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Political foundations of the resource curse☆

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Abstract

In this paper we argue that the political incentives that resource endowments generate are the key to understanding whether or not they are a curse. We show: (1) politicians tend to over-extract natural resources relative to the efficient extraction path because they discount the future too much, and (2) resource booms improve the efficiency of the extraction path. However, (3) resource booms, by raising the value of being in power and by providing politicians with more resources which they can use to influence the outcome of elections, increase resource misallocation in the rest of the economy. (4) The overall impact of resource booms on the economy depends critically on institutions since these determine the extent to which political incentives map into policy outcomes. Countries with institutions that promote accountability and state competence will tend to benefit from resource booms since these institutions ameliorate the perverse political incentives that such booms create. Countries without such institutions however may suffer from a resource curse.
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1. Introduction

Scholars of the industrial revolution and economic historians traditionally emphasized the great benefits which natural resources endowed on a nation.[1] Paradoxically however, it is now almost conventional wisdom that resources are a 'curse' for currently developing countries. This claim is supported both by some basic facts, for example, for OPEC as a whole GDP per capita on average decreased by 1.3% each year from 1965 to 1998 (Gylfason, 2001), and by cross-country empirical work (Sachs and Warner, 1995, 1999; Busby et al., 2004; Mehlum et al., 2006). Moreover, numerous case studies of resource dependent economies have linked resource abundance to poor development (Gelb, 1988; Karl, 1997; Ross, 1999, 2001).

The key question is what are the mechanisms linking natural resource endowments and their prices to development. Interestingly, the evidence seems overwhelming that bad economic policies are correlated with resource rents. The empirical literature on the resource curse consistently emphasizes that resource dependent economies and resource booms seem to lead to highly dysfunctional state behavior, particularly large public sectors and unsustainable budgetary policies. For instance, Newberry (1986, p. 334) argues that economists have had a missing element in their interpretation of the bad performance of many resource abundant countries since they assume a world with no government while "Their behaviour is really the key element". He notes that

> "It is also I suppose encouraging for economists because it must surely be very easy to go round and advise countries that experience booms to do various things which would clearly make things better. They make such large and obvious mistakes."

The large and obvious 'mistakes' are those made clear by different case studies, in particular the study of six oil exporting countries (Algeria, Ecuador, Indonesia, Nigeria, Trinidad and Tobago and Venezuela) by Gelb (1986). Summarizing the experiences from the case studies Gelb (1988, p. 139) concludes that "*the most important recommendation to emerge from this study is that spending levels should have been adjusted to sharp rises in income levels more cautiously than they actually were.*" (italics in original). The large World Bank project overseen by Lal and Myint (1996) came to the same conclusion since they "identify policy failure as the prime cause of the underperformance of the resource abundant countries" and the collection of case studies in Auty (2001) shows the same picture for those resource abundant countries that has failed to grow in that there seems to be (p. 132) "a chronic tendency for the state to become overexpanded."

Despite this emphasis in the empirical research, the theoretical work on the resource curse has not developed explicitly political models. The nearest thing to this might be ideas about rent seeking. Yet these models ignore politicians and political incentives and adopt the Becker–Olson approach of thinking of the state as simply an aggregator of pressure from interests groups. In reality, and particularly in developing countries, politicians seems to have quite a large amount of autonomy from interest groups (see Acemoglu et al., 2004). As Killick (1978, p. 35) put it in his seminal study of policy making in Ghana, "Nkrumah succeeded in capturing the lobbies; in making them dependent on him instead of himself on them". Therefore, in this paper we build, to our knowledge the first, explicitly political model of resource extraction. We use this to investigate the types of political incentives triggered by resource booms and how these may have adverse consequences for national income and development. In our account policy 'mistakes' will in fact be rational political strategies as politicians respond to the incentives induced by resource rents.

[1] See Wrigley (1988) on the British case.

The resources we have in mind are especially those that are publicly owned such as oil, gas and other minerals. For such resources the resource rents accrue to the public sector, and the government decides how much of the resources to extract. For instance, for practically all main oil exporters this is the case.[2]

Our model features an incumbent politician wishing to be 're-elected'. Though we shall in the main part of the paper discuss this as if this were an election with voting, we also extend the model to non-democratic politics, a situation obviously relevant to many resource rich countries. There are two periods with the election occurring at the end of the first period. The income from natural resources accrues to the government and the incumbent must decide how much of the resources to extract in the first period and consequently how much will be left for the future. Resource income can be used in either of two ways; the incumbent can 'consume' the income or he can distribute it as 'patronage' to influence the outcome of the election.

We model patronage as the offer of employment in the public sector, although one may also think about this as other benefits to targeted groups such as 'white elephants'—see Robinson and Torvik (2005). There is a large degree of consensus in the political science literature that "patronage refers to the way in which party politicians distribute public jobs or special favors in exchange for electoral support" [Weingrod (1968, p. 379)] and in her seminal study of the Christian Democratic political machine in Sicily Chubb (1982, p. 91) notes,

> "a substantial part of politics revolves around the posto ("job or position") and ... when all is said and done, a job signifies a vote and vice versa."

The connection between resource rents and public employment, noted above, is clearly recognized to be about gaining political advantage and Auty (2001, p. 135) notes in his discussion that "Public employment can be a politically appealing way to distribute rents" and Alesina et al. (1998) provide more systematic evidence.[3]

This patronage influences voting behavior because we assume that individuals are already matched into groups or selected into social networks and patrons tend to make offers to individuals from their own group or network. This allows patrons to credibly offer to clients from within their group things that people from outside the group could not offer. In our model this is because individuals within a group partially internalize the welfare of other members of the group (a sort of altruism).[4] This type of model is really a type of 'partisan politics' (see

[2] OPEC is an intergovernmental organization of oil exporters where member countries decide on extraction rates. To achieve control of their natural resources governments put the resources under national control in particular in the 1960s and 1970s. Or according to OPEC themselves (http://www.opec.org/aboutus/history/history.htm): "OPEC rose to international prominence during this decade [the 70s] as its Member Countries took control of their domestic petroleum industries". It is true even for the main oil exporters outside OPEC that the government decides on extraction rates. In Norway, for instance, the government determines the extraction rate by deciding how many oil and gas blocks to put up for auction to the private companies operating there.

[3] One issue is whether the total number of public sector employees can be large enough to influence the outcomes of elections/contests. However, the case study literature on clientelism shows that a single public sector employee sits at the apex of a pyramid of relatives and friends who all benefit from his access to favors and rents and whose votes/support he supplies to politicians (see Chubb, 1982, Chapter 4). Thus employing someone in the public sector in reality generates far more than one vote for a politician. See Achebe (1961) for a fictionalized account of social networks and patronage in Nigeria and Price (1975) for an analysis of the Ghanaian bureaucracy.

[4] One could imagine other mechanisms, for example group members interact with each other more frequently than they do with individuals outside the group and this allows them to cooperate better and use intertemporal sanctions to solve problems of commitment.

Persson and Tabellini, 2000 Chapter 13 for political economy models where politicians represent groups).

Clientelistic exchange between members of a group takes the form of employment in the public sector because although belonging to the same group mitigates problems of commitment, some things are more credible than others. In particular we show that while promises to give income in exchange for votes to members of ones own group may not be credible, offers of employment may be. Basically this is because employment can be decided in advance of an election and is costly to reverse. The fact that only an incumbent can determine employment in advance induces a type of incumbency bias which also seems to be recognized as a key part of clientelism.

What then are the implications of this framework? We establish four main results. First, politicians tend to over-extract natural resources relative to the socially efficient extraction path because they only care about the future stock of resources if they are in power. Politicians therefore discount the future by the probability of being in power which is irrelevant from the social point of view. Second, and somewhat surprisingly, we show that permanent resource booms improve the efficiency of the extraction path. Intuitively, resource booms, by raising the value of being in power, lead the incumbent to allocate more resources to staying in power. This increases the probability that an incumbent politician is re-elected. In this case the incumbent values future resource stocks more and his preferred extraction path moves closer to the one which is socially efficient. Thirdly, permanent resource booms increase resource misallocation in the rest of the economy. This follows because booms lead politicians to increase the extent of patronage in order to stay in power and public sector employment is relatively inefficient. Finally, the overall impact of resource booms on the economy depends critically on institutions since these can determine the extent to which political incentives map into policy outcomes. The relevant institutions here will be political ones which promote the accountability of politicians, and generally develop state institutions away from patrimonial practices towards the use of rational and meritocratic criteria in allocating public sector resources. Countries with institutions that promote accountability and state competence will tend to benefit from resource booms since these institutions ameliorate the perverse political incentives that such booms create. Countries without such institutions however may suffer from a *resource curse*.

Our results show that if resource booms create underdevelopment it cannot be because they induce inefficiency in the rate at which resources are extracted. However, *inefficiencies may well arise because of what politicians do with the resource rents*. This is certainly in line with the conclusion of Gelb (1986, p. 343) that the real problem is "how you *spend* rent income relative to other sources" (italics in original). We extend the model to examine both temporary and anticipated future resource booms.

The results that our model generates provide a new understanding of the implications of resource booms for development and are more consistent with the evidence than the previous literature.[5] The 'Dutch disease' literature emphasizes purely economic models where countries with comparative

[5] The earliest political–economy theory of the resource cruse is probably the argument of North and Thomas (1973) that silver and gold from the American colonies freed the Spanish state from the constraints of the Cortes (parliament). In Britain, Kings that wanted to fight wars had to negotiate for taxes with lords and commoners. This process of negotiation resulted in institutions such as annual parliaments which severely constrained the King and subsequently helped to guarantee property rights and development. On the other hand, the Potosi mines freed the Spanish crown from such concessions and led to an institutional malaise which is part of the story for the decline of Spain in the seventeenth century. North and Thomas's theory was a precursor to theories of the so-called 'rentier state' (see the survey in Ross, 1999).

advantage in resources may experience lower rates of TFP growth (van Wijnbergen, 1984; Sachs and Warner, 1995, 1999; Torvik, 2001; Bravo-Ortega and de Gregorio, 2002). Though we agree that inter-sectoral resource allocation is a key part of the story about the resource curse, in our theory this is driven by political not economic incentives. Another literature by Baland and Francois (2000), Lane and Tornell (1999) and Torvik (2002) has developed models of non-cooperative rent seeking. In their models a resource boom increases the incentive to lobby/rent-seek and this increases the amount of non-productive activities in the economy. As we noted earlier however, it seems likely to us that a better understanding of the resource curse will come from explicitly understanding the incentives of politicians to extract resources efficiently and how the presence of resources impacts on the choice of policy instruments.

Another problem with all of these papers is that they tend to predict a monotonic effect of resources on development. Yet this is inconsistent with the cross-country evidence. For every Venezuela and Nigeria, there is a Norway or a Botswana (on which see Acemoglu et al., 2003). A satisfactory model should explain why resources seem to induce prosperity in some countries but not others. The most obvious explanation, and the one we develop, is that the critical factor is the interaction between institutions and resources. Lane and Tornell (1999, p. 22) recognize this when they explicitly restrict the domain of their analysis to societies lacking "a strong legal–political institutional infrastructure". Indeed, Mehlum et al. (2006) show empirically using the data from Sachs and Warner (1995) that when you control for the interaction between institutions and resources (measured at the % of commodity exports in GDP) one finds that resources have a positive effect on growth when institutions are good and negative when institutions are bad.[6] Moreover, Boschini et al. (2003) and Mehlum et al. (2006) find that (i) the direct negative effect of resources is stronger for minerals than for resources in general, and that (ii) institutions are more decisive for the effect of minerals than for other resources. That resources mainly publicly owned are those potentially having the worst growth impact, and that the effects of these is most dependent on the quality of institutions, is exactly in line with the predictions of our model.

The political model we develop builds on the idea that resource booms may be bad because they increase the extent of inefficient redistribution. It is possible to model the microfoundations of this in various ways (see Coate and Morris, 1995; Acemoglu and Robinson, 2001; Robinson and Verdier, 2002), but the key source of inefficiency in our model, and the reason that there is not some form of political Coase Theorem is the inability of politicians to commit (Besley and Coate, 1998; Acemoglu, 2003).

The paper proceeds as follows. In the next section we develop our model and derive its main implications. In Section 3 we extend the model to deal with dictatorship, and in Section 4 we survey some of the empirical evidence on the resource curse and emphasize the explanatory power of our model. Section 5 concludes.

2. The model

We consider a two-period probabilistic voting model and a society with two parties or politicians, labeled A and B. Each politician cares about his own utility and to some extent about

[6] There is a significant concern that the Sachs–Warner measure of resources is endogenous. In the Congo under Mobutu as the economy fell to pieces the only sector left, apart from subsistence activities, was the extraction of resources. In this reading of events there is in any case a severe problem of omitted variable bias in the Sachs–Warner regressions.

the utility of his own group (party, clan, ethnic group, etc.) of voters also labeled A, B. The mass of voters is normalized to unity, and each group A, B is of equal size 1/2. One of the politicians initially has power but faces an election at the end of the first period.

We assume that there is some stock of natural resources with an intertemporal path of prices (p_1, p_2) which is determined on world markets and taken as given by the country under consideration. We shall vary this path exogenously to investigate the implications of temporary and permanent resource booms. The resource can be extracted in the period before and in the period after the election. The physical quantity of the resource extracted in the first period is denoted e. In the period after the election there is $R(e)$ left of the resource, with $R'<0$ and $R''<0$.

The incumbent politician has to decide initially on the amount of resources to extract and how to allocate the resource rents (all of which accrue to the government) between his own consumption, transfers to individual citizens, and employing people in the public sector. In addition the incumbent can tax incomes. Both politicians compete in the election by making promises about taxes, transfers and public sector employment and wages. After the election whichever politician wins takes power and consumes the remaining resource rents. We assume that there is no commitment to policies so that voters understand that after winning the election, a politician chooses to renegotiate policies optimally.

For each group $i \in \{A, B\}$; voters have linear preferences in their own income, where Z_t^i is the income of that member. The per-period utility V_t^i of a politician $i=A, B$ is assumed linear in own income and given by

$$V_t^i = X_t^i + \alpha \int Z_t^i \mathrm{d}i \tag{1}$$

Here X_t^i denotes the income of the politician and α is the weight reflecting the concern of the politician for members of his own group.[7] We rule out the case where a politician values the utility of another person in his group higher than his own. Therefore we assume that $0<\alpha<1$.

Per-period income Z_t^i for a voter in group i is given by

$$Z_t^i = \omega_t^i + T_t^i - \tau_t^i \tag{2}$$

Here ω_t^i denotes the wage income, T_t^i the transfer to the voter, and τ_t^i his lump-sum taxes paid. In case the voter is employed in the private sector the wage equals his exogenous productivity H. Productivity in the private sector is higher than in the public sector. For simplicity we set the productivity in the public sector to zero, so that H can be thought of as the productivity differential between the private and the public sector. In case a voter is employed in the public sector his wage is W_t (to be endogenously determined below). τ_t^i is constrained by the fact that agents can hide all income from taxation in the informal sector at cost δ. Thus the maximum tax that can be collected from each agent is δ.

The unit mass of voters are employed either in the private sector or in the public sector. Let G_t denote the total number of public sector workers in period t with $1-G_t$ the corresponding number of private sector workers. We use the notation $G_t^i(A)$ to denote whether or not a politician A offers a job to individual i in period t. When a politician offers a citizen a job in the

[7] As noted in the Introduction models of partisan politics typically assume that politicians represent a group and thus choose policies to maximize their utility. It seems unlikely however that politicians are perfect agents of a group. Our formulation is intended to capture both the group level preferences and the agency problem.

public sector he also makes a wage offer. We assume that it is costly for a citizen to be fired, and denote by F the cost of being fired after being hired in the previous period.

To find the re-election probability we employ a version of the probabilistic voting model. Each voter i has an ideological bias σ^i toward the incumbent, which in the remainder of the paper we assume is politician A. Denoting income of a voter i if the incumbent wins $Z_t^i(A)$ and income if the opposition wins $Z_t^i(B)$, the voter supports the incumbent if

$$Z_t^i(A) + \sigma^i + \theta > Z_t^i(B) \tag{3}$$

We assume that σ^i is uniformly distributed at the interval $\left[-\frac{1}{2s}, \frac{1}{2s}\right]$ with density $s>0$, and that θ is a popularity shock in favor of the incumbent uniformly distributed at the interval $\left[-\frac{1}{2h}, \frac{1}{2h}\right]$ with density $h>0$.

The timing of the game is as follows.

- The incumbent politician chooses the policy vector (W_1, G_1^i, e, T_1^i,τ_1^i).
- First period production, resource extraction, taxation and consumption take place.
- Politicians A, B compete in the election by non-cooperatively offering policies ($W_2(A)$, G_2^i(A), $T_2^i(A)$, $\tau_2^i(A)$) and ($W_2(B)$, $G_2^i(B)$, $T_2^i(B)$,$\tau_2^i(B)$).
- Whichever politician wins the election takes power and optimally chooses the policy to implement. In particular, we allow for wage renegotiation/firing for individuals who were employed in the public sector in the first period.
- Second period production, resource extraction, taxation and consumption take place.

2.1. Credible policies

Voters realize that for policies to be implemented they have to be ex post optimal for the chosen politician. Politicians cannot credibly commit to policies which are not in their own interest. To solve the model we thus apply backward induction. The politician who wins the election decides post-election policies; taxes, transfers, firings and hirings and wage renegotiation in the public sector, as well as extracts what remains to be extracted of the natural resource.

As both politicians value own income higher than the income of others ($1-\alpha>0$), any politician sets taxes so as to maximize revenue. Thus, each agent pays δ in taxes, which is also the total tax revenue due to the unit size of the population. Promises of higher or lower taxes are not credible.

For simplicity we set $\delta=0$ in the remainder of the paper, as this will not affect any of our conclusions. Also, since politicians value their own income higher than the income of others, promises of transfers will never be credible. Voters thus realize that whoever wins the election, they will not receive any transfers.

Next we turn to hirings in the public sector. Again, as both politicians value their own income higher than the income of others, there will be no post-election public sector hiring. When the public sector is inefficient, politicians cannot commit to hire voters after the election, as outlays for wages are not matched by sufficient production.

Consider now wage renegotiation and firing of public employees hired in the first period. We assume that when there is wage renegotiation, this occurs bilaterally between the winning politician and each employee according to a symmetric Nash bargaining solution where the status quo point is firing for the politician and private sector employment for the employee. In

such a context, firing will occur when what one party gets from the Nash solution is less than what he can get outside the bargain.

Suppose first that the incumbent A wins. Wage renegotiation with a member of his own group A will provide an optimal public sector wage level $W_{2A}^{*}(A)$ which is the solution of:

$$\max_{W} [(-W+\alpha W)-\alpha(-F+H)]\ [W-(-F+H)].$$

Here $(-W+\alpha W)$ is the utility the politician derives from employing in the public sector a member of his own group at a wage W, while $\alpha(-F+H)$ is the utility of firing this agent. On the other hand, the agent should get a second period surplus $W-(-F+H)$ in the public employment relationship. This gives the following expression for the wage,

$$W_{2A}^{*}(A)=\frac{1}{2}\frac{(2\alpha-1)(F-H)}{1-\alpha}.$$

Wage renegotiation with a public sector employee who is a member of the other group B should also provide an optimal public sector wage level $W_{2B}^{*}(A)$ as the solution to the problem;

$$\max_{W} [-W][W-(-F+H)].$$

Note that the utility gain of politician A is now simply $-W$ as he does not care about the income level of a member of group B, and that the utility of firing the agent is zero for the same reason. We get immediately that wage negotiations between politician A and group B members can never succeed—firing is always better for the politician.

Similarly, if the opposition B politician wins the election, one may compute that group A workers will always be fired and that the renegotiated wage between that politician and a public employee of group B is $W_{2B}^{*}(B)$ which is identical to $W_{2B}^{*}(A)$.

To study the interesting case in the model we make the assumption that $F>H$, which says that the cost of being fired is higher than the productivity gap between the private and the public sector. It follows that wage renegotiations between a politician and a public worker that belong to the same group succeed.[8] Thus a public worker employed in period 1 keeps being employed by the politician belonging to the same group i and obtains a wage equal to

$$W_{2}^{*}=W_{2i}^{*}(i)=\frac{1}{2}\frac{(2\alpha-1)(F-H)}{1-\alpha}$$

If this assumption is not fulfilled, it is impossible for the incumbent to affect his re-election probability. A natural requirement we make in addition is that $\alpha>1/2$ so that the second period wage is positive.

Before the election the incumbent A decides how many public sector employees he will hire from each group, and what wage he will pay them. If he hires workers from group B they realize that in case the incumbent wins the election they will be fired while if the opposition politician wins they will not. Thus, the incumbent can gain nothing by offering public sector employment to group B members, and hence none are hired. Moreover, politician B cannot credibly offer employment to group B voters in case he wins the election. He values his own income more than

[8] To verify that the interpretation of H as the productivity gap is correct also in the case of the Nash bargaining solution, assume that workers in the public sector have productivity $K>0$. Then wages will be given by $\frac{1}{2}\frac{K+(2\alpha-1)(F-H)}{1-\alpha}$, and the condition that negotiations succeed follows as $F>H-K$ (where the right hand side is now the productivity gap between the private and public sector).

the income of others and it is therefore not credible ex-post to satisfy his hiring promises. For group B voters, therefore, the post-election income is independent of the election outcome.

By standard techniques the share of voters that vote for the incumbent from group B is given by $1/2+s\theta$ so that the number of group B voters N_B that supports A is given by

$$N_B = \frac{1}{2}\left(\frac{1}{2} + s\theta\right) \tag{4}$$

The incumbent A can credibly promise public employment to group A members, but only by hiring them before the election. No politician will hire workers after the election. In case politician B is elected, however, the group A public employees will be fired. Politician B therefore cannot credibly promise public employment to any group. For the public employees actually hired before the election, therefore, the post election income depends on the election outcome. Given that the only credible wage offer from the incumbent is W_2^*, a public employee i supports the incumbent if

$$\sigma^i > -\theta - [W_2^* - (-F + H)] \tag{5}$$

The number of public employees that supports the incumbent, N_{AG}, is thus given by

$$N_{AG} = G_1 \int_{-\theta-[W_2^*-(-F+H)]}^{\frac{1}{2s}} s di = G_1\left(\frac{1}{2} + s(\theta + [W_2^* - (-F + H)])\right) \tag{6}$$

where G_1 is the number of public employees of group A hired in period 1. The number of private employees from group A that supports the incumbent, N_{AP}, can be found as

$$N_{AP} = \left(\frac{1}{2} - G_1\right)\left(\frac{1}{2} + s\theta\right) \tag{7}$$

The reelection probability,

$$\Pi(G_1) = Pr\left\{N_B + N_{AG} + N_{AP} \geq \frac{1}{2}\right\},$$

can then be simplified to

$$\Pi(G_1) = Pr\{\theta \geq -G_1[W_2^* - (-F + H)]\} = \frac{1}{2} + G_1 h[W_2^* - (-F + H)] \tag{8}$$

Note that $\partial\Pi(G_1)/\partial G_1 \equiv \Pi_G > 0$. Hence hiring public sector workers from among the people from his own group increases the incumbent's probability of maintaining power.

2.2. Equilibrium policy

Before the election the incumbent now faces the problem of choosing resource extraction (taxes and transfers equal to zero), public sector employment and public sector wages, so as to maximize expected utility. In case he wins the election we have already found that it is optimal for the incumbent to employ the same number of public sector workers as before the election. This implies that the incumbent only needs to determine public sector employment and wages initially and therefore let G_1 and W_1 be these initial levels. The incumbent also takes into

account that his chosen policies affect the reelection probability Π according to (8). Thus, the incumbent chooses policy (e, G_1, W_1) so as to maximize

$$\begin{aligned} & p_1 e - W_1 G_1 + \alpha W_1 G_1 + \alpha\left(\frac{1}{2} - G_1\right)H \\ & \quad + \Pi(G_1)\left[p_2 R(e) - W_2^* G_1 + \alpha G_1 W_2^* + \alpha\left(\frac{1}{2} - G_1\right)H\right] \\ & \quad + (1 - \Pi(G_1))\alpha\frac{1}{2}(-F + H) \end{aligned} \tag{9}$$

subject to (8) and the constraint that public sector workers must be at least as well off over the two periods as private sector workers;

$$W_1 + \Pi(G_1)W_2^* + (1 - \Pi(G_1))(-F + H) \geq 2H. \tag{10}$$

It follows immediately from $\alpha < 1$ that the first period wage W_1 is equal to $H+F-\Pi(G_1)(W_2^* + F - H)$ so that the participation constraint holds as an equality. By taking the derivatives with respect to e and G_1, we find the two first-order conditions with respect to e and G_1 to be:

$$p_1 + \Pi(G_1)p_2 R'(e) = 0 \tag{11}$$

$$\begin{aligned} & -H[1 + \Pi(G_1)] - (1 - \alpha)F[1 - \Pi(G_1)] \\ & \quad + \Pi_G(G_1)\left[p_2 R(e) - HG_1 + (1 - \alpha)FG_1 + \frac{1}{2}\alpha F\right] = 0 \end{aligned} \tag{12}$$

These first-order conditions generate a straightforward but important result. Denoting the efficient resource extraction e^{e} we have:

Proposition 1. *Resources are inefficiently over-extracted so that $e > e^e$.*

To see this, first note that the socially optimal extraction of resources in the first period solves,

$$\max_e p_1 e + p_2 R(e)$$

and thus is the solution to the first-order condition,

$$p_1 + p_2 R'(e^{\mathrm{e}}) = 0 \tag{13}$$

Comparing (11) with (13) it is (as $\Pi < 1$) immediate that $e > e^{\mathrm{e}}$. Inefficiency here arises from the fact that the incumbent politician discounts the future stock of resources by the probability he wins power. Compared to the socially efficient extraction path a politician when in power over-extracts resources.

By writing (11) and (12) in differential form we get:

$$\Phi_1 \mathrm{d}e + \Phi_2 \mathrm{d}G_1 = \Phi_3 \mathrm{d}p_1 + \Phi_4 \mathrm{d}p_2 \tag{14}$$

$$\Psi_1 \mathrm{d}e + \Psi_2 \mathrm{d}G_1 = \Psi_3 \mathrm{d}p_1 + \Psi_4 \mathrm{d}p_2 \tag{15}$$

where

$$\Phi_1 = \Pi p_2 R'' < 0, \Phi_2 = \Pi_G p_2 R' < 0, \Phi_3 = -1, \Phi_4 = \Pi R' < 0$$

$$\Psi_1 = p_2 \Pi_G R' < 0, \Psi_2 = -2[H-(1-\alpha)F]\Pi_G < 0, \ \Psi_3 = 0, \ \Psi_4 = -R\Pi_G < 0$$

The second-order conditions for the maximization problem are that $\Phi_1 < 0$, $\Psi_2 < 0$, and that $\Phi_1\Psi_2 - \Phi_2\Psi_1 = p_2[-2[H-(1-\alpha)F]\Pi\Pi_G R'' - p_2(\Pi_G)^2(R')^2] \equiv p_2 D > 0$. We assume that D has the correct sign so that the second-order conditions are fulfilled.

We can now find how resource extraction, as well as the efficiency of the extraction path, depend on resource prices. This result shows that the political incentives of changes in resource prices are absolutely key to understanding their implications for the extraction path and social efficiency and they depend on whether the resource boom is permanent, transitory, or anticipated.

Proposition 2.

i) A permanent resource boom (i.e. such that $dp_1/p_1 = dp_2/p_2 = dp/p$) reduces resource extraction and increases the efficiency of the extraction path.
ii) A temporary resource boom (i.e. $dp_1 > 0$ and $dp_2 = 0$) increases resource extraction and decreases the efficiency of the extraction path.
iii) An anticipated future resource boom (i.e. $dp_1 = 0$ and $dp_2 > 0$) reduces resource extraction and increases the efficiency of the extraction path.

Proof. For a permanent resource boom (i.e. such that $\mathrm{d}p_1/p_1 = \mathrm{d}p_2/p_2 = \mathrm{d}p/p$) it follows from (14) and (15) that

$$\frac{\mathrm{d}e}{\mathrm{d}p/p} = \frac{p_2 R(\Pi_G)^2 R'}{D} < 0 \tag{16}$$

As well it is easy to see that

$$\frac{\mathrm{d}e^{\mathrm{e}}}{\mathrm{d}p/p} = 0$$

Since $e > e^{\mathrm{e}}$, a permanent resource boom increases the efficiency of the extraction path.

ii) From (14) and (15) we find

$$\frac{\mathrm{d}e}{\mathrm{d}p_1} = \frac{2[H-(1-\alpha)F]\Pi_G}{p_2 D} > 0$$

Now differentiation of (13) provides

$$\frac{\mathrm{d}e^{\mathrm{e}}}{\mathrm{d}p_1} = -\frac{1}{R'' p_2}$$

Substitution of the expression for D gives also:

$$\frac{\mathrm{d}e}{\mathrm{d}p_1} = \frac{1}{-p_2 R''\Pi - \dfrac{(p_2 \Pi_G R')^2}{2[H-(1-\alpha)F]\Pi_G}} > -\frac{1}{R'' p_2}$$

hence[9]

$$\frac{\mathrm{d}e}{\mathrm{d}p_1} > \frac{\mathrm{d}e^{\mathrm{e}}}{\mathrm{d}p_1}$$

Since $e > e^{\mathrm{e}}$, it follows that overextraction $e - e^{\mathrm{e}}$ increases with p_1.

iii) From (14) and (15) we find

$$\frac{\mathrm{d}e}{\mathrm{d}p_2} = \frac{2[H-(1-\alpha)F]\Pi\Pi_G R' + p_2(\Pi_G)^2 RR'}{p_2 D} < 0$$

Now differentiation of (13) provides

$$\frac{\mathrm{d}e^{\mathrm{e}}}{\mathrm{d}p_2} = -\frac{R'}{R''p_2} < 0$$

Again after substitution of D, and rearrangement of terms, we get:

$$\frac{\mathrm{d}e}{\mathrm{d}p_2} = \frac{R'}{-R''p_2}\,\frac{2[H-(1-\alpha)F]\Pi\Pi_G + p_2(\Pi_G)^2 R}{2[H-(1-\alpha)F]\Pi\Pi_G + \dfrac{p_2(\Pi_G R')^2}{R''}} < -\frac{R'}{R''p_2}$$

hence

$$\frac{\mathrm{d}e}{\mathrm{d}p_2} < \frac{\mathrm{d}e^{\mathrm{e}}}{\mathrm{d}p_2}$$

Since $e > e^{\mathrm{e}}$, it follows that overextraction $e - e^{\mathrm{e}}$ decreases with p_2. □

For example, when $p_1 = p_2 = p$ then the efficient extraction path is independent of the level of p, yet as p varies, the benefit of being in power varies and thus the incentive to extract resources efficiently. The reason that a permanent resource boom increases the efficiency of the extraction path is that it makes it more valuable to be in power in the future. This induces the incumbent to expand the public sector and this increases the reelection probability $\Pi(G)$. When $\Pi(G)$ increases, the incumbent discounts the future less and moves the extraction path closer to that which is socially optimal.

The same result emerges with an anticipated resource boom. It has to be modified only in the case of a temporary resource boom. In this case the value of being in power does not change when only p_1 increases. It is now both politically rational and socially efficient for the incumbent to extract more resources in the first period. Interestingly, this is the one case where the efficiency of the extraction path may deteriorate since the equilibrium extraction may rise even more than the efficient level. This is certainly true when the marginal effect of resource extraction in the first period on the remaining resource stock is a convex function.

We now investigate the effects of resource booms on the extent of inefficient redistribution—on public sector employment.

Proposition 3.

i) A permanent resource boom (i.e. such that $dp_1/p_1 = dp_2/p_2 = dp/p$) increases public sector employment and decreases private sector employment.

[9] For simplicity we assume $R'''(e) = 0$. For the case where the third derivative differs from zero see Robinson, Torvik and Verdier (2002).

ii) A temporary resource boom (i.e. $dp_1 > 0$ and $dp_2 = 0$) decreases public sector employment and increases private sector employment.

iii) An anticipated future resource boom (i.e. $dp_1 = 0$ and $dp_2 > 0$) increases public sector employment and decreases private sector employment.

Proof. From (14) and (15) we find easily for the three cases i), ii) and iii) that

$$\frac{\mathrm{d}G_1}{\mathrm{d}p/p} = -\frac{\Pi\Pi_G RR''}{D} > 0 \tag{17}$$

$$\frac{\mathrm{d}G_1}{\mathrm{d}p_1} = \frac{\Pi_G R'}{D} < 0 \tag{18}$$

$$\frac{\mathrm{d}G_1}{\mathrm{d}p_2} = \frac{\Pi\Pi_G\left[(R')^2 - RR''\right]}{D} > 0 \tag{19}$$

Since private sector employment equals $1 - G_1$ the proposition follows. □

Since a long-lasting or an anticipated resource boom increases the rents from being in power, the incumbent politician has an incentive to influence the votes of more people by employing them in the public sector. Although this is good for the clients that receive jobs and the incumbent who is more likely to be re-elected, these deals decrease the efficiency of the economy by transferring labor from the relatively high productivity private sector to the low productivity public sector. A positive side effect, however, is that, as we noted in Proposition 2, the increased probability of re-election induces the incumbent to value the future stock of resources higher, which increases the efficiency of resource extraction.

When we consider a temporary resource boom, more resources are extracted in the period when the price is high. Since less resources are left for the second period, the value of remaining in power decreases, and the incumbent politician has less incentive to influence the votes of people by employing them in the public sector. In turn this decreases the probability of re-election, and the incumbent values the future stock of resources even less than in the first place. As the valuation of future resources has decreased, the efficiency of the extraction path has become worse. Thus, for the efficiency in the economy as a whole, the extraction path effect and the labor allocation effect pull in opposite directions. With more misallocation of labor the efficiency of the extraction path increases, while with less misallocation of labor the efficiency of the extraction path decreases. This leads to our final proposition.

Proposition 4. *Resource booms may increase or decrease total income.*

Proof. The total (net present value of) income Y in the economy equals production plus resource rents,

$$Y = 2(1 - G_1)H + p_1 e + p_2 R(e).$$

All the three types of resource booms considered have ambiguous effects on total income. We demonstrate this for the case of a permanent boom. (The same exercise may be undertaken to show that this also holds for a temporary boom and an anticipated future boom.) By

differentiating total income with respect to p the effect from a permanent resource boom on Y is given by

$$\frac{\mathrm{d}Y}{\mathrm{d}p/p} = p_1 e + p_2 R + (p_1 + p_2 R')\frac{\mathrm{d}e}{\mathrm{d}p/p} - 2H\frac{\mathrm{d}G1}{\mathrm{d}p/p} \tag{20}$$

A resource boom has three effects on income. First, the increased proportional value of the resource has the direct effect of increasing income (the term $p_1 e + p_2 R$). Second, a resource boom increases income as the efficiency of the extraction path increases (the term $(p_1 + p_2 R')\frac{\mathrm{d}e}{\mathrm{d}p/p}$ which is positive since $p_2 R' = -\frac{p1}{\Pi} < -p_1$ and $\frac{\mathrm{d}e}{\mathrm{d}p/p} < 0$). Third, as shown by the last term in (20), a resource boom transfers labor from the private to the less productive public sector, pulling in the direction of decreased income.

By inserting from (16) and (17) in (20) one finds after some calculation that

$$\mathrm{sign}\frac{\mathrm{d}Y}{\mathrm{d}p/p} = \mathrm{sign}\left[-2e[H-(1-\alpha)F]R'' - ep_2(R')^2\frac{\Pi_G}{\Pi} + p_2 RR'\frac{\Pi_G}{\Pi}\right] \tag{21}$$

Here the first term on the right hand side is positive. The two last terms are negative. It is in general not possible to sign the expression hence the proposition for permanent resource booms follows.

By undertaking the same exercise for a temporary and an anticipated future resource boom one finds that the effect on total income are ambiguous also in those cases. In the case of a temporary boom a higher resource price in the first period and decreased public employment pulls in the direction of increased income, while decreased efficiency of the extraction path (as the future is valued less due to the fall in public employment) pulls in the other direction. In the case of an anticipated future resource boom a higher resource price in the second period and increased efficiency of the extraction path pulls in the direction of increased income, while increased public employment pulls in the other direction. □

From (21) we note that income is more likely to go down with a permanent resource boom the more the incumbent can affect the re-election probability by hiring public sector workers, i.e. the higher is $\Pi_G = h\frac{1}{2}\left(\frac{F-H}{1-\alpha}\right)$. In regimes where it is not possible to affect the re-election probability by hiring clients of the incumbent in the public sector, the boom will increase income. In (20) only the positive direct effect of a higher price is then present, as public sector employment and resource extraction are unaffected. In regimes of this type, therefore, a resource boom has a positive effect on income. In other types of regimes, where the institutions allow politicians to engage in clientelistic strategies to influence voting behavior by offering individuals public sector employment, a resource boom is more likely to lower total income. Thus, the effect on income from a resource boom may be of opposite sign in regimes with high and low institutional quality.

The crucial institutional feature affecting Π_G in our model is related to the incumbent's credibility to offer rents to public workers after the election. In terms of the specific model here, this depends on the strength of "social links" between the incumbent and his own group as reflected by the parameter α, labor market institutions as reflected by the cost of being fired F and the distribution of political preferences (the parameter h). For instance, when α is small, the incumbent's ability to credibly offer rents to public sector workers is limited and a resource boom is likely to increase income. On the other hand, when α gets closer to 1; Π_G becomes very large and from (21), the sign of $\frac{\mathrm{d}Y}{\mathrm{d}p/p}$ is negative. A resource curse occurs in such a situation.

More generally, institutions clearly influence whether or not political criteria can be used to determine public sector employment, rather than say merit. An institutional reform which forced public sector hiring to be done on the basis of merit could completely remove the possibility of a resource curse even if nothing else (e.g. the ex post wage renegotiation game) changed.

3. Extension: dictatorship

Many resource abundant countries are not democracies with elections as modelled in the previous section. In this section we thus extend the model to deal with autocracies and dictatorships where political leaders are not chosen in democratic ways. According to Bueno de Mesquita et al. (2003, p. 19), autocrats "are not likely to survive the elimination of patronage or the corrupt benefits of cronyism. For autocrats what appears to be bad policy often is good politics". And (p. 28) "Make no mistake about it, no leader rules alone. Even the most oppressive dictators cannot survive the loss of support among their core constituents". Furthermore (p. 59): "To depose an incumbent, a challenger needs to convince a sufficient number of members of the winning coalition to defect him. On the surface this appears to be a relatively easy task. All the challenger has to do is to promise these members of the existing coalition more rewards than they currently receive. Unfortunately for the challenger, such a promise lacks long-term credibility". We show that taking these insights into account in a straightforward way produces an analysis which is very similar to that of the previous section.

As in Bueno de Mesquita et al. (2003) we assume that for a dictator to survive politically he must capture the support of what they term the winning coalition—a critical mass of people smaller than under democratic elections. We denote this winning coalition C, and thus in our setting $C<1/2$. We assume however, that people dislike political leaders not elected by themselves. Such leaders therefore suffer a downward shift in popularity equal to q. The dictator A now has to choose the same policy variables as in the previous section, taking into account that he survives politically with a probability that we term Q. Note that the bargaining solution in case he remain in power is the same as in Section 2.

The next step is then to determine the survival probability Q of the dictator. A public employee i now supports the dictator if

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

The number of public employees that supports the incumbent is thus now given by

$$N_{AG} = G_1 \int_{q-\theta-[W_2^*-(-F+H)]}^{\frac{1}{2s}} sdi = G_1 \left(\frac{1}{2} + s(\theta - q + [W_2^* - (-F + H)]) \right) \tag{23}$$

where as before G_1 is the number of public employees from group A hired in period 1. The number of private employees from group A that supports the incumbent can be found as

$$N_{AP} = \left(\frac{1}{2} - G_1 \right) \left(\frac{1}{2} + s(\theta - q) \right) \tag{24}$$

while the number of group B agents that supports the dictator is

$$N_B = \frac{1}{2} \left(\frac{1}{2} + s(\theta - q) \right) \tag{25}$$

The survival probability of the dictator is then the probability that he captures the winning coalition C:

$$Q(G_1) = Pr\{N_B + N_{AG} + N_{AP} \geq C\}$$

It is equivalent to

$$Q(G_1) = Pr\left\{\theta \geq q - \left(\frac{1}{2} - C\right)\frac{1}{s} - G_1[W_2^* - (-F + H)]\right\} \tag{26}$$

which can be simplified to

$$Q(G_1) = \frac{1}{2} - qh + \left(\frac{1}{2} - C\right)\frac{h}{s} + G_1 h[W_2^* - (-F + H)] \tag{27}$$

There are some interesting properties about this survival probability. Obviously, the less popularity lost q by being a dictator and the smaller the required winning coalition C, the more secure dictators are in power. Furthermore, the more heterogeneous a population is ideologically, that is the lower is s, the more likely that a dictator survives. An ideologically heterogenous population increases the number of 'core supporters' for both the dictator and the challenger. However, as long as the winning coalition under dictatorship is less than under democracy, this is an advantage for the incumbent dictator.

Most important for our purpose, however, note that $\Pi_G = Q_G$, i.e. the derivative of the reelection probability with respect to public employment is the same as the derivative of the dictators' survival probability with respect to public employment. It then follows from inserting Q for Π in (9) and (10) that all the propositions we established under democracy is also valid under dictatorship.

Finally, note that by comparing the two models we can say something about the case with endogenous democratic institutions. In our model politicians prefer democracy when

$$qs > \frac{1}{2} - C \tag{28}$$

Thus a society where the population 'punish' dictators (large q), the population is ideologically homogenous (large s), and rulers need a large winning coalition C under dictatorship, is one which is conducive to democracy.

4. The nature of the resource curse

In this section we provide some empirical evidence which is relevant to our main results. It is hard to prove one way or the other that the observed extraction path is socially inefficient. Nevertheless, Proposition 1 seems uncontroversial since it is a property of many political economy models. Still, the extent to which Proposition 1 is relevant may again depend on institutions. In some countries, for example Norway, the extraction of resources and the allocation of resource rents has been depoliticized and partly taken out of the hands of

incumbents. In this case Proposition 1 may fail to apply. We focus on evidence pertaining to our other main propositions.

4.1. Resource booms improve the efficiency of the extraction path

This implication of the model seems consistent with the available evidence. We limit ourself to the empirical connection between resource prices and extraction rates. The evidence from the oil-exporters on what happens to resource extraction when resource prices increase (or decrease) is mixed. The Arab embargo of October 1973 led to a sharp increase in oil prices in 1974–1975. Thereafter prices decreased slightly from 1976–1978, before they again redoubled in 1979–1980. The second oil boom ended in 1981. Oil prices dropped further in 1986. The oil producers reacted differently to these price changes. In the boom years 1974–1975 the volume of petroleum exports was on average 21% lower than in the two preceding years in Venezuela (unless otherwise noted, the numbers for the volume of petroleum exports come from IMF's Financial Statistics, various issues). From then on the volume of petroleum exports was on a downward trend until 1986, when they again increased by 12% (but export revenue from petroleum still decreased sharply as a result of the price fall). In Indonesia the volume of petroleum exports was about 8% higher in the boom years 1974–1975 compared to the two previous years. However, when prices decreased slightly from 1976–1978, petroleum exports rose by another 34%. In the boom years 1980–1981 the export volume decreased by 26% compared to the peak in 1978. It then fell until 1985, before it increased by 25% when oil prices collapsed from 1985 to 1986. In Algeria, the volume of petroleum exports was 11% lower in the boom years 1974–1975 compared to the two previous years. With the slight price decrease from 1976–1978 petroleum exports rose by 20%. In the second oil boom petroleum exports fell by 20%, and remained fairly stable through the rest of the 1980s. In Nigeria petroleum exports increased during the first oil boom, with the volume 25% higher in 1974 compared to 1972. However, during the second oil boom the opposite happened, as export volumes was almost halved from 1979 to 1981. With the price collapse in 1986 however, export volumes also fell sharply, by 38%. On Nigeria, more detailed econometric evidence is also available in the recent study by Iledare and Pulsipher (2000) who find that

> "The rate of oil extraction tends to rise with lower crude oil prices, ceteris paribus, thereby suggesting, among other things, that a backward-bending supply curve phenomenon underlines the historical oil depletion process in the nation."

At least in certain instances the policy response to increased prices seems to be decreased extraction, and vise versa. It is unclear, however, to what extend these production responses reflect the choices of production to changed prices, or the behavior of the OPEC trying to push prices up by decreasing production. One would therefore want to supplement the picture by considering small countries (that can be assumed to be price takers on the world market) that are not OPEC members. Among the countries mentioned above Trinidad and Tobago and Ecuador fulfill both of these criteria.

In Trinidad and Tobago the first oil price shock seems to have been associated with decreased petroleum exports. On average, export volumes was 4% lower in 1974–1975 than in the two preceding years. In the second oil boom export volumes decreased further, by 21% from 1979 to 1981. In Ecuador petroleum exports almost tripled from 1972 to 1973, while production fell by 40% from 1973 to 1975. During the second oil boom export volumes were

fairly stable, but when prices decreased production rose so sharply that according to Gelb (1988, p. 125)

> "Only Ecuador, which managed to raise oil output considerably and so compensate for falling prices, avoided a substantial reduction in windfall gains."

Supply of a good is normally thought to be higher the higher the price, and vise versa. What is somewhat surprising, therefore, is the many instances where a higher price seems to have decreased supply, while a lower price has increased supply. Our model provides an answer to this apparent puzzle by studying the optimal response of politicians, and not of firms, to changed prices on natural resources.

4.2. Resource booms lead to politically motivated expansions of the public sector

As we discussed in the Introduction there is a large body of evidence linking resource booms to a political strategy of expanding the public sector. For instance, in a study on effects of the oil boom in Nigeria Gavin (1993) finds that from 1973 to 1987 employment in all sectors contracted, the only exception being the service sector which includes government employment. Commenting on the policy of the sharp increase in the public sector wage bill (induced by the policy change referred to as the "Udoji accords") with the first oil boom Gelb (1988, p. 241) notes that

> "Commentators have interpreted the Udoji accords as an attempt by General Gowon to stay in power (despite an earlier promise to withdraw in 1975) by giving a pivotal sector of the population a sizable share of the oil wealth."

Similarly Lane and Tornell (1999, p. 39) considering resource booms show that "In each case government spending rose sharply in response to the improvement in terms of trade". Auty (1999) blames an overexpanded public sector in response to windfall income for the weak performance of Trinidad and Tobago, and notes that with the resource boom the government share of formal employment reached 50%. According to Gelb (1988, p. 278) with the second oil boom "The public sector wage bill was TT$ 3,1 billion in 1982, almost twice that of 1981 and four times that of 1978." Ecuador is another example where according to Gelb (1988, p. 185) estimates for 1973–1982 suggest a "doubling of employment in autonomous entities and in the central government". Venezuela is yet another example where public employment was increased with the oil boom (Gelb 1988, p. 296). According to Auty (2001, p. 209) the same policy mistakes happened in Mexico, which became a major exporter at the same time as the second oil boom set in, despite that "Mexico could also learn from the mistakes of other countries, notably Venezuela, whose windfalls was similar in size".

The situation was very similar in copper dependent Zambia. To secure power and access to copper income United National Independence Party (UNIP) and the president Kenneth Kaunda in 1972 banned other political parties and put in place a system that favored UNIP members offering employment and power. Many were employed directly by the party, and Bates and Collier (1993) report that (p. 391) "In 1985, UNIP filled over 40.000 local offices, i.e. at the section, branch, and ward level—in the city of Lusaka alone." According to Gelb et al. (1991), the average yearly growth rate in public employment in the period 1966–1980 was 7.2%, while private employment on average contracted by 6.2% each year.

4.3. Institutional foundations of the resource curse

Proposition 4 provides a very plausible way of thinking about the comparative evidence on the resource curse and provides microfoundations for the recent cross-country empirical work of Mehlum et al. (2006). Among the countries in Gelb (1988) Indonesia is the only country where natural resources has not led to economic policies constraining growth. They have had a more prudent macropolicy than the other countries (p. 198) and Gelb (p. 223) concludes that the good performance is not simply a reflection of the good health of the economy before 1973:

> "A more accurate statement, therefore, might be that Indonesia's good performance during the oil booms reflected the *institutions* developed earlier to nurse the economy back to health, the *approach to policy* set in the Suharto government's formative years, and the *unusual degree of continuity*. All the main institutional components of the post-shock period–BIMAS, IN-PRES, the balanced budget policy, a free foreign exchange market–predated the oil shocks. So did the cautious approach to macroeconomic policy". (Italics in original.)

But the origins of good macroeconomic policy in Indonesia stemmed from the fact that Suharto staffed the relevant bureaucracies not with political appointees but rather with Berkeley trained economists and technocracts hired on the basis of merit.

Other resource abundant developing countries have had policies that have helped made them to escape the low growth trap. According to Abidin (2001) the group comprises Botswana, Chile, Malaysia, Oman and Thailand. Why have these countries put policies in place that allowed them to escape the resource curse, while Algeria, Ecuador, Mexico, Nigeria, Saudi Arabia, Trinidad and Tobago, Venezuela and Zambia have not? Our hypothesis is that the incentives politicians face when they confront resource booms map into different policy choices depending on the quality of institutions. Low quality institutions invite bad policy choices since they allow politicians to engage in inefficient redistribution in order to influence the outcomes of elections. High quality institutions make such political strategies infeasible or relatively unattractive. There appear to be several different dimensions of institutions whose quality may be important. In the context of the model these are most obviously those relating to the rational organization of the public sector and institutions that limit the use of political criteria in the allocation of public resources. These will be influenced by how accountable politicians are but they are also influenced by the development of modern state institutions more generally (see Evans and Rauch, 2000).

Does the quality of institutions in the relevant senses differ between the group of countries that have escaped the resource curse and those that have not? Data on institutional quality in all the above mentioned countries except Oman and Saudi Arabia is found in Sachs and Warner's data (available on the home page http://www.cid.harvard.edu). The institutional quality index is an unweighted average of five indexes based on data from Political Risk Services; a rule of law index, a bureaucratic quality index, a corruption in government index, a risk of expropriation index, and a government repudiation of contracts index. For a more detailed description of the index, consult Knack and Keefer (1995). Higher institutional quality according to these measures seems to reasonably approximate the mechanism our model captures. According to these data Botswana, Chile, Malaysia and Thailand all rank ahead of Algeria, Ecuador, Mexico, Nigeria, Trinidad and Tobago, Venezuela and Zambia in terms of institutional quality. The countries that have escaped the resource curse and those that have not thus divide themselves into two distinct

groups as regards institutional quality. The only exception to this picture is Indonesia, which according Sachs and Warner's data have a very low institutional quality (thus to some degree contrasting the conclusion in Gelb, 1988). Finally, Acemoglu et al. (2003) show that it is exactly this type of institutional quality in Botswana that can account for most of its exceptional development experience.

5. Concluding remarks

In this paper we have presented what is to our knowledge the first formal political–economy analysis of the impact of natural resources on development. Existing studies have focused either on purely economic impacts of resources, or they have developed basically a-political theories about rent-seeking. Nevertheless, much of the non-formal and case study material suggests that the political incentives generated by natural resources are key to understanding how they influence the development path of a country. We argued that to understand how resource rents create inefficiency one needs a model where politicians are to some extent autonomous of social pressures and control and where they value resource income because it allows them to bias the outcome of elections, or in nondemocratic regimes political contests. This bias can be induced in many ways, but the informal literature points to the centrality of public sector employment as a tool for influencing people's voting behavior.

There are therefore two main innovations in our paper. First, we proposed a model of clientelism which can explain why politicians engage in inefficient redistribution by employing people in the public sector in order to influence the outcomes of elections. Second, we integrated this model with a model of natural resource extraction and studied the political incentives generated by resource rents and resource booms.

We emphasized several results which come from our model. First, resources tend to be over-extracted by politicians because they discount the future by the probability they remain in power. Second, permanent resource booms, because they increase the value of being in power lead politicians to allocate more resources to staying in power. As a result they tend to discount the future less and this leads to more efficient resource extraction. The fact that booms increase the probability of staying in power tends to counteract the inefficiency stemming from the fact that politicians discount the future too much. Third, we showed that despite this optimistic result, resource booms tend to create inefficiency in the rest of the economy because they encourage politicians to engage in inefficient redistribution to influence elections. However, the extent to which this phenomenon actually leads to a resource curse (which we defined as a situation where a resource boom leads to lower GDP) depends on the quality of institutions. In countries with institutions which limit the ability of politicians to use clientelism to bias elections, resource booms tend to raise national income. When such institutions are absent, the perverse political incentives may dominate and income can fall—there is a *resource curse*.

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