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BACKGROUND PAPER

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**NATURAL RESOURCES, GROWTH AND  
SPATIALLY-BASED DEVELOPMENT:  
A VIEW OF THE LITERATURE**

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# Natural Resources, Growth and Spatially-Based Development: A View of The Literature

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## Abstract

This paper reviews the literature concerned with the natural resource ‘curse’, economic growth and related spatial issues. A range of empirical work has established the presence of a negative relationship between growth and natural resource richness, variously measured. Economic theory suggests a range of explanations. First, resource booms may induce exchange rate appreciation which subsequently squeezes growth enhancing sectors. Second, resource rich economies may be subject to price volatility and trade shocks, which are both destabilising in resource allocation terms and which pose macroeconomic policy challenges. Third, natural capital appears to crowd out human capital and may foster inequality. Forth, natural resource sectors can feature a particularly weak configuration of linkages, limiting the extent of positive feedbacks to the rest of the economy. Finally, poor policymaking in a subset of resource rich economies appears to have contributed to their under-performance. Policy prescription is relatively clear with respect to the short run macroeconomic handling of resource rents. With regard to institutional dimensions, checks and balances on government activity appear to have high returns in resource rich countries. Spatially based and cluster initiatives may help foster productive linkages, technological upgrading, quality certification and market access.

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# 1 Introduction

Resource poor countries have grown two to three times faster than resource rich countries in the decades since the early 1970s, and the gap between growth rates has significantly widened over the period (Auty 2001). Mineral driven economies would appear to be well poised to grow, as their resource wealth expands their choice set over possible investment and import bundles. Yet these economies have been among the weakest performers. The basic pattern is illustrated in Figure 1, taken from Sachs and Warner (1995), providing the startling implication that economies rich in natural resources are somehow ‘cursed’. This has spurred a range of theoretical and empirical work, taking both economic and political economy perspectives.

In what follows we first outline the empirical findings. In turn we then provide an overview of economic and political economy based explanations for the resource curse finding, and examine their consistency with the evidence. We then examine some geographical and spatial dimensions of development, with a few country specific experiences with resource based development outlined in particular. Before concluding, we discuss some policy implications.

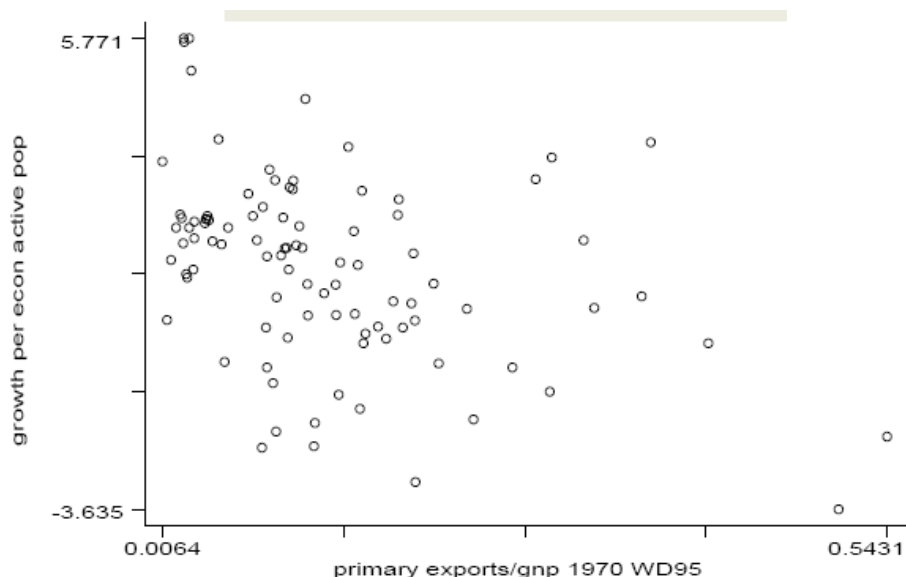


Figure 1: Natural Resource Dependence and Economic Growth. *Source:* Sachs and Warner (1995)

## 2 The Empirical Connection

Sachs and Warner (1995), after controlling for a range of growth correlates, find a negative statistical relationship between resource intensity and per capita GDP growth in a data set spanning over 80 countries since the 1970s<sup>1</sup>. They use the share of exports of primary products in GDP at the

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<sup>1</sup>The growth correlates controlled for in the study are initial GDP, openness policy, investment rates, human capital

beginning of the period as a measure of resource intensity. Their results indicate that, depending on specification, a one standard deviation increase in the share of primary exports in GDP is associated with a 0.6–0.8% drop in per annum per capita GDP growth rates. The Sachs and Warner measure used is really *export dependence*, in that it in some way captures the dependence of the economy on natural resources *for exports*. Subsequent studies have sought to generalise and confirm these findings by using a combination of different natural resource measures and other more powerful econometric techniques, notably approaches using time series<sup>2</sup>.

Subsequent studies include Collier and Goderis (2007) and Arezki and Van Der Ploeg (2007). The latter find that evidence of a resource curse based on OLS estimation does not survive instrumental variable techniques. However, instrumenting for institutional quality and openness reveals a direct negative effect of natural resource exports on income per capita after controlling for geography. Further, they find the conclusion of Mehlum, Moene and Torvik (2006) that the resource curse can be turned into a blessing given sufficiently ‘good’ institutions does not survive instrumental variables techniques either, but that trade openness can make the resource curse less severe, possibly turning it into a blessing. When the authors use resource abundance rather than dependence as their independent variable, they also reveal a resource curse, but a less severe one for countries with relatively liberal trade policies.

Collier and Goderis (2007) reconcile a resource curse ‘conundrum’: that much cross-sectional evidence supports the idea of a resource curse, while time series investigation using a VAR approach typically finds that increases in commodity prices significantly *raise* the growth of commodity exporters. By contrast, here the authors use co-integration methodology allowing them to distinguish short- and long-run effects. Moreover, they distinguish between types of commodity. Across all commodity types, the short run effects are benign for their exporters, reflecting both a terms of trade gain and induced growth. These effects persist over the long run for agricultural commodities. But for oil and non-agricultural commodities, the authors uncover substantial and adverse long run effects, supporting the resource curse hypothesis. For example, for Zambia, where 1990 commodity exports accounted for 35% of GDP, the authors find that a 10% increase in the country’s commodity exports leads to a 4.4% lower long run level of GDP per capita. This is also consistent with the idea that the spatial distribution of resource rents matters for the curse results. In particular, the benign effects of agricultural booms, providing a diffuse source of resource rents, contrasts with accumulation rates, changes in the external terms of trade, government expenditure ratios, terms of trade volatility, and the efficiency of government institutions.

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<sup>2</sup>As with any empirical work, a range of methodological issues and antithetical examples abound. Methodologically, a major challenge is to find exogenous measures of resource abundance or dependence. For example, measured resource abundance is likely in part to be endogenous to e.g. exploration costs, see inter alia Wright and Czelusta (2002). Moreover, taking an historical perspective suggests a wide range of countries successfully developed on the basis of natural resource endowments prior to the 1950s, see Maddison (1995). This raises questions when it comes to the interpretation of resource curse findings. For example, are the results driven by a particular configuration of context and policy present in the 1970s?

more spatially concentrated resources, like oil and minerals, which appear to induce curse effects.

Finally, any tendency towards lower growth in resource rich countries has been exacerbated by the fact that such countries have been more prone to *growth collapse* (Lal and Myint 1998). This is the experience of many resource rich countries following the 1970s oil shocks, in contrast to growth in manufacturing led resource deficient countries, for which growth accelerated (WorldBank 1999).

### 3 Economic Explanations of The Resource Curse

Much effort has gone into understanding the economic underpinnings of the resource curse. The existing research output can be conveniently broken down into the following areas, many of which are complementary.

#### 3.1 Dutch Disease

A key theoretical development in the 1980s was that of booming sector induced de-industrialisation, or ‘Dutch Disease’, formalised in the classic paper by Corden and Neary (1982) (see also Corden (1984)). The essence of the paper is that a relative price change, for example due to a boom in an extractive resource sector, induces an intersectoral reallocation of resources. A *spending effect* causes the price of non-tradable output to rise relative to the price of tradables, giving a *relative price effect*. Unless the increase in foreign exchange income is sterilised, there is an appreciation of the currency, which reduces the domestic price of exports and of imports competing with domestic output<sup>3</sup>. Hence there will be a *resource movement effect*, inducing resources to shift towards production of non-tradables, a squeezing of the output of exports, and a stimulus of imports. Note that nothing in this description indicates a ‘disease’; rather what we have described is an *optimal* reallocation of resources according to relative price changes. To argue the case for a disease, one must make further assumptions; specifically, one must introduce a market failure<sup>4</sup>.

Empirically, Dutch disease appears to be important, but not overwhelmingly so, according to Collier and Goderis (2007). They find an index of exchange rate overvaluation enters negatively and statistically significantly in their growth regression, suggesting that an overvalued exchange rate does indeed have a negative impact on long run GDP per capita. But they find the magnitude of this effect to be quite modest, and to explain a small proportion of the overall negative association between resource richness and growth. Nonetheless, if the aim is to use a boom in a spatially-based natural resource sector to stimulate other sectors, especially exports, this potentially deleterious effect needs to be considered.

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<sup>3</sup>The appreciation will also reduce rents in the booming sector, but may not be large enough to reduce its output.

<sup>4</sup>This is most often done by attaching a growth externality to one sector or another. For example, higher employment in a ‘high tech’ sector may enhance growth through ‘learning by doing’. Relevant papers in this vein include, inter alia, Matsuyama (1991), Krugman (1987), Torvik (2001), and the model presented in the appendix of Sachs and Warner (1995).

### 3.2 Price Volatility and Trade Shocks

A second, but related, explanation for the poor growth performance of resource abundant countries is that of price volatility giving rise to *temporary trade shocks*. While the Dutch disease explanation suggests a continuous growth deterioration, price volatility suggests the possibility of episodic crises. Indeed the case study literature points to post-boom crises as the key episodes during which growth suffers (Collier and Goderis (2007); see also Collier and Gunning (1999a)). Addison (2007) shows that since the discovery of oil, Nigeria has been one of the top ten most volatile economies in the world. Higher commodity prices, *ceteris paribus*, imply commodity exports account for a larger share of GDP; so any price fluctuation imposes a correspondingly larger shock on the rest of the economy (Collier 2007). This volatility can damage growth through a number of channels.

First, private investment becomes more risky, so for a given risk-return preference, investment is discouraged. This can prevent investment in all sectors, but can also reduce the scope for investments in the new technologies required to exploit the natural resource and exploit potential linkages (see section 4). By their very nature, spatially-based initiatives do not involve footloose capital, so the investment is irreversible and thus particularly vulnerable to volatility.

Second, the management of booms where rents accrue to the public sector can be problematic without adequate safeguards in place ensuring fiscal responsibility. Successful management requires saving in temporary booms and spending in temporary slumps, undertaken to good effect in Chile (which has a copper revenue stabilisation fund). But even if in place, adherence to such stabilising policies is endogenous to government behaviour, illustrated by recent changes to the oil stabilisation fund in Venezuela made by presidential fiat.

### 3.3 Consumption Booms

The theme of undertaking higher consumption ‘now’ at the expense of future growth is proposed as an explanation by Rodriguez and Sachs (1999). In their model, a resource rich economy lives beyond its means, optimally overshooting its steady state equilibrium in terms of consumption and investment, and converging to its steady state from above. It therefore has negative growth rates in transition. They surmise that such is the experience of Venezuela<sup>5</sup>.

### 3.4 Human Capital and Inequality

A number of studies explore the role of human capital formation in driving growth outcomes in resource abundant economies, following theoretical work by Lucas (1988, 1993) and empirical work by Mankiw, Romer and Weil (1992). Gylfason (2001) finds that public expenditure on education

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<sup>5</sup>Their model is an *optimal* growth model, an extended version of the Ramsey optimal growth model, to include a resource sector with an exogenous level of production which is declining in per capita terms. Nelson (2007) shows that such consumption booms can be non-optimal from a welfare perspective once growth externalities are accounted for.

relative to national income and gross secondary school enrolment are inversely related to the share of natural capital in national wealth across countries. That is, natural capital appears to crowd out human capital, impeding growth <sup>6</sup>.

Gylfason and Zoega (2002) link human capital to inequality, resource abundance and growth. They treat natural resource abundance as an exogenous variable, which is correlated with both inequality and growth. Natural resource abundance tends to crowd out human capital accumulation, through lower investment in schooling and education, worsening inequality. The link between natural resource abundance and growth is that of Sachs and Warner (1995). Hence one tends to find a negative relationship between inequality and growth.

Focussing on policy, Birdsall, Pinckney and Sabot (2001) argue that resource abundance tempts governments to move away from those activities which encourage investment in education, impeding the growth of a positive education–inequality–saving–investment–growth cycle. Populism may inspire stop-go public investment in education, the quality of which deteriorates. The result is little investment and dynamism outside the natural resource sector along with high inequality, poor schools, and little demand for education itself. Human Capital is also important for the development of linkages (see section 4) which may require the use of advanced technologies. Clearly, in this view, poor growth associated with resource abundance is not destiny; rather, policy is key.

### 3.5 Policy

Lal and Myint (1998) identify policy failure as a prime cause of under-performance. The crucial channel through which its impact is felt is the efficiency of investment — particularly in the quality adjusted workforce. Another critical component is the trade regime, as increasingly ambitious trade interventions proved less and less benign under the import substituting regimes of post war Latin America<sup>7</sup>.

Lal and Myint (1998) study 21 countries, of which most of the land abundant countries experienced a growth collapse, whereas none of the labour-abundant-land-scarce countries did. They attribute this to the greater reliance of land-abundant-labour-scarce countries to primary exports for longer periods in their development, so they must industrialise with higher wages than the resource deficient countries. This poses greater problems for governments in these countries in terms of provision of infrastructure and skills, they argue. Additionally, cuts in real wages may be required as the primary sector declines in importance, but are usually strongly resisted especially in weaker, factional states. The result is a public bailing out; a chronic fiscal deficit, a precursor to growth collapse. Point source resources arguably pose problems over and above a public finance issue. In still more weak and factional states (‘fragile states’), the fabric of society may begin to disintegrate as groups compete to control resource rents, ending in civil conflict.

Policy failure is linked closely with a complementary set of explanations focussing on the political

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<sup>6</sup>See Gylfason, Herbertsson and Zoega (1999) for a theoretical explanation.

<sup>7</sup>A legacy of ‘Stucturalist’ economic policy, see inter alia Prebisch (1950), and Duncan (1993) for the pitfalls

economy of resource richness.

## 3.6 The Political Economy of Resource Richness

### 3.6.1 Checks and Balances

Work on democracy and resource richness stresses the importance of checks and balances on government activity for growth performance. One can understand checks and balances as being one of two defining features of democracy, the other being electoral competition. This comes through in Collier and Hoeffler (2005), who find that in developing countries the combination of high natural resource rents and open democratic systems has been growth reducing. Crucially they show that checks and balances, specifically in the form of a free press, can offset this effect<sup>8</sup>. They suggest that resource rich economies need a distinctive form of democracy, with more emphasis on checks and balances rather than electoral competition per se. The theoretical mechanism they propose is via government incentives for public good provision. Public scrutiny may be weaker in countries with high natural resource rents because the government is not reliant on taxation to raise revenue; less taxation implies less pressure for political representation, meaning less scrutiny. Less scrutiny means more scope for patronage politics. Under certain conditions it can be more efficient for politicians to offer patronage politics to win votes, rather than provide public goods.

### 3.6.2 Institutional Quality

The role institutions play in the resource curse is somewhat vexed empirically. Mehlum et al. (2006) argue for the importance of the quality of institutions — distinguishing whether they are producer friendly or ‘grabber’ friendly — for outcomes in resource rich countries, in contrast to the conclusion of invariance drawn originally by Sachs and Warner (1995) and more recent work, discussed above, by Arezki and Van Der Ploeg (2007). Boschini et al. (2003) add to this an influence via the *type* of resource processed, contrasting the different technical appropriability of, say, point versus diffuse resources. Outcomes are driven by the combination of technical and institutional appropriability the context provides. Isham et al. (2003) consider the effect of this difference in the type of natural resource abundance on growth recovery following shocks. They find diffuse resources are consistent with faster growth recoveries. They argue that this difference works through influencing the capability of institutions to respond to shocks, echoing Rodrik (1999b). Sala-i Martin and Subramanian (2003) study the case of Nigeria and map the deleterious impact of oil discovery on institutional quality, and its disastrous growth record post 1970.

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<sup>8</sup>See Egorov, Guriev and Sonin (2006) for a model in which a free media is less likely to emerge in a resource rich economy where a dictator-leader is less interested in providing incentives for his subordinates.

### 3.6.3 Other Theoretical Explanations

Other theoretical contributions in this area include Robinson, Torvik and Verdier (2006), Tornell and Lane (1999) and Tornell and Lane (1998). In the first, the authors argue that political incentives are the key to understanding whether or not natural resources are a curse. For example, politicians may sub-optimally over extract a natural resource because they discount the future too much. Resource rents also raise the value of being in power, providing a source of revenues with which politicians can influence electoral outcomes, increasing resource misallocation in the rest of the economy. Institutions that promote accountability and state competence lead countries to benefit from resource booms, preventing these negative effects.

Tornell and Lane (1999) identify a *voracity effect*, in which an economy populated with multiple powerful groups interact via a fiscal process that allows effectively open access to the aggregate capital stock. A terms of trade windfall generates a more than proportionate increase in redistribution and reduces growth. The mechanism at work acts via a resource reallocation in response to increased tax rates, which apply only to the formal sector. A rise in the profitability of the formal sector attracts investment but also suffers an offsetting voracity effect — a more than proportionate increase in the demand for redistributive transfers. This is reflected in a higher rate of tax on the formal sector, causing resources to reallocate to the *informal* sector, which is safe from taxation. The return on capital in the informal sector is assumed to be lower than that in the formal sector, hence the reallocation of resources from former to latter reduces the rate of accumulation, and thus growth.

Tornell and Lane (1998) identify a different voracity effect at work in a non-representative agent model of the current account. Representative agent models predict consumption smoothing in the face of a temporary windfall, implying a current account surplus. The fact that many countries are observed to run current account deficits in response to windfalls is rationalised in a non-representative agent model, where fiscal claimants interact dynamically giving rise to an increase in aggregate appropriation by more than the original windfall itself. The result is a deterioration in the current account, and a dissipation of the windfall without any corresponding increase in welfare.

## 4 Spatial Issues, Economic Geography, and Some Country Experiences

### 4.1 Export Base, Linkages and Economic Geography

Baldwin (1956) attributes divergent economic growth experiences over time to differences in the ‘staple-good’ production function, which, if capital intensive, does not create pro-growth ‘linkages’. The latter concept is closely associated with Hirschman (1977), positing four types of linkage: *backward linkage*, arising out of activities established to supply inputs to the production of the staple, *forward linkage*, arising from processing prior to export, *fiscal linkage*, associated with taxation of

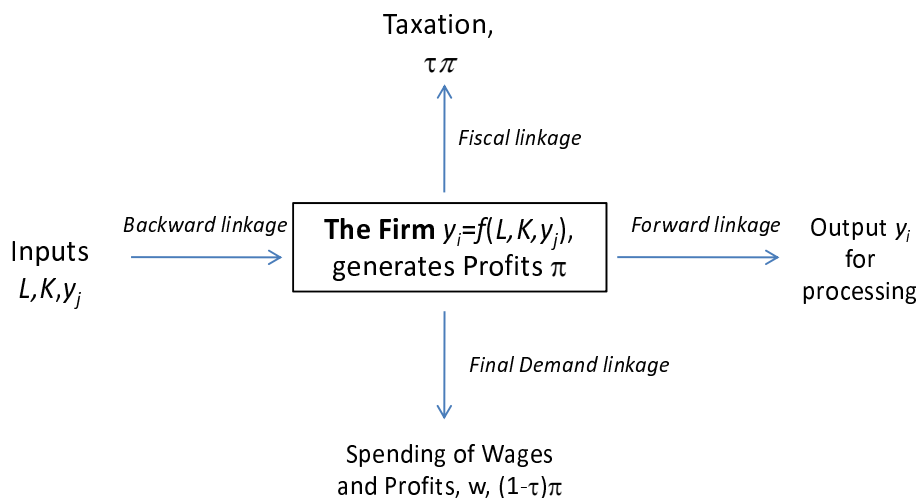


Figure 2: Linkages Configuration

activities associated with the staple, and *final demand linkage*, the multiplier arising from activity created by local spending of wages and profits, illustrated in Figure 2. The economy is said to be ‘mature’ when it has become sufficiently diversified that the dominance of linkages by one staple is not evident.

With this framework in mind, natural resource sectors have a peculiar linkage configuration. Taking nineteenth century staple production in the US as an example, consider a model with a ‘Southern’ region producing cotton and sugar, and ‘Western’ region producing food grains and tree crops. In the Southern region, where the bulk of the workforce is cheap labour, the resulting skewed income distribution provides little final demand linkage. Fiscal linkage may be minimal if plantations operate as ‘states within a state’, also providing little incentive for the development of infrastructure. Backward and forward linkages are limited if no other non-labour inputs are used and processing occurs overseas. So the economy remains specialised, and becomes vulnerable to external shocks and a growth collapse. The result is a distinctive ‘enclave’ character. By contrast, staples in the Western region have stronger linkages due to their low barriers to entry and a capacity for productivity improvements in response to modest investments. Children of farmers become entrepreneurs who run businesses; farmers have an incentive to pay taxes to improve infrastructure. Favourable diffuse linkages allow diversification and the economy to escape the trap<sup>9</sup>.

In a spatially-based natural resource setting, Norway exploits fiscal linkages effectively but Nigeria hasn’t so far. We have discussed how resource rents can result in patronage politics rather than

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<sup>9</sup>More broadly, the idea of linkages, combined with the importance of economies of scale, is now back in theoretical fashion. For a general discussion see Krugman (1994). The comparatively recent model of Murphy, Shleifer and Vishny (1989) formalises Rosenstein-Rodan’s ‘big push’ idea; see Sachs and Warner (1999) for an application to resource booms.

efficient use of fiscal resources in the absence of checks and balances. Thus, the potential for fiscal linkages can be improved with the appropriate safeguards. Canada enjoyed final demand linkages for in the form of exports (see section 4.2.1). Furthermore, payment to the factors of production can stimulate demand for other products, but also the resources for private investment in human capital.

Human capital is a key requirement for the adoption and adaptation of existing technologies and the development of new ones. Having these ingredients available locally makes it possible for backward linkages to develop within the region or country, rather than leak to overseas suppliers. We have suggested price volatility can impede investment in spatially-based industries and undermine this source of backward linkage. Forward linkages can take the form of beneficiation of minerals, although this can be highly capital intensive and hence undermine final demand linkages. Successful forward linkage examples include the development of steel and aluminium production (see section 4.2.3). Fresh attempts are being made at improving the efficiency and capacity of oil-refining operations in Africa so that petroleum products can be developed (Green 2008).

Linkages and returns to scale present in this earlier work have re-emerged, playing key roles in the characteristics of ‘New Economic Geography’ (NEG) models. Such models are intriguing in that they have startling implications for the regional distribution of economic activity. For example, they seek to explain the geographical agglomeration of certain industries (for example ‘manufacturing’) in particular regions (for example in the ‘north’ or ‘south’). Moreover, in contrast to, say, Heckscher-Ohlin trade theory, the models of Fujita, Krugman and Venables (1999) illustrate that ex ante symmetric countries can undergo ‘catastrophic’ agglomeration following temporary shocks. Such a shock in a basic two-region NEG model in which countries are ex ante identical can leave them in a ‘Core-Periphery’ equilibrium ex post, in which all manufacturing is concentrated in one region. Further, the authors show that the stability of agglomerated and diversified equilibria varies with trade costs, with, broadly speaking, the finding that agglomerated equilibria are more likely once trade costs fall below some critical level<sup>10</sup>. Although formal analytical and empirical work is yet to incorporate natural resources into this story, the presence of such a sector would likely interact with the agglomeration and dispersion forces at work. For example, one might tell an ‘extreme Dutch Disease’ story, in which rather than simply ‘squeezing’ manufacturing, a resource boom totally inhibits all manufacturing agglomeration. Conversely, the opposite may occur, where a resource boom increases the domestic market size, encouraging manufacturing agglomeration. Whether we have the former or the latter would likely be driven by, inter alia, the linkages fostered by the resource sector with the domestic economy through, for example, its factor use.

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<sup>10</sup>See also Neary (2001) for an introduction to the basic ideas. There has subsequently been an explosion of other theoretical and empirical work on the subject, for example see Baldwin, Forslid, Martin, Ottaviano and Robert-Nicoud (2003), and Henderson and Thisse (2004). The original Fujita et al. (1999) monograph goes well beyond this basic Core-Periphery model to consider a number of other contexts, including multi-region settings.

## 4.2 Clusters and Location

Parallel developments in the management literature have struck upon the role of “clusters” in determining national ‘competitive advantage’. Michael Porter (2000) has developed a conceptual framework for understanding the relevant forces at work in shaping the outcomes of industrial clusters, which he defines as “geographic concentrations of interconnected companies ... and associated institutions” (e.g. universities, standards agencies, etc). For example, he provides a schematic representation outlining the determinants of “locational competitive advantage”, which arise out of the interaction of firm strategy and rivalry, demand and factor input conditions, and related supporting industries.

Porter argues that thinking in terms of industrial clusters, rather than industrial sectors, provides a vehicle to bring companies, government and local institutions together in dialogue. Moreover focussing on clusters engages firms and other players in cluster-relevant policy issues, rather than broad based issues such as tax policy and export promotion. Action at this level is more easily taken. Porter argues that successful cluster initiatives share a number of common features — for example, a shared emphasis on productivity and innovation. The presence of customers and suppliers in clusters provides a natural check against the urge to seek subsidies and limit competition. Clusters may cross both internal and external borders, in which government actors play an active role in an overall privately led effort. This latter feature takes advantage of the private sector’s often superior implementation ability, and helps to ensure that changes of government do not bring an end to cluster initiatives. Porter lists a large number of cluster-base economic development initiatives. We briefly outline a couple of these with roots in natural resource based sectors, though such initiatives are relatively rare in developing countries, and moreover what follows does not provide a formal evaluation of these initiatives. Here we focus on mining in Canada, a range of natural resource based clusters in Chile, and a Spatial Development Initiative (SDI) in South Africa and Mozambique, the Maputo Development Corridor.

### 4.2.1 Canadian Mining

Mining in Canada is based around mineral extraction and processing together with mineral exploration and mine development<sup>11</sup>. Canada’s deposits include a wide range of metals (including copper, zinc and gold), non-metals (e.g. salt), mineral fuels (e.g. coal and natural gas) and structural materials (e.g. clay). The total value of extracted minerals was around US\$13bn in 1998, and the cluster employed around 100,000 people. Mineral extraction is not the whole story; mineral-related exports are significantly boosted by smelted or refined products. Moreover, a range of firms spanning large integrated producers to small-scale explorers and prospectors also undertake mineral exploration, with activity tending to move pro-cyclically with world mineral prices.

One example of a sub-cluster of mining activity in Canada is that based around the Sudbury

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<sup>11</sup>This section draws heavily on material presented in Ritter (2004)

Basin, Ontario, which includes significant Nickel and Copper deposits. The fortunes of the region have varied with, for example, variation in world mineral prices, a need to maintain productivity and sustain international competitiveness which has affected employment levels, and environmental standards. More recently, a process of diversification away from the mineral base has borne fruit in the form of increased dynamism of the local economy and improved environmental quality as a result of the diminution of sulphur emissions.

The Canadian cluster in general is highly integrated with the world economy, including investment by Canadian mining firms in projects abroad. These projects include both production activities and exploration, with strong links both in the US and Latin America. This reflects the range of services and expertise that have grown as a result of successful mineral productions in Canada, including things like specialised communications equipment (e.g. for underground work), consulting services (e.g. geological, exploration, environmental), research based activities, education of specialised personnel and financial services. An input-output study of Canada's mining sector calculated that the impact on total demand of the mining sector amounted to around US\$7bn in 1992, generating around 150,000 jobs in sectors providing inputs for the sector (Dungan 1997). Processing and further stages of production inflates these numbers.

Canada's significant mineral endowment provides the basis for its mining and related industries. The potential for technological upgrading and innovation has also been key, helped by proximity to the US providing access to leading edge technologies. Public policy has had a role to play too, beginning in 1842 when the Geological Survey of Canada was established. In addition to this, infrastructure investments have opened up new mining areas, and the government has provided some international marketing support, including negotiating improved foreign market access in fabricated products.

#### **4.2.2 Natural Resource-based Clusters in Chile: Mining, Agroindustry and Aquaculture**

Region II, Antofagasta, of Chile features a physical concentration of mining and related firms<sup>12</sup>. The region, the second largest in Chile, is the result of the 19th Century nitrate mining boom, but now features significant levels of copper production. It accounts for 53% of Chile's mining output, and over 90% of the region's exports. Antofagasta is also linked to other services via the Capricorn Corridor, a project to link the port there with other Chilean ports, and selected provinces of Argentina and Brazil.

Copper mining was nationalised in the early 1970s under Allende, but subsequent governments made attempts to attract foreign investment, relying on direct and indirect taxation for fiscal linkage. At the non-governmental level, private firms and universities have been involved in improving inter-firm linkages, in particular by more fully integrating small scale suppliers. In the early 1990s

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<sup>12</sup>Material presented in this section draws on Culverwell (2000) and Perez-Aleman (2005) with statistics from [www.chileangovernment.gov.cl](http://www.chileangovernment.gov.cl).

this was done via a Corporation for Productive Development (CDP), which subsequently received government and EU backing. A range of private initiatives have also received government support. The cluster is dominated by small (between 10 and 200 workers) and micro (fewer than 10 workers) size firms, which between them account for the majority of the region's workforce. Aside from these small scale operations, there are also a few large operators, with global linkages.

Other Chilean clusters include an agroindustry cluster centered around tomato processing, and an aquaculture cluster centered around salmon production. The tomato industry cluster is concentrated in a region beginning around 100km south of Santiago, extending around another 500km south. Government involvement came in the form of establishing the existence of foreign demand for processed tomato products, and also included work to improve the quality of inputs by adapting foreign varieties. New geographical zones suitable for production were also established. Much remained for private firms to work out, including building capabilities in quality control, procurement, logistics and management of supplier relations. International quality products began to emerge in the early 1980s, resulting in part from a period of learning and growing experience. Foreign firms also played a role in the cluster's development, both as a source of foreign demand and new ways to improve products. For example, ties with established Japanese multinationals helped foreign market access and provided insight into improved management practices, in particular with relation to quality. There was inter-firm coordination in the form of the joint creation of product standards, which also fostered collective learning.

Aquaculture accounted for over 50% of Chile's fishing exports in 2000, compared with less than 30% in 1990. Within aquaculture, salmon accounts for 95% of total export volume, or more than US\$1bn in 2003, and is concentrated in Region X, 1000km south of Santiago. Salmon is not native to Chile, but was introduced after some experimentation in the 1970s, which involved collaboration of Chile's National Fisheries Service and the Japan International Cooperation Agency. A public research program became an important source of independent firm start ups. Inter firm coordination was required in order to establish a Chilean 'brand' and install Chilean salmon on the international market, in competition with established producers in Norway, Scotland and Canada. To this end, horizontal networks and alliances were established, for example the Association of Salmon and Trout Farmers of Chile in 1986, giving rise to a quality seal certification defining product standards. Issues of sustainability were also addressed.

#### **4.2.3 South African Spatial Development Initiatives (SDIs): the Maputo Development Corridor**

South Africa's Spatial Development Initiatives programme was conceived in 1995 and began implementation during 1996<sup>13</sup>. SDIs have been promoted by the South African government as a vehicle for achieving higher rates of growth and job creation. SDIs are characterised by intensive short term intervention in an identified region in order to fast-track private sector investment, stimulate the

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<sup>13</sup>Much of what follows is drawn from Rogerson (2001).

growth of small enterprise, and enhance local employment rates. By early 2000, 12 industrial, agricultural or tourism-led SDIs had been launched across South Africa and beyond into neighbouring countries, one of which is the Maputo Development Corridor (MDC).

The MDC is a cross-border development strategy encompassing Mpumalanga province in South Africa and parts of Gaza and Maputo in southern Mozambique. The aim is to revitalise tourism, agriculture, mining and manufacturing in the region through cooperation between country governments and the private sector. Targets include improved infrastructure, private sector investment, environmental sustainability and empowerment of previously disadvantaged social groups.

Part of the initiative is the construction of a highway to combine two spatially-based natural resources. South Africa has minerals, while Maputo has the closest port to those minerals. The road will make it more efficient to ship goods via Maputo. Furthermore, the construction of the road is intended to create linkages by encouraging a range of industries, related or unrelated, to locate close to it. Thus, this initiative could be a force for natural-resource based agglomeration.

At the heart of Mpumalanga province's industrial base lies a series of resource-based industrial projects, concentrated in chemicals and petro-chemicals, basic iron and steel, food processing, and wood processing. Large coal reserves have encouraged the development of an oil-from-coal plant, providing a base for a large chemical and petro-chemical industrial economy. Locally based manufactured steel plants also benefit from nearby supplies of raw materials. This rich natural resource base precipitated an extension of the manufacturing base between the 1960s and the early 1990s, but which underwent significant job-shedding since 1990. The post 1996 SDI focus has been on promoting several identified clusters of activities, including stainless steel, chemicals and agro-food.

In Mozambique, the most advanced initiatives concern a US\$1.3bn aluminium smelter in Maputo, which will significantly change the structure of the country's industrial base. The South African development support agency, the Industrial Development Corporation, is supporting this private venture, as part of the wider Southern African Development Community. Another regional development, to be revived after the collapse Enron, one of its original financiers, is the US\$2.5bn Maputo Iron and Steel Project. Raw materials will be transported from Phalaborwa in South Africa to Maputo to be processed into iron and steel, using Mozambique's natural gas supplies in the iron ore reduction process. The project, which still has a number of technical and environmental barriers to overcome, is expected to be operational in 2011.

## 5 Interim Policy Implications

### 5.1 Macroeconomics: the Short-Run Policy Response

In terms of short run policy responses to resource booms, two crucial components in the optimal real response to windfalls appear to be: get the savings response right, and take measures to ensure the investment of such savings is as efficient as possible. The latter requires some smoothing where there are construction boom effects (see Collier and Gunning (1999b)), which may be accomplished

by e.g. increasing holdings of foreign assets out of the windfall, in addition to measures ensuring the accountability of revenue allocation between projects and over time. More generally Lal and Myint (1998) find that the efficiency of investment collapsed in resource abundance countries in the 1970s, particularly in Latin America, which may be linked to the dominant Structuralist ideology of the time (Auty and Kiiski 2001). A closed trade regime and the relaxation of market discipline slowed the transition to competitive, diversified industrialisation. Moreover the two self reinforce. A lack of competitive diversification leaving the country more dependent on natural resources increases vulnerability to external shocks; trade closure may be aimed at reducing this vulnerability.

On top of this a major challenge posed by these episodes is to correctly identify the likely duration of the windfall in order to gauge the appropriate savings response. Temporary windfalls interpreted as permanent might explain the divergent experiences of otherwise similar countries facing common shocks.

It is apparent that resource windfalls also pose challenges in terms of the optimal short run fiscal and monetary responses, for which see Collier (2007) for a comprehensive discussion. The optimal monetary response is to accommodate the private sector's temporary increase in demand for real money balances by expansion of the money supply in the short run. Such an increase need not be inflationary if the private sector wishes to hold these balances as extra savings rather than spend them. In such circumstances the demand for money is likely to be quite volatile so monetary targeting will likely produce unsatisfactory results. The price level should be directly targeted. The monetary authorities must also manage the balance between base money and 'inside money' — which can expand through the system of credit creation. If the expansion is sufficiently large, there may result an overall greater than proportional increase in the money supply, which is inflationary. The optimal response is to temporarily reduce the ratio of inside to outside money by increasing cash reserve ratio requirements.

The fiscal response has been well illustrated by countries that have adopted politically insulated fiscal stabilisation funds, notably Chile, with its copper revenue stabilisation fund, and Norway, with an oil revenue stabilisation fund. The idea is to save excess rents earned when the price exceeds a conjectured trend level, and run down reserves in temporary slumps. Fasano (2000) finds that in most cases, fiscal outcomes have been improved by de-linking expenditure from revenue availability. Investing excess funds abroad may also have helped mitigate real exchange rate appreciation in Norway and Chile. By contrast in Oman and Venezuela the experience has been less successful owing to frequent changes to the fund's rules and deviation from its intended purposes. Generally, success or failure is seen to be as much to do with fiscal discipline as with fund management per se, as the two are likely to be correlated. It has been more successful in countries with strong commitments to the former together with sound macroeconomic management. Various mechanisms to bypass this potential pitfall have been suggested, for example the direct redistribution of resource windfalls to the population (e.g. via bank transfers) (see for example Birdsall and Subramanian (2004) who suggest this for Iraq).

## 5.2 Policies for the Long-Run

With reference to the longer run, Mayer (1999) identifies the key policy issue in resource rich economies as how to ensure the primary sector is sufficiently productive to provide resources for investment in the economy as a whole, with the aim of initiating a process of gradual upgrading of skills and technology. Mayer argues that part of the disappointing performance of many natural resource economies is due to insufficient technological upgrading in their primary sectors. Wright and Czelusta (2002) argue that successful technological upgrading has occurred in the few successful resource rich economies — such as Chile, Australia and Canada. They argue that primary production can have the potential for high-tech growth, through advances in technologies of search, extraction and utilisation. There are several examples, they argue, of knowledge intensive mineral sectors, subject to learning by doing. Indeed Maloney (2006) cites deficient learning and innovative capacity, together with an extended period of inward orientation as the primary drivers of much of Latin America’s “missed opportunity” to exploit natural resource-based growth.

Spatial development and clustering initiatives may provide another route to successful resource based development, for example by fostering collaboration, productive linkages, innovation and foreign market access. Cluster initiatives may benefit from focussing on particular regions or localities, being business and outcome oriented and avoiding potential pitfalls of ‘standard’ industrial policy by promoting a set of consistent policies across buyer and seller groups. Some caution is in order however since the approach as yet lacks in- depth, systematic quantitative analysis and evaluation of outcomes.

The danger of the resource curse thesis is to close off potentially advantageous avenues of development. A related danger may be to encourage governments to pursue development policies that are not consistent with their countries’ underlying comparative advantage, wrongly believing that to do so would spell doom. Of course, with this type of policy recommendation, the underlying model we have in mind is crucial. More concretely, a basic Heckscher-Ohlin type trade model would suggest it may be a mistake for some African countries to pursue labour intensive manufacturing based industrialisation along the lines of the East Asian ‘Tigers’, as their comparative advantage in land and resources looks more like the 18th and 19th century US (on this, see Wood (2002)). By contrast, if one had a ‘new economic geography’ type model in mind, featuring increasing returns and the potential for agglomeration, the policy conclusions may be quite different. Here, the development of particular regions, characterised by the agglomeration of manufacturing activity, is the flip-side of underdevelopment in others. Moreover, such forces of agglomeration set the scene for international income inequality, and regional divergence (see e.g. Redding and Venables (2004)). Such models could be taken to suggest that governments in developing countries should expressly aim to *encourage* the development of manufacturing activity. Thus the potential cleavage in the theoretical literature brings with it a potentially contradictory set of policy prescriptions.

Regardless, the tendency for governments in resource rich countries to squander or manage their revenues badly has proved a major barrier to resource-led development. This last point provides

a link with policy recommendations based on ensuring transparency and accountability. Many of these constitute legal arrangements to be signed up to by sovereign governments of both developed and developing countries. Open Society Institute (OSI 2005) for example recommends compliance with the OECD Anti Bribery Convention, which includes recognition of corporate criminal liability and the assertion of criminal jurisdiction over complicity in spoliation crimes committed abroad; signing up to the Financial Action Task Force, to monitor lax financial supervision; the strengthening of international mechanisms for the pursuit of cross-jurisdictional corruption; and recognition of transparency and freedom of information laws. The last of these is as recommended by the Extractive Industries Transparency Initiative and the Publish What You Pay campaign, aiming to improve legislation requiring the disclosure of revenues and activities of both government and corporate actors, operating both at home and overseas. OSI cites Sao Tome and Principe's 2004 oil revenue management law as a model of disclosure law for resource rich countries. Advanced economies clearly also have a role to play in ensuring transparency and accountability of domestic firms operating overseas in resource rich countries.

In addition one should of course recognise that the impact of resource richness on political economy is not fully deterministic (Auty and Gelb 2001); it can both consolidate tendencies towards a highly centralised state, or spark civil war and the disintegration of the state. Similarly resource richness can support authoritarian regimes, or could underpin democracy by providing the financial basis for the organisation of working and middle class groups and the development of civil society. There is also reverse causality: political economy will affect how agents compete for access to resource rents and how they are allocated. The transparency and accountability recommendations above are consistent with this view, and aim to create an environment in which agents' interaction enters a productive and socially beneficial positive spiral, rather than one that is value-destroying and socially harmful.

## 6 Conclusions

A range of empirical work has established the presence of a resource 'curse' — a negative relationship between growth and natural resource richness, variously measured. Economic theory suggests a range of explanations. First, resource booms may induce exchange rate appreciation which subsequently squeezes growth enhancing sectors. Second, resource rich economies may be subject to price volatility and trade shocks, which are both destabilising in resource allocation terms and which pose macroeconomic policy challenges. Third, natural capital appears to crowd out human capital, in the sense that expenditure on and enrollment in schools inversely correlates with resource abundance. Forth, natural resource sectors may feature a particularly weak configuration of linkages, limiting the extent of positive feedbacks to the rest of the economy. Finally, poor policymaking in a subset of resource rich economies appears to have contributed to their under-performance. This last point is linked to the political economy of resource richness, which highlights the tendency for resource

rent windfalls to interact adversely with political institutions and their policy outcomes.

Policy prescription is relatively clear with respect to the short run macroeconomic handling of resource rents. With regard to institutional dimensions, prescriptions remain fairly broad brush, though there is evidence to suggest that strong checks and balances on state activity have atypically high returns in resource rich countries. Spatial and clustering initiatives may provide scope for successful natural-resource based development by fostering inter-firm linkages, technological upgrading, certified quality levels, and foreign market access.

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