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Resources for Sale: Corruption, Democracy and the Natural Resource Curse

Richard Damania and Erwin Bulte

University of Adelaide
Adelaide 5005 Australia

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Resources for Sale: Corruption, Democracy and the Natural Resource Curse

Richard Damania and Erwin Bulte

School of Economics
University of Adelaide, Adelaide, SA 5005, Australia
richard.damania@adelaide.edu.au

Department of Economics
Tilburg University, PO Box 90153,Tilburg
e.h.bulte@uvt.nl

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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 extend the existing literature by presenting a political-economy model that focuses on the effects of resource abundance on government decision-making, corruption and political

[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. We speculate that the econometrics of the curse will be an active area of research in the near future.

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 estimates provide considerable support for 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 2001).

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.

An alternative stream of literature explores these corruption and political economy aspects, focusing on the rent seeking consequences of resource booms. It is generally

[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.

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.[5] 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.

[5] This suggests that future empirical work might usefully employ specifications with flexible random coefficients (allowing for cross country heterogeneity). See, for example, Koop and Tole (1999) who used this approach to unmask the 'one-size-fits-all' hypothesis for the environmental Kuznets curve (linking environmental pressure to income)

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.[6] 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 decentralized agents, implies that long-run outcomes are fully determined by initial conditions. Despite the fact that there are multiple equilibria for society to end up, such models therefore have a rather deterministic flavour.

[6] 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).

The second explanation for the diverse effects of resource endowments on economic growth focuses on the insight that failure to appropriately manage resource rents 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 approach 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 two productive sectors: natural resources (*R*) and manufacturing (*M*). In the short run there are a given number of producers denoted N^M and N^R in each sector, which further sets this model apart from the earlier rent seeking literature where income gains between sectors are arbitraged away by entry and exit decisions of firms. Prices of both goods are determined in the world market and exogenous in the model. Inputs in production include labour (assumed perfectly mobile across sectors), sector-specific private capital (in case of the resource sector, this capital stock represents the *in situ* resource endowment or stock) and a sector-specific input in the form of a semi-public good, provided by the government. 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.[7] Regardless of the form of government, the 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.

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

The model is based on the following sequence of events. Each production sector (M and R) forms itself into a lobby group that pays bribes or political contributions to the government. Stage 1, defines the political interaction between the incumbent government and the lobby groups and 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 2.[8] Observing this, in stage 3 a rival announces the policies it will implement if it could secure power in the following stage. The party that wins the political contest implements the announced policies. Once policies have been set, production occurs.[9]

When the government retains power 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 government's payoffs, taking the contribution schedules into account. For a detailed proof see Bernheim and Whinston (1986, Lemma 2) and Grossman and Helpman (1994, Proposition 1).

3.1 Firms

[8] 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 first stage.

[9] 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.

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

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

Goods are produced using labour L^x, capital K^x and a publicly supplied input B^x ($x = R, M$). 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. Factor K^M represents manmade capital (broadly defined) and K^R represents factors like mineral deposits, land, and soil quality. Note that the specification in (1a) is sufficiently general to allow for decreasing returns in all factors in extraction, and increasing returns to all factors in manufacturing as postulated by Matsuyama (1992). The fixed labour endowment in the economy is allocated between the two sectors:

(1b) $L = N^M L^M + N^R L^R$.

Given the static nature of the analysis that follows, we assume the endowment of capital in each sector is fixed and equal to $N^x \overline{K^x}$. Capital may either be used for production in its predetermined sector or allocated to some alternative use at an exogenous rate of return r^x (possibly equal to zero if there are no alternative uses for capital). Aggregate profits in sector $x = R,M$ are then given by:

(2) $$N^x \Pi^x = N^x (P^x f^x(L^x, K^x, B^x) - wL^x + r(\overline{K^x} - K^x) - \frac{T}{N+L} - S^x)$$

where w is the wage rate, $N = N^R + N^M$ is the total number of capital (firm) owners, T is the aggregate lump sum tax burden which is shared equally amongst all agents (capital owners and labourers) in the economy. Finally, S^x are the bribes or contributions paid by each firm in each sector to influence the government's policies on the provision of the publicly supplied input to its sector B^x. The first order conditions for the choice of inputs are:

(3a) $P^x f^x_{L^x} - w = 0$, and

(3b) $P^x f^x_{K^x} - r = 0$.

Equations (3a) and (3b) yield factor demand equations $L^{x*}(w,r,P^x,B^x)$ for each firm in each sector, which together with the full employment condition in (1b) determines the wage rate. For future reference we note that total differentiation of (1b) using (3a) and (3b) yields:

$$\frac{dw*}{dB^x} = \frac{-(\partial L^{x*}/\partial B^x)}{\partial L^{x*}/\partial w* + \partial L^{y*}/\partial w*} > 0, \text{ and}$$

$$\frac{dw*}{dP^x} = \frac{-(\partial L^{x*}/\partial P^x)}{\partial L^{x*}/\partial w* + \partial L^{y*}/\partial w*} > 0 \ (x,y = R,M;\ x \neq y).$$

where (*) denotes equilibrium values of variables. Having defined equilibrium wages and input choices, we now consider how political contributions are determined.[10] The government is assumed to be self interested and cares about the bribes or political contributions that it receives from producers. 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).[11] Knowing this, producers have an incentive to influence the government's policies by paying bribes. Each sector is assumed to form itself into a lobby group that offers the government a bribe. The producer lobby groups simultaneously choose their political contributions S^x to maximise profits, taking account of the impact of their choices on the equilibrium wage rate and the government's response. The representative producer in

[10] To facilitate the exposition we deal with all firm, worker and government decisions separately, taking account of functional dependencies, where appropriate. Hence for example, since the firm sets contributions first, this implies that it takes account of the government's reaction function. We allow for this dependence in the optimising decisions of the firm in equation (4a) (i.e. the term $\partial B^x/\partial S^x$).

[11] 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.

sector x = M,R chooses S to maximise profits: $\Pi^x = (P^x f^x(L^x, K^x, B^x) - wL^x + r(\overline{K^x} - K^x) - \frac{T}{N+L} - S^x$. The associated first order condition is:

(4a) $$\frac{\partial \Pi^x}{\partial B^x}\frac{\partial B^x}{\partial S^x} - 1 = \left(P^x f^x_{B^x} - L^{x*}\frac{dw^*}{dB^x} \right)\frac{\partial B^x}{\partial S^x} - 1 = 0 .$$

From (4a): lobbying will only occur if further provision of the publicly supplied input is profitable to the producer.[12] We assume this is the case: $\frac{\partial \Pi^x}{\partial B^x} = \left(P^x f^x_{B^x} - L^{x*}\frac{dw^*}{dB^x} \right) > 0$. It follows that condition (4a) defines an interior solution only if $\frac{\partial B^x}{\partial S^x} > 0$, or lobbying only occurs if higher political contributions S^x induce the government to provide more of input B^x—which is evident. By the property of inverse functions, (4a) can be rearranged to yield:

(4b) $$\frac{\partial \Pi^x}{\partial B^x} \equiv \left(P^x f^x_{B^x} - L^{x*}\frac{dw^*}{dB^x} \right) = \frac{\partial S^x}{\partial B^x} .$$

Equation (4b) implies that in equilibrium, the change in each industry's political contribution (i.e. $\frac{\partial S^x}{\partial B^x}$), mirrors the effects of the policy on profits (i.e. $\frac{\partial \Pi^x}{\partial B^x}$). 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.

Finally, totally differentiating (4a) and rearranging, it can be verified that:

[12] With a potentially large number of agents 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.

(4c) $$\frac{dS^R}{dS^M} = -\frac{\partial^2 \Pi^R / \partial S^M \partial S^R}{\partial^2 \Pi^R / \partial S^{R^2}} < 0 .$$[13]

Thus rivalry in lobbying implies that contributions are strategic substitutes. 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. From equation (4a) it follows that the equilibrium contribution schedules of each lobby group is:

(4d) $$N^x S^{x*} = S^x(B^x, w^*(B^x, B^y, P^x, P^y), r)N^x$$ (*x, y = M,R and x* $\neq$ *y*).

3.2 Workers Utility

Workers obtain utility from consumption of the manufacturing sector's output and a pure public good B^z. The representative worker's utility function is:

(5) $$U^w = x^M + u(B^z),$$

where $u(B^Z)$ is the sub-utility function with $u' > 0$ and $u'' < 0$. Utility is maximised subject to the budget constraint specifying that the sum of consumption expenditures and tax payments equal wage income:

$$wL = P^M x^M + T/(N+L).$$

Thus, demand for good *M* is equal to $wL/P^M - T/[(N+L)P^M]$, and consumer's surplus from consumption of good *M* must equal $wL[1 - LT/(L+N)][(1 - P^M)/P^M]$.

3.3 The Government

The incumbent government cares only about the payoffs from retaining power:

(6) $$U^g = N^M S^{M*} + N^R S^{R*} + D + H$$

[13] To see why note that by the second order conditions $\partial^2 \Pi^R / \partial S^{R^2} < 0$ and $\frac{\partial^2 \Pi^R}{\partial S^M \partial S^R} = \frac{\partial^2 \Pi^R}{\partial B^R \partial L^R} \frac{\partial L^R}{\partial w^*} \frac{\partial w^*}{\partial B^M} \frac{\partial B^R}{\partial S^R} \frac{\partial B^M}{\partial S^M} < 0$.

where $D=T-\sum_{i\in R,M,Z} C^i(B^i) > 0$ is the surplus of tax revenue *T* over public expenditure, $\sum_{i\in R,M,Z} C^i(B^i)$ represents the costs of providing public goods B^R, B^M, B^Z; $(C_i^x > 0, C_{ii}^x < 0, C_{ij}^x = 0)$, and *H* is the intrinsic utility, if any, arising from holding office. The sum of bribes and fiscal surplus represents 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 simply embezzled for personal consumption. Without loss we assume that when the government looses office its utility is normalised to zero.

3.4 The challenger

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.[14] Let (B^M, B^R, B^z, T) be the set of policies proposed by the government, and let $W(B^M, B^R, B^z, T)$ be the resulting aggregate level of welfare of the three types of agents in the economy. Total welfare is simply defined as the sum of industry profits after paying taxes and bribes in sector's *M* and *R* and the utility of workers (which consists of consumer's surplus from the consumption of goods *M* and B^Z.)[15]

$$W(B^M, B^R, B^z, T) = N^R\Pi^R + N^M\Pi^M + Lu(B^z) + wL(1-\frac{LT}{L+N})(\frac{1}{P^M}-1).$$

It is assumed that a single challenger who, having observed the government's policies, announces the policy vector $(\bar{B}^M, \bar{B}^R, \bar{B}^z)$. Let the corresponding aggregate welfare level

[14] For a more detailed justification of this argument, see Mesquita *et al* (2003).
[15] Following much of the common agency literature we assume that the number and hence consumption of capital owners is assumed to be trivially small so that their consumer's surplus is ignored.

be $\overline{W}(\overline{B}^M, \overline{B}^R, \overline{B}^z, \overline{T})$. 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 welfare—since people care about welfare. Alternative interpretations are feasible, but these are left for future research. In the context of democratic societies, the above interpretation is perhaps obvious as raising aggregate welfare offers scope to make the median voter better off.[16] In the context of non-democratic societies, however, it is also true that popular support raises the odds of a successful *coupe d'état*, and increasing welfare could provide the means to ensure popular support.[17]

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.[18] This

[16] A necessary condition for the results in our model to go through with median voting is to assume that the number of players in the resource sector is small relative to other agents in the model, so that the median voter is from the non-resource sector.

[17] Sutter (2000) provides an analytical study of the determinants of rebellion. For a survey of related issues see Hardin (1997) and Tullock (1978).

[18] 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 $v(N^M S^M + N^R S^R + D)$ denote the welfare costs of a change in regime. We assume that $v'>0$ and $v''=0$.[19]

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

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

We adopt the convention that when (7) holds as an equality, the incumbent retains power. To determine when (7) 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: $\Lambda^W = (B^{MW}, B^{RW}, B^{zW}, T^W)$ with corresponding welfare maximising level of welfare $W^W(\Lambda^W)$. Given any set of policies of the incumbent (B^M, B^R, B^z, T) with associated welfare level $W(B^M, B^R, B^z, T)$, the rival can secure power by proposing a set of policies that yields aggregate utility level:

(8) $$W(B^M, B^R, B^z, T) + v(N^M S^M + N^R S^R + D) + \varepsilon_1 \equiv \overline{W}(\overline{\Lambda}),$$

for all $\varepsilon_1 > 0$. Condition (8) 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

[19] 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:

(9) $\quad W(B^M, B^R, B^z, T) + v(N^M S^M + N^R S^R + D) \geq W^W(\Lambda^W)$.

Observe that as *v* rises the government has more freedom to set policies that deviate from the welfare maximising ideal ($\geq W^W(\Lambda^W)$) – costly transitions generate slack that the incumbent can exploit to his own benefit. In oppressive regimes with no effective opposition equation (9) will hold as a strict inequality. In countries with high levels of political competition (9) will hold as an equality. To retain office the incumbent must propose policies to maximise (6), subject to:

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

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

The necessary (Kuhn Tucker) conditions of the government's problem in (5b) are:

(10) $$\frac{\partial L}{\partial B^x} \leq 0,\ B^x \frac{\partial L}{\partial B^x} = 0;\ \frac{\partial L}{\partial B^z} \leq 0;\ B^z \frac{\partial L}{\partial B^z} = 0;\ \frac{\partial L}{\partial \lambda_1} \geq 0, \lambda_1 \frac{\partial L}{\partial \lambda_1} = 0 \ (x = M, R)$$

where *L* is the Langrangean and λ_1 is the Lagrange multiplier for constraint (i). In the Appendix we demonstrate that the necessary conditions simplify to:

$$\frac{\partial L}{\partial B^R} = \left((N^R + N^M \frac{dS^M}{dS^R}) \frac{\partial \tilde{\Pi}^R}{\partial B^R} - \frac{\partial C}{\partial B^R} \right)(1 + \lambda_1 * v') +$$

(11a) $$\lambda_1 * \left(N^M \frac{\partial \tilde{\Pi}^M}{\partial B^R} + \frac{\partial w}{\partial B^R} L(1 - \frac{T}{N+L})(\frac{1}{P^M} - 1) \right)$$

[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 $\Phi = (W(B^M, B^R, B^z, T) - [\bar{W}(\bar{B}^M, \bar{B}^R, \bar{B}^z, \bar{T}) - v(N^M S^M + N^R S^R + D)])$ and Pr' > 0 ; Pr" < 0, Pr(Φ <0) = 0. For simplicity this is ignored.

$$\frac{\partial L}{\partial B^M} = \left((N^M + N^R \frac{dS^R}{dS^M}) \frac{\partial \tilde{\Pi}^M}{\partial B^M} - \frac{\partial C}{\partial B^M} \right)(1 + \lambda_1 * v') +$$

$$\text{(11b)} \quad \lambda_1 * \left(N^R \frac{\partial \tilde{\Pi}^R}{\partial B^M} + \frac{\partial w}{\partial B^M} L(1 - \frac{T}{N+L})(\frac{1}{P^M} - 1) \right)$$

$$\text{(11c)} \quad \frac{\partial L}{\partial \lambda_1} = \text{W}(B^M, B^R, B^z, T) \text{ - } W^W(\Lambda^W) + \text{v}(N^M S^M + N^R S^R + D),$$

where $\tilde{\Pi}^x = P^x f^x(L^x, K^x, B^x) - wL^x + r(\overline{K^x} - K^x) - \frac{T}{N+L}$ is profits gross-of-contributions.

Note $\lambda_1 * = \frac{\partial C / \partial B^z}{Lu' - v'(\partial C / \partial B^z)}$ when constraint (i) binds, and $\lambda_1 * = 0$ when (i) is slack.

It is instructive to compare the policy outcomes under political competition (i.e. a binding constraint), with the policies that obtain in the absence of political competition. Accordingly, let B^{xc} be the equilibrium supply of the public good when the constraint binds (i.e. under intense political competition) and let B^{xa} be the equilibrium supply of the public good when the constraint does not bind.

Lemma 1. *If increased provision of the public good B^x to sector x (x = M, R) lowers the aggregate welfare of other agents in the economy, then the amount of B^x supplied under political competition (B^{xc}) will be lower than the amount supplied in the absence of political competition (B^{xa}).*

(*i.e.* B^{xc} < (>) B^{xa} *if* $N^y \frac{\partial \tilde{\Pi}^y}{\partial B^x} + \frac{\partial w}{\partial B^x} L(1 - \frac{T}{N+L})(\frac{1}{P^M} - 1)$ < (>) 0)

Intuitively equations (11a) and (11b) suggest that the government determines the supply of public goods to each sector by comparing the politically relevant marginal benefits and marginal costs. In the absence of political competition the constraint does not bind, so that $\lambda_1 * = 0$ and the necessary conditions simplify to: $(N^y + N^x \frac{dS^y}{dS^x}) \frac{\partial \tilde{\Pi}^x}{\partial B^x} = \frac{\partial C}{\partial B^x}$. This implies that 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 (i.e. $N^y \frac{\partial \tilde{\Pi}^y}{\partial B^x} + \frac{\partial w}{\partial B^x} L(1 - \frac{T}{N+L})(\frac{1}{P^M} - 1) < 0$) 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 welfare maximising equilibrium when challenged by an opponent.

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 K^R. 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), we model a resource boom as an exogenous increase in the price of good P^R. Note that for any multiplicative production function, where $Q^R = a(L^R)^b(K^R)^c(B^R)^d$ and $\Pi^R = P^R Q^R$, 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.

4. Results

In analysing the effect of a resource boom on policies, as set-up in problem (10), we consider two cases. First, it is assumed that the government faces no potential challenger. Second, it is assumed that the government knows that there is a challenger waiting to take over, such that constraint (i) in problem (10) binds with equality. In what follows we assume that $P^x f_{B^x L^x} - \frac{dw^*}{dB^x}$ > 0, so that provision of the public good to each sector always raises the marginal payoffs to that sector from increased production. The main result of the former 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. Thus manufacturing output declines while resource sector output rises:* $dB^m/dP^R < 0$, $dB^R/dP^R > 0$ and $dB^z/dP^R = 0$.
>
> **Proof**: see appendix 1.

The interpretation is as follows. A resource boom, modelled either as a rise in the resource price or an increase in the resource stock (in case of a multiplicative production function), induces a transfer of support to the resource sector, at the expense of policies supporting the manufacturing sector. The manufacturing sector, which might be economically more attractive because of network effects or spillover benefits (see Matsuyama 1992; the specification of production is sufficiently general to allow for this case), gets squeezed.[21] In other words, policies are steered away from their most productive use (at the margin) which will lower growth relative to the first-best benchmark. The reason why this happens

[21] The resource curse is a consequence of the sub-optimal allocation of public goods to the non-resource sector, which lowers economy wide growth rates. Our results also apply to cases where manufacturing is assumed to be the "engine of growth" because of spill-over external benefits (e.g. Matsuyama 1992). This would simply strengthen our conclusions. Note from (4b) that each producer pays bribes up to the point where the individual's marginal gain from lobbying equals the marginal cost -- the external spill-over benefits from manufacturing are ignored. A government receptive to lobbying will place a lower weight on the spill-over benefits of manufacturing, resulting in greater policy distortions in the absence of political competition.

is that the '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.[22] In response, sectoral policies will favour the resource industry, at the expense of the other one.

In the Grossman-Helpman (1994) model where the incumbent cares about both bribes and welfare ('balanced' with a fixed weight in the government's objective function) a resource boom and the associated bribe response will lead the economy (further) away from the welfare maximising path. The resource boom distorts policies and lowers aggregate welfare – the resource curse always materialises in this case. But this result need not always hold in this model, as is evident from proposition 2 that 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. The provision of public goods to sector M increases and sector R declines if the costs of greater support for the non-resource sector are not too high.*

$$(dB^R/dP^R < 0 \text{ and } dB^M/dP^M > 0 \text{ if } (N^R + N^M \frac{dS^{R*}}{dS^{M*}})\tilde{\Pi}^R_{B^R P^R} Lu' > -\frac{\Pi^M_{B^R P^R} N^M C_{B^Z}}{Lu'})$$

Proof: see Appendix 1.

In other words, excessive (inefficient) levels of support for sector *R* may not be forthcoming if there is a political constraint that effectively forces the government to support the other sectors. The challenger disciplines the incumbent, forcing it to keep welfare in mind when setting policies for fear of being ousted. In effect, the incumbent trades off the prospect of retaining office against the immediate temptation of "bad policies" and the riches brought by them.

The economic explanation for the subtle result in the presence of political opposition is as follows. An increase in policies supporting the resource sector, B^R, induces

[22] 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.

an increase in employment in sector *R* and bids up wages. This negatively affects sector *M*, and this sector's fall in profits translates into a reduction in bribes that it is willing to pay to the government. This, in turn, implies that the manufacturing sector looses its political influence and its level of support received from the government. At first sight this result appears consistent with the Dutch disease explanation—a resource booms bids up wages at the expense of the manufacturing sector's competitiveness. But the underlying process is different – politically driven policy responses lead to distortionary policies being adopted.

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. The intuition for this result is the following. Recall that the incumbent can increase its hold on power by either raising the costs of regime change, or adopting policies that are closer to the welfare maximising ideal. When there is a resource boom the government faces a trade-off. It can use the extra resources to increase the costs of regime change by garnering further contributions from the resource sector, or it can adopt policies that improve general welfare. Proposition 2 summarises the natural condition that when the relative costs of adopting welfare improving policies are not too high, then a resource boom when accompanied by strong political opposition induces a transfer of support from sector *R* to sector *M.*

5. Empirical evidence

Ultimately the validity of our theoretical conjectures must depend upon the empirical evidence. In this section we therefore provide a direct test of the theory. However, it is useful to begin with a brief survey of some existing evidence on 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 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). Finally, we note that the extent of corruption distorts the set of policies chosen by the government, which lowers growth. 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 growth in autocratic regimes, but that the effect will be mitigated or even reversed in democratic systems. We proceed by directly testing these predictions by including measures of the degree of democracy or autocracy using the regression equations and data of Sachs and Warner (1997).

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.[23] For our purposes the most suitable measure is provided by the Polity data of Marshall and Jaggers (2003). Marshall and Jaggers provide separate measures of the democratic and autocratic attributes of each country. This therefore 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

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

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.

The other main index of democracy is provided by Vanhanen (2000). The focus of this index is on two specific attributes of democracy: political participation and political competition. The Vanhanen index ignores counteracting autocratic elements in a regime, which could negate the effects of democratic institutions.[24]

Our theoretical analysis predicts that the impact of resources on policies and hence growth is conditional upon the type of political regime. The separate measures of autocracy and democracy provided in the polity data set provide a reasonable vehicle for directly testing these theoretical predictions and are therefore used in the empirical analysis. As a robustness check we also provide results based on the Vanhanen democracy index in Appendix 2. This provides even stronger empirical support for our theoretical predictions.

Economists typically treat the degree of democracy as exogenous, even in light of evidence that income might affect democracy as well (Minier 1998). Recent work by Durham (1999) suggests that treating political regimes in growth regressions as exogenous is appropriate, and that income *levels* rather than *growth rates* affect regime types. Following earlier work (e.g., Barro 1996), we therefore assume that the degree of

[24] 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.

democracy and authoritarianism are exogenous and include them as explanatory variables.[25]

In Table 1 we present regression results. As is 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*] $\times$ [*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.

[25] 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.

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

	Regression 1	*Regression 2*	*Regression 3*	*Regression 4*	*Regression 5*
Initial income level	-1.82** (-8.79)	-1.74** (-8.89)	-1.69** (-8.66)	-1.69** (-8.01)	-1.49** (-6.58)
Openness	1.40** (3.45)	1.35** (3.53)	1.28** (3.29)	1.27** (3.18)	2.11** (4.79)
Terms of trade Change	0.10** (2.18)	0.089** (2.04)	0.097** (2.20)	0.09** (2.12)	0.02 (0.37)
Investment	0.076** (2.99)	0.087** (3.59)	0.089** (3.65)	0.08** (3.49)	
Rule of law	0.38** (3.58)	0.415** (4.12)	0.44** (4.45)	0.44** (4.35)	0.25** (2.19)
Resource abundance	-8.42** (-6.49)	-3.71 (-1.84)			
Resource abundance × Autocracy		-0.84** (-2.83)	-1.29** (-7.49)	-1.29** (-7.32)	-1.31** (-6.3)
Resource abundance × Democracy			-0.46 (-1.80)	-0.46 (-1.73)	-0.13 (0.48)
Autocracy		0.159** (2.96)	0.17** (3.26)	0.17** (2.02)	0.17 (1.84)
Democracy				-0.04 (-0.05)	-0.02 (-0.31)
Equipment					19.3** (3.67)
Observations	74	72	72	72	72
Adjusted R^2	0.736	0.769	0.767	0.762	0.765

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

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.[26] 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.

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

[26] 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."

resources on economic growth is through the level of corruption that distorts policies (see Leite and Weidmann 1999).

In our model, the curse may materialise because resource firms successfully lobby for semi-public goods that increase production in their sector. In the absence of political competition, governments are more receptive to special interest lobbying. Thus, during a resource boom (interpreted as either new resource discoveries or sudden price hike) lobbying increases in intensity. The government is ‘seduced’ to stray away from the welfare maximising path and provides excessive support to the resource sector at the expense of the manufacturing sector. This lowers manufacturing output and, depending on the exact specification of production, lowers aggregate welfare and economic growth. 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, and the associated costs implied by a regime change. The empirical evidence that we present appears to be consistent with our theoretical predictions.

To summarize, the main link between resources and manufacturing in our model is twofold. First, resource booms and the associated incentive to bribe the planner will bid up wages in manufacturing. This is reminiscent of the Dutch disease argument, albeit due to distorting policies rather than market clearing responses. Second, and enforcing the first effect, resource booms will lead to under-provision of the semi-public good 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 B^M 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 and rationally linked to low education through rent seeking and corruption.

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Appendix 1: Proofs of propositions

The Langrangean of the problem is:

$L = N^M S^{M*} + N^R S^{R*} + D + H + \lambda_1[W(B^M, B^R, B^z, T) - W^W(\Lambda^W) - v(N^M S^M + N^R S^R + D)]$.

The necessary conditions are:

(A1) $L_R = (N^R S_{B^R}{}^{R*} + N^M S_{B^R}{}^{M*} - C_{B^R})(1 + \lambda_1 v') + \lambda_1 (N^R \Pi^R_{B^R} + N^M \Pi^M_{B^R} + w*_{B^R}\ L\phi) = 0.$

where $\phi = (1 - \frac{LT}{L+N})(\frac{1}{P^M} - 1)$

From equation (4b) $\tilde{\Pi}^R_{B^R} = S^R_{B^R}$ and from equation (4c) $\Pi^R_{B^R} = \tilde{\Pi}^R_{B^R} - S^R_{B^R} = 0$. Moreover, $S^M_{B^R} = S^R_{B^R} \frac{dS^R}{dS^M}$. After the appropriate substitutions:

(A2) $L_R = ((N^R + N^M \frac{dS^R}{dS^M})\tilde{\Pi}^R_{B^R} - C_{B^R})(1 + \lambda_1 v') + \lambda_1 (N^M \Pi^M_{B^R} + w*_{B^R}\ L\phi) = 0.$

Similarly:

(A3) $L_M = ((N^M + N^R \frac{dS^M}{dS^R})\tilde{\Pi}^M_{B^M} - C_{B^M})(1 + \lambda_1 v') + \lambda_1 (N^R \Pi^R_{B^M} + w*_{B^M}\ L\phi) = 0,$

(A4) $L_Z = -C_{B^z} + \lambda_1 (Lu - v' C_{B^z}) = 0$, and

(A5) $L_{\lambda 1} \equiv W(B^M, B^R, B^z, T) - W^W(\Lambda^W) - \mathrm{v}(N^M S^M + N^R S^R + D) = 0.$

Solving (A4) for λ_1 yields: $\lambda*_1 = \frac{C_{B^z}}{Lu' - v' C_{B^z}}$, which can be substituted into the remaining equations. In cases where the constraint does not bind we have $\lambda*_1 = 0$ and condition (A5) does not form part of the necessary conditions.

Assume the SOCs are satisfied ($L_{RR} < 0$, $L_{MM} < 0$). Differentiating (A2), (A3) and (A5):

(A6) $L_{RM} = ((N^R + N^M \frac{dS^{R*}}{dS^{M*}})\tilde{\Pi}^R_{B^R B^M})(1 + \lambda*_1 v') + \lambda*_1 N^M \Pi^M_{B^R B^M} < 0,$

(A7) $L_{RP^R} = ((N^R + N^M \frac{dS^{R*}}{dS^{M*}})\tilde{\Pi}^R_{B^R P^R})(1 + \lambda_1 v') + \lambda_1 N^M \Pi^M_{B^R P^R} < (>)\ 0,$

(A8) $L_{MP^R} = ((N^M + N^R \frac{dS^M}{dS^R})\tilde{\Pi}^M_{B^M P^R})(1 + \lambda*_1 v') + \lambda*_1 N^R \Pi^R_{B^M P^R} < 0,$

(A9) $L_{\lambda 1 R} = ((N^R + N^M \frac{dS^{R*}}{dS^{M*}})\tilde{\Pi}^R_{B^R} - C_{B^R})(-\frac{1}{\lambda*_1}) > (<)\ 0$, (where (A2) has been used to further simplify the expression)

(A10) $L_{\lambda 1M} = ((N^M + N^R \frac{dS^M}{dS^R})\tilde{\Pi}^M_{B^M} - C_{B^M})(-\frac{1}{\lambda *_1})$ > (<) 0, (where (A3) has been used to further simplify the expression) and

(A11) $L_{\lambda 1Z} = Lu' - v'C_{B^Z}$ > 0 whenever $\lambda *_1 > 0$.

In what follows we assume that $P^x f_{B^x L^x} - \frac{dw*}{dB^x}$ > 0 so that provision of the public good to each sector always raises the marginal payoffs from increased production. With this assumption the following signs hold which have been used to sign the above expressions:

$$\Pi^x_{B^x B^y} = P^x f_{B^x L^x} \frac{dL^x}{dw*}\frac{dw*}{dB^y} - \frac{dL^x}{dw*}\frac{dw*}{dB^x}\frac{dw*}{dB^y} < 0;$$

$$\Pi^M_{B^R P^R} = P^M f_{B^M L^M} \frac{dL^M}{dw*}\frac{dw*}{dP^R} - \frac{dL^M}{dw*}\frac{dw*}{dB^R}\frac{dw*}{dP^R} < 0; \text{ and}$$

$$\Pi^R_{B^R P^R} = f_{B^R} + P^R f_{B^R L^R} \frac{dL^R}{dP^R} - \frac{dw*}{dB^R}\frac{dL^R}{dP^R} > 0.$$

Proposition 1

When the constraint does not bind and $\lambda_1 = 0$. It follows that $L_{RM} < 0$, $L_{RP}{}^R, > 0$ and $L_{MP}{}^R < 0$ and by the SOCs

$$\begin{bmatrix} L_{RR} & L_{RM} \\ L_{RM} & L_{MM} \end{bmatrix}\begin{bmatrix} dB^R \\ dB^M \end{bmatrix} = -\begin{bmatrix} L_{B^R P^R} \\ L_{B^M P^R} \end{bmatrix} dP^R.$$

Solving:

$$\frac{dB^R}{dP^R} = \frac{-L_{B^R P^R} L_{B^M B^M} + L_{B^M P^R} L_{B^R B^M}}{\Delta} > 0,$$

$$\frac{dB^M}{dP^R} = \frac{-L_{B^R B^R} L_{B^M P^R} + L_{B^R P^R} L_{B^R B^M}}{\Delta} < 0,$$

where $\Delta > 0$ is the determinant which is positive by the SOCs.

Proposition 2:

$$\begin{bmatrix} L_{RR} & L_{RM} & 0 \\ L_{RM} & L_{MM} & 0 \\ L_{\lambda_1 R} & L_{\lambda_1 M} & L_{\lambda_1 Z} \end{bmatrix}\begin{bmatrix} dB^R \\ dB^M \\ dB^Z \end{bmatrix} = -\begin{bmatrix} L_{B^R P^R} \\ L_{B^M P^R} \\ L_{\lambda_1 P^R} \end{bmatrix}$$

$$\frac{dB^R}{dP^R} = \frac{-L_{B^R P^R} L_{MM} L_{\lambda Z} + L_{\lambda Z} L_{B^M P^R} L_{RM}}{\Delta} \text{ , and}$$

$$\frac{dB^M}{dP^R} = \frac{-L_{B^R P^R} L_{RR} L_{\lambda Z} + L_{\lambda Z} L_{B^R P^R} L_{RM}}{\Delta} .$$

In general the signs are indeterminate. However in the case where $L_{B^R P^R} > 0$, then:

$$\frac{dB^R}{dP^R} = \frac{-L_{B^R P^R} L_{MM} L_{\lambda Z} + L_{\lambda Z} L_{B^M P^R} L_{RM}}{\Delta} < 0, \text{ and}$$

$$\frac{dB^M}{dP^R} = \frac{-L_{B^R P^R} L_{RR} L_{\lambda Z} + L_{\lambda Z} L_{B^R P^R} L_{RM}}{\Delta} > 0.$$

Rearranging (A7) and substituting for λ^*_1, a necessary condition for $L_{B^R P^R} > 0$ is:

$$(N^R + N^M \frac{dS^{R*}}{dS^{M*}})\tilde{\Pi}^R_{B^R P^R} Lu' > -\frac{\Pi^M_{B^R P^R} N^M C_{B^Z}}{Lu'} .$$

The left hand side are the benefits in terms of increased contributions from the resource sector and the right hand side represents the external welfare costs on other agents

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. The Vanhanen index only measures (two) attributes of democracy, 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 $\times$ *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 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	Highly Autocratic Polity Score ≤ -3	Countries with Polity Scores > -3
Initial income	-1.37**	-1.86**	-1.77**	-1.51**
	(-4.88)	(-6.05)	(-5.26)	(-6.33)
Resources	-2.96	-9.60**	-9.84**	-4.01**
	(-1.57)	(-5.83)	(-4.93)	(-2.56)
Openness	1.21**	1.88**	2.39**	0.88**
	(2.35)	(3.07)	(3.07)	(2.19)
Investment	0.10**	0.05	0.027	0.11**
	(3.26)	(1.32)	(0.52)	(4.40)
Terms of trade	-0.01	0.16**	0.19**	-0.018
	(-0.20)	(2.58)	(2.80)	(-0.29)
Rule of Law	0.27	0.54**	0.55**	0.33**
	(1.88)	(3.67)	(3.35)	(2.80)
Observations	36	37	29	45
Adjusted R^2	.626	.856	0.829	0.719

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. Are these results sensitive to the partition used? In column 3 we present results for all countries with polity values ≤ -3 ("highly autocratic"). Column 4 summarises the outcome for all other countries with scores > -3. The main conclusions are again supported by these results.

Finally there remains the possibility that resource endowments may influence the type of political system that eventuates. For instance, it could be argued that resources induce extreme forms of rent seeking, 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.

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