Resources for Sale:

Corruption, Democracy and the Natural Resource Curse

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Abstract: A puzzling piece of empirical evidence suggests that resource-abundant countries tend to grow slower than their resource-poor counterparts. We attempt to explain this phenomenon by developing a lobbying game in which rent seeking firms interact with corrupt governments. The presence or absence of political competition, as well as the potential costs of political transitions, turn out to be key elements in generating the 'resource curse.' These variables define the degree of freedom that incumbent governments have in pursuing development policies that maximize surplus in the lobbying game, but put the economy off its optimal path. We test our predictions by adding measures of democracy and authoritarianism to existing regression models of the resource curse, and obtain support for our hypotheses.

Keywords: Resource endowment and economic growth, development, rent seeking, bribing, corruption.

1. Introduction

Conventional economic reasoning suggests that increasing a country's stock of assets provides greater opportunities for economic development and should translate into more production. A number of influential studies have recently cast doubt upon the validity of this axiom. A substantial body of empirical evidence demonstrates an inverse relationship between natural resource endowments and economic growth, even when controlling for a wide variety of variables. Assuming that the share of primary exports in GDP is a reasonable proxy for resource wealth,[1] it has been shown that countries that are well endowed with natural resources tend to grow slower than their resource-poor counterparts (e.g., Sachs and Warner 1997, 2001; Auty 2001a). To be precise; Sachs and Warner estimate that an increase of one standard deviation in natural resource intensity (on average 16% of GNP) leads to a reduction of about 1 percent per year in economic growth. This phenomenon has been coined the resource curse hypothesis.

Not surprisingly, this counterintuitive finding has motivated a vast and rapidly growing literature seeking to examine its robustness, and the precise conditions under which it obtains. Theoretical explanations for the resource curse hypothesis now abound (see section 2). In this paper we focus on the key role played by corruption in linking resource abundance to economic growth – an angle that is appropriate in light of recent empirical work. We formally model the interaction between agents from the private sector competing for favours from the government, but expand on earlier rent-seeking models by treating the government as an active player with its own objectives and constraints as well. We also extend the existing literature by introducing a political challenger, who threatens to oust the incumbent regulator. In sum, we present a political-economy model that

[1] Gylfason (2001) employs another proxy for resource wealth (namely the ratio of natural capital to total capital—or the sum of natural, human, and physical capital), and finds that the qualitative results are unaffected. Stijns (2002), on the other hand, employs yet another measure (physical reserves) and finds that the curse disappears for resources other than land. Norman (2005) challenges this finding. We speculate that the econometrics of the curse will be an active area of research in the near future.

focuses on the effects of resource abundance on government decision-making, corruption and political incentives. Our model identifies two key factors necessary for the resource curse hypothesis to hold: the absence of effective political competition and a set of specific technological production relationships in both the resource and the non-resource sectors. The model thus links the resource curse to the degree of democracy or authoritarianism in the economy.

We test our theoretical conjectures using data from Sachs and Warner's (1997) seminal study. Our regression results support the main predictions emerging from the theoretical analysis. First, the empirical evidence suggests that resources have a large, negative and significant effect on growth in highly autocratic countries, but that the effect of resources on growth in democratic regimes is either statistically insignificant, small and negative, or significant and positive, depending upon the measure of democracy that is used. Secondly, we find that the main effect of resource abundance on growth occurs through interaction with political variables. The results are robust to alternative specifications of the growth equation and measures of democracy.

The remainder of this paper is organised as follows. Section 2 summarizes earlier work on the resource curse and places the current contribution within the rapidly expanding literature. Section 3 outlines the structure of the model and summarizes certain properties of the equilibrium. Section 4 presents the main predictions. Section 5 specifies the empirical model and discusses the data and results, while Section 6 concludes. Appendix 1 provides proofs and Appendix 2 examines the robustness of the empirical results.

2. Background: Explanations of the resource curse

Why might resource-rich countries grow slower than resource-poor ones? Early studies on the resource curse placed emphasis on declining terms of trade for primary products, and

on the failure of resource-abundant countries to develop a competitive manufacturing sector – the so-called *Dutch Disease* hypothesis. A resource boom results in an appreciation of the exchange rate followed by a contraction of the tradable manufacturing sector. In a related vein, Hausmann and Rigobon (2002) show how the tradable manufacturing sector might suffer from lack of investments because of the interplay between volatile resource returns and endogenous interest rates in imperfect capital markets. A booming resource sector might also crowd out public and private investments in education or human capital (Gylfason 2001), or discourage entrepreneurship (Sachs and Warner 2001). Thus a country's ability to compete on world markets is eroded, reducing the potential for export-led growth in the long run. These effects are re-enforced if the manufacturing sector is assumed to be the economy's main 'engine of growth' in the long run; manufacturing is often associated with positive externalities and increasing returns to scale (e.g., Matsuyama 1992; Sachs and Warner 1999; Torvik 2002).

Recent work by Leite and Weidmann (1999) casts doubt upon the validity of the Dutch disease story and related explanations. When controlling for the level of corruption, Leite and Weidmann find that variables representing the export shares of fuels and ores (arguably the types of resources many analysts have in mind when thinking about the resource curse) are no longer significant in growth regressions.[2] The resource curse appears to vanish when the resource variable is disaggregated into its components. But this conclusion could be premature as Leite and Weidmann also show that resource wealth tends to stimulate corruption, and that corruption in turn negatively impacts on economic growth. Hence, the curse may still hold for fuel and ores, but the effect may be indirect, through the level of corruption.

[2] Leite and Weidmann break up the natural resources variable into 4 components; fuels, ores, agriculture and food. While the variables for ores and fuels are not significant in the growth regression, the variable representing food export shares is significant and of the correct sign for the resource curse story.

An alternative stream of literature explores these corruption and political economy aspects, focusing on the rent seeking consequences of resource booms. It is generally assumed that resource rents are easily appropriable by an established elite, triggering bribes and distorted policies. [3] Using a simple and incisive model, Torvik (2002) shows that resource abundance increases the payoffs from unproductive rent seeking behaviour and thus lowers overall growth of the economy.[4]

Most of these models suggest a deterministic relation between resource endowments and economic performance. But there appears to be not much that is deterministic about these links. An overview of different case studies in Auty (2001a) demonstrates how complex and diverse the experiences of different countries are. Notable exceptions to the resource curse hypothesis are found in both the developed and developing world, and include countries like Malaysia, Australia, Norway, Botswana and Canada. Unlike countries like Nigeria, Mexico and Venezuela, who appear to have squandered their oil windfalls, these countries have used their resources judiciously to build modern and successful economies. These examples make clear that generalisations may at times be hazardous: there appears to be no 'one-size-fits-all' resource curse story. A satisfactory explanation of the resource curse hypothesis must explain why resource abundance retards growth in some countries and promotes development in others (also see Mehlum *et al*. 2002, Robinson *et al*. 2002).

[3] For a discussion of the deleterious impact of corruption on growth through the effect on (foreign) investment, the productivity of public investment and level of maintenance expenditures, the level of education and health expenditures and tax revenues, see Tanzi (1998) and Leite and Weidmann (1999). For a model where a fixed number of rent seekers competes for capital by demanding re-distributive transfers (effectively treating the fiscal system as a common pool), eroding profitability and investments in the comparative productive formal sector of the economy, see Tornell and Lane (1999).

[4] In the model, rent seekers compete for a share of the public sector's income that is acquired through resource sales and fixed-rate taxation of manufacturing. Individuals compare income from production (with increasing returns to scale) to income from rent seeking, and arbitrage away differentials between these occupations by entry and exit decisions. A resource boom tilts the balance in favour of rent seeking. As entrepreneurs switch from modern manufacturing, income and demand fall, as do profits for remaining entrepreneurs and existing rent seekers. Production in manufacturing falls more than the increase in natural resource income, a result driven by the assumption of IRS in manufacturing. Society as a whole is worse off.

There are two different sub-streams of the rent seeking literature that attempt to explain these diverging patterns of development in different countries. First, there exists a class of models analysing rent seeking, entrepreneurship and multiple equilibria. For example, Acemoglu (1995) and Baland and Francois (2000) demonstrate that multiple equilibria of unequal social desirability might materialise in a model where an endogenous number of rent seekers interacts with an endogenous number of entrepreneurs.[5] Baland and Francois' model is useful for interpreting the divergent effects of resource booms on economic growth. Depending on whether the economy is initially located in a favourable or unfavourable equilibrium (with few and many rent seekers, respectively), increasing the value of the domestic resource stock might increase or decrease aggregate income. Mehlum *et al*. (2002) develop a similar argument by adding institutions to the analysis. Building on the 'big push model' of Murphy *et al*. (1989), they assume that returns to entrepreneurial activities and rent seeking are determined by the institutional context. In so-called 'grabber-friendly' economies, resource booms trigger a move of labor from production to rent seeking at the detriment of aggregate growth—the curse materializes. In countries with good institutions ('producer-friendly economies'), instead, a resource boom boosts production. There is no true policy maker in these 'a-political models,' although rents are created by some exogenously set policy and rent seekers may interact with some exogenous entity to secure a share of these rents. The fact that there is no government to steer the development process, combined with the lack of foresight or true interaction between agents, implies that long-run outcomes are determined by initial conditions.

The second explanation for the diverse effects of resource endowments on economic growth focuses on the insight that failure to appropriately manage resource rents

[5] In Acemoglu's model rent seekers prey on the income from entrepreneurs, such that an increase in the number of rent seekers lowers returns to both activities. In contrast, Baland and Francois assume that entrepreneurs might undermine the returns to rent seeking (as domestic production might render rents from import quota increasingly valueless).

ultimately owes to bad policy choices. That is; this explanation focuses on policy making explicitly. Auty (2001a,b) distinguishes between different development trajectories, and argues that resource-rich countries (especially those characterized by so-called 'point resources' like oil fields) tend to be dominated by factional and predatory oligarchic policies, promoting narrow sectional interests. The resource curse occurs because resource-rich countries are more likely to have 'bad policies'—policies postponing the transition to competitive industrialisation and diversification of the economy. As a result, the resource sector supports a burgeoning non-tradable sector made up of infant industries and an inflated but unproductive public sector. While this line of argument contains many interesting observations, regularities and assertions, formal modelling appears to have lagged behind discursive and statistical analyses. The only exception we are aware of is a political model by Robinson *et al*. (2002), where the focus is on an incumbent politician who receives all resource rents and who might distort the allocation of labor between the private and public sector to generate political support and retain office.

In this paper we combine elements from these different approaches and develop a model that combines rent seeking firms with a corrupt and strategically acting government. We do not develop a growth model *per se*, but analyse the allocation of supporting government policies over competing groups in society (which in turn will affect growth). Following Grossman and Helpman (1994), policies are exchanged for bribes. Because the incentive to bribe is determined by the stock of resources, the institutional context, at least when proxied by the level of corruption, is *endogenous* in our model. Resource wealth might slow down economic growth because it sets the stage for a situation where policy makers are bribed more intensively to provide a socially sub-optimal set of public goods. But there is nothing deterministic about this outcome. Our theory predicts that, in autocratic regimes, resource endowments allow governments to extract greater surplus

(bribes) by pursuing policies that are detrimental to growth. However, the desire to retain power implies that these incentives are greatly attenuated when the regime faces strong political opposition. Thus, in democratic regimes, the surpluses available from resource endowments are more likely to be used in ways that promote welfare and growth.

3. The model

Consider a small open economy with three productive sectors: natural resources (R), manufacturing (M) and constant returns to scale agriculture (A). There are a given number of entrepreneurs in society, denoted N, and they are free to move between the resource and manufacturing sectors: $N = N^{R} + N^{M}$. In addition, there is a labor force of L people, which is perfectly mobile over all three sectors: $L = L^{R} + L^{M} + L^{A}$. Define $L^{R}=N^{R}l^{R}$ and $L^{M}=N^{M}l^{M}$, where l^{R} and l^{M} are the number of workers hired by firms in sectors R and M respectively. Prices of goods are determined in world markets and exogenous in the model. We denote the returns to labor in agriculture by w, so that for interior solutions wages are equal to w in all sectors. In what follows we assume this is the case.

Inputs in production in the R and M sectors include labor and a sector-specific input in the form of a semi-public good, provided by the government. In the resource sector, another input is obviously the *in situ* resource stock, but this is captured as a simple shift parameter in what follows. The government is assumed to be self-interested and maximizes its own utility, and producers can influence the supply of public inputs by paying political contributions or bribes to the government. But there are limits to the ability of the government to pursue its own limited interests as it must worry about losing office as well—there is a rival that threatens to take the government's place if its policies are too different from the public's interests.[6] Regardless of the form of government, the

[6] We define this constraint more precisely in the following section.

incumbent rulers face a trade-off between distorting policies for personal gain and tempering the distortions when faced with the credible threat of losing power.

The model is based on the following sequence of events. First, entrepreneurs decide which sector to enter (resource extraction or manufacturing). Second, political interaction takes place between the incumbent government and the lobby groups. This stage is analogous to the game described in Grossman and Helpman (1994). Specifically, each lobby group simultaneously offers the incumbent government a political contribution schedule. A lobby's strategy consists of a continuous function that maps every policy vector that the government might choose into a specific political contribution or bribe. Given knowledge of the lobby groups' strategies (i.e. contribution schedules), the government proceeds to set its optimal policies in Stage 3.[7] Observing this, in stage 4 a rival announces the policies it will implement if it could secure power in the following stage. A political contest takes place, and the party that wins implements the announced policies. Once policies have been set, production occurs by choice of labor in stage 5.[8]

When the government goes unchallenged the equilibrium of the game has the properties of the well-known common agency problem, where several participants (lobbyists) seek to influence the actions of a common agent (the government). The equilibrium in this case is defined by: (*i*) a set of contribution schedules that maximises the payoffs of each lobby group, taking as given the rival lobby group's schedule and the anticipated optimisation of the government; and (*ii*) a set of policies that maximises the

[7] As outlined below, we focus on equilibria where the incumbent exploits his first mover advantage and is able to retain power. Firms know this, and offer bribes in the second stage.

[8] We have assumed that the lobbies do not contribute to any challenger. Although we recognise that this is a simplification, the available evidence from the US provides reasonable support for this assumption. For instance, Magelby and Nelson (1990, p 56) report that PACs gave more than 80% of their contributions to incumbents. They conclude that contributions are given to influence policies of incumbents, rather than for electoral purposes. While similar evidence from non-democratic regimes is unavailable, it seems likely that in these countries too contributions will be paid mainly to incumbents since support for the opposition is typically either deemed subversive or illegal. Furthermore in highly unstable regimes the identity of the challenger may not be known in advance.

government's payoffs, taking the contribution schedules into account. For a detailed proof see Bernheim and Whinston (1986) and Grossman and Helpman (1994).

3.1 The resource and manufacturing sectors

The production function of firms in sector $x = M, R$ is:

(1) $Q^x = f^x(l^x, B^x),\ f_i > 0, f_{ij} > 0$ ($i,j = L^x, B^x$ and $i \neq j$).

Goods are produced using labour l^x and a publicly supplied input B^x ($x = R, M$) and, as mentioned, we treat the resource stock as a shift parameter in the production function of the resource sector. For manufacturing, B^M, public investments possibly represent investments in human capital or sector-specific technologies. For resource extraction, B^R, public investments may represent investments in infrastructure to 'open up' isolated areas, etc.—see Repetto and Gillis (1988) for an overview of government policies to support the logging industry and Karl (1997) for examples relevant for the oil industry. In what follows we assume diminishing returns in resource extraction ($f_{ii}<0$), and increasing returns *at the sector level* in manufacturing. In other words, as argued by Matsuyama (1992), Murphy et al. (1989), Torvik (2002) and others we assume there are external benefits from entrepreneurs moving into manufacturing. Of course individual entrepreneurs ignore these spillover effects in their private decision-making.

We model resource extraction as an activity that generates a certain output per period (depending on relative prices, policies and stock size). It can either be assumed that entrepreneurs enter a large conglomorate (and become rent seekers rather than benefit from their entrepreneurial talents) and jointly decide on optimal management, or more generally that entrepreneurs start up new firms, claim a fraction of the resource stock, and extract from their private sub-stock. For simplicity we deal with the former case though the results

are unaffected by this assumption. Profits per entrepreneur in the resource sector are obtained by 'dividing the pie' consisting of the associated resource rents, and is defined by:

$$(2) \qquad \pi^R = \frac{pQ^R - wl^R - S^R - \tau}{N^R},$$

where p is the price of the resource commodity, S^R is the (aggregate) bribe offered by the resource sector and τ is a tax levied by the government to finance the provision of public goods. Without loss we assume that all firms pay taxes but, alternatively and without loss, we can also assume that all agents in the economy ($L+N$) pay taxes. The optimal behavior of entrepreneurs in the resource sector in stages 2 (choosing the optimal bribe) and 5 (hiring the optimal amount of labor) follow directly from this expression:[9]

$$(3) \qquad \frac{d\pi^R}{dl^R} = \frac{p(\partial Q^R / \partial l^R) - w}{N^R} = 0 \rightarrow p\frac{\partial Q^R}{\partial l^R} = w \qquad \text{(Stage 5), and}$$

$$(4) \qquad \frac{d\pi^R}{dS^R} = \frac{p\dfrac{\partial Q^R}{\partial B^R}\dfrac{\partial B^R}{\partial S^R} - w\dfrac{\partial l^R}{\partial B^R} - 1}{N^R} = 0 \rightarrow p\frac{\partial Q^R}{\partial B^R} - w\frac{\partial l^R}{\partial B^R} = \frac{\partial S^R}{\partial B^R} \qquad \text{(Stage 2).}$$

From these first order conditions, not surprisingly, it follows directly that $dl^R/dp > 0$, $dl^R/dB^R > 0$ and $dS^R/dp > 0$. From (4): lobbying will only occur if further provision of the publicly supplied input is profitable to the producer.[10] We assume this is the case: $p(\partial Q^R/\partial B^R) - w(\partial l^R/\partial B^R) > 0$, so that (4) defines an interior solution only if $(\partial S^R/\partial B^R) > 0$ – lobbying only occurs if higher political contributions induce the government to provide more of the input (which is evident). Note that equation (4) implies that, in equilibrium, the change in political contribution mirrors the effects of the policy on profits.[11,12]

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[9] For expositional ease solutions are presented by agent rather than by sequence of events. However, all downstream impacts are incorporated into the solutions as appropriate.

[10] With a potentially large number of firms in the economy the possible increase in the individual's tax burden arising from a rise in B^x is assumed to be negligible. Producers ignore the impact of their lobbying on their tax burden. Relaxing this assumption complicates the analysis but does not alter the main conclusions.

[11] Thus, as noted by Grossman and Helpman (1994), the political contribution schedule is *locally truthful*. As in Bernheim and Whinston (1986), this concept can be extended to a contribution schedule that is globally truthful. This yields a function which accurately mirrors the preferences of the lobbyist's at all policy points.

Next, turn to the manufacturing sector, which consists of $N^M = N - N^R$ independent firms, but which, as mentioned above, is characterized by sector-wide increasing returns to scale. Profits per entrepreneur are given by:

$$(5) \qquad \pi^M = Q^M - wl^M - s^M + (N^M - 1)Q^{-M} - \tau,$$

where s^M are bribes per firm in manufacturing such that aggregate bribes paid by this sector are given by $S^M = N^M s^M$, and where sector-wide scale economies are captured in a simple and straightforward way by the term $(N^M\text{-}1)Q^{-M}$ (Q^{-M} is the output of other firms in the sector). Since there are scale economies in manufacturing this structure implies that in the first best allocation there would be a single firm in the resource sector, with all other agents engaged in manufacturing. However, as explained in subsequent sections, this outcome cannot be achieved by the government who sets policies after entrepreneurs have chosen which sector to enter.[13]

We assume that firms determine their bribes independently. This assumption seems reasonable if the manufacturing sector contains a large and disparate number of firms (e.g. Olsen 1965). We treat the price of the manufactured good as the numeraire. Optimal firm behavior follows from profit function (5):

$$(6) \qquad \frac{d\pi}{dl^M} = \frac{\partial Q^M / \partial l^M - w}{N^M} = 0 \rightarrow \frac{\partial Q^M}{\partial l^M} = w \qquad \text{(Stage 5), and}$$

$$(7) \qquad \frac{d\pi}{ds^M} = \frac{\partial Q^M}{\partial B^M}\frac{\partial B^M}{\partial s^M} - w\frac{\partial l^M}{\partial B^M} - 1 = 0 \rightarrow \frac{\partial Q^M}{\partial B^M} - w\frac{\partial l^M}{\partial B^M} = \frac{\partial s^M}{\partial B^M} \qquad \text{(Stage 2).}$$

From (7) follows the aggregate bribe: $S^M = N^M s^M$ (where N^M is endogenously determined – see below). As above, bribing occurs until marginal benefits equal marginal costs, and (7) is locally truthful. This outcome may be compared to the optimal bribe ($\hat{S}^M$) when firms

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[12] It is useful to note that in this case, even if bribes were determined individually rather than jointly, the same solution eventuates. That is the optimal individual bribe is simply $s^R = S^R/N^R$.

[13] The first best allocation of entrepreneurial talent over sectors likely involves an unequal return to talent (with the entrepreneur in resource extraction earning more than her colleagues in manufacturing). Such profit differentials cannot persist in our model and will be competed away by entry-exit decisions.

in the manufacturing sector collectively angle for government support – internalising the spillover benefits from production:

$$(7') \qquad \frac{d\pi}{d\hat{S}^M} = \frac{\partial Q^M}{\partial B^M}\frac{\partial B^M}{\partial \hat{S}^M} + (N^M - 1)\frac{\partial Q^M}{\partial B^M}\frac{\partial Q^{-M}}{\partial Q^M}\frac{\partial B^M}{\partial \hat{S}^M} - w\frac{\partial L^M}{\partial B^M}\frac{\partial B^M}{\partial \hat{S}^M} - 1 = 0\,.$$

It is apparent that $\hat{S}^M > N^M s^M$. Finally, differentiating (7) or (4) gives the result that:

$$(8) \qquad \frac{dS^M}{dS^R} = \frac{dS^R}{dS^M} = 0\,.$$

In other words, the reaction curves are orthogonal and one sector's bribe has no effect on the optimal bribe in the other sector.[14]

3.2 The government

We model the case of a selfish government caring only about its private returns. Alternatively, and without loss, we may consider the case where the government maximizes a linear function with exogenous weights given to both contributions and welfare (see Grossman and Helpman 1994).[15] The incumbent government's payoffs from retaining power are defined by:

$$(9) \qquad U^g = N^M s^M + N^R s^R + H + D$$

where H is the intrinsic utility, if any, arising from holding office, and $D = N\tau - C^M(B^M) - C^R(B^R)$ is the fiscal surplus as $C^i(B^i)$ denote the costs associated with providing semi-public good i (we assume convex costs: $C'>0$, $C''>0$). Bribes and fiscal surpluses are valued since

[14] We have also solved a more complex model without an agricultural sector where wages are set endogenously. With the R and M sector competing for labor, rivalry in bribing implies that political contributions are strategic substitutes: $dS^R/dS^M < 0$. Intuitively, an increase in political contributions, S^M, induces a greater supply of the public good B^M, so that output in sector M expands and equilibrium wages rise. *Ceteris paribus,* higher wages reduce the profitability of production in sector R. Since political donations are truthful and reflect the payoffs from a policy change (eq. 4b), contributions from sector R decline. Incorporating this effect would strengthen the results we derive below (albeit at the expense of additional algebraic clutter). Details are available from the authors on request.

[15] However in our model the relative weight that is eventually given to welfare is shown to depend on the intensity of political competition. Thus we take a small step towards endogenising the relative weights in the Grossman-Helpman (1994) formulation of the government objective function.

they represent discretionary funds that can be used for any purposes – personal or political – that the government chooses. These funds could be used to deter political rivals, suppress opposition, fund election campaigns, or embezzled for personal consumption. Without loss we assume that when the government loses office its utility is normalised to zero.

Let (B^M,B^R,T) be the set of policies proposed by the government, and let $W(B^M,B^R,T)$ be the resulting income level, or the sum of profits plus aggregate labor income:

(10) $W = N^R\pi^R + (N–N^R)\pi^M + wL.$

Upon substitution:

(10') $W = N^R pQ^R + (N–N^R)Q^M + wL^A - N\tau.$

We assume that the income level that eventuates affects political support. This assumption is plausible if the entrepreneurial class (whose profits feature prominently in the income measure) has a large influence on what happens in society. Alternatively, it is plausible if a broader group of people cares about aggregate income or expects some of it to "trickle down" (say, though fiscal policies not modelled here). While we do not model the trickle down effects this assumption seems highly plausible in the light of accumulating evidence that increases in private income remains an efficient and durable way for countries to eliminate poverty and develop (e.g. Dollar and Kraaij 2002, Bulte et al. 2005, Kraaij 2004). In addition, being closely related to GDP, the formulation of income in (10') generates predictions that are more amenable to empirical scrutiny.

3.3 The challenger and a threat of revolution

Incumbent leaders seldom govern without the potential threat of being challenged. The survival of a government is threatened when it is no longer able to garner sufficient resources either to sustain political support through its policies, or subdue political

opposition. Thus to retain office, incumbents must be attentive to the pressures they face from opponents (see Mesquita *et al.* 2003).

It is assumed that a single challenger who, having observed the government's policies, announces the policy vector $(\overline{B}^M, \overline{B}^R, T)$. Let the corresponding aggregate welfare level be $\overline{W}(\overline{B}^M, \overline{B}^R, T)$. We adopt two crucial assumptions about the political process. First, it is assumed that the transition of power from the incumbent to the challenger is more likely to occur if such a transition gains greater public support. We interpret this as follows; a transition is more likely to occur (that is; be supported) if it raises aggregate income. This assumption seems reasonable in the light of evidence that economic growth remains a robust way of delivering development benefits.[16]

Second, we assume that political transitions are not without costs. In non-democratic regimes the transition of power usually takes the form of revolutions and violent political struggles that disrupt economic activity and impose substantial costs on citizens. By contrast, in democracies the electoral process provides a (relatively) low cost and orderly opportunity for the transfer of power. The transition of power in a non-democratic regime imposes higher economic costs than in a democracy. It is assumed that the greater are the discretionary resources available to the incumbent, the greater will be its ability to resist a regime change. This is likely since discretionary funds can be used to deter or suppress opposition either by force, or through persuasive propaganda.[17] This

[16] In the context of democratic societies, the above interpretation is perhaps obvious as raising aggregate income offers scope to make voters better off as the benefits of growth spread across the economy. In non-democratic societies, it is probably also true that popular support raises the odds of a successful *coupe d'état*, and increasing income could provide the means to ensure popular support. Sutter (2000) provides an analytical study of the determinants of rebellion. For a survey of related issues see Hardin (1997) and Tullock (1978).

[17] See Grossman and Helpman (1996) for a model of political advertising. More importantly it is worth noting that the notion that costs of transition are higher in (i) autocratic regimes and (ii) where the government has greater resources at its disposal is not new in the political science literature. Some political economy studies have also explored this issue. For instance, Wintrobe (1978) discusses how autocrats use resources for repression and internal security in order to increase the costs of regime change and hence quell opposition. Tullock's (1978) review of autocracies provides further support.

imposes larger costs on the inhabitants when a regime change occurs. Let $v(S^M+S^R+D)$ denote the welfare costs of a change in regime. We assume that $v'>0$ and $v''=0$.[18]

From these two assumptions it follows that a change in regime will be income improving (and will thus occur) if the following holds:

(11) $$W(B^M, B^R, T) < \overline{W}(\overline{B}^M, \overline{B}^R, T) - v(S^M + S^R + D).$$

We adopt the convention that when (11) holds as an equality, the incumbent retains power. To determine when (11) is satisfied it is necessary to first derive the opposition's optimal policy vector. To do so define the welfare maximising set of policies as: $\Lambda^* = (\overline{B}^{M*}, \overline{B}^{R*}, T)$ with corresponding welfare maximising level of welfare $W^*(\Lambda^*)$. Given any set of policies of the incumbent (B^M, B^R) with associated welfare level $W(B^M, B^R)$, the rival can secure power by proposing a set of policies that yields aggregate utility level:

(12) $$W(B^M, B^R) + v(S^M + S^R) + \varepsilon_1 \equiv \overline{W}(\overline{\Lambda}),$$

for all $\varepsilon_1 > 0$. Condition (12) implies that the benefits of a regime change exceed the costs of the transition and there will be a change in government.

Knowing this, in stage 1 the incumbent will seek to retain power by setting policies that yield welfare of $\overline{W}(\overline{\Lambda}) + \varepsilon_2$, where $\varepsilon_2 > 0$. Ultimately, the incumbent as first mover knows that for any given policy vector Λ^i that it sets, the rival can seize power by offering policies that yield utility $W(\Lambda^i) + v + \varepsilon_i$ ($\varepsilon_i > 0$). So long as such policies exist, there will be a regime change. To retain power, the incumbent must set policies such that a regime change does not confer a net welfare gain. Intuitively, "Bertrand" type of competition in policies implies that the incumbent can only retain power if the opposition is required to

[18] We present results for the simpler case of linear costs, but the results are also consistent with convex costs.

offer policies that yield greater net utility than is available at the welfare maximising set of policies:

(13) $W(B^M, B^R) + v(S^M + S^R) \geq W^*(\Lambda^*)$.

Observe that as v rises the government has more freedom to set policies that deviate from the welfare maximising ideal ($\geq W^*(\Lambda^*)$) – costly transitions generate slack that the incumbent can exploit to his own benefit. In oppressive regimes with no effective opposition or, more specifically, when the transition costs $v(\cdot)$ are sufficiently large to quell any form of opposition, equation (13) will hold as a strict inequality. In countries with high levels of political competition (13) will hold as an equality.

3.4. Policy making

Recall that the government moves after entrepreneurs have allocated effort between sectors in Stage 1.[19] Formally, the government determines its optimal policies, taking as given the distribution of firms between sectors. The government's optimum choices are thus constrained by the first mover advantage enjoyed by the entrepreneurs and hence the first best distribution of firms between sectors cannot generally be induced through government support for different sectors. Rather, second-best or constrained welfare maximization may be pursued.

First we consider the (constrained) welfare maximizing policy without bribing. Maximizing (10), but without $S^i(B^i)$ and imposing $N\tau = C^B(B^M) + C^R(B^R)$, gives the following conditions for an optimal allocation:

(14) $$\frac{dW}{dB^R} = N^R p \frac{\partial Q^R}{\partial B^R} - \frac{\partial C^R(B^R)}{\partial B^R} + w\frac{\partial L^A}{\partial B^R} = 0, \text{ and}$$

[19] Assuming that firm migration takes place in stage 1 seems reasonable since the choice of sector is likely to be a longer term decision, where as production levels or policy support are more easily altered in the short run. Thus in determining the choice of sector, firms can be expected to anticipate and take account of policy responses and other downstream impacts.

$$(15) \qquad \frac{dW}{dB^M} = N^M \frac{\partial Q^M}{\partial B^M} - \frac{\partial C^M(B^M)}{\partial B^M} + w\frac{\partial L^A}{\partial B^M} + N^M \frac{\partial Q^M}{\partial B^M}\frac{\partial Q^{-M}}{\partial Q^M} = 0.$$

Next, turn to policy making by a selfish incumbent planner, who tries to fend off a challenger. To retain office the incumbent must propose policies to maximise (9), subject to the constraints:

(i) $W(B^M, B^R) \geq \overline{W}(\overline{B}^M, \overline{B}^R) - v(S^M + S^R + D)$,[20]

(ii) $\overline{W}(\overline{B}^M, \overline{B}^R) = W^W(\Lambda^W)$.

The necessary (Kuhn Tucker) conditions of the government's problem in (9) are:

$$\frac{\partial L}{\partial B^x} \leq 0, \; B^x \frac{\partial L}{\partial B^x} = 0; \; \frac{\partial L}{\partial \lambda} \geq 0, \lambda \frac{\partial L}{\partial \lambda} = 0 \;\; (x = M, R),$$

where L is the Langrangean and λ is the Lagrange multiplier for constraint (i). Using the first order conditions above, we obtain after some substitution:

$$(16) \qquad \frac{\partial L}{\partial B^R} = \frac{\partial S^R}{\partial B^R}(1 + \lambda v') - \frac{\partial C^R}{\partial B^R} + \lambda w \frac{\partial L^A}{\partial B^R}, \text{ and}$$

$$(17) \qquad \frac{\partial L}{\partial B^M} = \frac{\partial S^M}{\partial B^M}(1 + \lambda v') - \frac{\partial C^M}{\partial B^M} + \lambda w \frac{\partial L^A}{\partial B^M} + \lambda(N - N^R)\frac{\partial Q^M}{\partial B^M}\frac{\partial Q^{-M}}{\partial Q^M},$$

and the constrain again. Recall $\lambda=0$ when constraint (i) is slack in a regime with very high transition costs (little or no political opposition).

It is instructive to compare the policies that emerge under (constrained) income maximization with those that occur in an autocracy – i.e. those that occur when the incumbent is unconstrained by potential challengers such that $\lambda=0$. Let B^{R*}, B^{M*} be the amounts of public goods supplied to sectors R and M respectively in the income maximising equilibrium and define B^{Ra}, B^{Ma} as the public goods supplies under autocracy.

[20] It may be more reasonable to state this constraint in terms of probabilities. That is; the probability of retaining power is Pr = Pr (Φ) where $\Phi = (W(B^M, B^R) - [\overline{W}(\overline{B}^M, \overline{B}^R) - v(N^M S^M + N^R S^R)])$ and Pr' > 0 ; Pr" < 0, Pr(Φ <0) = 0. For simplicity this is ignored.

Lemma 1 compares the outcome in the two equilibria, holding the number of firms in each sector constant.

> **Lemma 1:** *For a given number of firms, the level of government support to the manufacturing sector under autocracy is less than the level of support given in the income maximising equilibrium. The level of support to the resource sector is unaffected by the type of regime when the number of firms is fixed.* $B^{R*} = B^{Ra}$ *and* $B^{M*} > B^{Ma}$.
>
> **Proof**: See Appendix.

Hence the manufacturing sector is relatively disadvantaged in an autocratic regime, while the resource sector continues to receive the same level of support, when the number of firms is fixed. Intuitively, the government is assumed to be completely self-interested and in an autocratic regime policies are guided by the desire to extract bribes from firms. The bribe paid by each firm reflects the private benefits that accrue to it from the public good. Firms in the manufacturing sector therefore ignore the sector wide returns to scale in determining their bribes and hence pay less than is collectively optimal and consequently receive fewer public goods. Since the supply of public goods in an autocratic regime differs from the income maximising levels, it necessarily follows that aggregate income levels under autocracy, must be lower than that in an income maximising regime. Moreover, since the definition of income used in this model proxies GDP, this suggests that:

> **Corollary 1**: *For any given number of firms in each sector, aggregate income levels and GDP in an autocracy will be lower than in the (constrained) income maximising equilibrium.*

How does political competition affect this outcome – i.e. what policies eventuate when $\lambda > 0$? It was noted above that, in the absence of policy competition, the government supplies public goods to each sector up to the point where the marginal benefits in the form of

increased political contributions equal the marginal cost of public good provision. However, political competition forces the government to take account of the welfare effects of its policy on other agents. Moreover, the weight given to these welfare effects is declining in v' – the marginal cost of regime change. It follows that if greater provision of a public good to sector $x = M,R$, generates a net welfare loss upon other agents, an incumbent who wishes to retain power is compelled to lower supply of the public good to that sector and vice-versa. In short, political competition is the channel through which the influence of special interest lobby groups can be attenuated. But as the costs of political change (v) rise, the potentially beneficial impact of political competition diminishes. Thus governments act rationally. They extract greater surplus through policy distortions when secure, and retract towards the income maximising equilibrium when challenged by an opponent. More formally as the political costs of a transition decline (i.e. $v \to 0$), then the solution in (16) and (17) converges to the income maximizing equilibrium. Hence, income levels (GDP) decline as political regimes become more autocratic.

These results are based on the assumption that the number of firms in each sector is fixed. In the following section we consider the impact of the movement of entrepreneurs between sectors.

3.5 Entrepreneurs choose a sector

In stage 1 of the model entrepreneurs choose between entering the manufacturing and resource extraction sector, taking account of all downstream impacts. Their entry decisions will arbitrage away any profit differentials on the margin, and in equilibrium the following must hold:

$$(18) \qquad Z \equiv Q^M - wl^M - s^M + (N^M - 1)Q^{-M} - \tau - \frac{pQ^R - wL^R - S^R - N^R\tau}{N^R} = 0 .$$

Total differentiation gives us the unsurprising result that, in equilibrium, the number of entrepreneurs in the resource sector is increasing in the relative price of the resource commodity (see Appendix):

$$(19) \qquad \frac{dN^R}{dp} = -\frac{\partial Z / \partial p}{\partial Z / \partial N^R} > 0.$$

How does this equilibrium compare to the case without bribing, or the constrained income-maximizing outcome? The arbitrage equilibrium without bribes is characterized by the condition:

$$(20) \qquad Z^* \equiv Q^M - wl^M + (N^M - 1)Q^{-M} - \tau - \frac{pQ^R - wL^R - N^R\tau}{N^R} = 0,$$

which is simply the earlier condition (18) but where bribes are omitted ($s^M = S^R = 0$). Once again it is evident that $\frac{dN^{R*}}{dp} = -\frac{\partial Z^* / \partial p}{\partial Z^* / \partial N^{R*}} > 0.$

4. Results

There are a number of ways to analyse the effect of resource endowments on economic growth. The key feature we are interested in concerns the effect of resource abundance on the setting of policies in political equilibrium. One straightforward approach would be to link provision of public goods B^M and B^R to the size of the resource stock X, which would be a shift parameter in resource extraction. However, we have chosen a slightly different avenue that allows us to leave the production functions unspecified. Consistent with the 'resource boom' analysis of Baland and Francois (2000) and others, we model a resource boom as an exogenous increase in the price of good p. Note that for any multiplicative production function, where $Q^R=a(L^R)^b(B^R)^cX$ and $\prod^R=pQ^R$, the analytical results with respect to the size of the (exogenous) resource stock are similar to the results with respect to the resource price. Therefore, while strictly analysing the impact of relative prices on

policies and growth, the results spill over to the case of resource endowments and growth for most common production functions.

In analysing the effect of a resource boom on policies, we consider two cases. First, it is assumed that the government faces no potential challenger ($\lambda=0$). This scenario will be referred to as autocracy in what follows. Second, it is assumed that the government knows that there is a challenger waiting to take over, such that constraint (i) in problem (9) binds with equality. The main result of the autocracy case is in the following proposition:

Proposition 1. *In the absence of an immediate political challenger, a resource boom induces greater provision of public goods to sector R and less to the manufacturing sector. The net result is a decline in private sector income (GDP).*

Proof: see appendix 1.

The interpretation is as follows. Under autocratic leadership, prior to a resource boom, a suboptimal allocation of policies is in effect. The boom – modelled either as a rise in the resource price or an increase in the stock – aggravates the pre-existing inefficiencies. It induces a transfer of support to the resource sector, at the expense of policies supporting the manufacturing sector. The manufacturing sector, which benefits from network effects or spillover benefits, gets squeezed. Relative to the first-best benchmark, too much support is given to the booming resource sector at the expense of manufacturing and policies are steered away from their most productive use.

The reason why this occurs is that a resource 'boom' raises the value of government support for the resource sector at the margin, and therefore raises the level of bribes offered to the incumbent.[21] Thus profits in the resource sector increase, attracting entrepreneurs from the manufacturing sector to restore equilibrium. Since there are spillover benefits in

[21] In a related but different vein, Collier and Hoeffler (1998) have established that thicker resource stocks are associated with strife and social war. While formal war is ruled out in the model above, we do note that thicker stocks are consistent with more lobby effort for scarce resources and therefore more competition.

the manufacturing sector it follows that a shrinking manufacturing sector lowers manufacturing profits. And since bribes are truthful, firms in the manufacturing sector will downscale their contribution schedule. In the absence of a credible political rival, the incumbent government's policies are guided by bribes and inducements rather than welfare considerations. Hence, the incumbent has no incentive to compensate the manufacturing sector for the loss of production externalities, and sectoral policies favor the resource industry at the expense of manufacturing. The resource curse materializes.[22]

But this result need not always hold in this model. Proposition 2 summarises the main result for the case when there exists political opposition.

> **Proposition 2**. *When the political constraint binds the effects of a resource boom are ambiguous. Income levels (GDP) may either increase or decrease following a resource boom.* [23]

In other words, excessive (inefficient) levels of support for the resource sector may not be forthcoming if there is a political constraint that disciplines the incumbent, effectively forcing it to support other sectors if those raise income.

The economic explanation for the ambiguous result in the presence of political opposition is as follows. Following a resource boom the 'constrained' planner expects additional bribing from the resource sector, resulting in an incentive to cater to this sector. However, doing so results in an income loss (as established above) while at the same time the potential level of income that can be promised by the challenger (offering a constrained income-maximizing policy package), has gone up. The incumbent essentially has two ways to mitigate the risk of being ousted. First, she may raise the costs of a regime change

[22] Note that a similar result may be obtained in a standard Grossman-Helpman (1994) model where the incumbent cares about both bribes and welfare ('balanced' with a fixed weight in the government's objective function). Also note that the effect discussed in the main text would be accentuated in a model with endogenous wages. If a resource boom bids up wages, profits in manufacturing fall with an adverse effect on that sector's willingness to pay bribes.

[23] Formally this result follows from the fact that in the equilibrium where the constraint binds $dB^M/dp > (<) 0$ – hence the outcome is ambiguous.

– a viable strategy if the additional transfers flowing from the resource sector are sufficiently large. Or, second, through choice of subsidies she may reverse the incentives of entrepreneurs to move from manufacturing to resource extraction. That is: by providing more manufacturing-specific public good she counteracts the relative improvement of profitability of extraction, restoring the (constrained) optimal balance of entrepreneurial talent over the two sectors. Which approach yields greater private benefits for the incumbent depends on parameters.

To sum up, the resource curse emerges when the incumbent can effectively suppress all credible opposition to its policies (proposition 1). In addition, the resource curse *might* emerge in the presence of political opposition, but only under specific conditions (proposition 2). Indeed, the opposite result can also occur – a resource boom might induce policy improvements. In a competitive political system, the credible threat of losing power compels the incumbent to trade off the income costs of a policy change against the private (bribe related) benefits.

5. Empirical evidence

Ultimately the validity of these theoretical predictions must depend upon the empirical evidence. In this section we therefore briefly review some of the relevant empirical evidence and provide an indirect (and albeit imperfect) test of the theory. Beginning with the empirical validity of the key predictions of the model. First, given the appropriate context, we argue that thicker resource stocks will translate into more corruption. This is consistent with results reported by Leite and Weidmann (1999). Second, we show that in autocracies more corruption implies a lower level of provision of (semi) public goods that do not directly favour the resource sector. This is confirmed by Deacon (2003) who showed that the supply of welfare improving public goods is increasing in the level of

democracy. Finally, we note that the extent of corruption distorts the set of policies chosen by the government, with detrimental effects for economic performance. This is consistent with a variety of studies, including Leite and Weidmann (1999).

Our theory predicts that resource endowments allow governments to pursue policies that are detrimental to GDP in autocratic regimes, but that the effect will be mitigated or even reversed in democratic systems. However, empirically testing this prediction is difficult for two reasons. First, democratic status is not exogenous to income levels and is highly correlated with income (Minier 1998). In addition, disentangling the direction of causality between these is complex and a matter of much contention. Some commentators argue that democratisation is a necessary condition for development,[24] while others suggest that development precedes democracy. Thus, as noted by Durham (1999), including democracy (autocracy) as an explanatory variable in a regression with the level of GDP as the dependent variable, could induce endogeneity bias in the regression.[25] Instead we attempt to indirectly test the theoretical predictions by examining the relationship between GDP growth rates, resources and democracy, closely following the approach of Sachs and Warner (1997). Recent work by Durham (1999) suggests that treating political regimes in growth regressions as exogenous is appropriate, and that it is income *levels* rather than *growth rates* that affect regime types (see also Barro 1996).[26] We proceed by including measures of the degree of democracy or autocracy using the regression equations and data of Sachs and Warner (1997). In other words, we follow the mainstream approach to testing resource curse theories, and do a straightforward cross-country regression analysis.

[24] For instance, this is the position adopted by the World Bank in the World Development Report 2003.
[25] Regrettably there do not seem to be any obvious instruments that can be used to overcome the potential endogeneity problem.
[26] Further problems may arise with the use of a single equation regression if resource endowments influence the type of political regime that eventuates. In the Appendix we report correlation coefficients between democracy measures and resource abundance. These don't demonstrate any statistical relationship.

Finding appropriate measures of democracy and autocracy at the cross-national level is difficult. In the political science literature democracy (autocracy) is usually defined in terms of political and institutional attributes of a regime. This is reflected in the two main measures of democracy that are available: the Polity data of Marshall and Jaggers (2003) and Vanhanen's (2000) Polyarchy index.[27] For our purposes the most suitable measure is provided by the Polity data of Marshall and Jaggers (but see Appendix 2, where we provide results based on the Vanhanen index as a robustness check). Marshall and Jaggers provide separate measures of the democratic and autocratic attributes of each country, which allows us to directly test for possible differences in the impact of resources across democratic and autocratic characteristics. Democracy is measured by an additive ten-point scale, with a score of ten being given to the most democratic system and zero to the least democratic. The democracy attributes include: the competitiveness of political participation, the competitiveness of executive recruitment, the openness of executive recruitment and constraints on the chief executive. The autocratic attributes are also measured on a ten-point scale, with a score of ten being given to the most autocratic. The autocratic attributes include proxies for: the lack of political competition, the regulation of political participation, lack of openness of executive recruitment and lack of constraints on the chief executive.

Our theoretical analysis predicts that the impact of resources on policies is conditional upon the type of political regime. Moreover, if growth depends upon policy choices, then countries with "good" policies can be expected to grow faster than those with distorted policies. This suggests that that when resources become available in autocractic regimes this unleashes extreme forms of rent seeking and growth depleting policies, while in democratic regimes the outcome is ambiguous and resource rents may (or may not)

[27] Freedom House also provide a proxy for democracy. However, their index is a subjective measure of civic and political freedoms, which, it is argued, is related to the level of democracy. For the measures required in this study the Freedom House index seems to be the least appropriate measure.

induce growth-increasing outcomes. The separate measures of autocracy and democracy provided in the polity data set provide a reasonable vehicle for testing these predictions and are therefore used in the empirical analysis.

***Table 1: Regression results* (*t-statistics in parentheses*)**

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Initial income level	-1.82**	-1.74**	-1.69**	-1.69**	-1.49**
	(-8.79)	(-8.89)	(-8.66)	(-8.01)	(-6.58)
Openness	1.40**	1.35**	1.28**	1.27**	2.11**
	(3.45)	(3.53)	(3.29)	(3.18)	(4.79)
Terms of trade	0.10**	0.089**	0.097**	0.09**	0.02
Change	(2.18)	(2.04)	(2.20)	(2.12)	(0.37)
Investment	0.076**	0.087**	0.089**	0.08**	
	(2.99)	(3.59)	(3.65)	(3.49)	
Rule of law	0.38**	0.415**	0.44**	0.44**	0.25**
	(3.58)	(4.12)	(4.45)	(4.35)	(2.19)
Resource abundance	-8.42**	-3.71			
	(-6.49)	(-1.84)			
Resource abundance		-0.84**	-1.29**	-1.29**	-1.31**
× Autocracy		(-2.83)	(-7.49)	(-7.32)	(-6.3)
Resource abundance			-0.46	-0.46	-0.13
× Democracy			(-1.80)	(-1.73)	(0.48)
Autocracy		0.159**	0.17**	0.17**	0.17
		(2.96)	(3.26)	(2.02)	(1.84)
Democracy				-0.04	-0.02
				(-0.05)	(-0.31)
Equipment					19.3**
					(3.67)
Observations	74	72	72	72	72
Adjusted R^2	0.74	0.77	0.77	0.76	0.77

*=significant at 5% level, **=significant at 1% level

In Table 1 we present regression results. As usual, the dependent variable is the average growth rate of real GDP from 1970 to 1990. The first column replicates the Sachs and Warner results using their data, and features the familiar result of a statistically negative coefficient for the variable representing resource abundance. The explanatory variables included in Sachs and Warner's preferred specification are: *initial income* measured by the log of GDP per economically active person in 1970; a measure of the degree of *openness* of the economy; growth of the log of the *terms of trade*; a *rule of law*

index, the log of the ratio of *investment* to GDP and *resource abundance* as measured by the share of primary exports in GNP.

The second column includes an interaction term: [*autocracy*] × [*resource abundance*]. The theory suggests that resources are detrimental for economic growth when the incumbent government does not face political competition, and therefore the interaction variable should have a negative sign. This is consistent with the empirical findings in Table 1. Moreover, note that *resource abundance* is insignificant at the 5% level after including the interaction variable. This suggests that the political interaction term captures the main effect of resource abundance on growth. These results are robust with respect to the inclusion of other variables reported by Sachs and Warner.

As a first robustness check we include in regressions 3 and 4, respectively, variables measuring the degree of *democracy* and *autocracy*. Regression 3 reveals that the resource term when interacted with democracy, is statistically insignificant at the 5% level, with a markedly smaller coefficient than the interaction of resources with autocracy. In regression 4, *democracy* is included as an explanatory variable and has an insignificant impact on growth. We have run various model specifications with different explanatory variables (such as those included by Barro 1991, King and Levine 1993 and others) and consistently find the interaction of *resources* with *autocracy* is large, negative and significant, but that *democracy* has a negative effect on growth and *autocracy* has a positive effect on growth (albeit these are not always significant). The latter finding is intriguing and perhaps disappointing, but it is not uncommon in the literature (for an overview of early studies, see Przeworski and Limongi 1993; for more recent work, see for example Barro 1996, Minier 1998, Durham 1999). The literature provides a number of reasons why democracy can be

bad for economic growth, but there is no clear consensus on this issue yet.[28] Przeworski and Limongi suggest that democracies can be beneficial for growth because democratic institutions constrain "predatory" tendencies of the ruling class, which might harm investment and growth. The theory and empirical results in this paper suggest a link between such predatory behavior and resource abundance. Finally, in column 5 we use investment spending on *equipment* as a fraction of GDP as an explanatory variable instead of the Sachs-Warner measure of investment. A number of the Sachs-Warner explanatory variables turn insignificant at the 5% level, as does the interaction between *resource abundance* and *democracy*. However, the interaction of *resource abundance* with *autocracy* remains highly significant and negative. This general finding appears to be robust and holds in various other empirical growth models that were tested also (see the Appendix for further empirical tests).

6. Conclusions and discussion

We develop a model that combines the rent seeking and lobbying efforts of firms with the strategic behaviour of a corrupt government, and discuss the conditions under which the well-known 'resource curse' result obtains. By combining both firm and government incentives the model extends earlier work. The focus on lobbying and bribing is appropriate in light of recent empirical findings that suggest that the main effect of resources on economic growth is through the level of corruption that distorts policies (Leite and Weidmann 1999).

[28] For example, Persson and Tabellini (1992) highlight the growth-retarding effect of redistributive taxation in democracies, and Przeworski and Limongi (1993) argue that investment may be facilitated by unpopular "strong measures" implemented with an "iron hand"—not necessarily the policies chosen by democratic leaders who fret about re-election. There is also anecdotal support that autocracy might have economic benefits. For instance in a recent review of the Malaysian economy the *Economist* (5 April 2003, p11) notes that "*There are some advantages to democratic dictatorship as practiced in Malaysia. If necessary, a government can take action with a degree of dispatch that leaves more pluralistic systems for dead*."

In our model, the curse may materialise because entrepreneurial talent re-allocates among sectors in an inefficient way, and the government (responding to bribes) implements policies that do not maximize economic growth. Following a resource boom, resource firms find that the marginal value product of government support has gone up and lobby for more support. At the same time, unless mitigated by policy, entrepreneurial talent will move from manufacturing to extraction, lowering the marginal value product of government support for the manufacturing sector. In the absence of political competition, a resource boom induces the incumbent government to stray away from the income maximising path. But resource booms are not always bad for growth – see Mehlum et al (2002). Whether it is feasible to purchase policies that trigger a "resource curse" is determined by the presence or absence of political competition (proxied by a measure of democracy), and the associated costs implied by a regime change. The empirical evidence that we present appears to be consistent with our theoretical predictions.

Interestingly, recent work by political scientists like Ross (1999, 2001) suggests that the degree of democracy is not invariant with respect to resource endowments. Countries well-endowed with so called 'point resources' (such as oil fields and mines) are more likely to be characterized by autocratic leadership – accentuating the main insights of our model.

One key result of our paper is to suggest that resource booms may lead to under-provision of semi-public goods that are important for manufacturing. For example, it is commonly assumed that manufacturing requires the use of human capital, which depends upon the provision of a semi-public good such as 'education'. Gylfason (2001) has emphasized and discussed the inverse statistical relation between resource abundance and 'education.' While Gylfason argues that "underrating" or "overlooking" the need for good economic policies may cause such a policy response, our model suggests that resource booms might be logically linked to low education through rent seeking and corruption.

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Appendix 1: Proofs of propositions

Proof of Lemma 1

Let * denote variables in the (constrained) welfare maximising equilibrium. In an autocracy $\lambda = 0$. Substitute (7) in (17), and compare the the FOCs for B^M (15) and (17) when $\lambda = 0$:

(15) $$\frac{dW}{dB^{M*}} = N^M \frac{\partial Q^{M*}}{\partial B^{M*}} - \frac{\partial C^{M*}(B^{M*})}{\partial B^{M*}} + w\frac{\partial L^A}{\partial B^{M*}} + N^{M*}\frac{\partial Q^{M*}}{\partial B^{M*}}\frac{\partial Q^{-M*}}{\partial Q^{M*}} = 0.$$

(17) $$\frac{dW}{dB^{Ma}} = N^M\left(\frac{\partial Q^M}{\partial B^M} - w\frac{\partial l^M}{\partial B^M}\right) - \frac{\partial C^M(B^M)}{\partial B^M} = 0$$

Note that $w(\partial L^{\mathrm{M}}/\partial B^{\mathrm{M}}) = - w(\partial L^{\mathrm{A}}/\partial B^{\mathrm{M}})$. Clearly $\frac{\partial C^{M*}(B^{M*})}{\partial B^{M*}} > \frac{\partial C^M}{\partial B^M}$. Since C^M is convex it follows that $B^{M*} > B^{Ma}$. By a similar comparison of FOCS (14) and (16) it follows that $B^{R*} = B^{Ra}$.

For the proof of Proposition 1 we derive the following results:

We may partially differentiate condition (18), and by using the first order conditions (16) and (17) we obtain:

(a1) $$\frac{dZ}{dN^R} = -Q^{-M} + \frac{\pi^R}{N^{R2}} > 0;$$[29]

(a2) $$\frac{dZ}{dp} = \frac{-Q^R}{N^R} < 0;$$

(a3) $$\frac{dZ}{dB^M} = (N^M - 1)\frac{\partial Q^M}{\partial B^M}\frac{\partial Q^{-M}}{\partial Q^M} > 0;$$

(a4) $$\frac{dZ}{dB^R} = 0.$$

Note that the following holds (from differentiation 20):

(a5) $$\frac{dZ*}{dB^M} = (N^M - 1)\frac{\partial Q^M}{\partial B^M}\left(\frac{\partial Q^{-M}}{\partial Q^M} + 1\right) > 0;$$

(a6) $$\frac{dZ}{dB^R} = -\frac{p}{N^R}\frac{\partial Q^R}{\partial B^R}.$$

[29] The sign of (19a) follows from the stability conditions – for a stable interior solution we need that π^{M} will cut π^{R} from below (when plotting π^{M} and π^{R} against N^{R}).

Comparing (a3-4) to (a5-6) we find that:

(a7) $\left|\frac{dZ^*}{dB^M}\right| > \left|\frac{dZ}{dB^M}\right|$; and

(a8) $\left|\frac{dZ^*}{dB^R}\right| > \left|\frac{dZ}{dB^R}\right|$.

Totally differentiating (16) and (17), holding N^R constant, yields:

(a9) $\frac{dB^M}{dp} = 0$

(a10) $\frac{dB^R}{dp} = -\frac{L_{B^M p}}{L_{B^R B^R}} > 0$, where L is the Langrangean and $L_{B^M p} = N^R \frac{\partial Q^R}{\partial p} > 0.$

Further, consider changes in the allocation of entrepreneurs across sectors:

(a11) $\frac{dB^M}{dN^R} = -\frac{L_{B^M N^R}}{L_{B^M B^M}} < 0$, where $L_{B^M N^R} = -\frac{\partial Q^M}{\partial B^M} < 0.$

(a12) $\frac{dB^R}{dN^R} = -\frac{L_{B^R N^R}}{L_{B^R B^R}} > 0$, where $L_{B^R N^R} = p\frac{\partial Q^R}{\partial B^R} < 0.$

Taken together this gives the following results:

(a13) $\frac{dB^M}{dp} = \frac{dB^M}{dN^R}\frac{dN^R}{dp} < 0$, and

(a14) $\frac{dB^R}{dp} = \frac{dB^R}{dp} + \frac{dB^R}{dN^R}\frac{dN^R}{dp} > 0$

Proposition 1

Define: B^i* is the welfare maximizing level of public goods provided to sector *i=M,R*.

B^i is the level of public goods supplied to sector *i=M,R* under autocracy.

Since (from a7) $\left|\frac{dZ^*}{dB^M}\right| > \left|\frac{dZ}{dB^M}\right|$, we know that $\left|\frac{dB^{M*}}{dp}\right| > \left|\frac{dB^M}{dp}\right|$. So it follows that with a resource boom (or resource discovery) the level of support for manufacturing declines and the change is greater than in the welfare maximising equilibrium.

Similarly (from a8) $\left|\frac{dZ^*}{dB^R}\right| > \left|\frac{dZ}{dB^R}\right|$ holds, so that $\left|\frac{dB^{R*}}{dp}\right| > \left|\frac{dB^R}{dp}\right|$ is also true. As a result, the equilibrium shifts further from the welfare maximum – the pre-existing policy distortion is accentuated as p increases.

Consider next the impact on private sector welfare (analogous in this model to private sector GDP). An increase in the resource price leads to a decline in profits of individual firms in the manufacturing sector because of the decline in government support and the migration of firms to the resource sector:

$$\frac{d\pi^M}{dp} = \underbrace{\frac{d\pi^M}{dB^M}}_{+}\underbrace{\frac{dB^M}{dp}}_{-} + \underbrace{\frac{d\pi^M}{dN^M}}_{+}\left(\underbrace{\frac{dN^M}{dp}}_{-} + \underbrace{\frac{dN^M}{dB^M}}_{+}\underbrace{\frac{dB^M}{dp}}_{-}\right) < 0 .$$

The impact on the resource sector is given by:

$$\frac{d\pi^R}{dp} = \underbrace{\frac{d\pi^R}{dB^R}}_{+}\underbrace{\frac{dB^R}{dp}}_{+} + \underbrace{\frac{d\pi^R}{dN^R}}_{+}\left(\underbrace{\frac{dN^R}{dp}}_{+} + \underbrace{\frac{dN^R}{dB^R}}_{+}\underbrace{\frac{dB^R}{dp}}_{+}\right) < (\geq) 0 .$$

By the arbitrage condition in equation (18), equilibrium is restored by the movement of firms until profits across sectors are equalised: $0 < \frac{d\pi^M}{dp} = \frac{d\pi^R}{dp}$. It follows that the profits of firms in the resource sector must also decline (entry by entrepreneurs from manufacturing implies the individuals' share of the resource pie falls, restoring equilibrium). Moreover aggregate payments to labour are unaffected by price changes in the resource sector $\frac{d(wL)}{dp} = 0$. It follows that aggregate private sector welfare declines:

$$W^p = N^M\pi^M + N^R\pi^R + wL = N\pi + wL \text{; and}$$

$$\frac{dW^p}{dp} = N\frac{d\pi}{dp} < 0.$$

Appendix 2: Robustness Checks

In this Appendix we check the robustness of our main results. First, we investigate whether the qualitative predictions of the model continue to hold using Vanhanen's alternative measure of democracy.[30] The Vanhanen index only measures (two) attributes of democracy (political participation and political competition), hence it is not possible to test for variations in growth across autocratic characteristics of regimes. Proposition 2 suggests that in more democratic systems, resource endowments are more likely to have a positive impact upon growth. This suggests that the Vanhanen's index of democracy could have a positive and significant effect on growth. This is confirmed by the regression results below. While resource endowments in general have a negative effect on growth, interacting the *resource* term with the *democracy* variable, it has a positive and significant effect. The negative coefficient on the resource term may reflect omitted variable bias stemming from the neglect of autocratic effects:

***Table A1: Regression results* (*t-statistics in parentheses*)**

	Regression 1
Initial income level	-1.83**
	(-8.17)
Openness	1.50**
	(3.75)
Terms of Trade Change	0.076
	(1.57)
Investment	0.080**
	(3.13)
Rule of Law	0.35**
	(3.45)
Resource abundance	-11.63**
	(-6.36)
[*Resource abundance*] × [*Vanhanen Index of Democracy*]	0.29**
	(2.29)
Vanhanen Index of Democracy	-0.031
	(-1.81)
Observations	76
Adjusted R^2	0.752

As an alternative check of our results we divide the sample into democratic and autocratic countries and assess the differential effects of resource endowments across regime types. In Table A2 countries are classified in terms of their Marshall and Jaggers (2003) so-called "polity score." This summary measure is obtained by subtracting the autocracy score from the democracy score. (defined as *polity score = democratic index – autocratic index)*. Countries with a polity score from 0 to 10 are considered democratic (column 1) and those

[30] Hence there are notable differences between the Vanhanen and Polity indices. For instance, a country such as Malaysia, which subscribes to the democratic process, has a high level of voter participation and political competition. It therefore scores relatively well on the Vanhanen democracy index. However, the authoritarian elements of the regime (such as lack of openness of executive recruitment and lack of constraints on the chief executive) give it a much lower score on the Polity index.

with a score from –1 to –10 are classified as autocratic (column 2). We replicate the Sachs-Warner regressions with this partition of the sample in Table 2 below:

Table A2: Regression results for democratic and autocratic regimes

	Democratic	Autocratic
Initial income	-1.37**	-1.86**
	(-4.88)	(-6.05)
Resources	-2.96	-9.60**
	(-1.57)	(-5.83)
Openness	1.21**	1.88**
	(2.35)	(3.07)
Investment	0.10**	0.05
	(3.26)	(1.32)
Terms of trade	-0.01	0.16**
	(-0.20)	(2.58)
Rule of Law	0.27	0.54**
	(1.88)	(3.67)
Observations	36	37
Adjusted R^2	.626	.856

In autocratic regimes (column 2) resources have a statistically significant and negative effect on growth, which confirms Proposition 1. In contrast, in regimes classified as "democratic," this effect is statistically insignificant at even the 10% level. This is consistent with Proposition 2.

Finally there remains the possibility that resource endowments influence the type of political system that eventuates. For instance, it could be argued that resources induce extreme forms of political patronage and favouratism, which in turn lead to more autocratic forms of governance. In this case, resource endowments and political regime type would be expected to be strongly correlated – rendering our estimates unreliable. However, there is little evidence of any multicollinearity between 'regime type' and 'resource abundance'. The correlation coefficient between *resources* and: (i) *autocracy* is 0.255; (ii) *democracy* is 0.261, (iii) *the polity index* is 0.23, and (iv) the *Vanhanen index* is 0.2461.