Minerals and economic development

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1. BACKGROUND AND ISSUES

There would appear to be resurgence in a long debate about the relationship between the development of mineral and energy resources and economic performance. That is countries or regions where mining is important to the economy have generally experienced poor economic performance and higher rates of poverty. This view has led to the World Bank, NGO's and others recommending caution on the part of national or regional governments when attempting to attract investment to discover and develop mineral resources. Two recent and widely read reports commissioned by Oxfam USA have challenged the benefits that developing countries can derive from mining developments.[1] According to the Oxfam foreword to the report by Power (2002):

> *The export of minerals such as gold, silver, copper and zinc is the most important economic activity in many developing countries. Yet despite their mineral wealth, these countries often experience low economic growth and high poverty rates. Indeed, as political scientist Michael Ross demonstrated in an Oxfam America report published last year, "mineral dependent" developing countries appear to suffer from a variety of ills, including poor health care and high rates of child mortality and income inequality.*

Oxfam state that in spite of these problems, governments and institutions like the World Bank continue to promote mining as a 'pathway to development'. Power (2002) questions the contribution that minerals have made to wealthy economies such as the US, Australia and Canada that are often cited as models for resource development The report highlights serious impacts on local communities and the environment. Oxfam recommend that (Power 2002 p. 3).

> *Decisions on the appropriateness of these activities in developing countries must be made in open and fair consultation — and with full respect for the rights of — local communities who will be affected by extractive operations. We also believe in local communities' right to have full information about the impacts and benefits of resource extraction, including access to an honest appraisal of the role these industries have played in the developed world.*

The Oxfam advice is sensible and in the interests of all stakeholders, including mining companies. In this paper, I present a methodology to systematically analyse the impacts of large resource development projects that can assist governments in the design of appropriate policies and regulations so as to maximise the potential income and employment opportunities of such projects. However, it is appropriate to briefly address the merits of the resource curse argument, as the development policy implications stemming from this argument are quite dangerous to development prospects in resource rich regions.

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1 Thomas Michael Power (2002), Digging to Development? A Historical Look at Mining and Economic Development, A report prepared for Oxfam America, September 2002. Ross, Michael L. 2001. Extractive Sectors and the Poor: An Oxfam Report. Boston

My paper addresses the following matters:

- A brief overview of the resources curse issues and its shortcomings;
- The design of regional impact assessments of resource development projects which covers the impacts on all things that people value (income, employment, environmental, health and social).

Resource developments and their regional impacts are multi-dimensional. Each of those dimensions varies somewhat around the world and within national economies. However, the nature of costs and benefits of such projects, from the perspective of the local community, have much in common. There appears to be a common set of policy and regulatory design principles. These principles are largely revealed by a thorough regional impact assessment.

2. RESOURCES: A CURSE OR A BLESSING

The argument that resource development reduces growth prospects and contributes to increased poverty is not obvious. Economic growth is generated among other things by increases in the size of a nation or region's capital stock. Capital consists of social capital (institutions, laws etc), human capital (people and knowledge), physical capital and natural resources. Mineral resources only become capital when they have been identified and development. Then these resources are an addition to the capital stock that should stimulate economic growth.

The empirical evidence for the so-called resources curse is drawn from statistical associations between economic growth rates (and a range of poverty indicators) and a variety of indicators of resource dependence (contribution to GDP, export earnings etc). This analysis has been questioned in recent papers by Eggert (2002) and Davis and Tilton (2002) that highlight shortcomings in the statistical analysis. Rather than focus on these statistical results, it is more important to focus on the mechanisms or channels through which minerals development can contribute to poor economic performance and increased poverty.

My bottom line on resource curse hypothesis is that it is nonsense. Many developing countries are dependent on resource exports. But this is because they have a comparative advantage in resources and not in other activities such as services and manufactures. If policies were adopted to hinder resource development, such countries would be even poorer as productive inputs would be allocated away from where they are most productive.

At least six mechanisms are mentioned in the literature. These are now briefly described and discussed.

Terms of trade effects

For a very long period of time the prices of resource commodities have fallen relative to the prices of other goods and services. Other things equal this means that the income earned from resource exports would have fallen over time. But, this is not necessarily the case.[2] Prices in themselves are no important. They are only important relative to costs. And costs have fallen ahead of reductions in prices so that the profitability of the resources sector has not fallen over time. Costs have fallen because of improvements in extraction and processing technologies. Market competition has allowed the benefits of reduced costs to be passed onto consumers through lower prices of resource commodities and the products manufactured from them.

There is no certainty that resource commodity prices will continue into the future. Prices are near historically high levels at present. The rapid growth of China and India has underwritten firm demand for resources. Relative to population, these giant economies are resource deficient (oil, natural gas, iron ore, base metals, bauxite and even coal). The development of China and India has a long way to go before per capita consumption of resource commodities approaches that of the industrialised countries. There is a strong possibility that continued economic development in these countries would underwrite decades of strong growth in demand for resources and probably rising resource commodity prices.

Price volatility

There is a view that commodity price volatility in harmful to economic development. For volatility to impose substantial costs, it must impact on the real sector of an economy. This is not inevitable. Foreign exchange and financial markets have well developed mechanism to neutralise the impacts of price fluctuations on real incomes. Regardless of the flexibility of nominal exchange rates, real exchange rates work to offset commodity price fluctuations. If the exchange rate is flexible it will fall when commodity prices fall, assisting exporters to maintain competitiveness. Local currency prices of resource commodities are far less volatile than world prices. Financial markets allow exporters to manage risks of volatility and to smooth prices over time. Governments can pursue macroeconomic policies to manage the effects of commodity prices volatility.

There have been a number of attempts to stabilise export earnings, or the release of income from those earnings. Stabilisation funds have a long, but unsuccessful history. There are strong prospects of the mismanagement of these funds including poor investments and diversion of funds to socially unproductive uses.

2 Problems in the measurement of relative prices and the attributes (or qualities) of manufactures and services have cast doubt on whether the observed fall in the relative prices of resources is actually true.

Crowding out and Dutch disease

These mechanisms are related. Crowding out describes the adverse impacts that the resources sector can have on other sectors of the economy that are competing for the same production inputs. In the short-term stocks of labour, capital and infrastructure are in relatively fixed supply. To attract inputs to the sector, prices paid for these inputs must rise, increasing the costs of traditional industries in the local economy. The attractiveness of working and investing in the traditional sector falls relative to the new sector. The traditional sector may therefore shrink in size. This is an efficient adjustment to economic change and should not be impeded. By definition, inputs are being reallocated to a sector that values them more highly. It values these inputs more highly because they are more productively engaged in the new sector. However, while there is likely to be a gain in total regional income, some groups in the community will suffer losses. There may be a case to compensate those adversely affected or to assist them in adjusting to the new economic order.

Dutch disease is similar to crowding out, except that it involves external account forces. The capital inflows to build resource projects and the subsequent increase in export earnings forces an appreciation of the real exchanger ate. This has the effect of lowering export prices and import prices across the board. As a result the profitability of traditional exporting and income competing industries declines somewhat and these industries may shrink. However, this does not result in a reduction in national income, only a change in the industrial composition of that income.

Environmental, health and social costs

Large-scale resource developments can have strong impacts (positive or negative) on the environment, on health and on the local community. Air and ground water pollution can seriously impact on local ecosystems and impose direct costs on other industries and households. Pollution can have serious health implications that impose significant costs on households and local governments. There are numerous studies describing the social impacts of large projects. However, mining projects can also deliver significant improvements in local conditions. The environmental technology or know how brought to the region to manage the impacts of the project can often be applied to addressing pre-existing environmental issues. The introduction of a project can have positive health benefits for the local community, particularly in isolated areas, through increasing the linkages between the region and the rest of the world. Companies often willingly open the doors of their staff health clinics to local residents.

Adverse impacts on the environment, community health and the social fabric are not inevitable. Regulations can be designed to control these impacts. Project design can be adapted to internalise these externalities. The latter is not only in the interests of local residents, but also in the interests of the longer-term financial viability of the project itself.

Governance impacts

This refers to a wide range of effects that a large project and the economic rents that it generates can lead to deterioration in the performance of local and national governments. Revenue from large resource development projects can often be substantial and this can result in substantial rent seeking activity. The rents from resource projects flowing into local and central government coffers are compensation to the community who has ownership rights to the resource and compensation to the community for the adverse impacts of projects on their environment, health and society. However, in may cases the flow of revenues to local governments and the community are small compared to what flows to central governments in the form of income taxes. The costs are borne locally but the compensation is delivered to the national capital. In many instances these revenues are diverted to private and socially unproductive purposes.

The nation's capital stock, the basis for generating future income growth, consists of natural and man-made assets. Natural resource depletion in a regional economy reduces the stock of natural capital and the ability to earn future income. However, if compensation for the depletion of natural assets is invested in increasing the stock of man made assets it is possible to increase the total capital stock available to the community. This requires that revenues flowing from the project be wisely invested in the creation of assets that generate the maximum social benefits. Areas such as education, infrastructure, health and the environment and industry development provide high social rates of return. The theft of rents, the use of rents to subsidise current levels of consumption or the investment of rents in non-viable projects can reduce the region's capital stock and the development potential of a region.

To conclude this brief look at the mechanisms that might cause resource developments to have negative community impacts, the main areas of concern are in relation to externalities (environment, health and society) and in relation to misuse of revenues paid by mining projects to local and central governments. These adverse impacts are not inevitable and can be avoided through good governance and careful study of the potential impacts of resource development projects.

3. APPROACHES TO REGIONAL IMPACT ASSESSMENT

There are a number of possible approaches to economic impact assessment that differ significantly in their information requirements, their degree of sophistication and the reliability of the results. In this section we briefly consider the advantages and disadvantages of these approaches. The main approaches are as follows:

Cost benefit analysis

Cost benefit analysis focuses on the financial and economic impacts of the project. An economic cost benefit study differs from a financial analysis by correcting for departures from market prices. For example, it adjusts prices for distortions introduced by taxes, subsidies and other government interventions.

Social cost benefit analysis

Social cost benefit analysis broadens out the scope of the study to include environmental, health and social costs and benefits. Sometimes an attempt is made to quantify these impacts.

Input-output analysis

Input-output analysis employs data bases that tracks interactions between each industry sector of the regional economy, households, governments and other parts of the national economy and the world economy. This approach is important because it attempts to measure not only the direct economic costs and benefits (such as those identified in a cost benefit analysis) but it also measures the indirect and induced implications of the project for the local economy. However, this approach does result in an overstatement of regional benefits and an understatement of the costs. It does this because the approach assumes that resources are freely available to the project and not competed away from other industries through changes in relative prices of inputs and outputs. Basically, input output analysis ignores the economic costs imposed on other industries and overstates the flow-on benefits to these industries.

General equilibrium models

Computable general equilibrium (CGE) models are based on input-output tables but also include a range of economic relationships that provide a more realistic representation of how an economy adjusts to a new project or a policy change. Transactions in input-output tables are divided into price and quantity components, with both allowed to adjust with changes in supply and demand factors. CGE models incorporate a series of behavioural assumptions.

Producers are assumed to maximise profits. Product and factor markets are assumed to be competitive. Profit maximisation dictates that firms act so as to minimise costs and factors are generally responsive to price changes. Households are assumed to maximise utility in their consumption decisions, responding to price differences across goods and services. Finally, prices adjust in goods, services, and factor markets to equate demand and supply.

The majority of CGE models can be separated into two broad categories, comparative static and recursive-dynamic. Like the I-O model, the comparative static CGE model does not contain any explicit time dimension. A recursive-dynamic CGE model can be linked to a macro-econometric model to produce a ‘business-as-usual’ forecast. The CGE model can then be used to trace out a specific time path of the economy following the change in the policy or introduction of the project. The economic adjustment can then be determined by the difference between the two alternative time paths.

The application of CGE models

A regional impact assessment with a CGE model involves a number of tasks, culminating in the estimation of the impacts of the project on the regional and national economies and the various stakeholders.

Task 1: Understanding of the nature of the project.

The various options that could be followed in developing the resource need to be identified. This will also involve identifying the demands for infrastructure services under each of the options. It is also critical to identify the stakeholders to the project. These are defined as all those persons or groups whose livelihood is impacted by the project.

Task 2: Financial and economic parameters of the project and associated infrastructure requirements.

The normal approach to establishing the economic and financial parameters of a project of this type is to source information from company financial studies. What are needed are the future streams of production by volume and value, price assumptions, major intermediate inputs by value, labour force (by different skill or occupational categories), royalty and taxation arrangements (income tax, royalties, import duty, local government taxes etc).

Task 3: The baseline scenario

Economic models measure the impact of a project against a baseline that describes how the economy would have moved in the absence of the project. Key elements of the baseline are projections or assumptions about economic growth, interest rates, inflation, exchange rates, economic structure, employment etc. An important element of the baseline will be determining what other major projects are likely to be built over the timeframe for the project and what that might imply for competition for the available resources (principally construction labour and infrastructure).

Task 4: Modelling methodology and assumptions

A general equilibrium (GE) model used to measure the economic impacts of the project rests on theoretical assumptions about how the economy functions. These assumptions need to be clearly spelt out. A number of the assumptions have important implications for the economic impact of the project at a regional, state and national level.

Task 5: Model estimation

The model produces impacts on a full range of economic parameters such as GDP, household income, government revenue, imports, exports, employment etc. It will also show the impact on other sectors of the economy in terms of their value of output and employment. These impacts can be estimated for the regional, provincial and national economies.

Task 6: Reality check and sensitivity analysis

The results need to be careful tested against economic theory and against plain common sense. Solving for economic impacts using GE models involves complex, and approximate, computational methods. The results therefore need to be carefully assessed.

Task 7: Assessment of broader economic implications arising from the project

GE models, while capturing most of the key economic implications of a project, do not capture a number of dynamic implications. For example, the measured impacts on the local economies are based on expansions or contractions of the activities are already located in the region. They do not anticipate the entry of input suppliers to the region or the development of new industries in the region as a result of various synergies with the Project. These implications need to be taken into account exogenously.

Task 8: Assessment of local and national government revenue and expenditure implications

On the revenue side, there is a need to estimate taxation revenue flows over time to all levels of government. These revenues include corporate income tax (taking into account allowable deductions, depreciation etc), mineral royalties, local government taxes and charges, import duties, consumption taxes etc. GE models normally assume that projects pay an average tax rate (around 30 percent). However, this will vary substantially across projects. It is therefore necessary to model tax flows explicitly using the project financial analysis.

Task 9: Assessment of local and regional impacts on industry development, Aboriginal participation in the economy, and infrastructure

The modelling will estimate the economic impact at the local or regional level in terms of potential employment and business development opportunities. To demonstrate opportunities for groups within the community, it is necessary to take a more micro approach in identifying what services would be required and the capacity of local groups to deliver those services.

Task 10: Identification of environmental, health and social impacts

GE models normally do not measure these impacts and a separate analysis of these impacts has to be undertaken. This is a result of the complexity of these impacts and the difficulty of formally modelling these impacts.

4. AN ILLUSTRATION OF REGIONAL ECONOMIC BENEFITS

The local benefits from mining projects are often not very well understood. Often, simplistic assessments seriously overstake local benefits and understate costs imposed. For example, the increase in gross regional product is often used as a measure of the economic contribution of the project to the community. However, this increase in gross regional product, or the value added of the project, is a source of income for all stakeholders involved, both within and outside of the region.

These stakeholders include:

- Foreign investors and investors from other regions;
- Local shareholders;
- Local workers;
- Central Government;
- Provincial Government; and
- Local business.

The following provides a simple example that illustrates the types of income benefits that flow to local communities from resource developments. The estimates are from a hypothetical bauxite-alumina project. If a GE framework was employed, the results would be much more detailed and complete, but such an exercise is beyond the scope of my paper today.

The project has the following features:

- Production of 3.5 million tonnes of dry beneficiated bauxite to be used as feedstock for a 1.5 million tonne alumina refinery;
- Coal provides the source of energy and gas for the project;
- The capital cost is assumed to be $1.5 billion, including mine, plant and infrastructure; and
- An alumina price of $220 per tonne is assumed.

The project has annual revenues of $330 million a year. Now, where is this revenue applied?

Investors are assumed to require a 10 percent rate of return on capital to justify investing in the project. This is a before tax rate of return. This rate of return is based on a combination of debt and equity funding, known as a weighted average cost of capital. This implies that about $150 million of the revenues is required to recoup the cost of capital. In economic terms this return to capital should be considered as a cost of investing in the project.

Normally projects have a high foreign equity share. Assume that 60 percent of the project is financed by foreigners, 30 percent from other parts of the nation and ten percent by locals. Assuming a tax rate of 30 percent, the return to capital is divided as follows:

- $45 million to the central government in taxation revenues;
- $63 million to foreign shareholders;
- $31 million a year to other provinces; and
- $10 million a year to local shareholders.

The project would employ around 1,000 local workers and it is assumed they are paid $4,000 per year on average. There is a temptation to treat this entire amount as benefits to labour. However, this is no the case since there is an opportunity cost of labour. Workers would be drawn from other jobs or from subsistence mining so they are diverted from other economic activities. Workers only benefit to the extent that the wage exceeds their opportunity cost. Jobs in mining projects are relatively highly paid. Therefore, we assume that benefits to local workers amount to $2 million.

The project has intermediate inputs of $150 million, of which:

- Caustic soda accounts for $40 million and this is imported;
- Energy inputs are valued at $40 million and are locally supplied; and
- Other inputs amount to around %50 million of which 50 percent is local content.

Therefore, local business gets $55 million in new business. But this is not all benefit as there are costs associated with the supply of goods and services. A reasonable assumption is that the value added (ie payments to business owners and workers) amounts to about 20 percent of this business. This implies $11 million in additional income. However, it is important to take into account opportunity costs. If the project merely involves a transfer of business from existing business towards the new project there would be little additional profits from supplying the new project.

A major input into alumina production is bauxite. If the bauxite is locally mined, depending on the allocation of responsibility for resource taxation, provincial governments can charge a royalty on mined bauxite. Commonly, provincial governments charge a royalty of $1 per tonne. This implies royalty payments of $3.1 million a year to the provincial government. In some cases it is appropriate to charge a higher royalty rate. The quality of bauxite deposits and the costs of mining them vary significantly. Some deposits are highly profitable and others are marginal. It is reasonable to impose a higher royalty charge on the former in order to capture what economists call resource rents.

In total the direct increase in income flowing from the project to the community is around $30 million a year. This is significant, but it is only around 10 percent of project revenues. This share reflects the contribution of the local community to the value created by the project. Provided that local community inputs to the project are priced according to their market value, there can be no complaint about this share of project incomes. If the community attempts to extract more than this share, the project would not proceed since the remaining revenues would not cover the projects costs. From the perspective of the local community, the returns to stakeholders outside of the community should be considered as necessary costs for the project to proceed.

The above analysis is only of the direct impact of the project on local incomes. In addition to this benefit, the project will have a range of indirect and flow-on effects. The $30 million increase in local incomes is invested or spent within the community creating a further round of income and employment creation. Typically, indirect income benefits are at least equal to the direct income benefits from the project.

5. CONCLUSION

In Australia, State Governments have long been concerned with the impacts of projects on regional economic development, the local environment and local communities. It has become standard practice for regional impact assessments to be undertaken to show whether economic benefits exceed any local costs. These assessments identify who wins and who loses. This is valuable information to both government and mining companies. Often with complex projects it is not clear what stakeholders are impacted and the nature of those impacts. This is because the effects of the project on any stakeholder may be very indirect, but still significant. Many stakeholders have concerns and these concerns are legitimate they need to be addressed.

The results of a regional impact assessment can be used to refine the design of the project so as to mitigate adverse impacts on particular stakeholders. Ideally, when running a regional impact assessment, a number of options are considered. Among these options, it is in the interests of the community for the company to adopt that option that maximises the collective welfare of all stakeholders.

Impact assessment involves the use of very complex models of national and regional economies. In Australia, I have undertaken many regional impact assessments for companies such as Alcoa, Alcan and Shell using a GE model of the Australian economy known as Monash and developed by the Centre of Policy Studies at Monash University. The capacity to undertake impact analysis in China is being developed. Ultimately, CRAI in association with Monash University will have the capacity to model the local impacts of resource developments in all of China's provinces, including Shanxi Province.

The model, in conjunction with other techniques, could also be used to assist in the design of a policy and regulatory framework to guide the development of the mining sector in Shanxi province. In particular, the model can be used to show the economic implications of alternative policy approaches, allowing governments to identify the most efficient approach to achieving economic development objectives. The model can also be used to demonstrate the community benefits from investing in improving the economic efficiency and the safety performance of the mining industry in the province. Another application of the model is in planning for future investments in infrastructure that is required by the sector.