Minerals and the Developing Nations

Philip Maxwell

Mineral Dependent Developing Nations
The Impact of New Mineral Development
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Institutional and Policy Issues

MINERAL DEPENDENT DEVELOPING NATIONS

With the demise of colonialism, the political geography of the world has been changing. Australia recently celebrated its centenary of self-government. When Australia became independent in 1901, there were perhaps 50 autonomous nations. While many of today's countries in Europe and the Americas were already sovereign states, Africa was still largely a colonial bastion, and much of Asia was in a similar position.

A dramatic change began on the African continent from 1960 onwards. There are now more than 50 independent countries in Africa. There have been parallel developments in Asia associated with the independence of India and Pakistan in 1947, of the South East Asian nations and more recently as a result of the break up of the Soviet Union.

Teams from more than 200 nations marched at the opening ceremonies of the Olympic Games in both Sydney in 2000 and Athens in 2004. While perhaps 30 members of this group are microstates (places such as Monaco and the Netherlands Antilles), Chapter 2 highlighted that the United Nations Development Programme now publishes estimated Human Development Index values for more than 170 nations in its *Human Development Report.* Many of these have either significant mineral endowments or mineral dependence or both.

While geologists estimate mineral endowments with statements of reserves and resources, there are several ways of assessing mineral dependence. Three recent assessments (those of Davis, 1995[1] and Eggert, 2001, 2003) appear in Table 3.1. The final contribution focuses only on non-oil and gas mineral producers.

Our view is that where minerals and energy account for 25 per cent or more of a country's merchandise exports, its economy depends significantly on the non-renewable resources sector.

For the second half of the 19th century, the first decade of the 20th century and for much of the past 40 years, Australia has met most of the criteria for a mineral dependent economy. In the 2002-03 financial year, for example, the mining sector, as defined in the Australian and New Zealand Standard Industry Classification code, accounted for over four per cent of Gross Domestic Product and almost 40 per cent of merchandise exports. If one defined mining somewhat more broadly to include basic metal processing and mining services, the share of GDP rose to more than eight per cent.

TABLE 3.1

Some recent classifications of mineral dependent nations.

Author	Criteria (and year or period)	Number of countries
Davis (1995)	Minerals GDP/GDP ≥8% and Mineral exports/ Total merchandise exports ≥40% (1990)	22
Eggert (2001)	Mineral exports/Total merchandise exports >25% (1999)	34
Eggert (2003)	Non-fuel mineral exports/Total merchandise exports >10% (1990-99)	37

Using export data from the 1990s, there are 44 countries listed in Table 3.2 that meet this mineral dependence criterion. They consist of 21 hard rock mining nations and 23 economies that depend strongly on oil and gas production. Additionally, the table includes 17 other marginal or potential mineral dependent nations. The criterion for marginal mineral dependence is a level of exports between ten and 25 per cent of total merchandise exports. There are additionally a group of five or six African nations that have either significant mineral potential that has yet to be developed or, if developed previously, have subsequently been adversely influenced by major political upheaval. Hence there are 59 countries on this list of actual, marginal or potential mineral dependent nations.

From an Australian and more general perspective, there are several reasons why these countries are of interest. At one level, there seems potential for those that experience a major mineral windfall to have the same economic development experience as Australia. In a similar fashion to the way the impact of the Victorian and New South Wales gold rushes dramatically changed the Australian economy, members of this mineral dependent country group could also be transformed.

At another level, the development of competitive mineral economies in other nations may threaten the competitive position of the Australian resources sector. This is not an issue that has received much attention in the literature but it may have implications for the economic fortunes of states and smaller

1. This taxonomy was also used by Nankani (1979), Gelb *et al* (1988) and Auty (1993).

TABLE 3.2

A revised classification of mineral dependent developing nations. Source: Eggert (2001, 2003); United Nations Development Programme (2003).

Value of HDI	Countries		
	Hard rock	**Oil and gas**	**Marginal or potential**
0.800-0.849	Chile	Qatar, Kuwait, UAE, Trinidad and Tobago	Cuba, Belarus
0.750-0.799	Suriname, Jamaica, Peru	Libya, Colombia, Venezuela, Saudi Arabia, Kazakhstan Oman	Bulgaria, Macedonia, Russia
0.700-0.749	Ukraine, Jordan, Uzbekistan	Azerbaijan, Ecuador, Iran, Algeria	Guyana, Armenia, Kyrgyzstan
0.600-0.699	South Africa, Tajikistan, Bolivia, Mongolia, Namibia, Botswana	Syria, Indonesia, Gabon, Egypt	Morocco
0.500-0.599	Ghana, Papua New Guinea	Togo	
0.400-0.499	Mauritania, Guinea	Cameroon, Yemen, Nigeria	Zimbabwe, Tanzania, Senegal
<0.400	Zambia, D R Congo, Mali, Niger	Angola	Mozambique, Burkina Faso, Sierra Leone
Total nations	21	23	15

regions that depend on marginal mineral deposits for their economic wellbeing. It may also adversely affect Australian national welfare.

In a more practical and positive vein, the development of world-class mines and oil wells in other nations provides opportunities for Australian companies to undertake investment abroad. As prospects at home become more limited, there is a natural tendency to focus attention on potentially profitable ventures elsewhere. During the 1990s there was a strong movement of investment offshore by Australian mining companies. Other developed nations with internationally competitive mining sectors, such as Canada and South Africa, also participated actively in this area[2].

The estimates in Table 3.3 provide one view of the status of the current world mineral economy. Minerals and energy were responsible for an estimated US$ 656 billion worth of national product in 2001. This represented 2.1 per cent of estimated world Gross Domestic Product. A key point of this table is that the developed nations, with only 15.3 per cent of the world's population, were responsible for more than half of the value of world mineral and energy production in 2001. This was 1.5 per cent of their Gross Domestic Product. This seems to imply that the countries of the developed world are depleting their mineral reserves at a more rapid rate than those of the developing world.

In the 23 'major mineral producing' nations, minerals and energy product was 5.7 per cent of GDP. Although this group of nations was responsible for only 13.3 per cent of world GDP, they were responsible for 39 per cent of world mineral production. With minerals and energy production more difficult in developed nations, either because mineral deposits are exhausted or factors such as greater environmental regulation are affecting their development, the opportunity for this group to expand its share of output, and benefit from it, seems significant unless their comparative advantage shifts as they build capital stock.

Finally, Australian-trained mining professionals have been moving throughout the world, building their careers. The internationalisation of Australian tertiary education has meant that many of these graduates have come originally from developing nations, and will return home to build their own country's minerals and energy sectors.

Against this background it is a worthwhile exercise to reflect on recent views about the way in which the expansion or contraction of minerals activity will influence developing mineral economies.

THE IMPACT OF NEW MINERAL DEVELOPMENT

Chapter 2 pointed out that the so-called 'traditional view' suggests that when any nation decides to develop a major mineral endowment there is a good possibility that this will bring major economic and social development. Hence, the exploitation of mineral and energy resources would seem to be a good thing. Yet, despite increases in measures such as the Human Development Index in many mineral-rich developing nations, some influential observers have argued that the economic performance of the world's developing mineral economies over the past 40 years has not been particularly impressive. This observation has led to much further discussion of what has been happening.

In their recent review of this discussion the authors of *Breaking New Ground, MMSD Project* (IIED, 2002) identify the interplay of three broad groups of factors influencing the process[3]. These are:

2. See for example the paper by Maponga and Maxwell (2000) that discusses the Australian experience, and relevant chapters in Canadian Minerals Yearbooks, Natural Resources Canada (various years) discussing the international activities of Canadian mineral companies.

3. Eggert (2001) used a version of this taxonomy in his paper.

TABLE 3.3

The contribution of the mineral sector to gross domestic product in selected groups of nations 2001. Source: United Nations (2002).

Country group	Population		GDP		Mineral sector GDP		
	(million)	**Per cent of total**	**(US$ billion)**	**Per cent of total**	**(US$ billion)**	**Per cent of total**	**Per cent of GDP in this group**
Developed nations (33)	935	15.3	24 959	79.5	375	57.2	1.5
Major developing mineral producing nations (23)†	3490	56.9	4184	13.3	256	39.0	5.7
Other developing economies (146)	1705	27.8	2257	7.2	25	3.8	2.0
World (202)	6130	100.0	31 400	100.0	656	100.0	2.1

† Countries in this group included Argentina, Azerbaijan, Brazil, Chile, Colombia, China, India, Indonesia, Iran, Mexico, Namibia, Nigeria, Papua New Guinea, Peru, Poland, Romania, Russian Federation, Saudi Arabia, South Africa, Syria, Thailand, Trinidad and Tobago, Venezuela.

- **external market forces** such as declining terms of trade, as well as mineral price volatility;
- **internal economic stresses,** which in particular lead to reduced economic growth because of Dutch disease effects, (as well as to changing fortunes of the different subnational regions touched directly or bypassed by new mineral developments); and
- **distorted processes of policy making,** which foster corruption and excessive rent seeking.

Each of these are now considered in turn.

External market forces

A nation's **terms of trade** is the ratio of the prices of the goods and services that it exports to the price of the goods and services that it imports. A fall in a country's terms of trade means that it needs to produce more of these goods to purchase the same amount of imports as previously. A rise in a country's terms of trade means that it needs to produce fewer exports than before to purchase the same amount of imports.

It is typical for statistical agencies to publish these measures on a regular (say quarterly) basis. The Australian Bureau of Statistics has conducted this exercise officially for much of the past 50 years, though it has undertaken a study of trends in the terms of trade since Federation. The information in Figure 3.1 is derived from an Australian Bureau of Statistics study.

This graph shows a decline in Australia's terms of trade over the past century. During this time there have been two or three notable spikes in the series (in 1924/25, 1950/51 and 1973/74) and also some notable troughs (in 1931/32, 1943/44 and 1986/87). But over the period, there has been an apparent fall in our terms of trade from around 130 in the early years of the 20th century to about 100 at the beginning of the new millennium. Note that the 1999-2000 financial year serves as the base year for the diagram. Throughout the century, natural resource-based products (minerals, energy and agriculture) have accounted for between 75 and 80 per cent of our exports. Manufactures have accounted for a similar percentage of our imports.

While the terms of trade measure does not take account of changes in product quality (manufactured goods have been improving in quality over that period), it does provide a measure of the perceived difficulties facing countries that depend on natural resource-based exports. Averaging around 30 per cent of total exports, minerals have been Australia's major export category for the past four decades. The situation that has been faced, with declining terms of trade, is similar to that of many of the mineral dependent developing nations. Yet what matters is profit (rent), not price. If the price of a commodity is falling more slowly than costs, the declining terms of trade could be coincident with improving welfare. Another view of movements in Australia's terms of trade since the 1960s appears in Table 3.4.

TABLE 3.4

Movements in Australia's terms of trade since 1960. Source: Australian Bureau of Statistics, 2006.

Period	Average level	Standard deviation
1960s	116.5	3.6
1970s	113.8	4.5
1980s	101.4	2.3
1990s	98.5	1.6
2000-01	100.0	na
2001-02	102.6	na

The terms of trade of mineral and energy economies vary widely. One indication of this comes from a review of terms of trade estimates in World Bank (1993). The base year was 1987, when terms of trade stood at 100.

Group	1985	1991
World	106	100
High income nations (23)	97	101
Fuel exporters (12)	167	85
Other mineral exporters (21)	122	94

The **volatility of mineral prices** – their movement around a long-term price level or trend – is also an issue. This seems particularly the case for gold, as well as for the mineral commodities traded in transparent markets such as the London Metal Exchange (LME) and the New York Mercantile Exchange (NYMEX or COMEX). It is relevant both for government policy makers, as well as for mining and oil company executives.

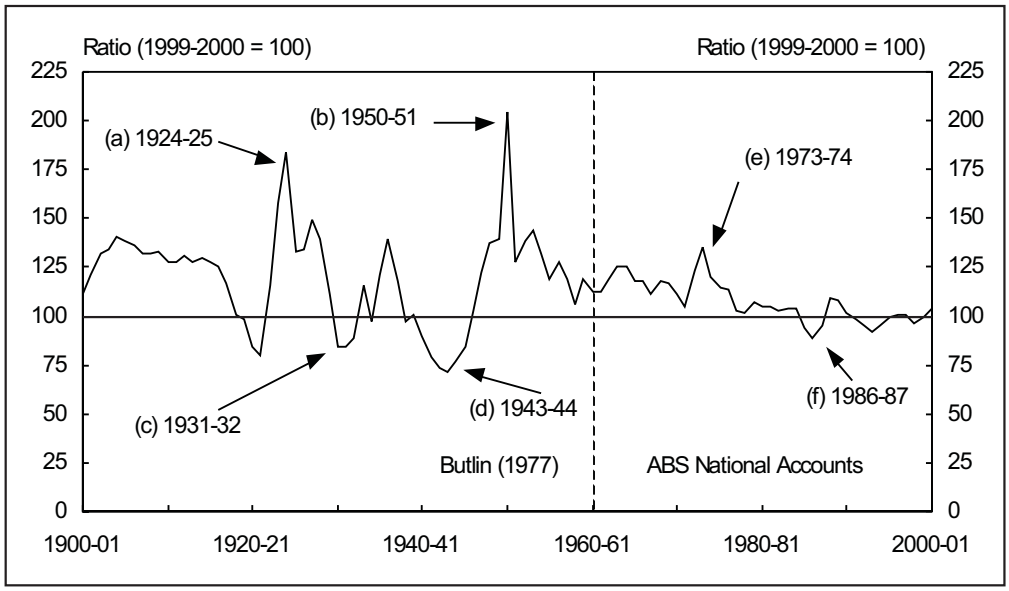

FIG 3.1 - Movements in Australia's terms of trade during the 20th century. Source: Australian Bureau of Statistics, 2006.

Governments prefer stable and predictable flows of taxes and royalties to assist national economic management. During periods of high mineral prices, politicians' expectations about the future are typically optimistic. Indeed they may well be over-optimistic. Governments in mineral-rich developing nations may be tempted to borrow large amounts to finance development in other sectors of the economy, expecting that revenue flows will easily meet debt repayments. Where mineral prices fall, this often has brought major external debt problems.

Shareholders count on mining company executives producing healthy profits, while the broader community expects them to be good corporate citizens, whether at local, regional or national level. Part of this latter expectation relates to environmental management, part to contributing to local communities and regions, and part to paying taxes and royalties. Mining company workforces anticipate competitive working conditions in the often remote and difficult conditions in which mines and oil wells are located. Senior managers and company boards face major challenges to satisfy each group of their stakeholders.

In their study of metal price volatility for the six metals traded on the London Metal Exchange between 1972 and 1995 (aluminium, copper, nickel, lead, tin and zinc) Brunetti and Gilbert (1995) found that volatility had remained relatively stable over the period. There had been high volatility associated with two periods of tight demand. Nickel prices had tended to be the most volatile and copper the least volatile among the group. These findings were at odds with those of Slade (1991) who, in analysing data between 1970 and 1986, found greater volatility in the 1980s than the 1970s. The price volatility of key minerals in the past decade seems likely to have increased.

Internal economic stresses

Much of the discussion in this area has focused on whether or not a nation experiences 'Dutch disease'. Named after the experience of the Dutch economy in the late 1970s, this is concerned with the effects on an economy arising from the uncomfortable co-existence of booming and lagging sectors, which often brings significant structural adjustment, following the discovery and initial exploitation of major new mineral resources.

A minerals or energy boom will increase a nation's exports, and it may also raise its exchange rate and drive up wages and inflation, at least in the short term. While the booming sector (say mining) will cope with this situation, 'lagging' domestically-based tradeable-good industries (such as agriculture and manufacturing) may struggle to compete with imports. As a result, they may have to close or severely contract their operations. When the boom subsides, and exchange rates return to lower levels, there may be difficulty to re-establish these industries[4, 5].

One justification for this view comes from the argument that 'learning by doing' occurs in producing manufactured goods, but not minerals. This improves production efficiency to maintain and enhance industry competitiveness. When a minerals boom leads to the complete or partial closure of a nation's domestic manufacturing sector, the benefits from the learning effect of manufacturing will disappear. If the total benefits from maintaining a manufacturing sector exceed those of mineral exploitation, the overall impact of mining on an economy would be negative. Yet much modern mining practice also involves 'learning by doing,' whether in the improvement of exploration practice, mining methods or mineral processing. In leading mineral-producing nations such as Australia, Canada and Chile, mining is akin to early stage manufacturing. The associated mining services sector also entails 'learning by doing' for its practitioners to establish and sustain a competitive edge.

Though identified for the Dutch economy and popularised by authors such as van Wijnbergen, the 'Dutch disease' has a much longer history and has applied in many other economies. There is now an extensive literature identifying the effect of the phenomenon in Australia, Nigeria, Indonesia and several other nations.

The Australian economy experienced some of the symptoms of Dutch disease in the resources boom period of the early 1970s, when mineral exports increased dramatically. Exchange rates rose strongly. In mid-1973 for example, the exchange rate between the Australian and US dollars was A$ 1 = US$ 1.51. Unsurprisingly at the time, manufacturing imports were very cheap. Local manufacturers of things like motor vehicles and white goods struggled. Australian farmers also faced difficult times, typically accepting much lower prices than normal in A$ for their internationally traded goods. In addition to this, there was a wage explosion and accompanying high rates of inflation soon followed.

The short-term stress that Dutch disease places on a capitalist economy will be greater if it is close to full employment when the major impact of new minerals-based development applies, and it is not easy to supplement the labour force quickly through migration. If there is large migration as a result of major new mineral development, this can assist the fortunes of lagging industries. Where there is major stress on lagging industries, this may however, be an optimal and welfare maximising response to changes in a country's resource endowments.

Distorted processes of policy making

In addition to the potentially negative impacts of **external economic stress** and **internal economic pressures** associated with Dutch disease, mineral-rich developing nations may be subject to distorted policy making outcomes that arise from a number of interrelated causes including:

- excessive rent seeking,
- corruption, and
- an underdeveloped institutional framework.

Where political differences are large, the combination of these factors can even lead to civil wars where citizens of some regions stand to derive great potential benefit from a mineral windfall, yet national governments seek to redistribute the surpluses in a way that is not favoured by the regional populations.

Although it was noted that mines generate **economic rent** in Chapter 1, the concept has not yet been discussed. Economic rent is the payment that any good (commodity) or service receives in excess of its supply price when a market is in equilibrium.

In their well-known treatise, Garnaut and Clunies Ross (1983) provide the following definition of **mineral rent:**

> *Mineral rent may be defined as the returns in excess of those needed to attract factors of production into the mining industry in the long run. It is the revenue remaining after all costs have been deducted. These costs include exploration outlays, expenditures on mine establishment and cash operating costs. Unlike the accountant's notion of costs, economic costs include the returns on capital invested, which are just sufficient to attract the capital to the enterprise.*

It is typical to illustrate economic rent using a diagram such as Figure 3.2, where the supply curve for producing mines is shown by *SS'*, and the equilibrium price that clears the market is *P*. The economic rent generated in this case will be given by the area of the triangle *SPQ'*.

4. Corden (1984) has provided one of the standard theoretical explanations of what happens in economies during resource booms.

5. There are, however, no published empirical studies as yet to support this argument.

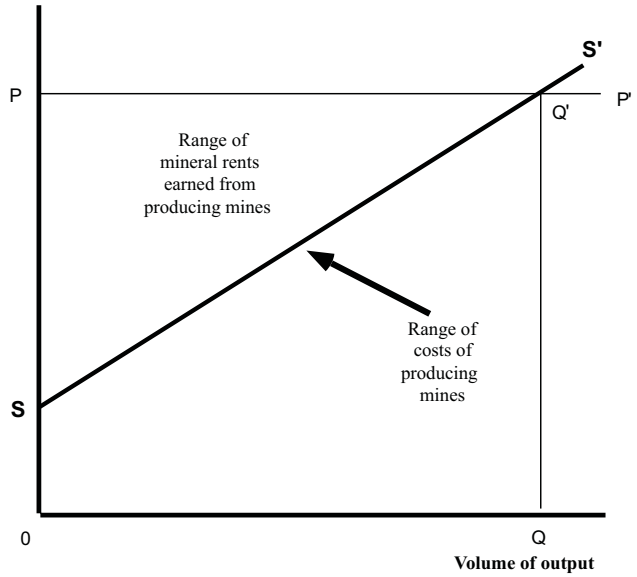

FIG 3.2 - The rent of mines in a competitive market.

Let us think for a moment what this means in the context of the operation of the Western Australian gold industry. Suppose that the current price of gold is US$ 400 per ounce. Suppose also that there are 50 gold mines operating in the state. It is possible to generate a supply curve similar to *SS'* for these producers. The amount produced in the state has been around 200 tonnes per annum (say six million ounces) for much of the past two decades. This corresponds to the distance *0Q*.

The lowest cost producer in the state has an average cost of say US$ 150 per ounce, while the most marginal mine produces at US$ 400 per ounce. The first producer will generate an economic rent of US$ 250 per ounce, while the second reaps no rent.

While it is possible, in principle, for government to tax away all of this rent and redistribute it to other parts of the economy, Chapter 15 shows that in practice, it is only possible to access part of this amount.

Equally, or even more important for the present discussion, are the key points about mineral rent made by Garnaut (1995):

- it can be absorbed by any party that has veto power over mine development;
- it can be dissipated by uncertainty as conflict between holders of the veto power raises the supply prices of inputs into production; or
- both of these things can happen.

Any group that can delay or prevent the approval, construction, or operation of mines or oil wells can exert this pressure. Members of local communities close to a mine, for example, may wish to obtain more of the rent to ensure what they perceive to be their long-term sustainability. Members of nearby indigenous populations may take a similar view. Where new mineral development interferes with their cultural heritage, they may try to prevent it from taking place. Conservation and environmental groups may seek either greater environmental regulation, which is more costly to the mining companies, or propose that mines not proceed at all because they will cause irreparable long-term damage to the surrounding physical environment.

Whether rent-seeking behaviour is excessive or not depends largely on how each stakeholder perceives the outcome of negotiations about the sharing of rent. If a company is considering starting a new mine in a developing nation such as Papua New Guinea, Fiji or Tanzania, there will be negotiations with local indigenous and other communities, regional governments, national governments, environmental lobby groups and perhaps some other non-government organisations (NGOs). Each group will have the ability to seek rent payments in varying degrees. Some of their demands may be so large that they undermine the profitability of the project. Senior executives will have to be confident that the project will be profitable if it is to proceed. There are many cases where companies do not proceed with mineral resource development projects in developing nations because they judge that claims on economic rent will be excessive.

The potential of considerable new riches may also distort policy-making processes and encourage **corruption**. The organisation Transparency International provides annual estimates in the perceived level of corruption in a broad cross-section of countries. In their 2002 report they focused on public sector corruption, defined as 'the abuse of public office for private gain,' providing estimates of a Corruption Perception Index for 102 nations. Their group included 26 of the 61 countries in the mineral economy taxonomy in Table 3.2. The range of the TI measure is from zero (for the case of extreme corruption) to ten (a total lack of corruption.)

If mineral economies are more corrupt than non-mineral economies, one might expect the relationship between perceived corruption and a measure such as the Human Development Index to reflect this. Assuming the Transparency International sample of countries is representative of the entire population, and its measure of perceived corruption is accurate, the analysis in Table 3.5 provides a rudimentary assessment. While this analysis is not concerned directly with whether the windfall causes corruption, it shows that the Unweighted Average Corruption Perception Index is in different HDI ranges for **developed** and **developing** mineral- and non-mineral economies.

Perceived corruption is considerably less in developed than in developing nations. Yet it does not differ greatly between developing mineral economies and non-mineral economies. High levels of perceived corruption in several of the former Soviet mineral economies meant that the unweighted average perceived corruption levels were higher in mineral economies in the HDI

TABLE 3.5

Perceived corruption and stage of development – comparing HDI values for 2001 against the Transparency International Perceived Corruption Index for 2002. Source: United Nations Development Programme (2003); Transparency International (2002).

Value of HDI	Mineral economies		Non-mineral economies	
	No	Unweighted Average Corruption Perception Index	No	Unweighted Average Corruption Perception Index
Developed nations				
≥0.900	2	8.8	22	7.94
0.850-0.899	-	-	7	6.03
Developing nations				
0.800-0.849	3	5.73	10	4.17
0.750-0.799	6	2.98	9	3.34
0.700-0.749	4	2.90	10	3.31
0.600-0.699	6	4.12	6	3.05
0.500-0.599	1	3.90	2	1.95
0.400-0.499	4	2.46	5	2.10
<0.400	2	2.15	3	3.03
Total developing nations	26	3.40	45	3.26
Total nations	28		74	

range between 0.700 and 0.799. Perceived corruption in the desperately poor mineral economies with HDI values less than 0.400 was also greater than in their non-mineral counterparts. In other HDI ranges, however, perceived corruption was greater in non-mineral economies than in mineral economies.

The message for any company considering resource sector investment in a developing mineral economy is clear. Expect greater levels of corruption than if investing in a developed nation. But the situation in developing mineral economies does not seem to differ greatly from that in non-mineral developing countries[6].

A stable government and well-formed institutions in any nation are more likely to facilitate the orderly development of a competitive minerals and energy sector. When such institutions do not exist, or they have been undermined because of political change, excessive rent seeking and corruption may emerge. When the African nations became independent, most had few properly formed institutions and there were few university graduates with the background and experience to lead them effectively. In a somewhat different fashion, the demise of the Soviet Union has been associated with institutional breakdown, the rise of criminality and corruption in many of its former republics.

Where newly independent mineral-rich nations consist of disparate ethnic and cultural populations, institutional structures are poorly formed and human capital levels are low, there appears to be a tendency towards **civil wars**. Ross (2001) identifies 14 civil wars in resource-rich nations that have taken place over the past 35 years. Nine were in Africa (in nations such as Angola, Nigeria, the Democratic Republic of the Congo (formerly Zaire), Liberia and Sierra Leone), two in Indonesia (Aceh and West Papua), two in the Middle East (Iraq and Yemen) and one in Oceania (the Bougainville conflict in Papua New Guinea).

The practice of colonising nations of drawing geographical boundaries, which did not coincide with ethnic and cultural homogeneity, in combination with weak institutions has also often been associated with military coups and poor government.

THE RESOURCE CURSE HYPOTHESIS

It became apparent in the late 1970s that the economic performance of several developing nations with large mineral and energy endowments, measured particularly in terms of real GDP growth, did not coincide with traditional expectations. Nankani (1979) observed this generally for all mineral exporting economies, while Gelb (1985) considered the situation in oil-rich economies. Although Gelb found mixed outcomes in his country case studies, Gelb *et al* (1988) subsequently posited the existence of a 'resource curse' thesis for the oil-rich developing nations. Auty (1993) extended the argument that a resource curse applied also in most 'hard rock' developing mineral economies. In an econometric study of the economic growth experiences of 97 nations between 1970 and 1989, Sachs and Warner (1995) provided further empirical insight. They have subsequently published further papers in the area and several other authors have written about these issues.

Before proceeding further, it is useful to reflect on the generally understood meaning of the **resource curse** hypothesis. Auty (1993, p 1) argues that the essence of the resource curse view is that:

> *the economic performance of nations with a significant mineral (or other natural resource) endowment **may** be worse than those without such endowments.*

Atkinson and Hamilton (2003, p 1793) perceive that it is:

> *the paradoxical but seemingly robust finding of a negative and significant relationship between natural resource [abundance][7] and the growth rate of per capita gross domestic product (GDP).*

Sachs and Warner (2001, p 827) describe 'the curse of natural resources' simply as: *the observation that countries rich in natural resources tend to perform badly.*

If growth in real GDP, or real GDP per capita, is a reasonable proxy for economic performance, then it would seem that minerals may have been a curse since 1970 for those nations that possess them. The combination of *external market forces*, *internal economic stresses* and *distorted processes of policy making* during the last three decades combined to bring this about.

One could describe such an outcome in terms of the simple diagram depicted in Figure 3.3. After the initial upward impact of the new resource development, the negative impacts associated with falling mineral prices, price volatility, Dutch disease, corruption and poor policy decisions come into play. By the time that the economy has adjusted, it is behind where it would have been without the resources windfall. It then begins to grow at the same rate as it would have without the mineral windfall. This is the key assumption – that it is behind where it would have been.

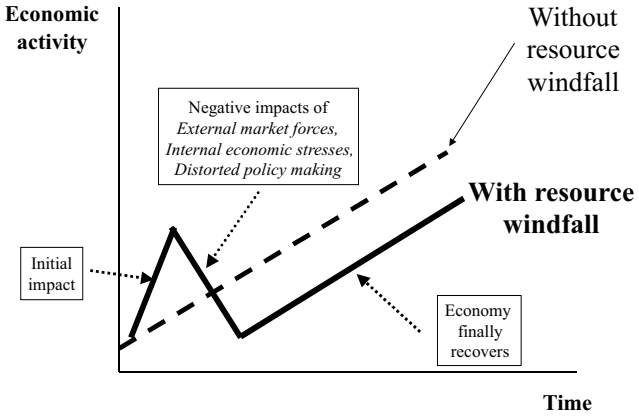

FIG 3.3 - A simple view of the resource curse hypothesis.

One way of classifying the empirical studies about whether minerals have been a curse or a blessing is to use the following three-part taxonomy:

1. the **case study**-based analyses of growth in real GDP per capita of by Gelb (1985) and Gelb *et al* (1988) and by Auty (1990, 1991, 1993 and 1994);
2. the **regression-based econometric analysis** of growth in real GDP per capita associated particularly with the key study by Sachs and Warner (1995), several further studies by the same authors, and a series of related studies by authors such as Gylfason (2001), Atkinson and Hamilton (2003) and Lederman and Maloney (2002); and
3. the more broadly-based comparative data analyses of authors such as Davis (1995).

The studies by Gelb and his colleagues focused on the oil-rich economies that had emerged in the wake of the OPEC oil price rises in the 1970s. Though Auty's initial papers were on oil and

6. On a different but somewhat related note, Transparency International (2002) reports that mining is not a major industry in foreign jurisdictions where senior public officials solicit bribes or where the size of bribes paid is particularly high for mining companies.

7. The absence of 'abundance' or a similar word from the definition appears to have been a typographical oversight.

gas-rich nations, much of his subsequent work has concentrated on non-oil 'hard rock' mineral economies. Both Gelb and Auty argued that the average GDP per capita growth of mineral and energy rich nations from the 1970s onwards had been disappointing. Their contributions have attracted considerable attention.

Yet it has been the subsequent contributions of Jeffrey Sachs and Andrew Warner that have had the greatest impact so far on the debate about whether minerals are a blessing or a curse in developing nations. In their 1995 study, they used multiple regression analysis for a cross-section of 97 **developed** and **developing** nations between 1971 and 1989 and considered factors that explained differences in real GDP per worker growth (for the economically active population). While interested particularly in the impact of natural resource dependence (among which minerals are a major contributor) they also considered a number of other variables. Their model takes the form:

Growth in real GDP per capita (of economically active population)	$= \gamma$	(Log GDP per capita in initial year) +
	α	(Natural resource exports/GDP) +
	β'	(Additional variables)

The first of these variables, the logarithm of GDP per capita in the initial year, has been used in many studies to allow for the observed tendency of affluent countries to grow more slowly than poor countries. Their additional initial variables reflected:

- trade policy openness;
- average annual rates of change in the terms of trade;
- gross domestic investment as a percentage of GDP;
- bureaucratic efficiency (indicating 'corruption, red tape and judicial independence'); and
- income inequality.

In their later studies, they have reported results for slightly different variables and time periods. After allowing for the impact of all of the above factors, Sachs and Warner find that a negative relationship remains between resource abundance and economic growth. This is the 'resource curse' effect.

With more widespread availability of key macroeconomic data from nations around the world since 1970 it is now possible to run the Sachs and Warner regressions to cover three decades. Such regressions generally continue to support the Sachs and Warner initial conclusions for the period between 1970 and 1989[8].

In the light of the above historical observations about the positive impact of mineral development of nations such as Australia, these findings come as a surprise. But Sachs and Warner (1995, p 1) argue also that:

> *The oddity of resource-poor economies outperforming resource-rich economies has been a constant motif of economic history. In the 17th century, resource-poor Netherlands eclipsed Spain, despite the overflow of gold and silver from the Spanish colonies in the New World. In the 19th and 20th centuries, resource-poor countries such as Switzerland and Japan surged ahead of resource-rich countries such as Russia. In the past 30 years the world's star performers have been the resource-poor Newly Industrialising Economies (NIEs) of East Asia – Korea, Taiwan, Hong Kong, Singapore – while many resource-rich economies such as the oil-rich countries of Mexico, Nigeria, Venezuela, have gone bankrupt.*

Even though there are problems with the availability of reliable historical data on Gross Domestic Product and natural resource intensity between nations, Lederman and Maloney (2002) have recently taken up the empirical issue of considering their relationship in earlier periods. They use the GDP data of Maddison (1994) during five periods:

- 1820 to 1870 (19 countries),
- 1870 to 1913 (23 countries),
- 1913 to 1950 (32 countries),
- 1950 to 1973 (37 countries), and
- 1973 to 1989 (37 countries).

They also assume (probably somewhat unrealistically) that the ratio of natural resource exports to GDP for the nations involved between 1820 and 1970 had remained constant at 1970 levels. Because of data limitations, they did not include additional variables in the specification of their model.

They found a **positive** relationship between real GDP growth and natural resource exports as a percentage of GDP between 1820 and 1870, and between 1913 and 1950. There were **negative** relationships between 1870 and 1913; 1950 and 1973; and 1973 and 1989. But *t* values were only significant at the five per cent level in the final two periods. While tentative, these findings question the validity of the resource curse hypothesis over longer periods. Despite their preliminary nature, these findings seem consistent with what has happened in countries such as Australia.

Two other empirical studies by Gylfason (2001) and Torvik (2002) have extended the Sachs and Warner analysis. Gylfason argued that, on average, nations with higher percentage levels of natural capital[9] (subsoil mineral and energy assets, farming and grazing land, forests and fisheries) experienced slower growth in real GDP per capita between 1965 and 1998. He posited that natural capital apparently 'crowds out' human capital in these nations, with fewer resources allocated to education spending. In his paper, Torvik argued that natural resource abundance crowds out entrepreneurial activity.

Many commentators have expressed doubt about whether GDP is the most appropriate measure of total production. For example, it excludes productive non-market activities, as well as those in the informal economy. Any measure of production should also allow for the capital depreciation. For these reasons, national accounting systems struggle to measure production in developing nations. Hence, comparing GDP per capita levels between nations is often misleading, even after allowing for purchasing power parity differences. A more fundamental critique of GDP accounting has arisen from ecological economists whose alternative measures suggest that production is declining.

An alternative approach is to explain and analyse variations in a broader range of variables that reflect economic and social development. Since development involves several dimensions other than income growth, this might involve econometric modelling that seeks to explain variations in factors other than income (eg human development indices). At a more rudimentary level it may simply involve broad data comparisons.

Using this later approach, Davis (1995) focused on the experiences of 79 developing nations (largely in the period between 1970 and 1990). Using the criteria outlined in Table 3.1, he defined 22 as mineral economies throughout the period, while 57 were 'never mineral' economies. A summary of his findings appears in Table 3.6.

8. The basis of this claim is from regressions undertaken by al Rawashdeh (2004).

9. The source of Gylfason's natural capital data was World Bank (1997).

TABLE 3.6

The development progress of long-term mineral economies and 'never mineral' economies – results from Davis (1995).

Mean values	22 mineral economies	57 'never mineral' economies
Life expectancy (% increase – 1960-91)	31.5	26.2
Infant mortality rate (% decline – 1970-90)	48.9	36.5
Calorie supply increase per capita (% increase – 1965-90)	21.1	9.1
Primary school enrolment (% increase – 1970-90)	20.7	16.0
Adult literacy rate (% increase – 1970-90)	47.9	36.0
Human Development Index (% increase – 1970-90)	23.1	20.3

Davis found greater progress in increased life expectancy, infant mortality decline, nutritional increase, primary school enrolment and adult literacy rate increases among the developing mineral economies than their 'never mineral' counterparts. The percentage increase in the Human Development Index between 1970 and 1990 among developing mineral economies was also higher than among the 'never mineral' developing economies sample[10]. While these findings focus on alternative measures, they may not be at odds with the resource curse view. In the above empirical tests in might be argued that the resource curse only refers to trends in economic welfare and not their levels. It may be possible to have slow growth and yet have higher development indicators.

So where does this leave the empirical debate? Despite the important contributions of authors such as Sachs and Warner in developing a body of econometric analysis about the impact of minerals and energy development on economic growth, much remains to be considered. Further econometric analysis might profitably be extended to consider variations in a wider range of development indicators. If such analysis supports the findings of authors such as Sachs and Warner, whose major interest has been in explaining variations in GDP and GDP per worker growth, then the resource curse hypothesis will be on stronger ground. Supporters of the traditional view doubt that such analysis is possible.

INSTITUTIONAL AND POLICY ISSUES

Despite the prognosis of the resource curse hypothesis, the historical experiences of nations such as Australia, which moved from developing to developed status over a relatively short time period suggests that the combination of a favourable **mineral endowment**, well organised and operated **institutions** and appropriate **government policy** can and has led to favourable development outcomes. It is to these later elements that we now turn. The discussion in this section also has links to a more detailed review of mineral policy in Chapters 13 and 15.

If one embraced the resource curse hypothesis, mineral-rich developing nations would be better off not to exploit their mineral wealth. Yet, as well as the apparently depressing list of bad news stories associated with the economic fortunes of mineral economies, several developing nations have derived positive benefit from mining in the past two decades. Two of the most prominent are Chile and Botswana. Each has received considerable attention in academic literature[11]. Others such as Ghana, Namibia, Peru and Tanzania can be added to this list.

Chile's recent experience is of particular interest because, as well as exhibiting strong economic growth, the nation's record with other development indicators has been impressive. Poverty has fallen appreciably, life expectancy has risen to levels similar to those of developed nations, literacy rates are high and the level of post-secondary education has been rising significantly. A summary of some of these trends appears in Table 3.7.

TABLE 3.7

Relative movements of key quality of life indicators in Chile. Source: Maxwell (2004).

Indicator	Chile	High income nations	World
Life expectancy (years)			
1977	67	75	64
1990	72	77	66
2000	75.3	78	67
Infant mortality rate (no per '000 live births)			
1970	78	20	85
1990	17	8	52
2000	10	6	45
Adult literacy rate (per cent)			
1990	93	95.5	60
1999	95.5	na	64
Percentage of age group in tertiary education			
1970	13	36	13
1990	15.6	33	11
1999	37.5	na	na
Percentage income share of top quintile			
1989	48.9	≈25	na
1998	39.1	≈25	na
Percentage of population below the poverty line			
1992	21.6	na	na
1998	21.2	na	na
Human Development Index		**Leading nation**	**Gap**
1975	0.702	0.859	0.157
1990	0.782	0.901	0.119
2000	0.831	0.942	0.111

Also, notwithstanding the continuing strength of the copper industry, other parts of the economy have been developing strongly and several are now competitive.

One way to assess the economic experience of such nations is in terms of the rudimentary framework of Weber-Fahr (2002), which suggests that **economic performance** (encompassing somewhat more than strong economic growth) in mineral-rich nations will depend on both the **quality of economic management** and the **quality and stability of key institutions.**

The **quality of economic management** in any nation depends on a number of factors. The calibre and experience of the civil service is important. So is the integrity and training of the politicians who make up the government. This will come under significant challenge if Dutch disease accompanies a resources boom. A simple conceptual formulation might be that:

Quality of economic management	= f (Quality of civil service and politicians, level of corruption, nature of policy, relative size of resources windfall)

10. This trend is unlikely to have continued since 1990 because of the adverse impacts of the HIV/AIDS epidemic on life expectancy in many mineral-rich African nations.

11. See for example Auty (2001) on the situation in Botswana, and Maxwell (2004) for a discussion about Chile.

Factors affecting the **quality and stability of a nation's institutions** include the size of its human capital stock, national ethos about issues of equity such as poverty, income and wealth inequality and the extent of ethnic and cultural differences within the population.

It is possible, therefore to hypothesise a relationship of the form:

Institutional quality and stability	= f (Human capital stock, poverty and inequality, cultural homogeneity, political harmony)

Joining these two equations together, one might therefore argue that:

Economic performance	= f (Policy environment, relative size of resources windfall, human capital stock, poverty and inequality, cultural homogeneity and political harmony)

where the **policy environment** variable incorporates a combination of the quality of the civil service, political decision-makers and policies formulated, as well as a lack of corruption.

The policy environment, human capital stock and extent of cultural homogeneity and political harmony are all positively related to the process of development. The relative size of the resources windfall and the level of poverty and inequality are inversely related. How a nation develops its mineral energy resources will depend on the interaction of these positive and negative forces. In the case of Chile, it seems clear that the nation has been able to perform well in each of the factor areas that affect the development process[12].

Some other notable recent contributions to the discussion about public policy have been from the World Bank mining group and Richard Auty (the former seem to ascribe more to a resource blessing view of minerals, while the latter sees them more as a curse).

12. For a more detailed discussion on this issue see Maxwell (2004).

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