

**Performance Evaluation of Public
Sector Enterprises: The Case of
Mining In Bolivia and Indonesia**

S. Malcolm Gillis and Glenn P. Jenkins

PERFORMANCE EVALUATION OF PUBLIC SECTOR ENTERPRISES: THE CASE OF MINING IN BOLIVIA AND INDONESIA

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I. INTRODUCTION

The purpose of this paper is to outline an approach to the evaluation of public sector enterprise performance that attempts to integrate aspects of the financial, economic and social objectives that these organizations often strive to attain. To provide an empirical basis for this discussion we will draw heavily on our experience of the mining sectors in Bolivia and Indonesia, which are dominated by public enterprises.

It is generally incorrect to assume that governments as owners of public enterprises provide a clear set of long-run objectives to guide decision making in these firms. Often the political process is such that directives are given to alleviate short-run problems which may divert the enterprise from its longer term objectives. The numerous objectives that are expressed as guidelines for public sector enterprise performance can be generally classified into three types. Firstly, there are those which are financial, in that they deal with the revenues and costs of the firm or the budgetary relationship between the enterprise and the government. Secondly, there are economic objectives that are related to efficient allocation of the country's scarce resources and to the net contribution of the enterprise to the output and growth of the economy in general. Thirdly, public enterprises have distributional objectives which are often referred to as the enterprises 'social' objectives. These objectives usually are concerned with the level of income, wealth, or privilege, of various subgroups of

the population. Government objectives that are viewed as 'political' often can be analysed as distributional objectives, because political favours usually have as their principal goal an income distributional impact on someone. Actions require the use of scarce resources, thus if a public enterprise is used as an agent to attain these objectives it can be evaluated to see if it is being used to meet the specific political objective in a cost effective manner.

Often in the evaluation of the performance of public sector enterprises there is a tendency to examine the financial, economic and distributional impacts of an enterprise as three independent outcomes of the firm's activity. However, these areas of public sector performance are generally closely interrelated and should be viewed as three stages of an overall evaluation of a public sector activity. A necessary condition before an enterprise can have a significant long term distributional impact is for the firm to be viable financially. Similarly, the economic attractiveness of a firm depends heavily on the ability of the firm to generate output in an efficient manner so that a surplus exists to be distributed either to the workers or to governments in the form of taxes, dividends and/or to consumers through lower prices. Only when these externalities are created will the economic appraisal of a firm differ from its financial performance.

A serious problem faced by analysts concerned with performance evaluation of public enterprises is to determine what will be the criteria for measuring its financial, economic and distributional effectiveness. The mistake is often made when these enterprises are compared using private business financial criteria even though their financing sources and cost of finance as well as their wage and pricing policies are entirely different, and perhaps even outside the control of the enterprise. A more meaningful approach is to compare public enterprises with private firms or with other public enterprises on the basis of their economic performance when all measureable externalities such as taxes, subsidies, consumer surplus and environmental externalities (such as congestion) are included. However, this is not meant to imply that the financial performance of public enterprises does not matter. Financially weak enterprises that continuously have to rely on government subsidies and emergency assistance will generally find it very difficult to formulate and carry out a consistent

business plan, essential for the development of a healthy firm. Therefore, it may be important that enterprises that could potentially generate measurable net returns to the economy be allowed to retain enough of the total economic benefits to enable them to be financially viable.

In undertaking a comparative study of public sector enterprises it is always difficult to normalize for the different technological factors between industries while evaluating the performance of enterprises for those variables under the control of government or management. It may be impossible to isolate which policies are successful when comparing enterprises as diverse as a utility, a mine and a trading company, but if a comparison is made between a set of firms within any one of these industries it is much easier to distinguish between the effects of the technological characteristics of the industry and the impact of government or managerial policies on the performance of the enterprise.

The cases of public sector mining firms in Bolivia and Indonesia provide an important base for the analysis of the public sector mining enterprises because both sectors are dominated by tin production, and in both countries there are also private enterprises operating in the mining sector. A brief review of the nature of these public enterprises will be made later in this paper.

II. FINANCIAL ANALYSIS AND PUBLIC SECTOR ENTERPRISE PERFORMANCE

Public sector enterprises typically operate in a very different financial environment than do private enterprises. Usually they obtain their investment funds from another government agency at a price that differs substantially from the cost of such funds paid by private enterprises in the same country. In addition, many public enterprises do not pay the same rate of taxes or are free to set their prices to the same degree as are private firms.

Because of these large discrepancies between what is usually considered the basis for a financial evaluation of a firm's performance and the situation faced by most public enterprises, should we consider carefully the proper use of the traditional financial analysis measures such as the financial rate of return as a guide to the evalua-

tion of public sector performance? We think that the answer to this question is that the traditional financial analysis of public sector enterprises, including the calculation of the rate of return and a ratio analysis of asset and liabilities categories, will more often than not lead to spurious results. However, the use of financial data will give us very important information concerning the financial resources available to the enterprise in conducting its day to day affairs and implementing its expansion programs. They will also indicate the degree of financial independence from the government that a particular enterprise enjoys.

In this case the examination of the annual net financial cash flows will provide a more useful indication of the ability of this enterprise to continue operation than will a discounted cash flow or an internal rate of return. The data used to construct this net cash flow will also be an essential ingredient for the completion of an economic analysis.¹ Table 1 contains a listing of the items that are included in such an analysis. The detailed breakdown of the revenue, input cost and investment expenditures is provided to indicate the level of data required to extend the financial analysis into an evaluation of the economic and distributional impact of the enterprise.

Typically a financial cash flow statement will only contain the summary data provided in items 6, 14, 25, 33, 38, 41, 42, 43, 44, 45, 46 and 47 in Table 1. However, the information provided by the sub-components is largely accounting data or can be readily estimated from the accounts of the firm. The examination of the net financial cash flow of a public enterprise for a number of consecutive years will reveal its source of revenue, i.e. whether from sales of traded goods, non-traded goods or from government revenues. It will also tell us if the firm has had liquidity problems or if it has generated excess cash which might be put to better use elsewhere. If the firm does have a liquidity problem the analysis of the financial cash flow will tell us the sources of additional funds and a judgement can be made as to whether or not this financing has been adequate. It will also indicate the problems that will likely occur in the future and the financial capability of the enterprise to carry out a program of expansion.

It is important to realize that the existence of a large positive financial cash flow tells us little or nothing about the attractiveness

Table 1
VARIABLES USED TO CONSTRUCT THE FINANCIAL NET
CASH FLOW OF PUBLIC ENTERPRISE

ITEM	(+) cash inflow (-) cash outflow	PERIODS (- -n)
REVENUE		
1.	Quantities and Sales Revenue from Traded Output (+)	
2.	Quantities and Sales Revenue from Non Traded Output (+)	
3.	Sales taxes paid on Traded Output (-)	
4.	Sales taxes paid on non-traded Output (-)	
5.	Unit subsidies (+)	
6.	Total Revenue (1 + 2 + 5 - 3 - 4) (+)	
VARIABLE COSTS		
LABOUR		
7.	Unskilled labour (operating) Wages (-)	
8.	Social security and other indirect labour costs (-)	
9.	Semi-skilled labour (operating) wages (-)	
10.	Social security and other indirect labour costs (-)	
11.	Skilled labour (operating) wages (-)	
12.	Social security and other indirect labour costs (-)	
13.	Total costs of Foreign labour (-)	
14.	TOTAL LABOUR COSTS (7 + 8 + 9 + 10 + 11 + 12 + 13) (-)	
MATERIAL AND SERVICES		
15.	Non-traded goods purchases (-)	
16.	Taxes on non-traded inputs (-)	
17.	Traded input purchased locally supplied (-)	
18.	Taxes on locally produced traded inputs (-)	
19.	Imported input purchases (-)	
20.	Tariffs and Taxes on Imported inputs (-)	
21.	Non-Traded services (-)	
22.	Taxes on Non-traded services (-)	
23.	Trades services (-)	
24.	Taxes on Traded Services (-)	

25. TOTAL COSTS OF GOODS AND SERVICES (-)

INVESTMENT COSTS

Plant and Equipment

- 26. Unskilled construction labour costs (-)
- 27. Semi-skilled construction labour costs (-)
- 28. Skilled construction labour costs (-)
- 29. Non-traded investment input (-)
- 30. Taxes on non-traded investment inputs (-)
- 31. Traded Investment inputs (-)
- 32. Tariff and taxes on traded investment inputs (-)
- 33. TOTAL INVESTMENT IN PLANT AND EQUIPMENT (-)

INFRASTRUCTURE

- 34. Labour costs by level of skill (-)
- 35. Cost of input Non-traded, locally produced traded and imported (-)
- 36. Maintenance Cost of Infrastructures (-)
- 37. Government contribution to cost and maintenance of Infrastructure (+)
- 38. TOTAL INFRASTRUCTURE COSTS (+)

WORKING CAPITAL

- 39. Additions to cash required for business operation (-)
- 40. Additions to inventories of finished goods (-)
- 41. TOTAL COST OF WORKING CAPITAL (-) or (+)

FINANCING

- 42. Loans obtained, short and long term (+)
- 43. Interest payments (cost of loan servicing) (-)
- 44. Loan repayments (-)

TAXES

- 45. Income Taxes (-)
- 46. Property Taxes (-)
- 47. NET FINANCIAL CASH FLOW (+) (-)

to the country of past or future investment decisions concerning this activity. The public enterprise may have a large positive financial net cash flow because it is receiving large output subsidies (item 5) from the government, or because its cost of capital is held artificially low by government policies (item 43). Both of these factors would distort the true productivity of the enterprise. Public enterprises also often have this true productivity distorted in a way that makes them appear unattractive with very small (or negative) financial cash flows. Government policies such as price ceilings cause some of the values of the product to get transferred to consumers without financial remuneration being made to the public enterprise, which results in sales revenue (items 1 and 2) being biased downward. Also often labour costs (items 7 through 12) in public sector enterprises are inflated by wage rates that are far above the supply prices that these workers would be willing to work for and thus the financial wage payments partially represent simple redistributive transfers to these labour groups. These distortions will cause the financial performance of the enterprise to appear to be poor while in fact it might be an economically productive enterprise. To summarize, the financial analysis of a public sector enterprise may provide valuable information on the ability of the firm to survive and implement future investment plans but an economic analysis is required in order to evaluate the performance of an enterprise to determine if the country's scarce resources are being used efficiently in promoting economic development in the country.

**III. ECONOMIC ANALYSIS AND PUBLIC SECTOR
ENTERPRISE PERFORMANCE**

To move from a financial to an economic analysis there are three types of adjustments that have to be made to the financial data. First there are certain items that are viewed as costs and benefits by the enterprise such as taxes and subsidies, but these are only income transfers between the government and the enterprise and thus should not be deducted or added to the cash flow of the enterprise. From Table 1, such taxes are, sales taxes paid on traded and non-traded output (items 3 and 4), taxes on locally produced traded inputs (item 18), taxes and tariffs on imported inputs (item 20), taxes

on traded service inputs (item 23), taxes and tariffs on traded investment and infrastructure inputs (items 32 and 36) and income and property taxes (items 45 and 46). All these items should be added back to the net financial cash flow to derive the net economic benefit stream generated by the public enterprise. Similarly, unit subsidies, (item 5) and government contributions to cost and maintenance of infrastructure should be subtracted from the firm's cash flow as they are only transfers from the government and are not a measure of the value of output generated by the enterprise². Another adjustment of this type arises because typically a financial analysis looks at profitability of the enterprise from the owner's point of view. From this perspective loans are additional to the enterprise's cash flow and loan repayments and interest payments are costs.

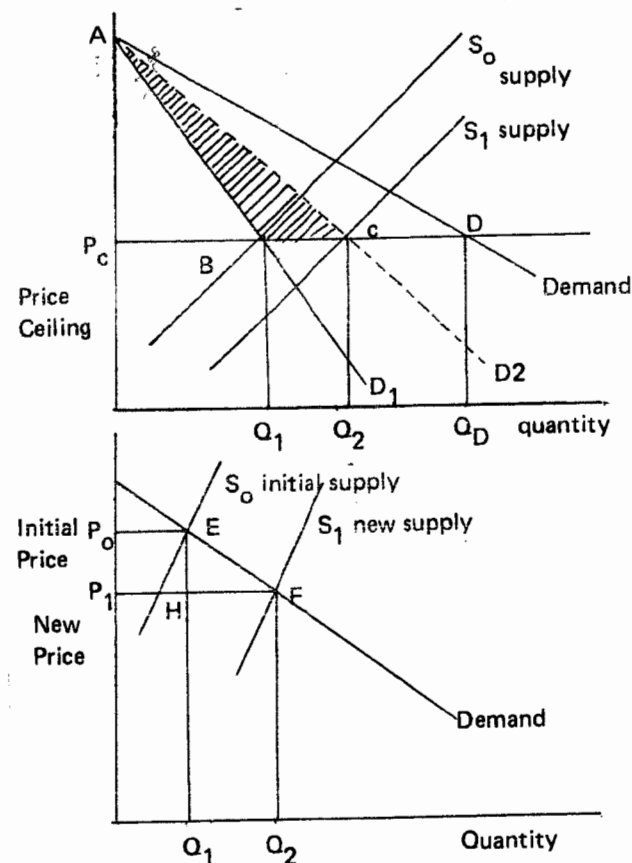
However, the economic worthiness of the enterprise should not be determined by the type of financing that it has arranged, but by the use it has made of the inputs of capital investment and labour. Thus, loans are not treated as positive additions to the economic benefit stream of the enterprise nor are loan repayments and interest payments deducted.

The second type of adjustment to be made to the financial data occurs because some of the financial payments to inputs do not reflect their opportunity cost to the economy. Also sometimes the gross of sales tax price paid by consumers of a product does not reflect its true value to the economy. On the input side, payments to labour are the most common source of discrepancy between financial and economic cost. Often because of the policy of the public enterprise or the minimum wage laws particular groups of labour are paid significantly more than the minimum as they would be willing to present themselves for work at the enterprise, given the range of alternatives available to them. When this occurs the opportunity cost to the economy of using this labour in the public enterprise will generally be less than the financial wage paid. Therefore, we should not charge the enterprise with payments to labour over and above the amount that represents labour's economic opportunity cost if we want to measure the net economic benefits produced by this activity. To do this the opportunity cost of labour is substituted for the financial cost of labour that appeared in the financial statements. The methodology for estimating the opportunity cost of labour will not

be presented here as it is treated extensively in the literature concerned with social cost benefit analysis.³ This same adjustment should be made for all financial costs which do not reflect their economic resource costs.

Economic benefits will not be accurately measured by the gross of sales tax price of the output if this price is either held down by government regulations or if the additional production of the public enterprise causes the market prices for the items it produce to fall⁴. These two situations are shown in Figure 1A and 1B.

Figure 1



A
Value of Increased
Production if Price
Ceiling and Rationing.

B
Value of Increased
Output if Market
Price Falls

In Figure 1A the price of the good is maintained by a price ceiling at a level P_c at which a quantity Q_1 is supplied. At this price a greater quantity Q_D will be demanded, thus, the quantity supplied Q_1 will have to be rationed among the consumers of the good. If the demand is rationed in a way so that everyone receives a given proportion of the quantity he would want to purchase if at the price P_c then the effective demand curve is represented by the line AD_1 . If the public enterprise now increases the supply of the good to Q_2 in the market by an amount of $(Q_2 - Q_1)$ it will receive sales revenue equal to $Q_1 BC Q_2$. This is less than what society as a whole values the output because now the degree of rationing can be somewhat relaxed. The effective demand curve is now AD_2 . Thus, consumers will gain in consumer surplus an amount BAC increasing the economic value of the production of by $Q_1 B AC Q_2$. This additional area BAC can be measured as $\frac{1}{2} (P_{MAX} - P_c) (Q_2 - Q_1)$. Where P_{MAX} is the maximum price any of the consumers would pay to consume the good, P_c is the ceiling price and $(Q_2 - Q_1)$ is the number of units of the goods and services produced by the firm. If the increase in the value of sales is taken as the full measure of the economic value of production it may seriously under-estimate the economic value of the output in the case where price ceilings are enforced in the market for the good.

Figure 1B illustrates the market for a good where the public enterprise production has a significant impact on the price at which the good is traded in the market. If the initial quantity of goods demanded and supplied in the market is Q_1 at a price of P_0 and the public enterprise expands total supply by an amount $(Q_1 - Q_1)$, then the market price must fall to P_1 in order for the market to clear. In this case the enterprise will receive an amount $Q_1 H F Q_2$ for its output, however, this again will measure the economic value of the increased sales. The fall in price will cause an increase in consumers' surplus equal to the area $P_0 EF P_1$ in figure 1B. One part of this consumer surplus, $P_0 EH P_1$, is just a transfer from producers to consumers and will net out if the good was previously domestically supplied. However, the other part of the consumer surplus represented by the triangle EPF is a net gain in economic welfare which is not reflected in the gross of sales tax revenues received for the product.

This area can also be estimated as $\frac{1}{2} (P_1 - P_0)(Q_2 - Q_1)$ or one half of the change in price times the quantity of output produced, which will be exact in the case of linear demand and supply functions and an approximate measure if they are otherwise. The value of this additional consumer surplus would be added to the value of the output of the public enterprise in order to estimate its total social output. In the case of public sector enterprises we would expect this adjustment to be very small because the price of most mineral products are fixed by the world market. However, public enterprises in other sectors have often been created to augment the supply of a good that is in short supply because of price controls, and they have also been formed to decrease the power of domestic monopolies. In both of these cases the value of the additional consumer surplus created by the enterprise is an essential element in the evaluation of the performance of the enterprise. There is nothing 'unreal' about consumer surplus, it is simply income that is left in the hands of consumers that they would have been willing to give up to producers in exchange for the goods, but because of the market circumstances were not required to do so.

The third set of adjustments that need to be made to the financial analysis to construct an economic evaluation arises because some of the investments made by the enterprise will have spill-over effects on the community at large. These are particularly significant in the case of mining projects or any large scale enterprise that is set up in a rural area.

Roads, electrical generation for facilities, hospitals, schools, housing, and recreational facilities are investments that are often made by enterprises in communities where they are operating. It is often asserted that the cost of these items should not be included as a cost of the enterprise as the services generated by this community infrastructure are external benefits created by the firm. Alternatively, if the costs are attributed to the enterprise then the services provided by this infrastructure should be added to the other output or benefits that constitute the primary purpose of the enterprise's operations.

In the next section of this paper we wish to outline in some detail methods for the evaluation of the social benefits and costs that should be appropriated to the enterprise for these facilities that are

used by the community at large. Often, projects are justified or losses explained away because of these social externalities. Therefore, it is important that as accurate a measure as is feasible be made of these costs and benefits in order for the economic evaluation to accurately reflect the contribution of the enterprise to economic development.

IV. EVALUATION OF SOCIAL EXTERNALITIES FROM INVESTMENT MADE BY PUBLIC ENTERPRISES IN COMMUNITY INFRASTRUCTURE.

To identify what is or is not an external benefit from this infrastructure investment it is necessary to determine what proportion of the expenditures on these facilities is required in order to induce sufficient labour to work in this enterprise in its particular location. It is also necessary to measure the value placed on the community services that are now available to other individuals in other parts of the country because some workers have moved from these areas to work in this enterprise.

To analyze this problem we will examine two alternative cases that are descriptive of many natural resource operations such as mining, petroleum and timber activities. First, a methodology will be developed for evaluating community infrastructure in a situation where prior to the enterprise beginning its operations no significant level of habitation existed in the immediate area. In the second case we assume a community existed prior to the development of the activity. The enterprise employs a significant amount of its labour from the local population, but also attracts skilled workers from other parts of the country. A substantial number of people in the community who are not directly or indirectly employed by the enterprise are able to use some of the community infrastructure constructed by the enterprise.

a. Remote Region Location

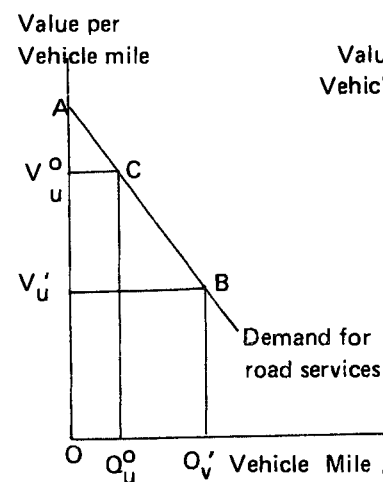
When an enterprise is located in a region where no previous community existed then as a first approximation all community infrastructure cost including such things as roads which may also be used by the labourers in non-work related activities should be in-

cluded as costs of the enterprise operations. The key questions to ask are: (a) would this infrastructure investment have been made for the community by some other government agency if the enterprise were not in the region, and (b) are these infrastructure investments just adequate or are they more than adequate to attract the incremental labour force required by the enterprise to the region?

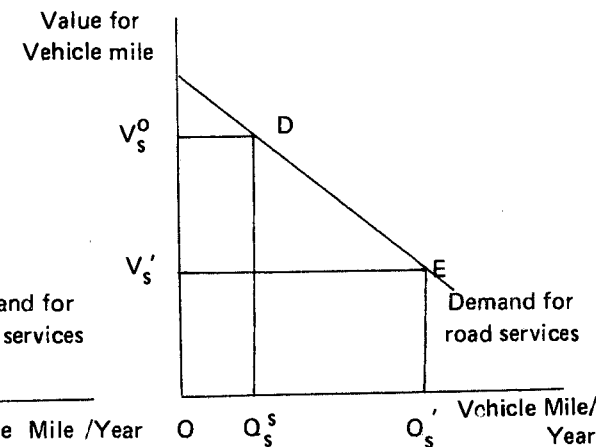
If these facilities would not have been built without the existence of a firm and the investments are just adequate to attract the required amount and quality of labour to the area then the surplus or economic rent received by the intramarginal labour should be included as an externality to the firm together with the value of facilities released elsewhere. The unskilled labour will place a relatively low evaluation on such items as roads and electricity facilities as they do not have or can afford a smaller quantity of the capital items, e.g. automobiles and appliances, that are complementary to the consumption of the services from these community infrastructure investments. On the other hand the skilled and other higher income workers will value these items more as they already have or plan to purchase a significant quantity of the complementary capital items. These two evaluations can be illustrated by the compensated demand curves shown in figure 2A and 2B.

Figure 2

A: Unskilled Worker



B: Skilled Worker



V_u^o and V_s^o are the total value of time, gasoline, maintenance, depreciation expended per vehicle mile by skilled and unskilled workers prior to the road improvement, V'_u and V'_s refer to these same costs after the road has been upgraded.

The value that the unskilled (low income) workers place on the road improvement is the difference between what it would cost them to make the trip if the road were not improved V_u^o and what it costs with the improved road V'_u times their previous quantity of trips Q_u^o plus the marginal valuation of the increased use they make of the road.

If we approximate the demand for road services by a linear curve then the value that a representative unskilled worker places on this service per year can be written as follows:

Annual Benefits

- (1) from road improvement
for an unskilled worker

$$= (V_u^o - V'_u) Q_u^o + \frac{1}{2} [(V_u^o - V'_u)(Q'_u - Q_u^o)]$$

Annual Benefits

- (2) from road improvement
for a skilled worker

$$= (V_s^o - V'_s) Q_s^o + \frac{1}{2} [(V_s^o - V'_s)(Q'_s - Q_s^o)]$$

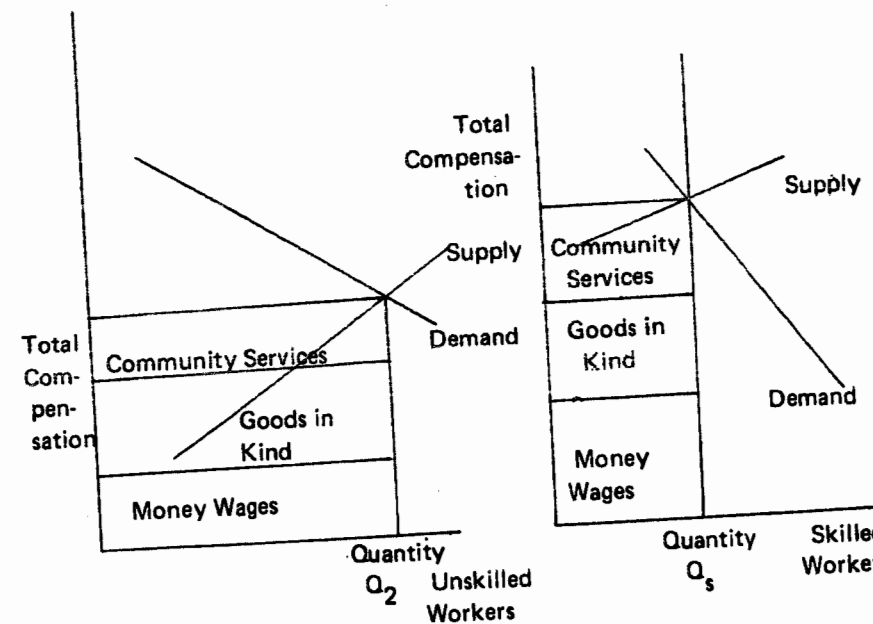
It is important to note that the value of expression (1) for the unskilled worker will generally be much less than the value of expression (2) for the skilled workers and management even though the road is available to all the people who live in the community. We would also expect that the total costs per vehicle mile V'_s for skilled workers would be significantly larger than the cost per mile for unskilled worker V'_u because of the greater value placed on the time required for travel in the case of the skilled workers. By the same reasoning it is also expected V'_s will be greater than V'_u . However, the ratio of V_s^o/V'_s will probably be larger than the ratio of V_u^o/V'_u because the overall travel costs of higher income people will fall by a greater proportion due to the road improvement because the time

costs of travel are a larger proportion of the total costs of travel for the high income individuals.

In the decision to work in a remote community the workers of different types will require a level of compensation that is a combination of a monetary payment, on some occasions a payment in kind and community services that will make them at least indifferent between working at this site and being engaged in their next best alternative activity. The community services provided by the enterprises such as roads, communications and electrification will be valued higher per worker by those in the higher wage categories than for the unskilled (low wage) workers.

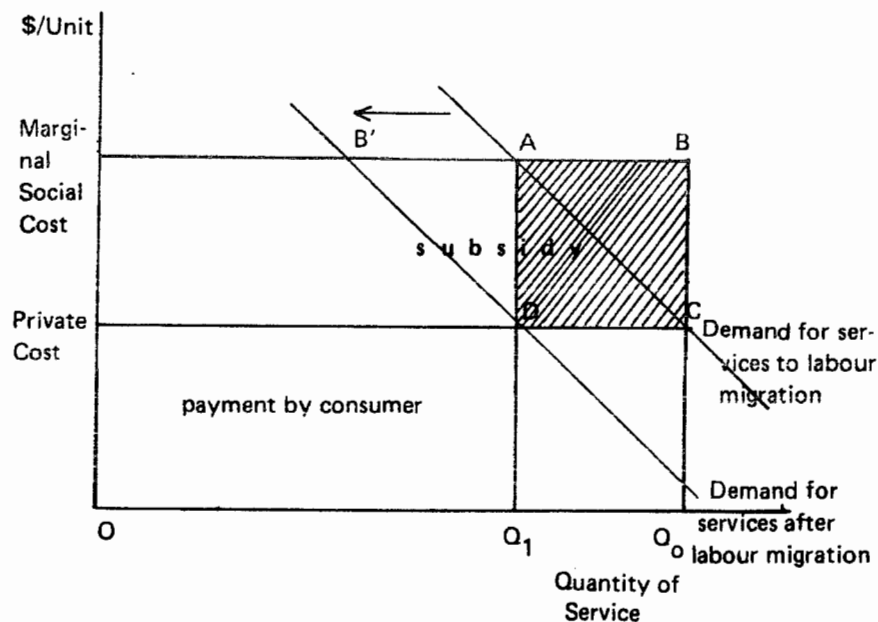
Figure 3

A: Market for Unskilled Workers B. Market for Skilled Workers



In this case the money expenditure on roads or electrical services should be included in the cost of the enterprise but there are no direct benefits from these services that should be added to the value of the output. An indirect benefit may arise, however, if the movement of labour to the community causes a reduction in the amount of subsidy paid by the government for the supply of these services or their substitutes in the community in which the individual previously lived. This value is shown as the shaded area ABCD in figure 4.

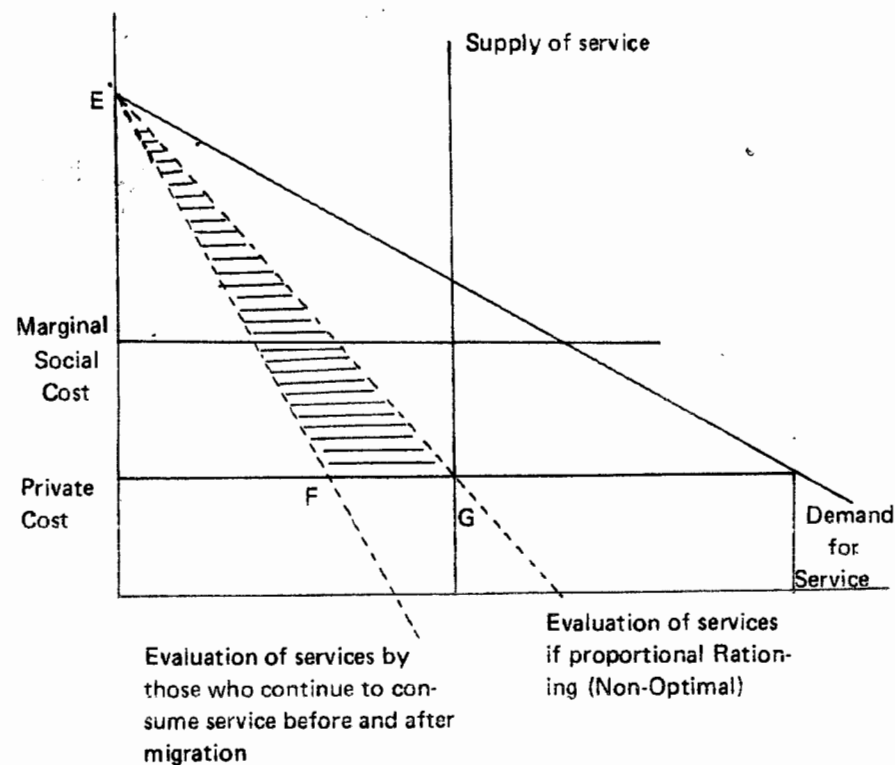
Figure 4
Indirect Benefits From Labour Migration
Reduction of Subsidies in Sending Region



A more realistic case might be that the service is now being rationed in the area from which labour is migrating. In this case the indirect benefit that is added to the enterprise's output should be the value

that new consumers place on the service now that some of the previous consumers of the service have moved to the remote community. If the services are being rationed in a proportional and non optimal manner then the value of the additional released service is measured by the area of triangle EFG in Figure 5.

Figure 5
Indirect Benefits From Labour Migration
Release of Consumption in Sending Region



The area EFG represents the consumer surplus received by those individuals who prior to the migration of labour from the community would not have consumed the service but who are now able to obtain the service. This shaded triangle can be estimated in an approximate fashion as follows:

$$(3) \text{ Indirect Benefit from region} = \frac{1}{2} \frac{(\text{The maximum that (any of the new consumers would be willing to pay per unit for the service)}) \times (\text{The number of (units of service previously consumed by migrants from the region)})}{(\text{OE}) \text{ less the Private (cost of a unit of the service)}}$$

This analysis has dealt primarily with investments such as roads and electric services. However, community investments are also made for such things as hospitals and schools which are made available to the inhabitants. While such services are likely to be valued more by the higher income individuals on a willingness to pay criterion, they are essentially investment expenditures on consumption. For such expenditures a person's willingness to pay may be greatly constrained by his ability to pay.

In many cases the families of workers would have previously been using hospital and school services in the area they migrated from but enjoy more and better quality services after they have moved to the new community. In addition, these services are not likely to be fully valued in the family's current income. As it is difficult to measure the present value of the benefits of education and health care again, we should assume that these benefits have a present value approximately equal to the cost of the expenditures that are made. The maximum value of the additional benefits generated by the enterprises from providing community services would be equal to the cost of the expenditure made, while a minimum estimation would be equal to the government expenditures on school and health facilities previously consumed. An operational estimate would be to average these two values and include this amount as indirect benefit to the mining enterprise.

b. Community Infrastructure Investments by Enterprises in Populated Regions

On many occasions mining companies do invest in community infrastructure which will be used by both the employees of the enterprise and the indigenous people in the area. It is generally the case

when an enterprise operates in such a community that it will utilize the local unskilled labour, but will draw skilled labour to the area from other communities.

The community services the enterprise provides to skilled migrants should be evaluated in the way outlined in section 1. However, the benefits accruing to the existing population require further examination.

In the analysis which follows the assumption is made that the company builds or operates the facility but does not discriminate in determining who in the community can use the service. We will also assume the enterprise is as efficient in providing these services as is the government department which has the primary responsibility for providing such services in the country.

For such expenditures as hospitals and schools the externality received by the previous inhabitants of the area can be approximated by the total expenditures made on these items by the company multiplied by the proportion of the total users of the facilities that are non-migrant. Expenditures made on such items as roads and electricity are more difficult to analyse as they are primarily developed for the use of the enterprise itself.

c. Road Improvements

To evaluate the benefits received by the local population from the use of an improved road it is first necessary to determine the frequency (Q_L^0) of travel between the points the road connects if no road improvement had been made. It is also necessary to estimate the costs in terms of fuel, maintenance and the value of time required to complete the journey without the road improvement (C_L^0). Finally we require an estimate of the costs that would be incurred by travelers on the improved road and the frequency of use of the improved road. This information will allow us to estimate the annual net benefits received by the community from the mine's expenditures on road improvement. The benefit received in one year is shown in Figure 6 as the shaded area $C_L^0 ABC_L'$ and can be expressed as in equation (4).

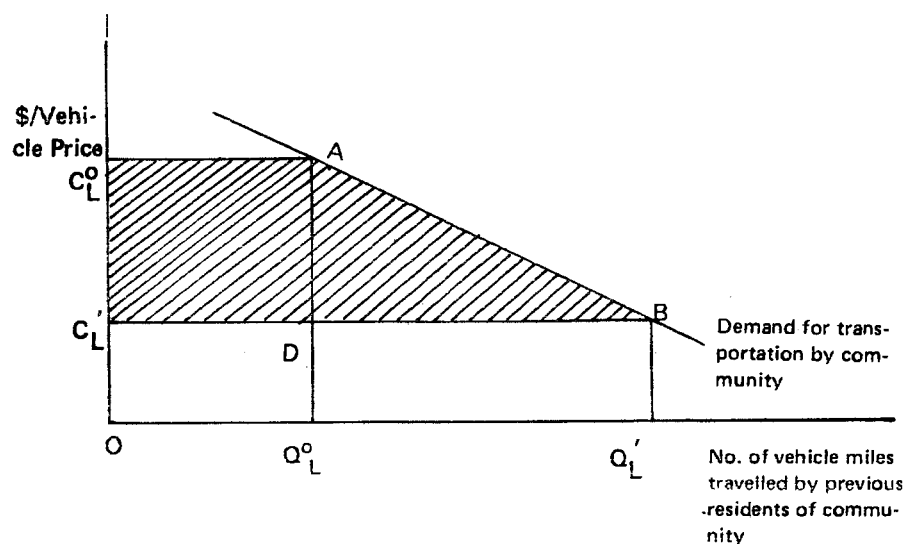
(4) Net Benefits from Improved Road in year t

$$= (C_L^0 - C_L')_t (Q_L^0)_t + \frac{1}{2} [(C_L^0 - C_L')_t - (Q_L' - Q_L^0)_t]$$

—(Change in road maintenance costs borne by local community or government because of activity of the enterprise).

Where Q_L^0 is the number of vehicle miles travelled on the road by the local community if no road improvement project were undertaken by the enterprise, and Q_L' is the number of vehicle miles travelled by local residents after the road is improved. The full costs of the road improvement should be included as a cost to the enterprise with the above net benefit serving as a partial offset to these expenditures.

Figure 6
Measuring the Benefits from Road Improvement

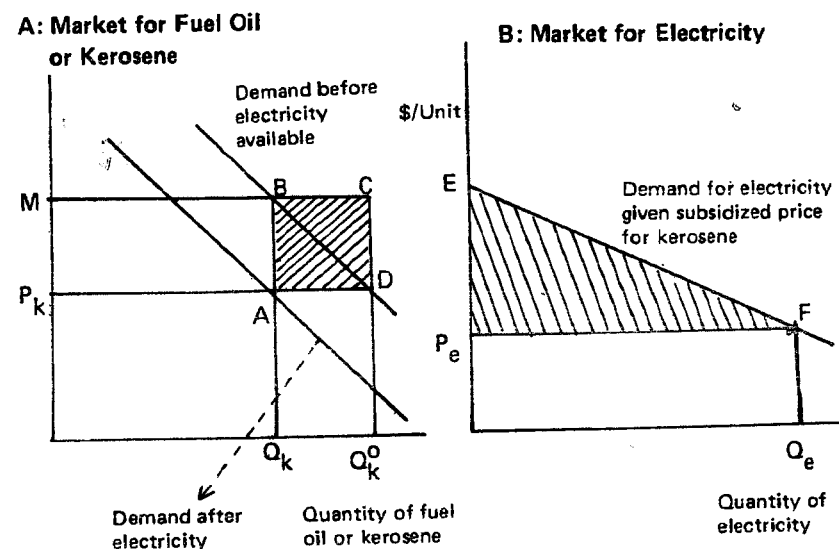


d. Rural Electrification

The benefit from rural electrification projects are particularly interesting to analyse because such projects involve the provision of a substitute to fuel oil and kerosene, which are often provided at a subsidized price in developing countries. Figure 7A illustrates the market for fuel oil or kerosene. Prior to the introduction of electricity the quantity Q_k^0 is being consumed at a price per unit P_k . This fuel is

being subsidized by an amount per unit of $(M - P_k)$. With the introduction of electricity there will be a decrease in the quantity of fuel oil or kerosene consumed, thus the government gains the subsidy payments it would have had to make, as represented by the shaded area ABCD in Figure 7A. Because electricity is usually offered at a very low rate to consumers there will likely be some consumer surplus generated in the market for electricity. This is illustrated by the shaded area $P_e EF$ in Figure 7B.

Figure 7
Measuring the Benefits from Rural Electrification



This area can be approximately measured as:

Consumer	(The maximum any local)	(The quantity)
	$= \frac{1}{2}$ (consumer would pay to)	()
(5) Surplus	(have electricity where)	(of electricity)
	(fuel oil or kerosene)	()
	(is available at the)	(consumed)
	(subsidized price less the)	
	(price the local)	
	(consumers have to pay)	
	(for electricity)	

As in the case of roads the full cost of providing electricity should be included in the cost of the enterprise's operation. However, the enterprise should count as indirect benefits from providing electricity to the local community both the revenue it received from the sale of electricity, the decrease in government subsidy on kerosene, and the increase in consumer surplus from the sale of electricity.

e. Roads and Other Development Activity

It has been suggested that an externality is created when a road is built for the use of an industrial enterprise, but this road also makes possible other activities, for example, timber harvesting. The externality created by the road is not equal to the entire value added of this secondary activity. The net benefits that should accrue to the road project from the new activities such as timber harvesting is equal to the maximum amount that could be charged to the timber activity for the use of the road before the timber enterprise would either not wish to undertake operations in the area or would choose an alternative form of transportation. It is a common error to credit the road for the value added of the labour and capital that are used in conjunction with the transportation services to produce and market these other products. Only the transportation benefits measured in the above way should be included as indirect benefits to the enterprise's expenditures for the road.

V. CRITERION FOR DETERMINING TARGET RATES OF RETURN FOR PUBLIC ENTERPRISES

After completing the adjustments to the financial cash flow as outlined in the previous section we will have estimated the stream of net economic benefits generated by the enterprise for the years under consideration. The problem is now one of determining whether or not this stream of net economic benefits is large enough to make the enterprise an attractive one in which to invest. To do this we must first decide on the target rate of return that must be reached before the economy is made better off by the existence of this public enterprise.

The first point that must be understood is that the weighted average financial cost of funds to the enterprise, or the cost of capital

funds faced by comparable private sector investments are usually irrelevant measures for the determination of the target rate of return for the public sector investment. It has often been stated that these capital market financial costs of capital are too high for the evaluation of public sector projects, but in fact they are almost universally too low. This is the case because the private financial cost of capital and the financial net cash flow are both calculated net of all taxes and externalities. For an economic analysis the net benefit stream is evaluated gross of all taxes and externalities and thus must be compared with the gross of tax social opportunity cost of these resources.

The social opportunity cost of government expenditures, simply stated, is the value of production either in terms of consumption or investment goods that is foregone by the private sectors of the economy due to the expansion of government expenditures. To form general criteria for the social opportunity cost of government expenditures we need to obtain a measure that has general applicability and does not vary drastically through time.

For most governments the domestic and foreign capital market have been the marginal sources of funds for the financing of investment funds. Also in periods of budgetary surplus funds are dispersed into the capital market either by slowing down the rate of government borrowing or by diminishing the size of the public debt. In this way the social opportunity cost of government borrowing can be viewed as the relevant social cost of funds to compare with the economic performance of the public sector enterprises. It is important to note that for performance evaluation it is the marginal cost of government funds and not the average cost that is the relevant opportunity cost.

When governments borrow they obtain their financing from other sectors which postpone expenditures on investment and consumption in order to lend to the government. Therefore, to estimate the social opportunity cost of government borrowing we must weight the gross rate of return in each of the sectors that forego expenditures by the proportion of the funds that are obtained from that source. In most countries the relevant sectors that are affected by government borrowing are domestic private investment, domestic consumption of the various income groups, residential construction,

domestic agriculture and foreign investment. The methodology for the estimation of the rate of return or cost of obtaining funds from each of these sectors is well developed and has been applied many times in both developing and developed countries.⁵

This weighted set of social gross rates of return of the sectors which give up funds when the government borrows is the marginal social opportunity cost of any government expenditure. Setting aside distributional considerations, if a public sector enterprise does not generate an economic return at least as large as the social opportunity cost of government borrowing then the operation of this enterprise is hindering the growth of the economy. When we consider distributional or social objectives in the next section we will relax this criterion somewhat if the firm is meeting these social objectives in a cost effective manner.

To summarize, in order to make a meaningful evaluation of the performance of the enterprise on the basis of its economic efficiency, it is the net economic benefits not the net financial returns that are the relevant measures of the output of the firm. After calculating these net economic benefits, we determine if the enterprise is performing satisfactorily as far as the economy is concerned by seeing whether or not it is producing an economic rate of return at least as large as the social opportunity cost of government borrowing.

VI. DISTRIBUTIONAL GOALS AND PUBLIC SECTOR ENTERPRISE PERFORMANCE

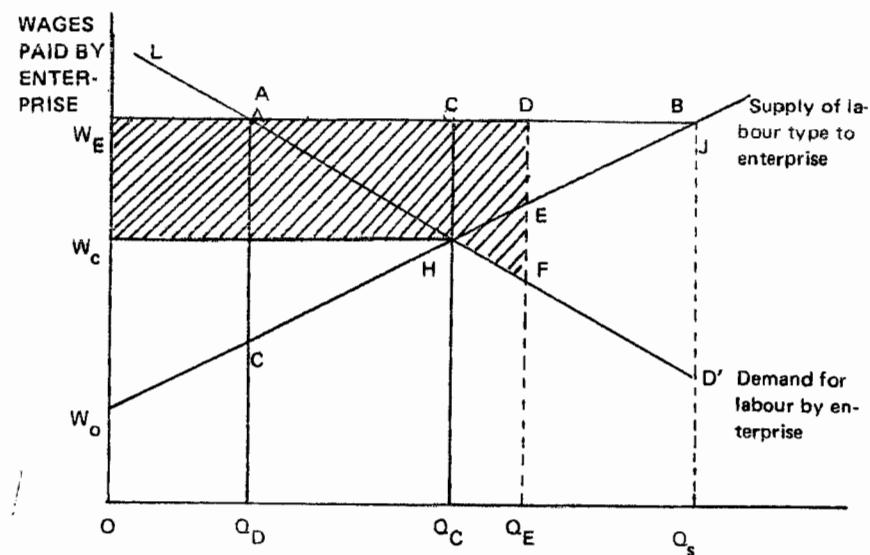
Public enterprises are often given government objectives that are distributional or social in nature. Common examples are that the government wants the public enterprises to assist in increasing the income of the poor in the country, or it may want to provide more employment opportunities to recent university graduates, or it may wish to provide training to unskilled middle aged workers.

In the evaluation of the distributional performance of public sector enterprises we must keep in mind that there are generally several other transmission mechanisms used by governments at all times to move the economy toward its objectives. Thus, it is the task of the analyst to determine if a public enterprise is moving the economy towards these objectives in a cost effective manner as compared to these other instruments.⁶

A public sector enterprise can alter the distribution of income in three ways. Firstly, it can pay more for the inputs than the minimum supply price these inputs could be purchased for and used in the project. The difference between what the enterprise pays and the input's supply price is the income transfer received by the owners of the inputs. Secondly, the output of the project may be sold at a price below what would be the price if it were set by the market without government interference. Thus, the purchasers of the goods will receive a transfer of income equal to the difference between the market price and the public enterprise's price times the quantity purchased. Thirdly, the enterprise may provide items such as schools and hospitals and thus generate external benefits for the community which the community does not pay for, (as was discussed in section IV). The recipients of any of these externalities are receiving an income transfer from the public enterprise.

In all three of the above cases the income transfer is not the gross wage rate nor the gross factor payment. The transfer is equal to only the net gain that is over and above what they would have received in

Figure 8
MEASUREMENT OF THE DISTRIBUTIONAL IMPACT
OF EMPLOYMENT



alternative activities. When providing a product, it is not the total value of output, but only the difference between the price charged and what would have been the market price that is the transfer. Figure 8 illustrates the measurement of this distributional transfer for the case of unskilled labour.

In figure 8, the line W_0S measures the price at which labour would voluntarily supply themselves to work for this enterprise. This provides a measurement of their opportunities elsewhere. The curve LD' measures the demand for labour of this type by the enterprise. If the wage rate were determined by the market then it would be at a level of W_c . However, in this case the enterprise pays a wage rate of W_E which is above the market wage rate. At the wage rate of W_E labour would be willing to work for the enterprise up to the quantity Q_s , while only Q_D can be employed by the enterprise if the wage rate is not to be greater than labour's marginal product. To be realistic, let us assume that the public enterprise not only pays higher than market wages, but also employs more workers than it would if it wished to maximize profits. We denote the quantity it employs by Q_E .

The firm is still faced with the problem that there are more workers wanting to work for the enterprise than it is willing to employ. We have assumed that the firm randomly hires the quantity Q_E from the Q_s available. Therefore, the average supply price of the workers

employed will be equal to $\frac{W_0 + W_E}{2}$. As the wage they are being paid

is W_E the amount of income transferred to this group of workers is

equal to $\left[W_E - \frac{(W_0 + W_E)}{2} \right] Q_E$.

We now wish to evaluate what is the cost to the enterprise and to the country in terms of the misallocation of resources caused by this policy. If the firm were employing labour so as to maximize its profits it would be employing Q_c units and paying W_c per unit. For these units it is now paying a wage of W_E so the additional financial cost is $(W_E - W_c)Q_c$. It also employs an additional number of labourers of $(Q_E - Q_c)$. These workers generate a product for the firm equal to an amount $Q_c HFQ_E$, but they are costing the firm $Q_c GDQ_E$, therefore, the financial loss is $HGDF$. Combining these

two losses in profits the total reduction in profitability of the enterprise from this policy is shown by the shaded area $W_E DFHW_c$.

However, this financial cost does not represent the economic cost to the country from having the enterprise operate as a distribution agency. To measure this cost we first have to determine the benefit the economy receives by distributing income from the financiers of the public enterprise to the people who receive the distributional transfers. As a simplification let us assume that the only income transfer made by this enterprise is to the labour it employs and in addition, the government desires to transfer income to this group.

By using the public enterprise to bring about this transfer it is then saving on other programs it would have had to undertake in order to bring about this same transfer. If the cost of bringing about a unit of income transfer is k for alternative programs then the public enterprise in this case will save the economy

$k \left[W_E - \frac{(W_0 + W_E)}{2} \right] Q_E$ of

resources by transferring $\frac{(W_E - \frac{(W_0 + W_E)}{2})}{2}$ of income on average to

each of its Q_E workers. This saving is then added to the economic benefits to give us the total social benefit generated by the project. On the other hand, if the enterprise generates transfers to groups in society who the government would prefer to transfer income away from, then an additional resource costs of k (amount of transfer) should be deducted from the benefits of the enterprise because the government will have to now use more of its other programs to correct for this undesirable income transfer.

With this added adjustment for the social benefits created by the enterprise we can now compare the return of the enterprise to the social opportunity cost of public funds. If the enterprise generates a social return greater than this opportunity cost then it is both efficient in terms of the use of resources, and cost effective in its distributional activities. Alternatively, if the social rate of return of the particular public enterprise is less than the social opportunity cost of capital it may or may not be financially and economically attractive, but we will know that it is not a cost effective instrument to bring about the desired social objectives.

exploitation of Indonesia's mineral deposits by dredge, hydraulic mining or by plants that can process large volumes of low grade ores. There are also significant differences in the extent of foreign participation in the nonfuel mineral projects in the two countries. Active foreign investment in the Bolivian non-fuel minerals sector is confined to one medium size zinc mine. By contrast, since 1967 several large-scale foreign investment projects have been initiated in Indonesia under contracts of work by such international firms as Freeport (copper), INCO (nickel) and Broken Hill (tin), all of which have brought operations on stream. In addition, substantial exploration activities have been conducted by Alcoa, Kennecott, Rio Tinto and others.

b. Public Sector Enterprises

The state mining enterprises in the two countries display considerable similarities. *COMIBOL* is the sole state enterprise operating in non-fuel minerals exploitation in Bolivia, producing tin, tungsten, copper, lead, bismuth, and silver.

This enterprise was formed in the 1950's as a result of a socialist revolution led by the miners' unions which nationalized the Bolivian-owned Patina mining enterprises and all other private mining companies.

Overall, *COMIBOL* is at present typically responsible for nearly two-thirds of the value of total mineral production in Bolivia, the remaining coming from private medium scale and small-scale firms.

In Indonesia, state enterprise participation in non-fuel minerals extraction involves two firms: P.T. Timah (in tin) and P.T. Aneka Tambang (gold, bauxite, nickel and other metals). These firms were formed through the nationalization of foreign owned enterprises (mostly Dutch) after independence. Until 1974, these firms accounted for virtually all mineral production in Indonesia. By 1976, new foreign investment projects in copper and nickel had begun production, reducing the state enterprise share of total production to about 2 percent in the case of copper and perhaps 50 percent in the case of nickel. P.T. Timah continues to account for 95 percent of tin production.

In terms of employment and foreign exchange generation the state mineral enterprises in the two countries are surprisingly similar.

VII. PUBLIC ENTERPRISE PERFORMANCE AND THE MINING SECTORS OF INDONESIA AND BOLIVIA

The opportunity to study the performance of public sector enterprise in the mining sector of these two countries arose because of independent requests to the Harvard Institute for International Development by the respective governments to undertake an interdisciplinary evaluation of the tax and regulatory system that applies to the mining sector within their economies. These two major studies were completed during the period 1975 to 1977.⁷

In both Bolivia and Indonesia public enterprises dominate the mining sector. At the same time both countries also have participation of private firms in the sector. Public sector mining enterprises in both countries are faced with the same types of financial, economic and distributive objectives that have been outlined in the previous sections of the paper. While it is not possible in this paper to detail all the steps of the calculations that arise out of the methodology for performance evaluation previously outlined we will attempt to summarize our impressions from our examination of the financial, economic and distributive activities of these public enterprises. First, we will outline some background information concerning the mining sector in these two countries.

a. Nature of the Mining Sectors

The mining sectors in both countries are heavily dominated by tin production. Bolivia is responsible for 16 per cent of world production and Indonesia's share is approximately 14 percent. However the nature of mining activity differs significantly between the two countries. Virtually all of Bolivia's present mines are underground operations in high altitude narrow-vein mines. Nearly all of Indonesian mines are surface dredging operations carried out at or near sea level involving exploration of tin deposits in the soil either on land or at sea. In the case of nickel the deposits are lateritic in nature. Except for tin there are no substantial overlaps in the types of minerals produced in the two countries. Indonesia produces virtually no bismuth, antimony, tungsten or lead, while Bolivian output is a major factor in world markets for the first three of these metals.

The average size of mining projects is far greater in Indonesia than in Bolivia, owing to the much larger scale capital requirements for

COMIBOL employs 25,500 workers, while total employment in the two Indonesian enterprises number 33,300 (27,800 in P.T.Timah). Total export values of the period 1972-74 were \$494.6 million for the Bolivian state firm, and 395.6 for the two Indonesian enterprises combined (of which P.T.Timah accounted for \$338.2 million).⁸

c. Management and Relationship to Government

In both Indonesia and Bolivia, the president of the enterprise (traditionally a senior military officer) is, for all practical purposes, chosen by the President. In both countries a supervisory board of government-appointed officials is charged with protecting the government's interest as stock holder and in setting and reviewing general policies for enterprise conduct. Such boards function primarily in 'watchdog' fashion and do not normally become involved in operating decisions, this being left to the president and managing directors. In both the Bolivian and Indonesian firms, management is nominally organized along geographical divisions, but decision making remains rather centralized in head offices, more so in the case of COMIBOL.⁹

d. Financial Performance

When examining the financial performance of these state mining enterprises in both countries we find that they passed through extremely difficult periods in the nineteen fifties and sixties. In COMIBOL the period was characterized by recurring strikes, disruptions and falling productivity. The firm was able to make almost no new investment in exploration and development. Until 1972, the enterprise generated virtually no financial surplus and also paid little or no taxes.

During the 1970's the financial cash flow difficulties of COMIBOL have arisen from principally three sources. First, Bolivia is the world's highest cost tin producer. Part of this cost differential between Bolivia and the other major producers is caused by the nature of the mines which are narrow veined underground mines located at an average altitude of 4,000 metres.¹⁰ Also the underground primary deposits in Bolivia are, relative to the alluvial and eluvial (dredge-mined) Indonesian deposits, fine grained and contaminated with such impurities as arsenic and sulphides that make treatment and recovery

more expensive and difficult. The second cause of liquidity problems in COMIBOL is the existing 'regalia' system of taxes which is in fact almost a fixed rate on the sales price per pound of refined tin. As a result when prices change taxes do not change by as large a proportion as does the net cash flow. Third, the availability of short term credit to finance working capital is very limited and thus any decrease in world demand for tin that necessitates a stockpiling of tin creates a further liquidity problem because the higher inventory costs cannot be easily financed.

These three factors have made the financing and execution of long range investments in exploration and development extremely difficult. As a result the level of reserves in COMIBOL mines have been falling for more than a decade, while at the same time it holds vast areas of unexplored territory. This lack of long range planning is no doubt also partially created by the nature of the enterprise's decision making process which will be discussed later.

In Indonesia, the two non-fuel mineral enterprises were treated as 'financial cows' in the period 1960-66, the latter part of the Sukarno era. The government not only withheld new capital from the enterprises, but appropriated, in extra-budgetary fashion, about 80 percent of the net cash flow, including depreciation, from both. Due to these severe financial constraints exploration and development activity came to a virtual halt, and the productive infrastructure in exploration and processing was allowed to dilapidate rapidly. A gradual process of recovery began in 1967, first with the rehabilitation of production infrastructure 1968 to 1972, and the reinitiation of exploration budgets thereafter. As a result, at the present time explored reserves are adequate to maintain current levels of production and are growing.

While the principal method of taxation has been a fixed percentage export tax or royalty on the sales value of the minerals, Indonesia does also levy a 25 percent profits tax on the public enterprises which has been in fact largely a negotiated payment. Thus, in periods when the net financial cash flow has been small, either because sales were low or investment expenditures were high, the negotiated liability of the profits tax has been flexible enough to avoid overly severe liquidity problems. Tax flexibility of this type would probably not be recommended by professional tax administrators but such prac-

tices have assisted in the financial planning of public sector mining enterprises in Indonesia.

e. Economic Performance

The economic performance of these public mining enterprises has varied considerably through time. During the 1950's and early 1960's COMIBOL's productivity fell and as a result it paid little or no direct taxes. However, it did pay wages that were well above the supply price that would have induced enough labour to the mining sector and it also made considerable expenditures in hospitals and schools. By the late 1960's and throughout the 1970's the mining sector had contributed heavily either directly through output taxes or indirectly through import taxes to the revenues of the Bolivia government. This sector's share of total government tax revenues rose from approximately 26 percent in 1968 to 40 percent in 1974. In 1973-74 mineral taxes in Bolivia amounted to 17.6 percent of the total value of mineral sales. At the present time COMIBOL has substantial responsibilities in the fields of employment, education, nutrition, hospital care and transport infrastructure in the mining communities in which it operates.

While the financial record of COMIBOL has not been good and its planning for the future limited, it has at least in recent years generated substantial positive economic externalities.

The public sector mining enterprises in Indonesia have also undertaken functions such as schools, hospitals, roads and electrification. However, many of these expenditures are necessary for the operation of mines in remote areas and therefore should be considered as part of the mining costs. Recently (1975-76) both P.T. Timah and P.T. Aneka Tambang have been converted into limited liability companies from their previous states as branches of government departments. This change will give them more opportunity to reduce the scope of their social responsibilities.

Unlike COMIBOL the Indonesian mines were taxed extremely hard during the early 1960's and thus their performance economically is substantially better than it was financially. Since that time their tax payments have been more modest, but in 1973-74 tax payments were comparable to Bolivia amounting to 16.7 percent of export sales.

Hydrocarbons account for a substantial share of total export earnings in both Bolivia and Indonesia and in both countries, the non-fuel minerals sector is at present a significant user of energy.¹¹ In Bolivia non-fuel minerals mining (exclusive of smelting) accounts for 5 percent of direct consumption of refined petroleum products overall (15.6 and 12.0 percent of diesel fuel and industrial lubricants, respectively), and perhaps another 5 percent of purchased consumption of oil-fired electric power.¹² As COMIBOL accounts for over two-thirds of the value (and volume) of mineral production, it seems reasonable to assume that it consumes a proportionate share of petroleum energy. Comparable figures for energy consumption by the Indonesian mining sector and state mineral enterprises are unavailable. However, operations of both P.T. Timah and P.T. Aneka Tambang are quite energy-intensive. Fourteen of the 28 tin dredges operated by the former are powered by diesel/electric thermal plants, and another thirteen utilize purchased energy generated by oil-fired electricity plants. Further, Timah's large (28,000 ton) smelter is powered by diesel-run generators.¹³ Aneka Tambang's bauxite and nickel operations involve very large energy requirements. This is particularly true for the enterprise's production of ferronickel from lateritic ores in Sulawesi, which requires four times as much energy (predominantly oil) as nickel produced from Canadian sulphide ores.¹⁴

In both countries, energy consumption is markedly underpriced relative to world prices, and in both countries investment decisions in extraction and processing cannot help but be heavily influenced by the availability of low-cost energy. Until November 1975, the domestic price of Bolivian crude oil was held at approximately \$3.00 per barrel, while the f.o.b. export price was approximately U.S. \$12.60.¹⁵ For 1976, the domestic price was raised to \$10.00/bbl., while the average f.o.b. price (inclusive of \$0.60 in costs of preparing crude for export) moved up to \$13.45/bbl. In Indonesia, the average 1976 f.o.b. price was \$12.60/bbl., while the price of crude used in the domestic market was held to \$8.40/bbl. But the overall per barrel subsidy to domestic consumers of petroleum products in both countries is even greater than would be indicated by the difference between world crude prices and domestic crude prices. In the Bolivian case, the calculation of the subsidy begins with the well-

head net price of U.S. \$12.85 (world price of \$13.45 minus costs of preparation for export) that Bolivia receives for its exports of crude oil. To this must be added U.S. \$4.60 for resources devoted to transportation, refining and distribution, to arrive at the economically efficient average retail price (exclusive of road user charges) of \$17.45.¹⁶ Thus, non-automotive users such as the minerals state enterprises should, on economic efficiency grounds, pay an average of U.S. \$17.45 for each barrel of refined petroleum products purchased.¹⁷ Thus, the overall subsidy to non-automotive users of crude products in Bolivia is U.S. \$7.45 per barrel (U.S. \$17.45-\$10.00), and Bolivian firms pay only 57 percent of the opportunity costs of petroleum fuel they utilize. The overall subsidy, net of road user charges, to all domestic consumers of petroleum products amounted in 1976 to U.S. \$58 million (\$7.45 x estimated 1976 domestic consumption).¹⁸ The subsidy itself amounted to some three to four percent of GNP, but this of course overstates the welfare losses arising from price controls on domestic crude. McLure, employing Harberger-type measures of welfare costs, has calculated that the total annual welfare loss from the subsidy at 1975 levels of consumption amounted to 0.32 percent of GNP at a price elasticity of demand of 0.5, or 0.59 percent of GNP, using an elasticity figure of 1.1.

For Indonesia, with its lower ceiling on domestic price and substantially higher domestic consumption of petroleum products (300 thousand bbls./day vs. only 21.2 thousand in Bolivia in 1976), the absolute size of losses from the subsidy is, of course, much greater. At the same level of costs for preparation of crude for export as in Bolivia (U.S. \$0.60/bbl.), the net well-head price for Indonesian crude was \$12.00 in 1976. If costs of refining, transportation and distribution are also U.S. \$4.60 in Indonesia, then the economically efficient retail price (exclusive of road user charges) would be \$16.60. Since the controlled price in 1976 was \$8.40, the average net per bbl. subsidy was \$8.20/bbl. Therefore, the subsidized price is almost exactly 50 percent of the unsubsidized price. At 1976 levels of consumption (109.5 million bbls./year) the aggregate subsidy totaled U.S. \$877.9 million, or about 4.3 percent of estimated GDP. Employing McLure's measure, we may place the aggregate welfare costs of the subsidy at U.S. \$131.5 million,¹⁹ or 0.6 percent of GDP if demand elasticity is 0.5, or about 1.1 percent of GDP when

demand elasticity is 1.1. As noted earlier, the state mineral enterprises are at present significant consumers of subsidized petroleum fuel (about 4 percent of total domestic consumption in the Bolivian case and perhaps an equal percentage in the Indonesian cases).

At their present levels of energy consumption by public mining firms, welfare losses arising from the particular allocative distortion would not be much reduced if they alone were required to pay the opportunity cost of petroleum fuels. However, investment plans of public firms in both countries include potential projects that are very energy-intensive in nature. In Bolivia, new public investments in zinc and copper smelters and in tungsten refining are now being contemplated, while in Indonesia a state-owned alumina plant is under consideration, and other public enterprise projects involving substantial consumption of fossil fuels are under construction, or being reviewed. Should domestic energy prices continue to remain at levels less than half of opportunity costs, and state firms respond to this price signal, it is probable that many such energy-intensive projects will be adopted, some of which might involve negative domestic value-added if world prices were employed instead.

Comprehensive studies of the full social cost of investment funds in the Bolivian and Indonesian public sectors remain to be done. But in both countries it is doubtful whether the relevant rate is much below 12-14 percent net of inflation. In both countries, the state mineral enterprises secure investment funds through a combination of equity inputs by government, retained earnings and borrowing (both domestically at subsidized interest rates (in Indonesia) and in international capital markets (in both countries)). The enterprises in both countries tend in all but the very largest projects (where it is necessary to tap lenders abroad, who insist upon inclusion of interest as a cost of capital) to view capital as costless in investment decisions. The consequence has been efficiency losses arising from the misallocation of resources resulting from artificial incentives to choose capital-intensive methods of production.

An example from the experience of one of the firms we studied illustrates the point very clearly. This firm utilizes an important processing facility that is characterized by fixed coefficients in the middle of the process and variable coefficients on either end. That is, there is little scope for capital-labor substitution in the basic

metallurgical process, but ample scope for such substitution in handling of both feed-stocks and the pure metal output of the process. Traditionally this firm has utilized manual labor for casting molten metal into ingot form, a process which employed about 30 workers per day, all of whom used simple ladles (to pour molten metal into forms). However, the firm was about to invest (in 1976) in a mechanized ladle process that would require only 3–6 workers per day, as calculations indicate that such a step would make a positive contribution to net cash flow. However, the computations were based on the assumption of zero cost of capital. Had the firm been required to use the opportunity cost of capital in its decision-making, the further mechanization of production would have appeared inadvisable and likely would not be implemented. While this particular case would not in itself involve sizable economic efficiency losses, the pervasive under-pricing of capital in this firm and the other firms, if the enterprises do follow maximizing behavior, should be expected to have significant welfare-reducing effects throughout each.

In the evaluation of the overall economic performance of the public sector mining enterprises in Indonesia and Bolivia it would appear that those in Indonesia are providing a larger economic contribution to the country relative to resources they are using. Also the more aggressive exploration and development policies undertaken by the Indonesian enterprises indicates a better promise for their economic contribution to the development of the country in the future.

f. Distributional Performance

The distributional impact of the public sector enterprises in both Bolivia and Indonesia has been to increase the economic well-being of mining workers as well as the recipients of government expenditures financed by tax revenues. For many years the miners and other mining sector employees in both countries have had incomes well above the average in the country and thus it is doubtful that any additional credit should be given to these public enterprises for continuing to distribute income to these groups. However, their performance (especially in Indonesia) as producers of tax revenue has enabled their respective government to undertake additional expenditures which are presumably providing increases in the incomes of the groups the government desires to assist.

NOTES

1. For a more complete review of the construction of cash flow statements from accounting data see; A.J. Merrett and Allen Sykes. *The Finance and Analysis of Capital Projects*. 2nd edition, Longman, 1974, chapter 2.
2. The measurement of the social externalities produced by infrastructure investments are discussed in section IV.
3. Arnold C. Harberger. *Project Evaluation: Collected Papers*. Chicago, Markham, 1972 Ch. 7, 'On Measuring the Social Opportunity Cost of Labor.'
- John R. Harris and Michael Todaro. 'Migration, Unemployment and Development: A Two-Sector Analysis.' *American Economic Review*. 60 (1), March 1970: 126–42.
- John C. Evans. *The Social Opportunity Cost of Labour in Canada*. Thesis (Ph.D) University of Chicago, 1977.
- Glenn P. Jenkins and Chun Yan Kuo. 'On Measuring The Social Opportunity Cost of Permanent and Temporary Employment.' *Canadian Journal of Economics*, 11(2), May 1978: 220–239.
4. The value of sales will not reflect the economic benefits if there are trade distortions such as tariffs on imports/taxes and subsidies on exports and quotas. The correction for these distortions will not be analyzed in this paper.
5. Arnold C. Harberger and Daniel L. Wisecarver, 'Private and Social Rates of Return to Capital in Uruguay' *Economic Development and Cultural Change*. 25(3), April 1977.
- Glenn P. Jenkins, *Capital in Canada: Its Social and Private Performance 1965–74*. Ottawa, Economic Council of Canada, ch. 6.
- Carlos Langons. *A Study in Economic Growth: The Brazilian Case*, Thesis (Ph.D) University of Chicago, 1970.
6. A very important article of the distributional impact of projects is, Arnold C. Harberger. 'On the Use of Distributional Weights in Social Cost-Benefit Analysis.' *Journal of Political Economy*. 86(2), Part 2 April 1978: 587–5120.
7. A fuller discussion of the Bolivian Mining Tax study is provided in Malcolm Gillis. et al *Taxation and Mining*. Cambridge, Mass.: Ballinger Press, 1977.
8. Malcolm Gillis. 'Taxation, Mining and Public Ownership' (paper presented to conference on Resources Taxation in the Western States, sponsored by the University of Arizona School of Mines and the Lincoln Institute of Land Policy; in Tucson, February 2, 1977.)
9. In Bolivia the supervisory board is dominated by officials from the Ministry of Mines; In Indonesia the supervisory board consists of one official each from the Ministries of Mines and Finance, and one from another ministry typically Defence.
10. 'Tin Mining Today—Place and Lode Mining and Benefication.' *World Mining* 30(2), February 1977: 42–46.
11. But whereas Indonesia, with 1976 output at about 1.5 million bbls/day, is the ninth largest producer, Bolivian oil fields, in 1976, generated but 49,000 bbls/day. About 80 percent of Indonesia's output is exported, compared to half for Bolivia.
12. Figures on mining sector consumption of refined products are from Charles E. MacLure, Jr. 'Taxation of Domestic Consumption of Petroleum' (paper prepared for Musgrave Commission on Fiscal Reform for Bolivia, August 1976). Table 4. Estimates of the mining sector's consumption of purchased energy are based on previous unpublished work by the author.
13. P.T. Timah. *Tin in Indonesia*. Jakarta, 1972, pp. 10–11.

14. Martins, Ball, & Albrecht. 'The Nickel Industry in Energy Crisis'. Toronto circular, January 1974.
15. Malcolm Gillis et al. *op. cit.*, chapter 2.
16. McLure, *op. cit.*, p. 5.
17. If marginal road user charges average U.S. \$0.10 per gallon, automotive users (trucks and autos) should pay U.S. \$19.00/bbl. for refined products. See McLure. p. 5.
18. For 1975, the overall subsidy to domestic users in Bolivia was far larger, given that the domestic crude price was held at \$3.00/bbl. until November 25, when it was raised to the present \$10.00 figure.
19. In the Harberger Tradition, welfare losses may be expressed as $AW = \frac{1}{2} (\Delta P \Delta Q)$. Expressing the unsubsidized price as equal to 100, we know that ΔP (unsubsidized price minus subsidized price) is equal to 50. If we also express the unsubsidized quantity as equal to 100, we can compute Q by employing an assumed figure (0.5) for the price elasticity of demand. If the welfare loss is expressed as a percentage of sales recorded with the subsidy, we have:

$$\Delta W^* = \frac{\Delta W}{P_s Q_s} \cdot 100 = \frac{1}{2} \left[\frac{\Delta P}{P_s} \cdot \frac{\Delta Q}{Q_s} \right] \cdot 100$$

Where: P_s = subsidized price
 P_u = unsubsidized price (see below)
 Q_s = subsidized quantity
 P = $P_s - P_u$

In circumstances where $\frac{P_s}{P_u} = 50\%$, it can be shown that with an arc elasticity of demand

of 0.5 (arc elasticities must be used because of the large price changes involved), then $\frac{\Delta Q}{Q_s} \cdot 100$ will be about 28.6%. Since $\frac{\Delta P}{P_s} = 1$, then,

$W^* = 14.3\%$ of the value of subsidized sales. Since the value of subsidized sales in 1976 was approximately U.S. \$919.8 million, then the welfare cost of the subsidy may be put at about U.S. \$131.5 million, or 0.6% of GDP. Similarly, with demand elasticity at 1.1, the welfare cost of the subsidy was about 26.8% of subsidized sales value, or about 1.1% of GNP. (Note: Strictly speaking, the Harberger-type expression for estimation of welfare costs is suitable only when the elasticity of demand is less than unity. See Harberger, *Taxation and Welfare*, p. 88.

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