the coalition of selectors whose support is necessary for the political survival of the leader.*

4.1.2 Democracies

While selectorate theory can arguably capture more democratic institutions as the size of the coalition of political supporters approximates half of the population, one may be interested to find out whether elections, as a specific form of political competition, are better able to constrain the rent-seeking of political agents. The following model is by Robinson et al. (2006).

There is a population N of voters who are divided evenly into two groups (e.g. party, clan, ethnic group), L and C, and assume that the incumbent leader/politician

[9] To simplify, I restrict the analysis to the case where the costs of rebelling and of a failed revolution are too high such that (17) is always true so that the presence of a revolutionary activist poses no binding constraint. Smith also considers the case when the LHS of (17) is negative, and shows that there exists a region (g_1, g_2), $g_2 > g_1$, for which the revolution constraint binds with equality. The incumbent then chooses either g_1 or g_2, depending on which yields relatively higher discretionary resources.

belongs in L while a challenger politician belongs in C. Normalising N to one, L and C are each of size $\frac{1}{2}$. Each voter in each group has linear preferences in their own income, while the incumbent and challenger each derive utility from their own income and the incomes of each member of their own group. That is, denoting Z^i as the income of a member of group $i \in \{L, C\}$, and X^i the income of the politician who belongs in group i, the politician has utility $V^i = X^i + \alpha \int Z^i di$, where $\alpha \in (0, 1)$ is the weight the politician attaches to the welfare of each voter in her own group.

Assume each voter i has bias σ^i towards the incumbent, where σ^i is uniformly distributed on the interval $[-\frac{1}{2s}, \frac{1}{2s}]$ with density $s > 0$, and there is a shock θ in favor of the incumbent that is uniformly distributed on $[-\frac{1}{2h}, \frac{1}{2h}]$ with density $h > 0$. Denote the income of voter i when the incumbent is in power as $Z^i(L)$, and $Z^i(C)$ when the challenger is in power. Voter i thus supports the incumbent if $Z^i(L) + \sigma^i + \theta > Z^i(C)$.

Incomes of voters are determined by the policies of the politician in power, specifically, on the latter's choice of natural resource extraction which generates government revenues, and on public sector wages and employment. As in BDM and Smith, income X of the politician in power is discretionary resources - revenues less expenditures.

The following describes a finite game that is played in two periods.

1. In the first period $t = 1$, the incumbent chooses policy vector (W_1, G_1^i, e), where e is the amount of natural resources to extract, W_1 the public sector wage, and G_1^i the number of individuals from group i that are employed in the public sector. (Total public sector employment is $G_1^L + G_1^C = G_1$, and the remaining $1 - G_1$ are employed in the private sector with exogenous productivity and wage given by H. Setting productivity in the public sector to zero, H is also the productivity differential between the sectors.)[10]

2. First period production, resource extraction, and consumption take place. Only

[10]I simplify the exposition by abstracting from choices on taxation and transfers. Robinson et al. explicitly include such choices but show that since politicians value their own income more than others', they will choose tax rate δ that maximizes tax revenue, which they set to $\delta = 0$. By the same reasoning, promises of transfers are not credible, and voters realize this. Thus, both taxes and transfers are zero.

$R(e)$ natural resources remain (with derivatives $R_e < 0$ and $R_{ee} < 0$).

3. The incumbent and a challenger politician compete in an election by offering voters their respective second-period policies $(W_2(L), G_2^i(L))$ and $(W_2(C), G_2^i(C))$.

4. The winner chooses and implements optimal policies in the second period.

5. Second-period production, resource extraction, and consumption take place.

The game is solved by backward induction. Trivially, all of the remaining resources, $R(e)$, are extracted in the last period. More importantly, since politicians value their own income more than others', it is not optimal for the election winner to hire more public sector workers. This is because the public sector is inefficient - wages cannot be matched by productivity (which is zero). However, it may be optimal to renegotiate wages and/or fire public employees that were hired in the first period. Any wage renegotiation is assumed to be the result of Nash bargaining between the winning politician and each employee, where the status quo is firing for the politician and private sector employment for the employee. Let F be the cost of being fired. Thus, wage renegotiation between the winner and a member of her own group is obtained by maximising the joint surplus $[(-W + \alpha W) - \alpha(-F + H)][W - (-F + H)]$, where $(-W + \alpha W)$ is the utility the politician derives from employing a member of her own group, $-\alpha(-F + H)$ the utility from firing the member, and $W - (-F + H)$ the member's surplus. This gives wage $W^* = \frac{1}{2}\frac{(2\alpha-1)(F-H)}{1-\alpha}$. Thus, assuming that $F > H$ (and $\alpha > 1/2$), wage renegotiation with one's own group succeeds. Meanwhile, wage renegotiation with a member of the other group is obtained from maximising the joint surplus $[-W][W - (-F + H)]$ (since the politician does not care about members of the other group). This gives $W = -\frac{F-H}{2} < 0$, which implies that such renegotiation can never succeed. Thus, it is always better for the winning politician to fire members of the other group.

In equilibrium, only public sector workers who were employed in period 1 and who are members of the winning politician's group remain employed in the public sector, and each is paid the following wage in the second period:

$$W_2^* = \frac{1}{2}\frac{(2\alpha - 1)(F - H)}{1 - \alpha} \tag{20}$$

To get the reelection probability of the incumbent, note that since the incumbent cannot credibly promise employment to members of group C in the second period, post-election income is independent of the election outcome for group C voters. Thus, the share of voters from C that vote for the incumbent is $1/2 + s\theta$, which means that the number of group C voters who support the incumbent is

$$N_C = \frac{1}{2}\Big(\frac{1}{2} + s\theta\Big) \tag{21}$$

Meanwhile, the incumbent can credibly promise employment to group L voters, but only by hiring them in the first period. Thus, $G_1 = G_1^L$. (The challenger cannot credibly promise employment to any group, since it will fire the group L public employees, and no politician will hire in the second period.) Since the only credible wage offer from the incumbent is W_2^*, a public employee i obtains income/surplus from the incumbent $Z^i(L) = W_2^* - (-F + H)$ and votes for the incumbent if

$$\sigma^i > -\theta - [W_2^* - (-F + H)]. \tag{22}$$

The number of public employees who support the incumbent is thus

$$N_{LG} = G_1 \int_{-\theta-[W_2^*-(-F+H)]}^{\frac{1}{2s}} s di = G_1\Big(\frac{1}{2} + s(\theta + [W_2^* - (-F + H)])\Big) \tag{23}$$

Finally, the number of private employees from group L who support the incumbent is

$$N_{LP} = \Big(\frac{1}{2} - G_1\Big)\Big(\frac{1}{2} + s\theta\Big). \tag{24}$$

Using (21), (23), (24), and simplifying, the reelection probability of the incumbent, $\Pi(G_1) = Pr\Big\{N_C + N_{LG} + N_{LP} \geq \frac{1}{2}\Big\}$, is thus

$$\Pi(G_1) = Pr\{\theta \geq -G_1[W_2^* - (-F + H)]\} = \frac{1}{2} + G_1 h[W_2^* - (-F + H)]. \tag{25}$$

It remains to obtain equilibrium (first-period) policies (W_1, G_1, e). Let the price of extracted resources in the first and second periods be respectively denoted by p_1 and p_2 so that government revenues are $p_1 e$ in the first period and $p_2 R(e)$ in the second period. The incumbent's expected stream of first and second-period utilities is thus given by:

$$\begin{aligned} p_1 e - W_1 G_1 + \alpha W_1 G_1 + \alpha\Big(\frac{1}{2} - G_1\Big)H \\ +\Pi(G_1)\Big[p_2 R(e) - W_2^* G_1 + \alpha G_1 W_2^* + \alpha\Big(\frac{1}{2} - G_1\Big)H\Big] \\ +(1 - \Pi(G_1))\alpha\frac{1}{2}(-F + H), \end{aligned} \tag{26}$$

where $\Big(\frac{1}{2} - G_1\Big)H$ is the sum of utilities/income of members of L employed in the private sector, and the incumbent earns only $\alpha\frac{1}{2}(-F + H)$, the weighted sum of utilities of members in her group (who are fired in the second period), if she loses the election.

Thus, the incumbent chooses policies (W_1, G_1, e) that maximise (26) subject to the participation constraint of public sector workers:

$$W_1 + \Pi(G_1)W_2^* + (1 - \Pi(G_1))(-F + H) \geq 2H. \tag{27}$$

To maximise (26), (27) must hold as an equality, which yields equilibrium public sector wages in the first period

$$W_1^* = H + F - \Pi(G_1^*)(W_2^* + F - H). \tag{28}$$

Meanwhile, e^* and G_1^* are implied by the following FOCs:

$$p_1 + \Pi(G_1)p_2R_e(e) = 0 \tag{29}$$

$$-H[1+\Pi(G_1)]-(1-\alpha)F[1-\Pi(G_1)]+\Pi_{G_1}(G_1)\Big[p_2R(e)-HG_1+(1-\alpha)FG_1+\frac{1}{2}\alpha F\Big] = 0. \tag{30}$$

Conducting comparative statics on G^* obtains the following result:

Proposition 4.3 *Permanent resource booms (i.e. $dp_1/p_1 = dp_2/p_2 = dp/p$) and anticipated future resource booms (i.e. $dp_1 = 0$ and $dp_2 > 0$) generate a political resource curse whereby patronage in the form of public sector employment increases. Temporary resource booms (i.e. $dp_1 > 0$ and $dp_2 = 0$) induce a political resource blessing whereby public sector employment decreases.*
With intense political (electoral) competition, the curse from permanent resource booms is mitigated, while the curse from anticipated future booms is exacerbated.

Note, then, that the model is capable of generating more nuanced results by qualifying the timing of resource booms. With permanent and anticipated future resource booms, the value of remaining in power increases, which induces the incumbent to buy/influence votes by providing more public employment although the latter is inefficient. When the boom is temporary, the first period incumbency becomes more valuable, which makes the incumbent willing to allocate employment more efficiently at the risk of losing power in the future.

What is interesting is that strong political competition can actually make matters worse when a future boom is anticipated. In this case, since resource rents are only obtained in the second period, remaining in power becomes even more valuable. When the probability of reelection is small, the incumbent is then induced to buy even more votes to ensure that she gets the second period rents.

In the models described thus far, rent-seeking by the government is possible because leaders and politicians cannot credibly commit to future policy. Once in office, the leader will choose policy that maximises her own utility, which is decreasing in public good provision and increasing in rents. Coalition members or voters cannot fully threaten to punish the incumbent by switching to the opposition since the latter would also seek rents once it is in power. In other words, inefficiency occurs because of contractual incompleteness between leaders and their constituents.

Brollo et al. (2013) adopt the model of Persson and Tabellini (2000) to consider a different source of inefficiency - that of incomplete information of voters who use their knowledge of the incumbent's past performance, not to sanction the incumbent in elections, but in order to gauge the leader's expected future performance relative to other candidates. Rent-seeking is possible simply because voters do not know for certain whether or not the politician they elect is a rent-seeking type. Brollo et al. consider an interesting extension by endogenising the decision of candidates to enter the political contest. Thus, their model not only shows how resource revenues lead to more rents appropriated by the leader, but also reveals another kind of political resource curse in which a greater number of candidates who are the rent-seeking type decide to enter the pool. Note, then, that the strength of the political competition is itself eroded, in the sense that the (endogenous) entry of rent-seeking candidates eases the electoral pressure that a rent-seeking incumbent faces.

I thus present the model by Brollo et al. Consider a population of $2N$ individuals, with N large and discrete, who are both voters and potential candidates and are divided between two groups $J = H, L$, each of size N, where H denotes high quality and L low quality type of candidate. Once in office, a high (low)-quality candidate, on average, generates more (less) government revenues, and appropriates less (more) rents, thereby providing more (less) public goods.

To depict this, let τ denote an exogenous stream of government revenues that is entirely in the form of windfall gains, non-tax revenues, or unearned income, such that a resource curse is interpreted as the effect of increasing τ.[11] Denoting the rents appropriated by the politician in office as r, public goods provided by the politician is

$$g = \theta(\tau - r), \tag{31}$$

where θ is, on average, high (low) for a high (low)-quality candidate. Specifically, θ is a random variable drawn from a uniform distribution with density ξ and a known mean. For a type J candidate, this mean is $1 + \sigma^J$, with $\sigma^H = \sigma = -\sigma^L$ and $\sigma \in (0, 1)$ a known parameter.

Consider two periods, indexed by $t = 1, 2$. The expected utility of a type J politician who is in office in periods 1 and 2, respectively, are

$$V_1^J = \alpha^J r_1 + R + p^J V_2^J \tag{32}$$

$$V_2^J = \alpha^J r_2 + R, \tag{33}$$

where R is some exogenous benefit from holding office (i.e. ego rents), p^J is the probability that an incumbent of type J is reelected, and $\alpha^J > 0$, with $\alpha^H < \alpha^L$. Assume that rents cannot exceed an upper bound, i.e. $r_t \leq \psi\tau \equiv \overline{r}$.

Voters care only about the public good, and their utility in each period is simply $W_t = g_t$.

The following describes a finite game that is played in two periods.

1. At the start of period 1, individuals decide whether or not to enter politics. All individuals who enter have equal probability of being selected as the single opponent who will run against the incumbent in the election that is to be held at the end of the

[11] In Brollo et al., resources τ are revenues that come from the federal government and, hence, are windfall gains from the point of view of the local government.

period.

2. The incumbent chooses r_1. She knows her own type, but does not know the realization of her own competence θ, nor the identity of her future opponent.

3. The identity of the opponent is revealed and her type becomes known.

4. The election takes place. Voters know the incumbent's and opponent's types, and observe g_1, but not r_1.

5. In period 2, the winner of the election sets r_2.

The game is solved by backward induction. In period 2, the elected leader, regardless of type, chooses maximum rents $\overline{r} = \psi\tau$ since $\alpha^J > 0$.

To obtain the probability p^{JO} that the incumbent of type J wins against opponent of type O, $J, O = H, L$, in the election in period 1, note that since period 2 performance is the same for both candidates, voters will elect the candidate with higher expected competence, conditional on observed g_1 and known candidate types. Thus, the incumbent of type J wins against the opponent of type O if $E(\theta|g_1, J) \geq 1 + \sigma^O$. From (31), $E(\theta|g_1, J) = \frac{g_1}{\tau - r_1^{eJ}}$, where r_1^{eJ} is the r_1 that voters expect an incumbent of type J to choose. From the point of view of the incumbent (who knows r_1^J), $g_1 = \theta(\tau - r_1^J)$, so that $E(\theta|g_1, J) = \frac{g_1}{\tau - r_1^{eJ}} = \theta\frac{\tau - r_1^J}{\tau - r_1^{eJ}}$.

Thus, $p^{JO} = Pr[\theta\frac{\tau - r_1^J}{\tau - r_1^{eJ}} \geq 1 + \sigma^O] = Pr[\theta \geq \frac{\tau - r_1^{eJ}}{\tau - r_1^J}1 + (\sigma^O)]$ which, given the distribution of θ, is equal to

$$p^{JO} = \frac{1}{2} + \xi(1 + \sigma^J) - \xi\frac{\tau - r_1^{eJ}}{\tau - r_1^J}(1 + \sigma^O). \qquad (34)$$

In setting rents r_1 in the first period, the incumbent maximises (32), which gives the FOC: (i) $\sigma^J + \frac{\partial p^J}{\partial r_1}V_2^J = 0$, where (ii) $V_2^J = \sigma^J\psi\tau + R$. To get an expression for $\frac{\partial p^J}{\partial r_1}$, note that when the incumbent sets r_1, she does not know her opponent, but only has an expectation as to the latter's competence, given by $\hat{\sigma} \equiv \sigma(1 - 2\pi)$, where π is the probability that the opponent is type L. Substituting $\hat{\sigma}$ for σ^O in (47) gives p^J.

Taking the derivative of p^J with respect to r_1^J and imposing the equilibrium condition that $r_1^{eJ} = r_1^J$ yield (iii) $\frac{\partial p^J}{\partial r_1^J} = -\frac{\xi(1+\hat{\sigma})}{\tau - r_1^J} < 0$. Combining (i), (ii) and (iii) gives an expression for the rent that the incumbent sets in period 1:

$$r_1^J = \tau - \xi(1+\hat{\sigma})(\psi\tau + R/\alpha^J) \tag{35}$$

Finally, from the decision of individuals to enter politics, one can derive the share π of L types in the pool of opponents. Let n^J denote the the number of individuals from group J who decide to enter politics, such that the pool of candidates has size $n = n^H + n^L$. Each of them has equal probability $\frac{1}{n}$ to become the single opponent of the incumbent in the election. Each individual $i = 1, 2, ...N$ in group J has an opportunity cost $\beta_i y^J$ of entering politics, where $\beta_i = i$ and $y^H > y^L > 0$. Thus, individual i enters politics if the opportunity cost of doing so is no greater than the expected benefit, i.e. $iy^J \leq \frac{p^J}{n} V_2^J$, where (with slight abuse of notation) p^J here denotes the probability that an opponent of type J wins against the incumbent in the election. In equilibrium, $r_1^{eJ} = r_1^J$ which, when imposed on (34) gives $p^J = \frac{1}{2} + \xi(\sigma^J - \hat{\sigma})$. Since the incumbent's type is unknown at this point, then $\hat{\sigma} = 0$, which means that individual i enters politics if $iy^J \leq \frac{\frac{1}{2} + \xi\sigma^J}{n} V_2^J$. The (last) individual from J for which this latter condition just holds gives the total number n^J of individuals from J who enter the pool of opponents:

$$n^J y^J = \frac{\frac{1}{2} + \xi\sigma^J}{n} V_2^J \tag{36}$$

Solving for n^J, $J = H, L$, gives the equilibrium share $\pi = \frac{n^L}{n^H + n^L}$ of low-quality candidates which, when plugged into (35) gives equilibrium rents. Conducting comparative statics gives the following result:

Proposition 4.4 *Unearned income generates a political resource curse whereby the incumbent leader appropriates more rents at the expense of public good provision, and the share of low-quality candidates in the pool of election opponents increases. The erosion* *of candidate quality, which implies weakening of the political (electoral) competition, may increase the rate at which unearned income decreases public good provision.*

4.1.3 Bribery

Notice that in all the models discussed thus far, rent-seeking by the government and political agents is done simply by (mis)appropriating government revenues. An increase in rents mechanically implies a decrease in public goods. What limits the extent of misappropriation is the political competition - the stronger the threat posed by challengers who can offer more efficient policies, the more accountable is the incumbent to the general public (who prefer more public goods).

Bulte and Damania (2008) explicitly consider rent-seeking in the form of bribery. Applying the Grossman and Helpman (1994) framework in which lobby groups offer the government political contributions in exchange for policy, the authors let firms offer bribes to the government in order to influence the provision of public goods that firms use in production. The incumbent then allocates government revenues between public-good inputs to a resource sector that has decreasing returns to scale, and inputs to an increasing returns to scale manufacturing sector. Note that social efficiency requires greater provision to the latter, more productive, sector. However, an increase in the price of resource commodities enables firms in the resource sector to bribe more, which incentivises the government to provide more public-good inputs to that sector. With the threat of political challengers, public spending towards the resource sector is mitigated, constraining the incumbent to provide inputs to the manufacturing sector as well.

The problem is that since the manufacturing sector has increasing returns to scale technology, public-good inputs produce larger profits than in the resource sector, which means that manufacturing firms are also able to pay larger bribes. Thus, with a sufficiently strong political competition such that a resource boom induces an increase in public-good provision to both resource and manufacturing sectors (even when the increase to the latter is slight), the total amount of bribes unambiguously increases. When political competition is entirely absent (i.e. there are no challengers), public goods provision to the resource sector increases while that to the manufacturing sector decreases. Since the drop in manufacturing-sector profits is larger than the increase in resource-sector profits, total bribes actually go down.

A resource boom thus induces a trade-off between public goods provision and corruption that depends on the strength of the underlying political competition. Greater competition allows more efficient allocation of public goods (towards the manufacturing sector), but which generates larger bribes. In the absence of competition from political challengers, revenue-allocation is inefficient, but corruption decreases.

I formally derive this result from the following model of Bulte and Damania.

An economy is composed of three sectors - resources R, manufacturing M, and a constant-returns-to-scale agriculture sector A. There are N firms that can move freely between R and M, i.e. $N = N^R + N^M$, and labor force L that is perfectly mobile between all sectors: $L = L^R + L^M + L^A$, where $L^R = N^R l^R$, $L^M = N^M l^M$, and l^R and l^M are the number of workers per firm in the R and M sectors, respectively. Wages are equal in all sectors, and w denotes the wage rate.

Output Q in sector $i = \{M, R\}$ is produced from labor and publicly supplied input B^i: $Q^i = f^i(l^i, B^i)$ (with derivatives $f^i_l, f^i_B, f^i_{lB}, f^i_{Bl} > 0$.) To induce the government to provide the input, each firm offers bribe s_i. Total bribes in each sector are $S^i = N^i s^i$.

Profits per firm in the resource sector are thus:

$$\pi^R = pQ^R - wl^R - s^R - \tau, \tag{37}$$

where p is the price of the resource commodity and τ the tax rate. Profits per firm in the manufacturing sector are:

$$\pi^M = Q^M - wl - s^M + (N^M - 1)Q^{-M} - \tau \tag{38}$$

where the price of the manufacturing good is one, and Q^{-M} is the output of other firms in that sector. The term $(N^M - 1)Q^{-M}$ captures the assumption that the manufacturing sector generates increasing returns only for that sector. (In constrast, it is assumed that sector R exhibits diminishing returns to scale).

The following game takes place.

1. N firms simultaneously decide whether to enter a resource sector R or manufacturing sector M.

2. Each firm offers a bribe to the incumbent government in exchange for the provision of the public-good inputs used in production.

3. The incumbent chooses the tax rate τ, and B^M, B^R - the amount of public goods provided to sectors M and R, respectively.

4. A challenger to the incumbent announces its policies, and a political contest takes place. The winner implements its policies.

5. Production proceeds.

By backward induction, one can construct an SPNE in which the incumbent retains power. Fix $\tau = T$, where T is the maximum tax rate beyond which firms avoid paying taxes. The policy vector chosen by a government thus reduces to (B^M, B^R). This maps to aggregate welfare W, which is the sum of profits and total labor income:

$$W = N^R p Q^R + (N - N^R)Q^M + wL^A - NT. \tag{39}$$

Suppose the challenger announces policy $(\overline{B}^M, \overline{B}^R)$ which would yield welfare $\overline{W}(\overline{B}^M, \overline{B}^R)$, and assume that the following welfare cost is incurred whenever a challenger replaces the incumbent: $v(S^M + S^R + D; d)$ (with derivatives $v' > 0, v'' = 0$), where $D = NT - C^M(B^M) - C^R(B^R)$ is the fiscal surplus, C^M, C^R are the cost of providing public goods B^M and B^R respectively, and d is an indicator variable for democracy.

Thus, in order to retain power, the incumbent must offer (B^M, B^R) that satisfies constraint

$$W(B^M, B^R) \geq \overline{W}(\overline{B}^M, \overline{B}^R) - v(S^M + s^R + D; d) \tag{40}$$

while maximizing the incumbent's utility from bribes and fiscal surplus:

$$U = N^M s^M + N^R s^R + D. \tag{41}$$

Going backward, such policies are plugged into the respective production functions of sectors M and R to get output Q^M and Q^R. Firms then choose (s^M, l^M) and (s^R, l^R) that maximise their respective profits (38) and (37).

Finally, given such optimal values for (s^M, l^M), (s^R, l^R), Q^M and Q^R, the number of firms in each sector, N^M and N^R, are obtained by imposing a zero-profit condition. That is, since firms move between sectors until profit differentials are zero, the optimal values of N^M and N^R satisfy

$$Q^M - wl^M - s^M + (N^M - 1)Q^{-M} - T - [pQ^R - wl^R - s^R - T] = 0. \tag{42}$$

One can then conduct comparative statics to obtain the following result:

Proposition 4.5 *Suppose firms from a decreasing-returns-to-scale resource sector and an increasing-returns-to-scale manufacturing sector bribe the government in exchange for public-good inputs. Then resource booms generate a resource curse and a blessing. In the absence of political competition, public good provision becomes less efficient, but corruption (bribery) decreases. When there are political challengers to the incumbent, public goods provision becomes more efficient, but corruption increases.*

4.2 Breakdown of Political Institutions

The political competition in the previous models essentially assumes that leader turnover is achieved through relatively peaceful means, that is, according to rules specified by the underlying political institutions. The incumbent has an advantage over potential challengers, whether because of contractual incompleteness, asymmetric information of citizens, or competition costs in general, and is thus able to seek rents while in office. This generally produces an inefficient allocation of government revenues in which public goods are underprovided (but which may, however, lower corruption, as seen in Bulte and Damania).

When there are no stable institutions that specify the rules of political turnover, the competition is characterised by conflict in which groups vie for political power (in order to capture the rents) by investing in 'fighting' efforts or violence. Such competition, then, is more aptly captured by a contest function, e.g. Tullock. (From here on, I thus use the term political 'contest' in lieu of competition.) I interpret the (ex ante) intensity of the political contest in terms of the opportunity costs of fighting. When the latter is high, entry into the contest is prohibitive, which implies that groups that have been able to surmount high costs are ex ante strong adversaries. The intensity of the contest, which is a parameter, is thus distinct from the ex post fighting efforts that the groups choose.

In this subsection, I present a model in which the descent into conflict is endogenised, as groups decide whether or not to accept election outcomes. There are thus two kinds of contest environments - democracy and conflict, and the model characterises the (necessary) condition that determines whether democracy survives or breaks down. In the next subsection, a conflict environment is assumed, and the models solve for the equilibrium levels of violence.

The following is by Aslaksen and Torvik (2006). A population of N individuals, normalised to one, is divided into two groups/parties $I = A, B$ that compete for political power. The particular form of competition depends on the institutional environment - democracy or conflict, which is endogenous in the model. In a democracy, the groups compete in elections, and the winner decides how to allocate government revenues from natural resources between public goods or rents/transfers to the incumbent politician.

However, the losing party can choose not to accept the election result, and initiate conflict. In a conflict environment, the groups fight over the natural resource revenues.

To clarify, the following describes the timing of events of a game that is played for infinite time periods $t = 0, 1, 2, ..\infty$:

1. Groups A and B announce political platforms and/or initiate conflict.

2. If A and/or B initiates conflict, conflict takes place and the winner consumes the rents before the period ends. Otherwise, an election is held.

3. If an election is held, the losing party decides whether to accept the result or initiate conflict. If conflict is initiated, conflict takes place and the winner obtains and consumes the rents before the period ends.

4. If conflict is not initiated, the policy of the election winner is implemented, and the latter consumes any rents it appropriates.

5. A new period starts.

Focusing on a stationary SPNE in which conflict is never initiated, one can then derive the effect of resource revenues on the likelihood that democracy survives.

A necessary condition for such "self-enforcing democracy" is that the election loser accepts the result. This is possible since even if the loser has zero utility in the period in which it lost the election, it has a chance to run again in future elections. Denote, then, the expected value of group/party I from losing an election as V_D^I, and its expected value from initiating conflict as V_C^I, self-enforcing democracy requires $V_D^I > V_C^I$ for $I = A, B$.

To obtain an expression for V_C^I, let F denote the fixed number of soldiers required in a conflict environment, G^I the fighting effort expended by group I, and w the wage rate or marginal productivity of labor. The cost of conflict for I is given by $C^I = wF + wG^I$. The gains Ω^I are the expected share of natural resources R, where the probability of winning in conflict is given by the Tullock contest function $\frac{G^I}{G^I+G^J}$, $I, J = A, B$, $I \neq J$.

Each group chooses its own effort G^I to maximise $\Omega^I = \frac{G^I}{G^J+G^I} R$ subject to cost C^I, which yields reaction functions $G^I = \sqrt{\frac{G^J R}{w}} - G^J$, $I, J = A, B$, $I \neq J$. Fighting effort in equilibrium is thus

$$G^I = \frac{R}{4w} \tag{43}$$

which, when substituted back into Ω^I gives the per-period utility of I in a conflict environment:

$$U_C^I = \frac{R}{4} - wF. \tag{44}$$

Let β denote the discount factor, common to both groups. The expected value of initiating conflict is thus

$$V_C^I = \frac{\frac{1}{4}R - wF}{1-\beta}. \tag{45}$$

Meanwhile, the expected value of losing an election at $t = 0$ is

$$V_D^I = 0 + \sum_{t=1}^{\infty} \beta^t U_D^I, \tag{46}$$

where U_D^I is the per-period expected utility of running in the election, which is given by

$$U_D^I = p^I r^I, \tag{47}$$

with p^I the probability of winning the election, and r^I the discretionary revenues or rents appropriated from natural-resource revenues R after providing public goods g^I to each voter i. That is, with voters normalised to one,

$$g_I^i = R - r^I. \tag{48}$$

Voter i cares about her wage w^i and transfers g_I^i, and her utility is given by

$$u_I^i = \ln(w^i + g_I^i) + (\sigma^i + \delta)D_B, \tag{49}$$

where D_B is an indicator for party B, σ^i an individual-specific ideology parameter uniformly distributed on $[-\frac{1}{2\phi}, \frac{1}{2\phi}]$ with density $\phi > 0$, and δ a parameter capturing the relative popularity of the candidate from B that is uniformly distributed on $[-\frac{1}{2\psi}, \frac{1}{2\psi}]$ with density $\psi > 0$. Thus, voter i supports the candidate of party A if $\sigma^i < \ln(w + R - r^A) - \ln(w + R - r^B) - \delta$, and the number of voters that support A is $N^A = \int_{-\frac{1}{2\phi}}^{\ln(w+R-r^A)-\ln(w+R-r^B)-\delta} \phi di$, or,

$$N^A = \frac{1}{2} + \phi[\ln(w + R - r^A) - \ln(w + R - r^B) - \delta]. \tag{50}$$

The election probability for A is thus $p^A = \Pr\{N^A \geq \frac{1}{2}\} = \Pr\{\delta \leq \ln(w + R - r^A) - \ln(w + R - r^B)\}$. Thus, $p^A = \int_{-\frac{1}{2\psi}}^{\ln(w+R-r^A)-\ln(w+R-r^B)} \psi di$, or,

$$p^A = \frac{1}{2} + \psi[\ln(w + R - r^A) - \ln(w + R - r^B)], \tag{51}$$

while for candidate B, $p^B = 1 - p^A$.

Given these probabilities, the policy platform of I is $r^I = \arg\max_r^I p^I r^I$. One can then obtain the following result:

Proposition 4.6 *Natural-resource revenues generate a curse whereby democracy is less likely to survive and conflict more likely to ensue. The curse is mitigated when the political contest is (ex ante) intense, that is, when the costs of fighting are high.*

4.3 Conflict

While the focus in Aslaksen and Torvik has been in showing that resource rents induce groups to initiate conflict in order to capture the rents, it is straightforward to solve for the equilibrium level of fighting efforts or violence that groups choose. Equation (43) implies that violence is increasing in resource rents and decreasing in the opportunity cost of fighting.

I present two other models in order to demonstrate that such a result is robust to different specifications of the conflict between groups. In, Besley and Persson (2011), the incumbent and opposition groups simultaneously choose their fighting efforts as in Aslaksen and Torvik, but the contest function takes a more general form (of which the Tullock function is a special case). Tsui (2010) lets the incumbent be the first mover who invests in counterinsurgency efforts, which challengers then take into account in deciding whether to engage in insurgency.

I begin with Besley and Persson. There are two groups A, B where either can be the incumbent I or opposition O, who can each invest in respective levels of violence or fighting efforts L^I and L^O in order to remain in, or obtain, political power. The probability that O wins in such contest is given by the function $\gamma(L^O, L^I; \xi)$, with ξ a parameter vector, which has the following properties:[12]

(a) $\gamma \in (0,1)$, $\gamma_{L^O} > 0, \gamma_{L^I} < 0, \gamma_{L^O L^O} < 0, \gamma_{L^I L^I} > 0$

(b) $\frac{-\gamma_{L^I}(0,0;\xi)}{\gamma_{L^O}(0,0;\xi)} \geq 2[1-\gamma(0,0;\xi)]$

(c) $\frac{\gamma_{L^I}\gamma_{L^O L^O}}{\gamma_{L^O}} \geq \gamma_{L^I L^O} \geq \frac{\gamma_{L^O}\gamma_{L^I L^I}}{\gamma_{L^I}}$

The group in power has control over the government budget $R - \Sigma_{J\in\{I,O\}}\frac{r^J}{2} - G - wL^I \geq 0$, where R captures total revenues including those from natural resources and foreign aid, r^J are private transfers to group $J \in \{I, O\}$, G are public goods, and w is the wage rate of labor. In addition, the incumbent is able to fund its cost of fighting out of government revenues. (In contrast, the opposition can only fund L^O from its own labor endowment.) The incumbent is constrained, however, to give $\sigma \in [0,1]$ to the opposition for every transfer of 1 to its own group. Thus, $r^O = \sigma r^I$ which, assuming the budget constraint holds with equality, implies that $r^I = 2(1-\theta)[R - G - wL^I]$,

[12]As the authors note, these are satisfied by the Tullock-Skaperdas type of contest function, $\frac{\xi L^O}{\xi L^O + L^I}, \xi \geq 1$, as well as the logistic form $\frac{\exp[\xi_O L^O]}{\exp[\xi_O L^O]+\exp[\xi_I L^I]}$ in Hirschleifer and the semi-linear form $\gamma_O + \xi_1[h(L^O) - \xi_2 h(L^I)]$.

where $\theta = \frac{\sigma}{1+\sigma} \in [0, \frac{1}{2}]$. The authors interpret θ as a parameter that captures the extent of representative or cohesive political institutions - if $\theta = \frac{1}{2}$, the transfers are shared equally by the two groups.

Transfers, public goods, and fighting efforts are determined in the following game.[13]

1. Group I and group O simultaneously choose L^I and L^O, respectively.

2. Group I remains in office with probability $1 - \gamma(L^O, L^I; \xi)$.

3. The winning group becomes the new incumbent and determines transfers r^J and public goods G.

The game is solved by backward induction. Let groups have utility $V^J = \alpha H(G) + c^J$ (with derivatives $H_G > 0, H_{GG} < 0$), where α is a parameter reflecting the value of public goods, and c^J is private consumption of group $J \in \{I, O\}$ which is financed by wage income and transfers. The winner of the political contest chooses the optimal level of public goods $G = \arg\max_G \alpha H(G) + 2(1-\theta)[R - G - wL^I] + w$, where recall that the second term is the transfer to the incumbent.

With probability $1 - \gamma(L^O, L^I; \xi)$ of remaining in office, the expected payoff of the original incumbent from choosing fighting effort L^I is thus

$$V^I = \alpha H(G) + w + [(1-\theta) - \gamma(L^O, L^I; \xi)(1-2\theta)]2[R - G - wL^I], \qquad (52)$$

while the expected payoff of the opposition, who has probability of winning $\gamma(L^O, L^I; \xi)$, from choosing fighting effort L^O is

$$V^O = \alpha H(G) + w(1 - L^O) + [\theta + \gamma(L^O, L^I; \xi)(1-2\theta)]2[R - G - wL^I], \qquad (53)$$

[13]Besley and Persson actually specify an infinitely repeated version, but where each generation dies at the end of the period after consuming all income and public goods, and a new generation replaces it in the next period. (Incumbency is inherited from the previous generation). However, there are no state variables - at each time period, new values of R and w are realized. To simplify, I thus present the game played by one generation.

where, as noted previously, L^O is financed by the opposition's labor endowment. Maximizing these payoffs obtains equilibrium fighting efforts of I and O, and yields the following result:

Proposition 4.7 *Natural resource revenues and/or foreign aid generate a curse whereby the likelihood of repression and/or civil war increases. The curse is mitigated when the political contest is (ex ante) intense, that is, when the costs of fighting are high.*

Finally, Tsui (2010) shows how resource revenues encourage the entry of more insurgent groups, which induces the incumbent to invest in more repression to suppress the insurgency.

Let the incumbent have a total government budget of $r + pg + \delta\tau_y y(g) + \tau_R R$, where r are the leader's rents, g are public goods (priced at p), $y(g)$ the total output from a non-resource sector, which uses g as inputs, R is output from the resource sector, τ_y and τ_R are tax rates imposed on the non-resource and resource sectors, respectively, and δ a deadweight loss from taxing the non-resource sector.

Assume that there are also deadweight losses associated with the rents r. In particular, the incumbent is only able to obtain net rent $\gamma r - \beta(b)$, where $(1-\gamma)$ is some transaction cost incurred when rents are appropriated, while $\beta(b)$ is the cost of maintaining repression or political entry barrier b, with $\beta(0) = 0, \beta_b > 0, \beta_{bb} \geq 0$. That is, whenever the insurgent challenges the incumbent, the former incurs cost b , and so $\beta(b)$ can also be interpreted as the cost of counterinsurgency efforts of the incumbent.

An infinitely repeated game is played between an incumbent and challengers, whereby at each $t = 0, 1, 2, ...\infty$:

1. The incumbent chooses policy vector $(g_t, b_t, \tau_{y,t}, \tau_{R,t})$.

2. Each potential insurgent decides whether or not to challenge the incumbent. The total number of challengers is c_t, and each $j = 1, 2, ...c_t$ has success hazard h_{jt}.

Tsui constructs an equilibrium in which the incumbent survives for T periods. The value of being in power beginning at some t and remaining until T periods is

$$v_t(T) = [\gamma r_t - \beta(b_t)] \int_0^T e^{-is} ds = [\gamma r_t - \beta(b_t)] \Big(\frac{1 - e^{iT}}{i} \Big), \tag{54}$$

where i is the interest rate. With the hazard rate for ending a regime given by $c_t h_t$, where h_t is the average success hazard among challengers, the expected value of governing at t is

$$V_t \equiv \int_0^\infty c_t h_t e^{-c_t h_t T} v_t(T) dt = \frac{\gamma r_t - \beta(b_t)}{i + c_t h_t}. \tag{55}$$

Let an individual challenger j's hazard be a function of her performance relative to the prior incumbent's:

$$h_{jt} = \frac{z_{t+1}}{z_t}, \tag{56}$$

where $z_t = (1 - \tau_{yt}) y(g_t) + (1 - \tau_{Rt}) R$ is after-tax income. She incurs cost of challenging b_t to overcome the entry barrier set by the incumbent, and a reservation wage w, which is her opportunity cost. The expected return from challenging (and being the next period's incumbent) is thus

$$\pi_{jt} = \frac{h_{jt} V_{t+1}}{1 + c_t h_t} - b_t - w. \tag{57}$$

Thus, a challenger will enter until $\pi_{jt} = 0$ for all $j = 1, 2, ...c_t$. Assume symmetry such that $h_{jt} = h_t$. Then, setting π_{jt} to zero in (57) and inverting give the number of challengers

$$c_t = \frac{V_{t+1}}{b_t + w} - \frac{i}{h_t}. \tag{58}$$

The equilibrium is thus an infinite sequence of policies $\{g_t, b_t, \tau_{yt}, \tau_{Rt}\}_{t=0}^\infty$ obtained from the optimisation problem:

$$\max_{g_t, b_t, \tau_{yt}, \tau_{Rt}} \frac{\gamma r_t - \beta(b_t)}{i + c_t h_t} \tag{59}$$

subject to the following constraints:

$$r + t + pg_t = \delta\tau_{yt}(g_t) + \tau_{Rt}R \tag{60}$$

$$\frac{h_t V_{t+1}}{1 + c_t h_t} - b_t - w = 0 \tag{61}$$

$$h_t = \frac{(1 + t_{y,t+1})y(g_{t+1}) + (1 - \tau_{R,t+1})R}{(1 + t_{y,t})y(g_t) + (1 - \tau_{R,t})R}, \tag{62}$$

where sequence $\{g_t, b_t, \tau_{yt}, \tau_{Rt}\}$, $s \geq t + 1$ is taken as given by the regime/incumbent at t.

Because of the deadweight loss from taxing the non-resource sector, the tax rate $\tau_{R,t}$ in the resource sector is relatively higher in equilibrium. Tsui shows that when R is sufficiently small (case 1), $\tau^*_{y,t} < 1$ while $\tau_{R,t} = 1$, and when R is large (case 2), $\tau^*_{y,t} = 0, \tau^*_{R,t} < 0$. To focus on the existence of a political resource curse, one can derive comparative statics on b^*_t and c^*_t and obtain the following result:

Proposition 4.8 *Natural resource revenues generate a curse whereby resource revenues encourage more insurgent groups to fight the incumbent, which induces the latter to increase the political barriers and enforce it with repression/counterinsurgency efforts. The curse is mitigated when the political contest is (ex ante) intense, that is, when the costs of fighting are high.*

5 Conclusions

In surveying existing formal models, I propose a definition of the political resource curse that is *not* based on the particular outcomes of rent-seeking, but rather on the actors that engage in it. Natural resources and other windfall gains have indeed been empirically shown to lead to worse governance, e.g. lower public goods provision and higher corruption, the instability of democratic regimes, and increased likelihood and magnitude of violent conflict, but these outcomes are not exclusively political, since they also affect economic welfare. What singularly distinguishes a *political* resource curse is the fact that rent-seeking is done by political agents, rather than (just) the private sector.

This distinction is not trivial. In fact, I have shown that if political agents are assumed to want to capture rents from public revenues, resources that increase the value of such rents will always lead to a socially inefficient outcome. That is, as long as political agents who decide on the allocation of public revenues have utility functions that are different from the principal's (social) welfare/utility function, then the revenues will be misallocated.

In contrast, when rent-seeking is done solely by private agents, they will allocate their endowments towards rent-seeking than to productive endeavors if the marginal benefit from the former is relatively larger. Social costs may be incurred if there are deadweight losses from rent-seeking, but this has to be assumed. Indeed, a contest function is used precisely to capture the deadweight loss from the spillover of one's own 'fighting' effort to other's efforts. Even then, the social costs may be offset when rents are sufficiently large. Thus, as I show in the model of Hodler, total social consumption/welfare may actually increase when resources rents are large enough.

What a rent-seeking political agent can do that a private individual cannot is distort the weights assigned to individual's utilities. In capturing rents, the political agent values her, or her own group's, utility more than others', whereas private individuals can have the same utility over rents vs. production. In the latter case, there is no misallocation among groups, and rents affect everyone's individual welfare to the same extent.

Thus, there is always some social inefficiency when political agents are rent-seeking, but there may not be if only the private sector is rent-seeking. In other words, resources and other windfall gain always generate a political resource curse whenever political agents want to capture rents.

Of course, one can argue that even if rents are desired, it may not be possible to obtain them. The private sector may be prevented from capturing rents when governance and institutions are effective. But what prevents the government from appropriating rents?

I thus show that political competition or contests among potential leaders can constrain the incumbent from capturing too much rents. The constraint, however, does not perfectly prevent rent-seeking. No leader can credibly commit to future performance, and nor can citizens perfectly predict whether the leader is a rent-seeking type. More generally, the incumbent may enjoy some cost advantage over challengers. Thus, in equilibrium, any type of political competition selects a leader who is able to appropriate rents.

To date, then, formal models of the political resource curse generate the same overarching result. Political agents misallocate revenues from natural resources and other windfall gains (which is reflected in specific outcomes, e.g. lower public goods provision, greater likelihood of conflict, increased violence), but the misallocation is mitigated by the strength of the underlying competition or contest over political power.

References

[1] Abdih, Y., Chami, R., Dagher, J., Montiel, P. 2012. "Remittances and institutions: are remittances a curse?" *World Development* 40: 657666.

[2] Ahmed, Faisal Z. 2012. "The Perils of Unearned Foreign Income: Aid, Remittances, and Government Survival." *American Political Science Review* 106 (01):146-65.

[3] Aslaksen, Silje, and Ragnar Torvik. 2006. "A Theory of Civil Conflict and Democracy in Rentier States." *The Scandinavian Journal of Economics* 108(4): 571-85.

[4] Auty, Richard M. 1993. *Sustaining Development in the Mineral Economies: The Resource Curse Thesis*. London: Routledge.

[5] Bates Robert H., and Da-Hsiang D. Lien. 1985. "A Note on Taxation, Development, and Representative Government." *Politics & Society* 14:53-70.

[6] Besley, Timothy, and Torsten Persson. 2011. "The Logic of Political Violence." *The Quarterly Journal of Economics* 126: 1411-45.

[7] Brollo, Fernanda, Nannicini, Tommaso, Perotti, Roberto, and Guido Tabellini. 2013. "The Political Resource Curse." *American Economic Review* 103(5): 1759-1796.

[8] Bueno de Mesquita, Bruce, Smith, Alastair, Siverson, Randolph M., and Morrow, James D. 2003. *The Logic of Political Survival*. Cambridge, MA: MIT Press.

[9] Bueno de Mesquita, Bruce, and Alastair Smith. 2010."Leader Survival, Revolutions, and the Nature of Government Finance." *American Journal of Political Science* 54:936-50.

[10] Bulte, Erwin, and Richard Damania. 2008. "Resources for Sale: Corruption, Democracy and the Natural Resource Curse." *The B.E. Journal of Economic Analysis and Policy* 8(1): 1-28.

[11] Collier, Paul, and Anke Hoeffler. 2004. "Greed and Grievance in Civil War." *Oxford Economic Papers* 56:563-595.

[12] Deacon, Robert T. 2011. "The Political Economy of the Natural Resource Curse: A Survey of Theory and Evidence." *Foundations and Trends in Microeconomics* 7(2): 111-208.

[13] Deacon, Robert T. and Ashwin Rode. 2015. "Rent Seeking and the Resource Curse", in *Companion to the Political Economy of Rent Seeking*, Roger Congleton and Arye L. Hillman, eds. Cheltenham, U.K.: Edward Elgar Publishing.

[14] Fearon, James D., and David D. Laitin. 2003. "Ethnicity, Insurgency, and Civil War." *American Political Science Review* 97(1): 75-90.

[15] Grossman, Gene, and Elhanan Helpman, 1994. "Protection for Sale." *American Economic Review* 84: 833-50.

[16] Hirshleifer, Jack. 1989. "Conflict and Rent-Seeking Success Functions: Ratio vs. Difference Models of Relative Success." *Public Choice* 63: 101112.

[17] Hodler, Roland. 2006. "The Curse of Natural Resources in Fractionalized Countries." *European Economic Review* 50: 1367-1386.

[18] Kydd, Andrew H. 2015. "International Relations Theory: The Game-Theoretic Approach." Cambridge, U.K.: Cambridge University Press.

[19] Lane, Philip R., and Aaron Tornell. 1996. "Power, Growth and the Voracity Effect." *Journal of Economic Growth* 1: 213-241.

[20] Mehlum, H., Moene, K., and R. Torvik. 2006. "Institutions and the Political Resource Curse." *Economic Journal* 116: 1-20.

[21] North, Douglass C., and Barry Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History* 49:803-32.

[22] Persson, Torsten, and Guido Tabellini. 2000. *Political Economics: Explaining Economic Policy*. Cambridge, MA: MIT Press.

[23] Robinson, James. A., Torvik, Ragnar, and Thierry Verdier. 2006. "Political Foundations of the Resource Curse." *Journal of Development Economics* 79(2): 447-68.

[24] Ross, Michael L. 2015. "What Have We Learned About the Resource Curse?" *Annual Review of Political Science* 18: 239-59.

[25] Sachs, Jeffrey, and Andrew Warner. 1995. "Natural Resource Abundance and Economic Growth". NBER Working Paper 5398.

[26] Skaperdas, Stergios. 1996. "Contest Success Functions." *Economic Theory* 7: 283-90.

[27] Smith, Alastair. 2008. "The Perils of Unearned Income." *Journal of Politics* 70:780-93.

[28] Tornell, Aaron, and Philip R. Lane. 1999. "The Voracity Effect." *American Economic Review* 89(1): 22-46.

[29] Torvik, Ragnar. 2002. "Natural Resources, Rent-seeking and Welfare." *Journal of Development Economics* 67: 455-70.

[30] Tilly, Charles. 1992. *Coercion, Capital, and European States, AD 990-1992.* 2nd ed. Malden: Blackwell.

[31] Tsui, Kevin K. 2010."Resource Curse, Political Entry, and Deadweight Costs." *Economics and Politics* 22(3): 471-97.

[32] Tullock, Gordon. 1980. "Efficient Rent Seeking." In J. Buchanan, R. Tollison and G. Tullock, eds, *Toward a Theory of the Rent Seeking Society.* College Station: Texas A&M University Press.

[33] Wiens, David, Post, Paul, and William Roberts Clark. 2014. "The Political Resource Curse: An Empirical Re-evaluation". *Political Research Quarterly* 67(4): 783-794.

Appendix

Proof of Proposition 3.1

Solving (6) obtains reaction function

$$f_i^R(f_{-i}) = \sqrt{\frac{k\Omega f_{-i}}{a}} - f_{-i}. \tag{63}$$

Since this holds for each group, then

$$\sum_{j=1}^{k} f_j = \sqrt{\frac{k\Omega f_{-i}}{a}}. \tag{64}$$

In equilibrium, $f_i^* = f^*$, in which case f^* can replace f_i for all $i = 1, 2, ...k$ in (64) to obtain each group's equilibrium level of fighting,

$$f^* = \frac{(k-1)\Omega}{ka}, \tag{65}$$

which can then be substituted into (5) to get the extent of property rights in equilibrium

$$p^* = 1 - (k-1)\frac{\Omega}{aX}, \tag{66}$$

and which, with (2), (3) and (4), gives $c^* = [1 - \frac{(k-1)\Omega}{aX}][\frac{aX-(k-1)\Omega}{k}] + \frac{1}{k}[\frac{(k-1)^2\Omega^2}{X} + \Omega(1-(k-1)(a+1)) + aX]$.

Differentiating (65) and (66) with respect to windfall gains Ω obtains the following comparative statics: $\frac{\partial f^*}{\partial \Omega} = \frac{k-1}{ka} > 0$; $\frac{\partial p^*}{\partial \Omega} = -\frac{k-1}{aX} < 0$. Note also how a larger value of parameter a implies a smaller effect of Ω on f^* and p^*.

Proof of Proposition 4.1

By (9) and (10), the optimal level of public-good substitutes that households provide themselves is

$$z^* = (1-\lambda)[(1-\tau)y + R_2] - \lambda g, \tag{67}$$

which is clearly increasing in remittances R_2. Plugging (67) into (10) gives c^* which, with z^*, obtains U_h^*. The government thus incorporates the latter into its problem ((7) and (8)), which yields equilibrium public good provision[14]

$$g^* = (\tau - \alpha)y + (1-\alpha)R_1 - \alpha R_2. \tag{68}$$

Substituting into (8), rearranging, and dividing by y give the share of income that the incumbent appropriates as rents:[15]

$$\frac{r^*}{y} = \alpha\Big(1 + \frac{R_1 + R_2}{y}\Big), \tag{69}$$

which is increasing in the share of unearned income to total income. (By (8), larger rents imply lower public good provision.) Specifically, $\frac{\partial \frac{r^*}{y}}{\partial \frac{R_1+R_2}{y}} = \alpha > 0$. Note, then, that the rate of increase is lower when $1-\alpha$ is high (since α is small).

Proof of Proposition 4.2

I derive the comparative statics of g and r with respect to unearned income R by applying Cramer's rule to (18), (19), and (14):

$$\frac{\partial g}{\partial R} = -\frac{\det\begin{pmatrix} 0 & 0 & v_g \\ 0 & \lambda u_{rr} & u_r \\ -\frac{1}{W} - \frac{\partial g_C}{\partial R} & u_r & 0 \end{pmatrix}}{\det\begin{pmatrix} \lambda v_{gg} & 0 & v_g \\ 0 & \lambda u_{rr} & u_r \\ v_g & u_r & 0 \end{pmatrix}} \tag{70}$$

[14] This is $g^* = (\tau - \alpha)y - \alpha R_2$ in Abdih et al., as they do not consider R_1.

[15] This is $\frac{r^*}{y} = \alpha\Big(1 + \frac{R_2}{y}\Big)$ in Abdih et al.

$$\frac{\partial r}{\partial R} = -\frac{\det\begin{pmatrix} \lambda v_{gg} & 0 & v_g \\ 0 & 0 & u_r \\ v_g & -\frac{1}{W} - \frac{\partial g_C}{\partial R} & 0 \end{pmatrix}}{\det\begin{pmatrix} \lambda v_{gg} & 0 & v_g \\ 0 & \lambda u_{rr} & u_r \\ v_g & u_r & 0 \end{pmatrix}} \tag{71}$$

where recall that $u_{rr}, v_{gg} < 0$. Evaluating and simplifying gives:

$$\frac{\partial g}{\partial R} = \frac{-v_g[-\lambda u_{rr}(-\frac{1}{W} - \frac{\partial g_C}{\partial R})]}{-\lambda v_{gg} u_r^2 - \lambda v_g^2 u_{rr}} \tag{72}$$

$$\frac{\partial r}{\partial R} = \frac{u_{rr} \lambda v_{gg}(-\frac{1}{W} - \frac{\partial g_C}{\partial R})}{-\lambda v_{gg} u_r^2 - \lambda v_g^2 u_{rr}} \tag{73}$$

Note that (13) implies that R increases g_C, i.e. $\frac{\partial g_C}{\partial R} > 0$. It follows then that $\frac{\partial g}{\partial R} < 0$, while $\frac{\partial r}{\partial R} > 0$. From (72) and (73) the effects are smaller in absolute value the larger W is. The result is thus similar to Ahmed and Abdih et al.

Proof of Proposition 4.3

Robinson et al. derive the effect of price booms, i.e. changes in p_1 and p_2, on resource extraction, public sector employment, and total income. To be analogous to Ahmed, Abdih et al., BDM and Smith, I focus on the resource curse as it applies to public sector employment G_1. Since the public sector is inefficient, employment therein is simply a particular form of patronage that politicians distribute to its supporters. Robinson et al. write (29) and (30) in differential form:

$$\phi_1 de + \phi_2 dG_1 = \phi_3 dp_1 + \phi_4 dp_2 \tag{74}$$

$$\psi_1 de + \psi_2 dG_1 = \psi_3 dp_1 + \psi_4 dp_2, \tag{75}$$

where $\phi_1 = \Pi p_2 R_{ee} < 0$, $\phi_2 = \Pi_{G_1} p_2 R_e < 0$, $\phi_4 = \Pi R_e < 0$, $\psi_1 = p_2 \Pi_{G_1} R_e < 0$, $\psi_2 = -2[H-(1-\alpha)F]\Pi_{G_1} < 0$, $\psi_3 = 0$, and $\psi_4 = -R\Pi_{G_1} < 0$, and show that: (i) when $dp_1/p_1 = dp_2/p_2 = dp/p$, then $\frac{dG_1}{dp/p} = -\frac{\Pi\Pi_{G_1} RR_{ee}}{D} > 0$, (ii) when $dp_1 > 0, dp_2$, then $\frac{dG_1}{dp_1} = \frac{\Pi_{G_1} R_e}{D} < 0$, and (iii) when $dp_1 = 0, dp_2 > 0$, then $\frac{dG_1}{dp_2} = \frac{\Pi\Pi_{G_1}[R_e^2 - RR_{ee}]}{D} > 0$, where $D \equiv -2[H-(1-\alpha)F]\Pi\Pi_{G_1} R_{ee} - p_2 \Pi_{G_1}^2 R_e^2 > 0$.

To show the extent to which the political (electoral) competition mitigates the curse of patronage, I differentiate (i) and (iii) with respect to Π. Since the latter is the incumbent's probability of reelection, a high value of Π captures relatively weak competition. In turn, note from (25) that this is more likely the higher the cost F of firing a public employee and the lower the productivity H in the private sector. In such a case the efficiency loss (from allocating employment to the public rather than private sector) is small, which eases the electoral pressure on the incumbent, enabling her to favor her own group more easily.

Differentiating $\frac{dG_1}{dp/p}$ with respect to Π gives $\frac{-D\Pi_{G_1} RR_{ee} - (-\Pi\Pi_{G_1} RR_{ee})[-2(H-(1-\alpha)F)\Pi_{G_1} R_{ee}]}{D^2}$, which is positive (such that lowering π, i.e. strengthening the competition, decreases the effect), while differentiating $\frac{dG_1}{dp_2}$ with respect to Π gives $\frac{D\Pi_{G_1}(R_e^2 - RR_{ee}) - \Pi\Pi_{G_1}(R_e^2 - RR_{ee})[-2(H-(1-\alpha)F)\Pi_{G_1} R_{ee}]}{D^2}$, which is negative.

Proof of Proposition 4.4

Solving for n^J, $J = H, L$, gives the equilibrium share $\pi = \frac{n^L}{n^H + n^L}$ of L types in the pool of opponents:

$$\pi = \frac{1}{1+x}, \\ x \equiv \frac{V_2^H y^L \frac{1}{2} + \xi\sigma}{V_2^L y^H \frac{1}{2} - \xi\sigma} = \frac{(\alpha^H \psi\tau + R) y^L \frac{1}{2} + \xi\sigma}{(\alpha^L \psi\tau + R) y^H \frac{1}{2} - \xi\sigma} \gtrless 1. \tag{76}$$

Lastly, plugging π into $\hat{\sigma} \equiv \sigma(1-2\pi)$ in (35) gives the equilibrium rents that the incumbent extracts from revenues

$$r_1^J = \tau - \xi\Big[1 - \sigma\Big(\frac{1-x}{1+x}\Big)\Big](\psi\tau + R/\alpha^J). \tag{77}$$

Taking the derivative of (77) and (76) with respect to τ shows that a political resource curse manifests in two ways: higher rents (and less public goods) and the erosion of the quality of the candidate pool. That is, $\frac{\partial r_1^J}{\partial \tau} = 1 + \xi\alpha(\frac{1-x}{1+x})\psi > 0$ and $\frac{\partial \pi}{\partial \tau} = \frac{-\partial x/\partial \tau}{(1+x)^2} > 0$.[16] Furthermore, note that $\frac{\partial r_1^J}{\partial \tau} = 1 + \xi\alpha\pi(1-x)\psi$ itself is increasing in π if $x < 1$. In this case, the curse of lower public good provision is exacerbated as candidate-quality is eroded.

Proof of Proposition 4.5

Bulte and Damania formally show that if there is no challenger (such that constraint (40) does not bind), an increase in p unambiguously decreases B^M and increases B^R. (Intuitively, an increase in p enables firms in the resource sector to offer higher bribes, which induces the incumbent to move public-good spending away from the more productive manufacturing sector and towards the resource sector.) That is, with no political challengers, $\frac{\partial B^M}{\partial p} < 0, \frac{\partial B^R}{\partial p} > 0$. This generates a drop in welfare, i.e. $\frac{dW}{dp} < 0$. To see this, note that when profits equalise in equilibrium, welfare $W = N^M\pi^M + N^R\pi^R + wL$ reduces to $N\pi + wL$, and hence, $\frac{dW}{dp} = N\frac{d\pi}{dp}$. With $\frac{\partial B^M}{\partial p} < 0, \frac{\partial B^R}{\partial p} > 0$, profits in the manufacturing sector decline by more than any increase in resource-sector profits (because of the sector-wide spillovers in manufacturing). Thus, in equilibrium, it must be that $\frac{d\pi}{dp} < 0$, which means that $\frac{dW}{dp} < 0$.

Now if there is a challenger such that (40) binds, the incumbent is also induced to provide more B^M. (From (40), the increase in B^M is likely to be larger the smaller the cost v incurred by challengers, that is, the stronger the political competition.) Thus, with $\frac{\partial B^R}{\partial p} > 0$ and $\frac{\partial B^M}{\partial p} > 0$, profits rise in both sectors, which means that in equilibrium $\frac{d\pi}{dp} > 0$, implying that $\frac{dW}{dp} > 0$.

Thus, faced with threats from challengers, an increase in the value of resources may

[16] That $\partial x/\partial \tau < 0$ can be seen by getting $\partial \frac{V_2^H}{V_2^L}/\partial \tau = \frac{\psi R}{(V_2^L)^2}(\alpha^H - \alpha^L) < 0$.

generate a blessing in the form of higher public goods provision and aggregate welfare. However, the authors do not draw attention to the implication that the increase in welfare may come at the expense of greater corruption. Increasing provision of B^R and B^M increases profits in both sectors, which means that all firms can afford to pay more bribes. The increase is higher for the manufacturing sector which internalises the positive effect of B^M on other firms in that sector.

Specifically, suppose constraint (40) binds such that $\frac{\partial B^M}{\partial p} > 0$ (while $\frac{\partial B^R}{\partial p} > 0$ is always true). Then if public goods sufficiently raise productivity such that (i) $p\frac{\partial Q^R}{\partial B^R} > w\frac{\partial l^R}{\partial B^R} + \frac{\partial s^R}{\partial B^R}$, then $\frac{\partial s^R}{\partial p}$. Similarly, if (ii) $\frac{\partial Q^M}{\partial B^M} > w\frac{\partial l^M}{\partial B^M} + \frac{\partial s^M}{\partial B^M}$, then $\frac{\partial s^M}{\partial p}$. (To see this, one can differentiate profit (37) with respect to s^R and profit (38) with respect to s^M and note that profits rise with s^R, s^M, inducing firms to increase the latter, for as long as (i) and (ii) hold.) When (i) and (ii) hold, aggregate bribes unambiguously increase.

Proof of Proposition 4.6

By symmetry, both candidates choose the same policy platform (and win with probability $\frac{1}{2}$):

$$r^I = \min\Big(R, \frac{w+R}{2\psi+1}\Big). \tag{78}$$

Plugging r^I back into U_D^I and using $p^I = \frac{1}{2}$, the per-period expected utility of running in the election is

$$U_D^I = \min\Big(\frac{1}{2}R, \frac{w+R}{2(2\psi+1)}\Big), \tag{79}$$

and the expected value of losing in the election is

$$V_D^I = \frac{\beta}{1-\beta}\Big(\frac{w+R}{2(2\psi+1)}\Big). \tag{80}$$

Thus, the necessary condition for self-enforcing democracy, $V_D^I > V_C^I$, is $\frac{\beta}{1-\beta}(\frac{w+R}{2(2\psi+1)}) > \frac{\frac{1}{4}R-wF}{1-\beta}$, or, simplifying:

$$\beta + F(4\psi + 2) > (\psi + \frac{1}{2} - \beta)\frac{R}{w}. \quad (81)$$

Restrict attention to the case when $\psi + \frac{1}{2} > \beta$. Then condition (81) is less likely to be satisfied when R is large and F and w are low.

Proof of Proposition 4.7 Define $Z = \frac{R-G}{w}$. Then equilibrium fighting efforts are

$$L^{I*} = \arg\max_{L^I} 2w\{[1 - \theta - \gamma(L^O, L^I; \xi)(1 - 2\theta)][Z - L^I]\} \quad (82)$$

$$L^{O*} = \arg\max_{L^O} w\{2[\theta + \gamma(L^O, L^I; \xi)(1 - 2\theta)][Z - L^I] - L^O\}, \quad (83)$$

which are both increasing in R (for $\theta < \frac{1}{2}$).

Besley and Persson derive thresholds Z^I and Z^O, $Z^I < Z^O$, such that:

(i) for $Z \leq Z^I$, $L^{O*} = L^{I*} = 0$.

(ii) for $Z \in (Z^I, Z^O)$, $L^{I*} > L^{O*} = 0$.

(iii) for $Z \geq Z^O$, $L^{I*}, L^{O*} > 0$.

Case (i) captures a peace equilibrium as neither group fights; case (ii) captures repression in that only the incumbent engages in violence; and case (iii) captures civil conflict since both groups fight. (That it requires a smaller value of Z for the incumbent to start engaging in violence intuitively follows from the assumption that the incumbent funds its fighting efforts out of government revenues and thus has a cost advantage over the opposition.) The result holds since Z is increasing in R and decreasing in w.

Proof of Proposition 4.8

As in Tsui, one can then plug the constraints (61) and (62) into (59). For case 1, one can then impose $\tau^*_{R,t} = 1$ into (60) to get an expression for $\tau_{y,t}$ which is also plugged into (59).[17] The optimisation problem then becomes

[17] A similar exercise can be done for case 2 by setting $\tau^*_{y,t} = 0$.

$$\max_{g_t, b_t, r_t} \frac{(b + t_w)[\gamma r_t - \beta(b_t)][y(g_t) + \frac{R}{\delta} - \frac{p}{\delta} g_t - \frac{r_t}{\delta}]}{V_{t+1}[(1 - \tau_{y,t+1}) y(g_{t+1}) + (1 - \tau_{R,t+1}) R]}, \tag{84}$$

which implies that $g_t^* = \arg\max_{g_t} y(g_t) - \frac{p}{\delta} g_t$.

The respective FOCs for r_t^* and b_t^* are

$$\gamma[y(g_t^*) + \frac{R}{\delta} - \frac{p}{\delta} g_t^* - \frac{r_t^*}{\delta}] - \frac{\gamma r_t^* - \beta(b_t^*)}{\delta} = 0 \tag{85}$$

$$[\gamma r_t^* - \beta(b_t^*)] - \beta_b(b_t^*)(b_t^* + w) = 0. \tag{86}$$

Differentiating the latter gives

$$\frac{\partial b_t^*}{\partial R} = \frac{\gamma}{3\beta_b + 2\beta_b b(b_t^* + w)} > 0. \tag{87}$$

Furthermore, in a stationary equilibrium, $V_t = V_{t+1}$, which means $h_t = 1$. Imposing these and using (86) in the objective function in (59) gives the value of governing in equilibrium

$$V^* = \sqrt{\beta_b}(b^* + w), \tag{88}$$

which gives the equilibrium number of challengers

$$c^* = \frac{V}{b^* + w} - \frac{i}{h} = \sqrt{\beta_b} - i, \tag{89}$$

Let $\beta_{bb} > 0$ such that β_b is a function of b. Since b increases with R, then β_b and, hence, c^*, are increasing in R. Thus, $\frac{\partial b^*}{\partial R}, \frac{\partial c^*}{\partial R} > 0$. (Since β increases with b, then an increase in b is readily interpreted as an increase in repression/counterinsurgency.) Note by (87) that a higher wage rate dampens the effect of R on b and, hence, also the effect on c^*.